

17th Annual
AIR FORCE
ALMANAC

SEPTEMBER / \$1.25

AIR FORCE

and **SPACE DIGEST**

The Magazine of Aerospace Power

Published by the Air Force Association

USAF's FIRST TWENTY YEARS *A Picture Review*

USAF Thunderbirds fly F-100s over
Falcon Stadium at Air Force Academy



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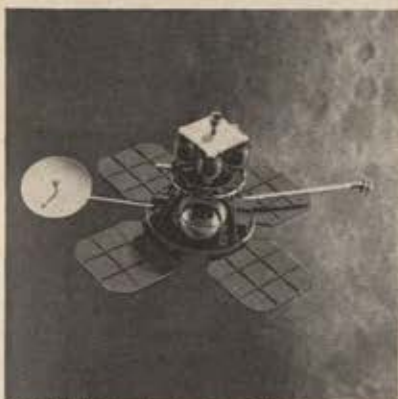
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NASA's Boeing-built Lunar Orbiter



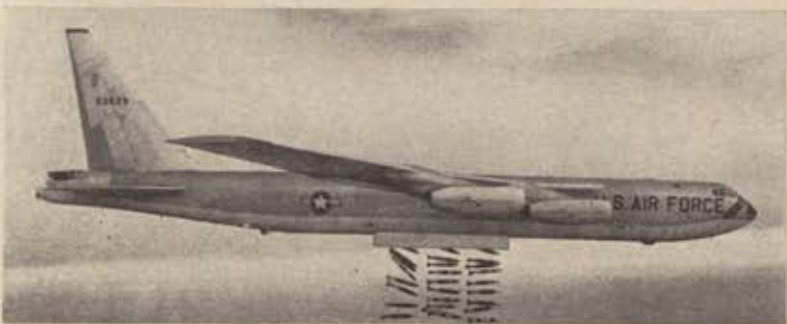
U.S. Air Force Minuteman ICBM



SRAM, Air Force short-range attack missile



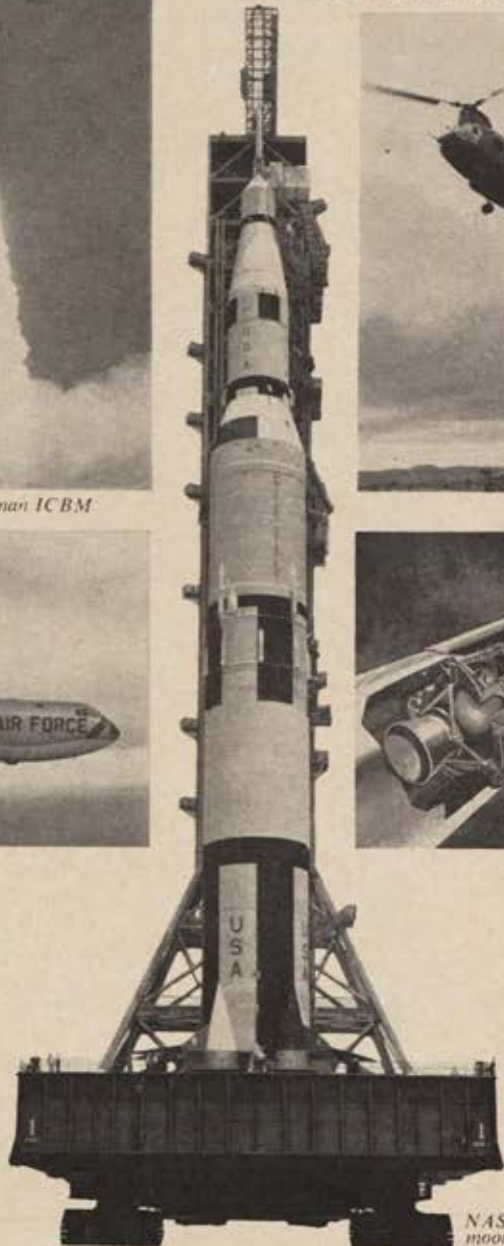
Boeing helicopter



B-52 eight-jet Stratofortress



Burner II



NASA's Apollo/Saturn V moon rocket

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737 is world's newest, most-advanced short-range jetliner. When it enters service next year, it will be the first airliner to bring big-jet comfort to short-haul routes.

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bombing missions against the Viet Cong.

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Twin turbine Boeing helicopters, built by Vertol Division, are deployed to Vietnam. They serve with U.S. Army, Navy, Marine Corps.

Burner II, USAF's new Boeing-built upper

stage vehicle, is smaller, less costly than other upper stages. It's applicable to almost all USAF launch vehicles, also scientific experiments, weather, navigation or communications satellites.

NASA's Apollo/Saturn V moon rocket, largest, most powerful in world, will launch first Americans to moon. Boeing builds first stage booster, also performs systems engineering and integration support for NASA on entire Saturn V system.

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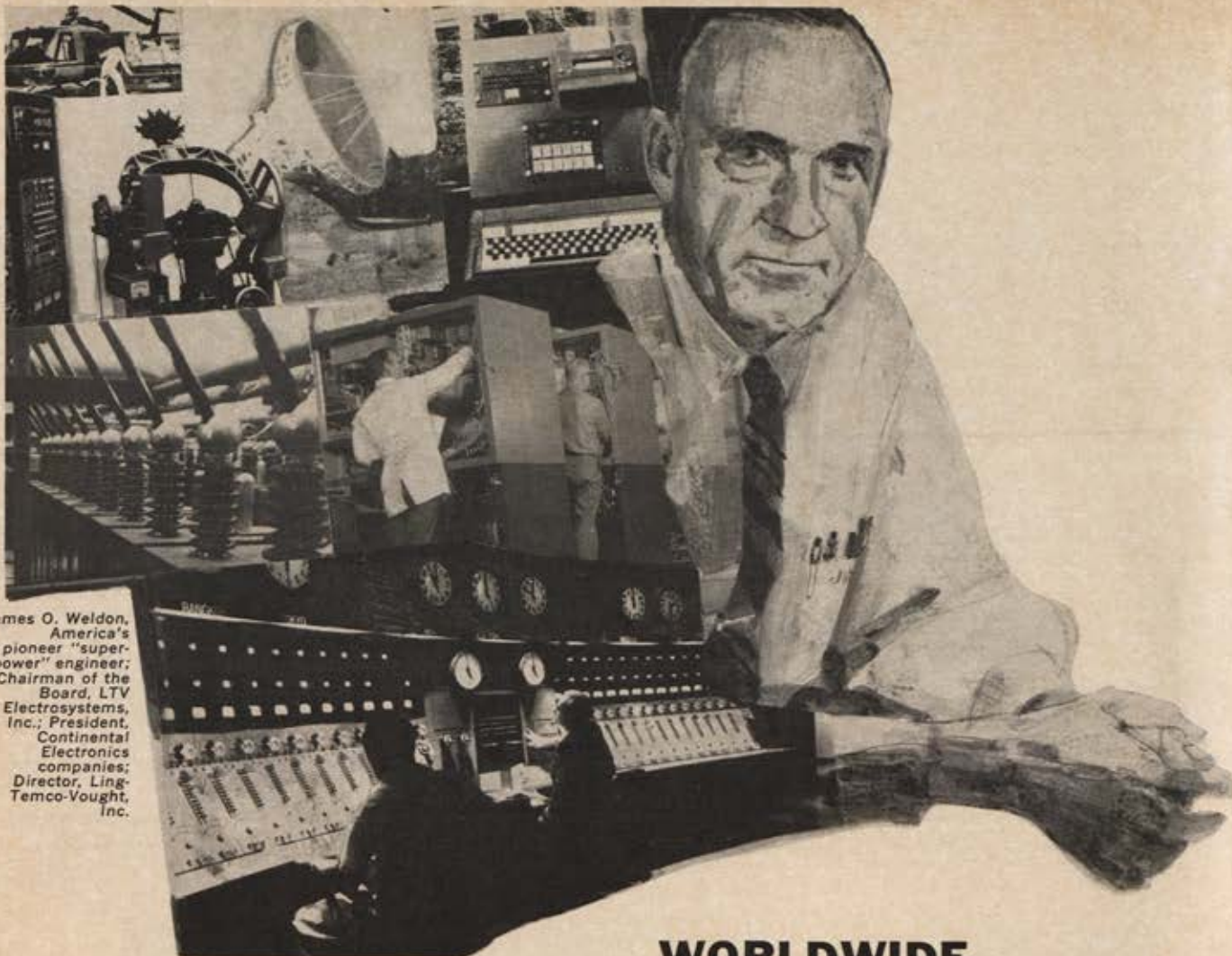
Since 1939, Westinghouse has been one of the country's foremost radar pioneers. The new Westinghouse overland radar antenna design is another pioneering step.

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20 years of USAF air



superiority



The Lockheed F-80 Shooting Star, America's first operational combat jet fighter, was on duty when the United States Air Force was created in September 1947. Over the years since then, Lockheed has designed, developed and built a whole new generation of aircraft to serve the Air Force.

Lockheed's famed Constellation series of aerial pickets has long helped guard America against enemy attack. Its two place T-33 jet trainer, of which more than 5,800 were built since 1948, strengthened the Free World's defenses. And another Lockheed aircraft, the rocket-spitting F-94

Starfire, fulfilled an urgent need for an all-weather interceptor.

In today's Air Force, the Lockheed C-140 JetStar serves as a utility transport for priority cargo and personnel. On freedom's front lines, Lockheed's "missile with a man in it," the F-104 Starfighter, serves 14 nations throughout the globe.

The C-141 StarLifter—the world's first operational fan-jet cargo airlifter—is among the most recent Lockheed aircraft to enter the service. It will soon be joined on the flight line by the giant C-5A, the largest plane in history. In addition, the fastest, highest flying

jet plane in the world—the SR-71—also has the Lockheed name behind it.

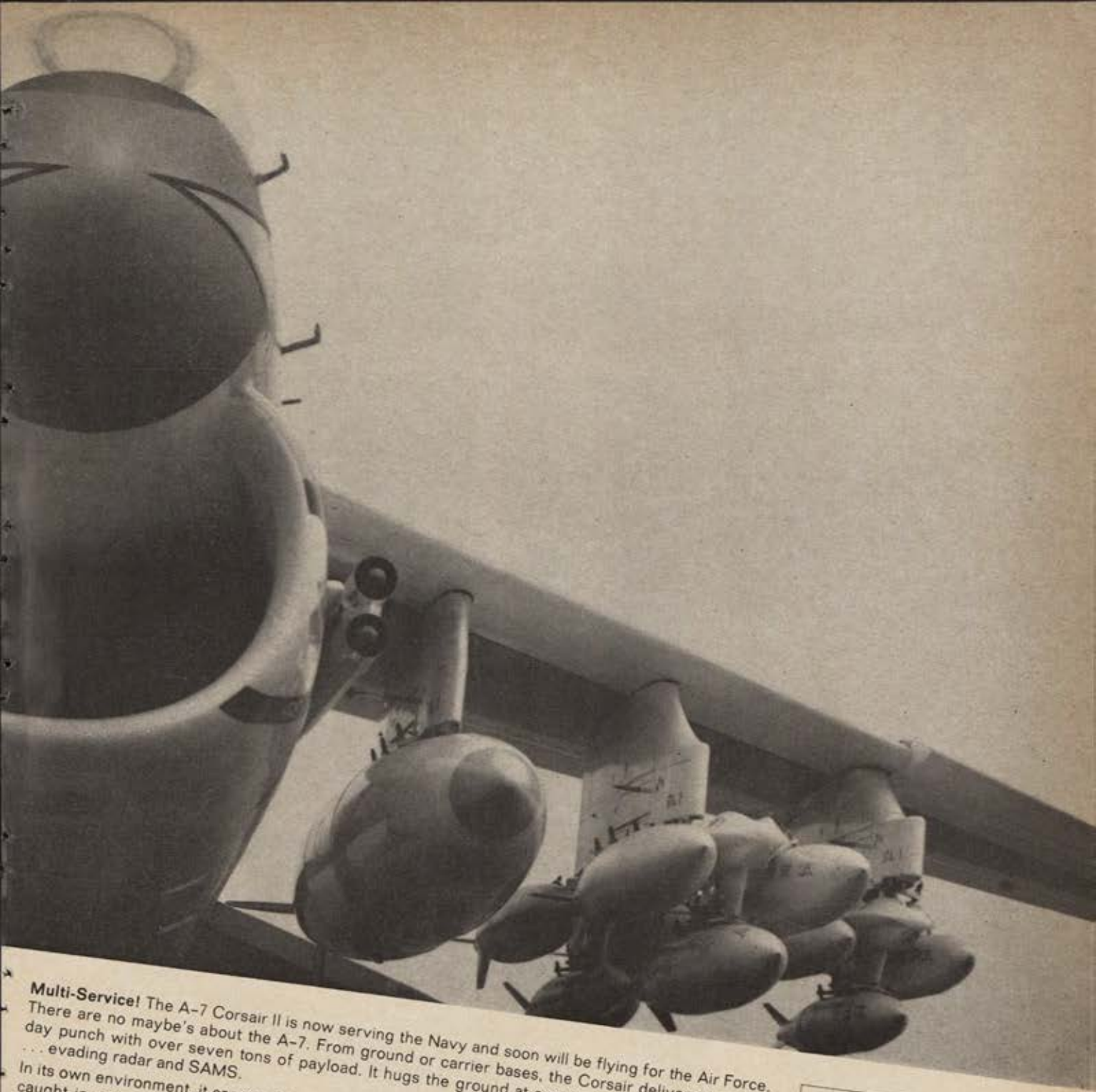
In space, with vehicles such as Agena, Lockheed is continuing to find even newer ways to serve. And looking forward to the challenging decades yet to come, Lockheed is proud to be a working partner in the United States Air Force's never-ending commitment to freedom.

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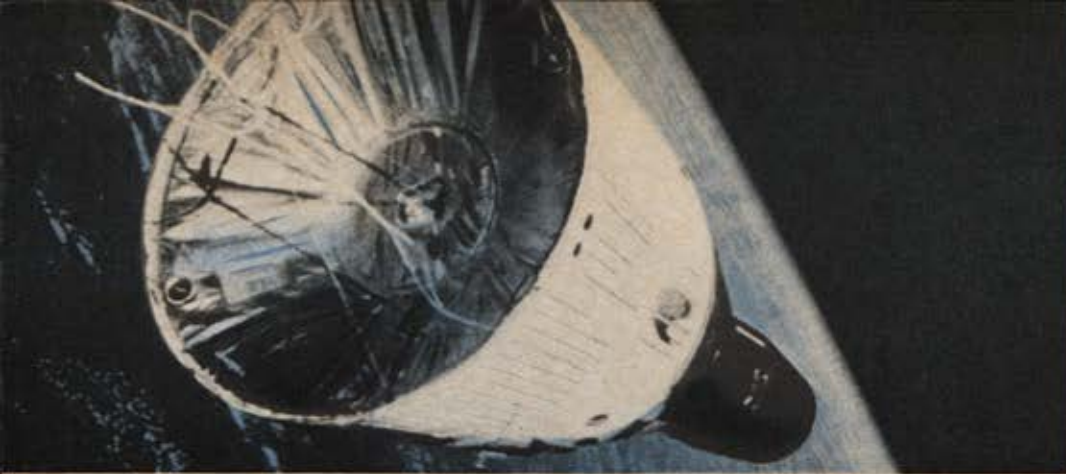
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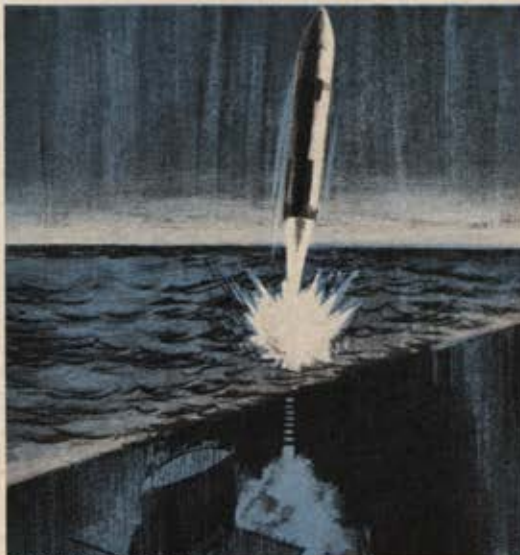
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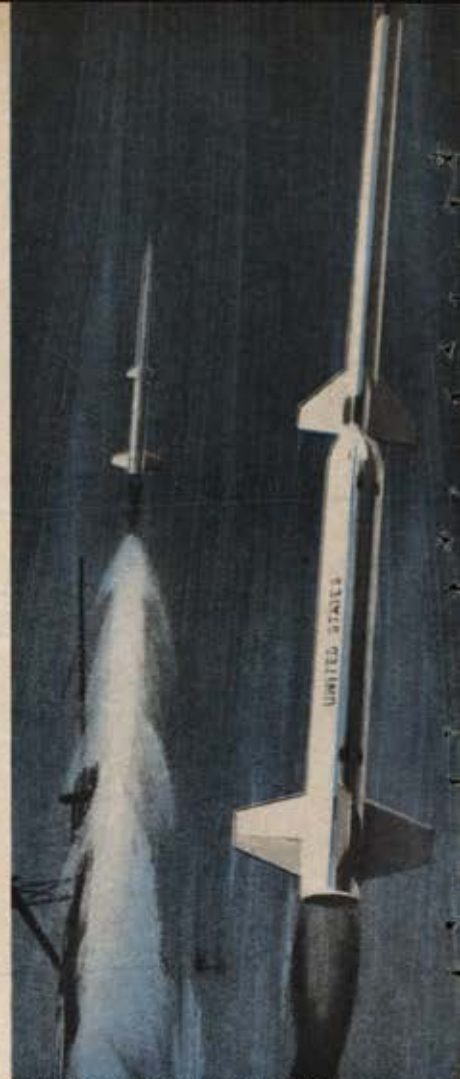
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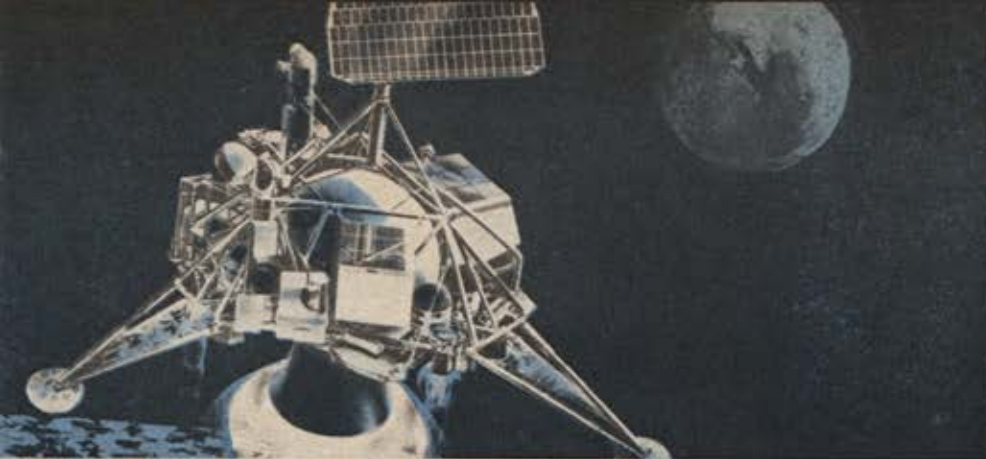
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advanced technologies for a new generation of progress in rocketry.

Thiokol Chemical Corporation

BRISTOL, PA.

SCIENCE/SCOPE

Survivability of materials in outer space is being studied at Hughes under a NASA contract. A special environmental chamber was designed to investigate the effects of high vacuum, extreme temperatures, and radiation on typical space-vehicle materials. Up to 25 specimens at a time can be mounted on its "Lazy Susan" turntable, and special experiments can be made to discover the "failure mechanism" when damage occurs.

An experimental tactical communications satellite for the U.S. Air Force is being built by Hughes under the direction of USAF's Space & Missile Systems Organization. Giant spacecraft -- biggest communications satellite ever built -- will have an array of five UHF antennas, each nearly eight feet long, extending from the top. It will be spin-stabilized, with the solar panels rotating while the antennas and inner structure remain in a fixed position.

Two new dielectric materials for encapsulating repairable high-voltage electronic components in spacecraft have been developed by Hughes. One is a lightweight polyurethane foam-in-place that has proved its long dielectric life aboard Hughes communications satellites. The other is a granular, ceramic-filled polymer with a very high filler-to-binder ratio. It is especially useful for high-voltage space and airborne networks that require dissipation of high thermal energy.

An improved infrared spectrometer for Nimbus D, scheduled for launch in 1969, is being built by Santa Barbara Research Center, a Hughes subsidiary. It will measure worldwide temperature and humidity distribution of the troposphere, providing useful data for weather forecasting. SBRC is also developing a two-channel, five-pound infrared radiometer to measure the surface temperature of Mars. It will be carried by the two Mariner flyby spacecraft to be launched in 1969.

Large, ultra lightweight structures for space are getting special attention at Hughes. Structures would be compactly packaged for stowage in the launch vehicle. In space, they'd be unfurled and inflated, then chemically rigidized. Hughes chemists have developed vapor-catalyzed and ultraviolet- and infrared-activated systems. One particularly promising system uses the vacuum of space to cause automatic rigidization of fiber-reinforced structures that have been impregnated with gelatin -- such as precision antenna parts, gravity gradient booms, radomes, parabolas. System is reversible: structures can be erected on the ground (preferably in a dry climate), tested, and then softened and repackaged.

A new photographic technique developed by Hughes scientists is based on light-induced polymerization. Photopolymer pictures can be taken, developed, fixed, and projected in 1/2-second. The continuous tone photographs have excellent contrast and high resolution. Process uses only light or light and heat...needs no developing or fixing solutions. Potential uses: data-storage and large-screen displays.

Creating a new world with electronics

HUGHES

HUGHES AIRCRAFT COMPANY

Unfettered Airpower

Gentlemen: Congratulations to Mr. Claude Witze on his July editorial "KISS in the Desert." It was certainly an enlightened approach to the principles involved and their implications.

MAJ. WILLIAM G. MEYER
APO New York

Middle East Arms

Gentlemen: I have just read your "Letter from Europe" ("Accelerating Hostility in the Middle East," by Stefan Geisenheyner, March '67 issue). This article is excellently written, but (as a result of) the outcome of the war in the Near East, it now is in some way outdated) I want to correct some errors:

1. The Soviet tanks Egypt, Syria, and Iraq received were mainly T-34/85s and T-54s. A T-55 officially does not exist. Tanks delivered until spring 1967 were manufactured between 1957 and 1959. Furthermore, they were mostly stripped in some ways (compared with T-54s used by the Soviet army) of their infrared equipment; only low-standard sight-and-communication systems were installed.

2. Egypt never will receive any "MIG-23s" because a plane called MIG-23 was never built. This designation (a purely "Western" creation) is hypothetical. The plane (MIG-23) is called by the NATO nomenclature the "Flipper," a Mach 2.3-plus interceptor prototype, shown to the public first in an overpass at the Tushino display in 1961. It is evident that this plane is called the E-166 by the Soviets, a record-breaking research plane, but always demonstrated with two radar-guided Awl air-to-air missiles. No mass production of the Flipper was ordered.

3. The USSR will not give SU-9 "Fishpot" all-weather fighters abroad in the near future because the SU-9 is the latest and most modern fighter in the Soviet air arm. There is still a shortage of this aircraft, and Soviets still are forced to use old MIG-17s and -19s besides MIG-21s and SU-7s. Furthermore, Egypt had not hesitated to sell new Soviet weapons for hard

money to other countries, e.g., the T-54 to the Federal German Republic, etc. The truth is that Egypt received some Mach 2.1 SU-7 "Fitter" planes which had been offered also to India, Iran, and Pakistan.

4. The number of weapons [scheduled to be] delivered to Syria is to be cut by seventy-five percent. A gun or a mortar needs two to five men to fire plus two to five for administration, logistics, towing, fire directing, etc. Exact number of guns and howitzers delivered to Syria is 320. Strength of the Syrian Army is 45,000 and consists of nine brigades.

The total strength of the Syrian Air Force before the war was: combat planes—MIG-21s, thirty-two; MIG-15s and -17s, twenty-five; IL-28s, two; other planes—fourteen; personnel strength—4,000 men.

Losses during the war: all MIG-21s, ten other combat planes.

FRED W. KORKISCH, JR.
Vienna, Austria

• Mr. Geisenheyner, our Editor for Europe, tells us that:

1. The T-54 in service with the Egyptian army underwent certain changes, e.g., removal of infrared equipment. Actually the tank was fully adapted to desert warfare. The treads were altered and the air intakes for engines and air conditioning changed. The result of these alterations is the T-55, a basic T-54 in desert clothing.

2. The "MIG-23" is an advanced version of the MIG-21. Externally this is barely discernible. The original MIG-21 series was very poorly equipped in electronics as well as engine controls. The Finnish and Indian Air Forces are flying the early models today and are, reportedly, far from happy with them. The technological advances of more than ten years were incorporated in an advanced version of the old -21, retaining the basic airframe. For sheer simplicity we call it the MIG-23.

3. During the latter part of last year a number of SU-9s were observed refueling over the Mediterranean, flying in the direction of Egypt.

Today we know that they must have been an element of the Red Air Force on a long-range training mission since these aircraft did not make an appearance during the Israeli-Arab conflict. At the time, however, it was assumed that they were flying to the UAR to bolster the obsolescent MIG-21 fleet.

4. Press reports circulated early this year pointed to a considerable influx of weapons through the Syrian ports. It was assumed that the weapons were to be used to equip or reequip the Syrian army.—THE EDITORS

Demise of the Service Number

Gentlemen: Reference the letter in "Airmail" entitled "Numbers Racket," in the July issue.

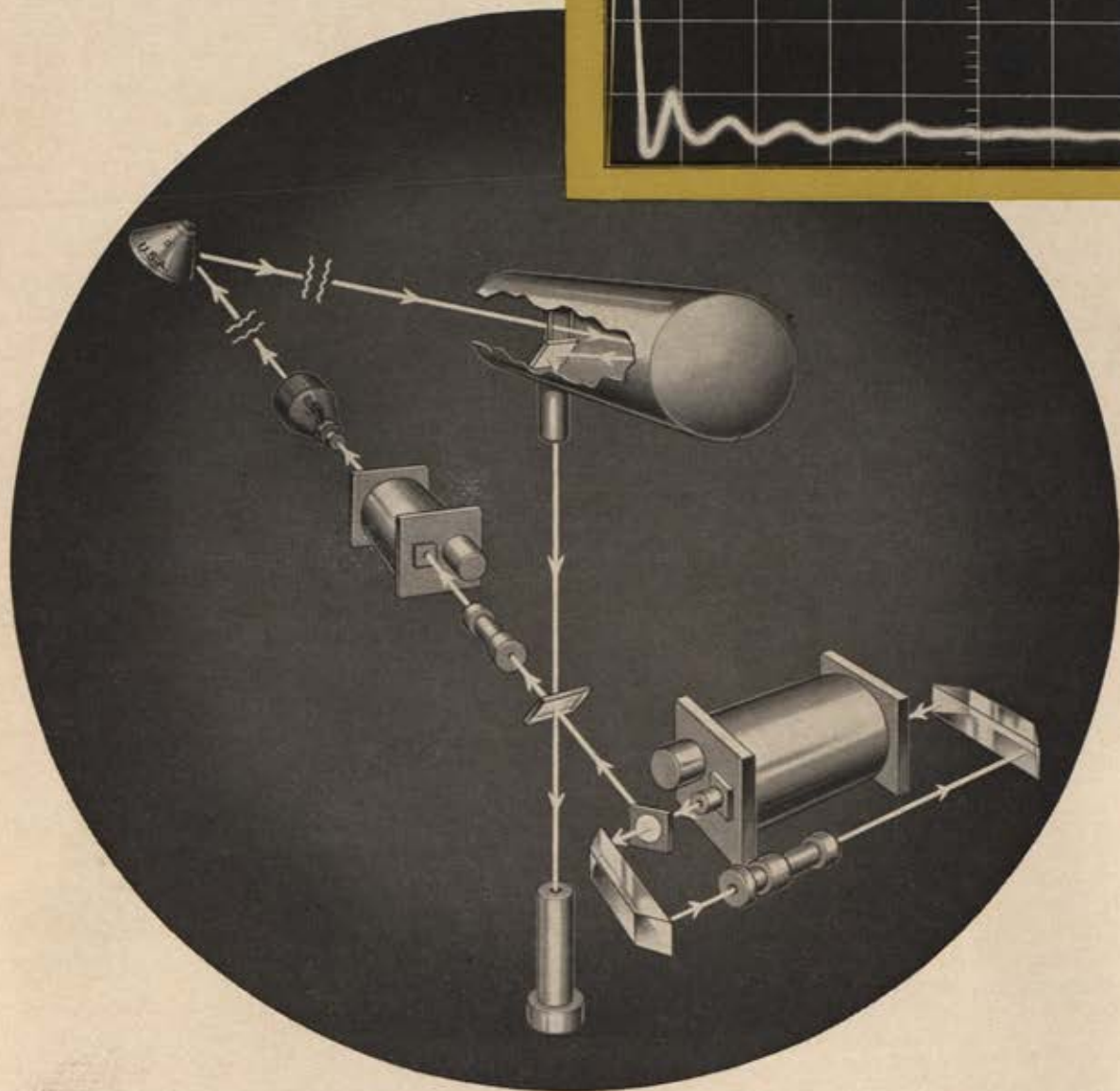
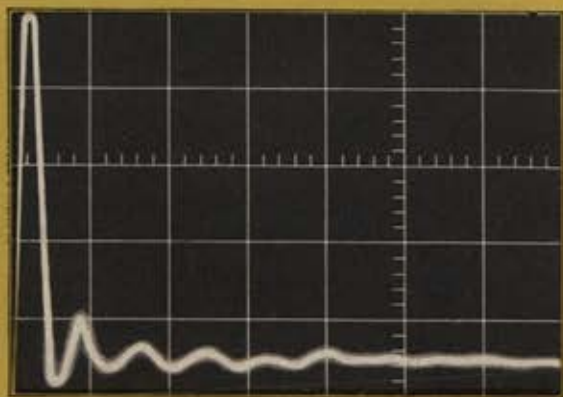
Such complaints are balderdash. I cite to you the most recent list of selectees for permanent lieutenant colonel, Regular Air Force.

One officer in the list was a classmate of mine at a service school in 1946. He acquired an insignia change from major to lieutenant colonel as the result of his selection for permanent promotion on their recent list. That was twenty-one years ago when we were classmates.

Another officer serving on active duty and a selectee for brigadier general also was selected as a permanent lieutenant colonel on the above mentioned list. These two officers are separated by 433 files, and the brigadier general selectee has the higher digital service number.

This is just one example. There are literally thousands in all services. Only service academy graduates and a few other exceptions by school class, geographical or elemental commissioning in sequence, can identify their standing within their own minor grouping. This facility does little to promote morale for anybody except "nonprogressive traditionalists."

Military personnel are a minority including all the war veterans of all wars who are still living. The Social Security number is for the majority. The Social Security number is a necessity.
(Continued on page 15)



ELECTRO-OPTICAL SPACE SYSTEMS

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ALTIMETRY

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SPACE LASER

SURVEILLANCE

RECONNAISSANCE

New laser radar techniques promise space rendezvous velocity accuracy of 1 ft./sec.

At Raytheon, advanced techniques have created a unique laser pulse doppler radar whose single-mode transmitted pulse can be optically heterodyned with a target echo. Such equipment promises major improvement in space rendezvous and docking accuracy.

The optical radar consists of a pulsed single ruby-laser master oscillator, optical isolator and power amplifier. In operation, the master oscillator produces a high intensity spike followed by a low-power CW pulse. This output reference signal is then optically heterodyned with the target echo to accurately determine velocity using optical doppler techniques.

The advanced concepts that produced this doppler laser radar are also being applied to many other areas of Raytheon's total systems capability. For complete information, please write or call: *Manager, Advanced Program Development, Raytheon Company, Space & Information Systems Division, 528 Boston Post Road, Sudbury, Mass. 01776; Tel.: (617) 443-9521.*



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sary identity number for all citizens and persons falling within the law. This includes all citizens in the military entitled to Social Security benefits, notwithstanding their relative rank.

Military personnel are distinctively set apart like convicts with service peculiar numbers. The use of the Social Security number will be another step in giving the military careerist broader citizenship status, which has been difficult in coming to him because of "traditionalist" attitudes. Military service numbers are in the same class as black powder and saddle bags, not to mention Cavalry spurs on pilots' boots.

The US does not need, nor does it meet, the principles set forth by the founding fathers to distinctively number military personnel just so you can distinguish them from so-called "civilians." We were, are, or will be civilians—all of us, thank God.

The cost of changing the system will be recovered a thousandfold once the old service numbers are discarded.

As for the "Numbers Racket," that was my professional specialty for over thirty years. I know what I am talking about, and the Department of Defense agrees with me. I suggest that Colonel McCormack memorize his Social Security number. He will have almost 200 million classmates.

COL. STANLEY A. FULCHER,
USAF (Ret.)
Bossier City, La.

UNIT REUNIONS

29th Bomb Group (VH)

A reunion is being planned for former members who served with this B-29 Group on Guam. For further details former members should contact

James D. Baird
P. O. Box 5188
Madison, Wis. 53705

Air Traffic Control Association

The 12th National Convention of the Air Traffic Control Association will be held at the St. Paul Hilton Hotel, St. Paul, Minn., October 1-4, 1967. For further information contact

Clifford P. Burton, Exec. Dir.
ATC Association, Inc.
Suite 409, ARBA Bldg.
525 School St., S.W.
Washington, D.C. 20024

AMD Conference

An "Airline Management Development" Conference is being held by the Transportation Center at Northwestern University on September 13-14, 1967. Airline executives and others interested in information regarding the Conference should write to

Kenneth E. Schaeffle
Director, Management Programs
The Transportation Center
Northwestern University
1818 Hinman St.
Evanston, Ill. 60204

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Toward Newer Horizons

BY CLAUDE WITZE

Senior Editor, AIR FORCE/SPACE DIGEST

THIS issue of AIR FORCE/SPACE DIGEST, which could be subtitled Looking Backward, is a useful exercise and not only because it documents these twenty years of USAF history. The requirement has forced our editors into contemplation and reminiscence; we have been through the scrapbooks and browsed in our own library.

We discovered to our consternation that some scoundrel had stolen our copy of *Toward New Horizons*, the historic study of 1945 in which Dr. Theodore von Kármán and a distinguished panel of experts looked ahead for twenty years and conjured up a blueprint called "Science, the Key to Air Supremacy." A borrowed copy has filled the void.

It is a fascinating document and cannot be mentioned in 1967 without reference to the fact that the byline of H. S. Tsien appears over no fewer than six contributed essays. Tsien then was one of America's leading rocket scientists. Now he is Red China's leading rocket scientist. Which recalls the fact that when Tommy White retired as USAF Chief of Staff he predicted that Communist China would become a first-class atomic power and threaten the entire world. That was in 1961.

There is no room here to review the entire von Kármán report, but a few items are worthy of mention. One is its recognition that the bombing methods used in World War II did the job, but were not going to be satisfactory in the future. Looking forward to supersonic flight, all-weather operation, and a wide arsenal of atomic (*sic*) weaponry, the report called for "revised" bombing equipment. The authors did not foresee a future war in Vietnam, fought with iron bombs. Or that USAF's pilots in 1967 would testify that there has been little, if any, improvement in the accuracy of delivering conventional ordnance since World War II.

The 1945 report says that one of the great defense problems will be the threat of the missile. The authors seemed to assume that future rockets would be winged.

"No serious attempt has yet been made to hit a projectile or missile moving with, say, twice the velocity of sound," the paper says. "However, by adapting the target-seeking principle to winged rocket

projectiles, it should be possible to accomplish this aim, provided location and warning occur sufficiently in advance."

The papers come reasonably close to the techniques being exploited today in the antiballistic missile program. There is mention of jamming equipment, decoy targets, and "the possibility of premature explosion or otherwise incapacitating missiles by means of some form of ray."

"If the missile carries a proximity fuze," the paper continues, "it may indeed be possible to operate it by a suitable electronic jammer and thus explode the bomb, whether it consists of atomic or ordinary explosive. In the absence of a proximity fuze or of a system for remote electronic control of detonation, science offers no prospect of detonation at a distance."

"The interaction of electromagnetic radiation with matter has been thoroughly investigated from long radio waves through microwaves, infrared, visible light, ultraviolet, X-rays, gamma rays, to cosmic rays."

The conclusion is that because waves spread the way they do, it is not easy to concentrate radiant energy at a distant point. There is no mention of the laser. On the other hand, all is not hopeless.

"One possibility in the future," the report speculates, "may be the rocket barrage with atomic warhead." Now we know a more likely answer is the rocket barrage with thermonuclear warhead.

Nuclear propulsion is mentioned frequently in the report in reference to both airplanes and rockets. Both uses have remained lively subjects, despite the demise of USAF's initial project a few years ago. When Charles E. Wilson was Secretary of Defense he characterized the nuclear airplane project (ANP) as a shitepoke, and there is not much convincing evidence that the man was wrong in this case.

Even the von Kármán report opined that atomic power for a manned aircraft would have to be in the distant future, but urged an attack on the problem. It was more optimistic about an application of atomic propulsion to rocketry or pilotless airplanes, and in this connection the word "satellite" makes its only appearance in the text.

That lonesome notation, plus the complete absence of any discussion of possible military operations in



This 1959 photo was taken at dedication of von Kármán Gas Dynamics Facility at Arnold Engineering Development Center in Tennessee. Left to right: Dr. von Kármán, Dr. Hugh Dryden, Lt. Gen. Bernard A. Schriever, then ARDC Commander, and Maj. Gen. Troup Miller, Jr., AEDC Commander. Dr. Dryden was the speaker at ceremony unveiling portrait (in background) of Dr. von Kármán and his sister, Pipő.

space, has long been an item of curiosity about the von Kármán report. In 1963, the year Dr. von Kármán died, this reporter wrote to Dr. Hugh L. Dryden, then Deputy Administrator of the National Aeronautics and Space Administration, and asked him why space was neglected in *Toward New Horizons*. Dr. Dryden, now also deceased, had served as deputy director for science under Dr. von Kármán on the 1945 AAF Scientific Advisory Group.

Dr. Dryden replied that in 1945 "the realization of satellites was felt to be dependent on nuclear developments. There was nothing foreseen in space travel, and the present form of ICBM was not foreseen.

"The forecasts which were made were generally based on only moderate extrapolations of the state of the art as then represented principally by German experience, although some at the time did not regard the extrapolation from V-2 to rockets of intercontinental range as moderate."

Dr. Dryden made further comments that are worth putting down for their historic interest:

"Neither von Kármán nor myself had a very enviable record about foreseeing the present development of astronautics. We were rather conservative engineers. On the fiftieth anniversary of flight in 1953, I proposed that 'taking into consideration the speed at which guided missiles travel, that at which models have been propelled, the experimental data from hypersonic experiments in wind tunnels and ranges, and the theoretical calculations which have been made, we may reasonably suppose that a satellite vehicle is entirely practicable now and that travel to the moon is attainable in the next fifty years.'

"A year later [1954] von Kármán wrote that he did not 'want to be either too skeptical or too enthusiastic. . . . It is improbable that a return [from space] can be achieved without using rocket power as a brake. This of course means an enormous amount of fuel reserve. . . . It appears to me that the use of nuclear energy will make the rocket so much more efficient that serious attempts to build a spaceship should await the advent of the nuclear rocket. . . .

"Perhaps the effort necessary to proceed from the

present-day long-range high-altitude rocket to a manned space rocket is no more than the effort which led from the Wright brothers' airplane of 1903 to today's supersonic aircraft.'

"These extracts will suffice to show the danger of attributing too much significance to prophecies for ten years ahead," Dr. Dryden commented. "Those of us carrying the responsibility of making good on our promises might well adopt von Kármán's statement—I do not want to be either too skeptical or too enthusiastic."

To those of us who knew Dr. Dryden well, this conclusion did not need to be spelled out. The man was a great scientist, and his contributions to aeronautics and astronautics should be cataloged in printed tribute. But he was a conservative—he was a lay preacher in his church and a man who practiced infinite pains in his profession—who recognized that it is necessary to make technical decisions on the basis of what he called "imperfect knowledge."

It is hard to conclude that Theodore von Kármán was in the same conservative coterie as the solid Dutchman Hugh Dryden. Dr. von Kármán was a Hungarian genius whose unbounded energy and eagerness to explore unknowns will become more widely known with the publication this month of his autobiography. The book is called *The Wind and Beyond* (Little, Brown & Co., \$10) and was written with the help of Lee Edson, who had the book under way when Dr. von Kármán died, and finished it by himself.

This outstanding study in itself is a chapter in the history of the US Air Force. It will be reviewed in a forthcoming issue of this magazine. In the book, Dr. von Kármán tells the story of how he met with Gen. H. H. "Hap" Arnold at La Guardia Airport in New York in 1944 for a secretive conference in a parked automobile. He quotes the General as saying:

"We have won this war, and I am no longer interested in it. I do not think we should spend time debating whether we obtained the victory by sheer power or by some qualitative superiority. Only one thing should concern us. What is the future of airpower

(Continued on page 22)

**Portable nuclear power:
it works where
nothing else will.**





Martin Marietta is producing small nuclear power systems that provide reliable electric power where it has never been possible before. One system under development controls the flow of oil from undersea oil wells. It will sit on the ocean floor and operate unattended for years at a stretch. Other systems are supplying electric power for weather monitors, radio transmitters and navigation lights.

Martin Marietta is now manufacturing small nuclear power systems for commercial use. These systems are designed to meet low power requirements in locations where it's impossible or too expensive to maintain a conventional power source.

At the heart of each system is the LCG, a nuclear generator which produces 25 or 50 watts non-stop for five years without maintenance. The 50-watt generator produces over 2-million watt-hours without refueling.

The generator has no moving parts, so never wears out. It converts the heat produced by its radioisotope fuel core directly into electricity through thermocouples. The unit is about three feet long by two feet in diameter and weighs 3000 pounds. Price, with five years of fuel, \$63,320.

Systems can operate on a cyclical basis, automatically storing power in batteries when it's not needed. Power output of the system can thus be stepped up to several hundred watts.

Martin Marietta built its first nuclear generator for the Atomic Energy Commission in 1959.

The LCG system now being developed for the offshore oil industry will be placed atop wells on the ocean floor. On command by acoustical signals transmitted through the sea, the system will turn valves on and off, sending oil up to a tanker or a barge. A central console on the surface will monitor and control units on up to 10 wells.

We also are developing a system which will use portable nuclear power to prevent costly and destructive "blow-outs" during the drilling of a well.

Portable nuclear systems could be the answer to many of the remote power problems of the offshore oil industry, now engaged in exploration or production in over 60 nations.

The future for portable nuclear power is bright. Any government or industry needing advanced types of remote communication, monitoring and control systems is a potential user.

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Our Nuclear Division has for several years been conducting studies of uses for LCG nuclear systems in remote areas. Some of this work may relate to areas in which you are interested. For further information, write Nuclear Division, Martin Marietta Corporation, Baltimore, Maryland 21203.

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MARTIN MARIETTA



At first meeting of Scientific Advisory Board (formerly the Scientific Advisory Group) in Pentagon, June 1946, are seated from left: Dr. George E. Valley, Jr., Dr. Frank L. Wattendorf, Dr. George A. Morton, Dr. Nathan M. Newmark, Dr. Walter S. Hunter, Dr. Lee A. DuBridge, Dr. Detlev Bronk, Dr. Theodore von Kármán, Dr. Charles W. Bray, Dr. C. Richard Soderberg, Dr. Courtland D. Perkins, Dr. Charles S. Draper, Dr. Harold T. Friis, and Dr. William R. Sears. Standing, from left: Dr. Pol E. Duwez, Dr. Hsue-shen Tsien, Dr. William H. Pickering, Dr. Ivan A. Getting, Dr. W. J. Sweeney, Dr. W. Randolph Lovelace, II, Dr. Julius A. Stratton, Dr. Duncan P. MacDougall, Dr. Edward M. Purcell, Dr. Vladimir K. Zworykin, Dr. Fritz Zwicky, Dr. Robert H. Kent, Col. William S. Stone, and Col. Roscoe C. Wilson. Members not present at this meeting were Prof. Enrico Fermi, Dr. George Gamow, Dr. Hugh L. Dryden, Dr. Walter A. MacNair, and Col. Benjamin C. Holzman. Many of these men, who contributed to the recommendations in *Toward New Horizons*, still are active in military aerospace, including Dr. Tsien, who is credited with a major role in the rocketry programs of Communist China. Dr. von Kármán was disappointed in early implementation of his committee's suggestions and gives credit to Stuart Symington, first USAF Secretary and now a Senator from Missouri, for fighting to get congressional approval and funding.

and air warfare? What is the bearing of the new inventions, such as jet propulsion, rockets, radar, and the other electronic devices?"

"What do you wish me to do, General?" von Kármán said.

"I want you to come to the Pentagon and gather a group of scientists who will work out a blueprint for air research for the next twenty, thirty, perhaps fifty years."

That is when the Scientific Advisory Group, father of the present Scientific Advisory Board, was born. Not long after this, the first meeting was held, and General Arnold came up with his prediction:

"I see a manless Air Force. I see no excuse for men in fighter planes to shoot down bombers. When you lose a bomber, it is a loss of 7,000 to 40,000 man-hours, but this crazy thing [V-2] they shoot over there takes only 1,000 man-hours. For twenty years, the Air Force was built around pilots, pilots, and more pilots. . . . The next Air Force is going to be built around scientists—around mechanically minded fellows."

Well, the war in Vietnam comes to mind again. There are no men in fighter planes shooting down bombers, but there are pilots, pilots, and more pilots. There is a shortage of pilots.

And, at that 1944 meeting, von Kármán says Hap Arnold came up with a requirement. He didn't know about Vietnam, but he said, "We want to fly over enemy territory and look through the leaves of trees and see whether they're moving their equipment." We still do.

The von Kármán group, of course, settled on the most modest request from the General. The group looked twenty years ahead. From time to time there still are efforts to look ahead. USAF had a flurry of excitement a few years ago with Project Forecast, which consumed far more talent and effort than its impact seems to have justified. And Dr. von Kármán, in his book, probably has defined the secret of why his 1945 accomplishment cannot be repeated:

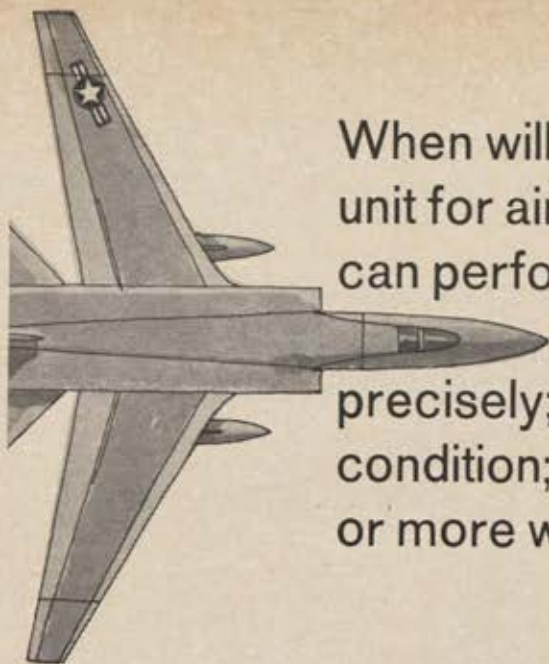
"What is the ultimate consequence of the vision of Hap Arnold and of our report, *Toward New Horizons*?"

"One thing that has emerged is the great desire on the part of the Air Force to continue with research and with scientific planning in unknown fields."

"In 1953, for instance, the Air Force General Staff asked me to write another report on the future—a sequel to the 1945 report. I thought about it and said no, it couldn't be done by the Board alone. The field has grown too much since the war's end, and the unique opportunities of 1945 were no longer available to me or anyone else."

"In 1945 with the Great War just concluded you could sit down with every war scientist and persuade him to reflect on the future. It is difficult to do this again, especially in a time of cold war when the political future of the world has elements of great uncertainty. The best that could be done, I told the General Staff, was to make a continuing series of studies on a modest scale."

When Dr. von Kármán rejected the project in 1953, (Continued on page 25)



When will someone build a checkout unit for aircraft electronics that can perform 600 tests in 5 minutes; pinpoint faults precisely; verify its own go-no-go condition; and operate 25,000 hours or more without major overhaul?

Autonetics already has



It is the C-93 BACE (Basic Automatic Checkout Equipment) which has spent more than a quarter-million hours keeping Navy and Marine aircraft battle ready. This same performance and reliability is being designed into Autonetics' new drawer-sized checkout unit called MINI-BACE, now in development.

North American Aviation  Autonetics Division



...and now the Army

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Unique protection against foreign object ingestion permits successful operations in primitive environments . . . New Guinea, Sudan, and Alaska. Maintenance? The entire power section of the T74 can be removed in the field for easy service. The T74 is now doing the job—reliably—for three services.

**United
Aircraft**
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In 1960, General Dynamics Corp. came up with this design for an atomic-powered aircraft. The proposal called for two nuclear engines in the tail and two conventional engines mounted under the wings. The 1945 von Kármán report saw this type of airplane in the distant future, and said the problem should "be attacked urgently."

USAF turned to the National Academy of Sciences, and the Woods Hole Study was created. The 1945 report was reviewed and seems to have been criticized because it was so conservative.

Here the satellite project is brought up again, and Dr. von Kármán discloses that he supported a RAND Corporation proposal that one be launched. And at the Woods Hole meeting in 1957 a program was set up to study the problem in detail.

But, complains Dr. von Kármán, "instead of agreeing with our plans, the Air Force told us to 'play down' space because it was a 'dirty word' in Congress and would only result in budgetary trouble. One well-known politician, who came up from Washington, remarked to a general with him: 'Be careful. Satellites exist only in the minds of the professors.'"

Three months later, Sputnik went up.

Dr. von Kármán's opinion that the 1945 exercise cannot be repeated has sound support in the most authoritative circles. Chester N. Hasert, who was a member of the 1945 group and still serves as technical director of the Scientific Advisory Board, points out how much more sophisticated the Air Force is today than it was when General Arnold pleaded for help. Also, that the nation's laboratories are busy today and they know which directions to take. As the war ended, there were idle laboratories practically faced with the same kind of demobilization that was sweeping the military forces. *Toward New Horizons* helped keep them in action for the technological phase of the cold war to follow.

Long-range planning now is fully incorporated into USAF. And the in-house laboratories are geared not only to look ahead but, increasingly, to cope with the day-to-day problems that come out of new weapons development and the war in Vietnam.

Nowhere is this flowering of the von Kármán philosophy more evident than it is in the Air Force Systems Command, which has eight laboratories. Each of them is growingly concerned with current problems and is expected to profit from this experience when it takes

a look down the road at future aerospace requirements.

USAF's own propulsion laboratory, for example, is deeply involved in the work on improved intake configurations for the F-111 airplane, described as "a real challenge in propulsion and flight dynamics."

This illustrates the theory that work on today's complexities provides a stepping-stone to the things ahead. For being involved in the F-111, the USAF laboratory presumably will be better equipped to determine what a Mach 5 air intake must look like.

And the avionics laboratory is involved in the applications of electronic warfare in Vietnam. The most important projects are highly classified, but bits and pieces of the effort applied in Rome, N. Y., are being exploited and perfected in the jungles today.

The armaments laboratory, which was ordered to stop development work on iron bombs in 1958, now is described as "going full bore."

AFSC has a twelve-man office integrated with the Seventh Air Force in Saigon, and four of these men spend all their time in the field. Their job is to make sure the crews have what they need, and that it works. R&D activity is being brought closer to the using command at home and abroad.

All of this is part of the changed environment that surrounds USAF for its twentieth birthday. It was accurately expressed a few years ago by Gen. James Ferguson, now AFSC Commander, in an address in which he recalled that 1945 was the year that "we suddenly knew we had arrived at a new age—the Atomic Age. By the early '50s, it was clear that the Missile Age was upon us—and before that decade was out, we had reached the Space Age.

"The most startling thing about this bursting forth of technology is the increased pace of change. Technology seems to be rushing headlong into the future. The newest succeeds the new. It's a common joke among engineers that if you know how to build a thing, it's obsolete. In fact, if you don't stay alert today, you may miss an Age as it goes past."—END

AEROSPACE WORLD

By Allan R. Scholin

ASSOCIATE EDITOR, AIR FORCE/SPACE DIGEST

WASHINGTON, D. C., AUG. 21

Air Force and Navy pilots intensified their fighter-bomber raids on North Vietnam early in August when the White House removed more key targets from the restricted list. The pilots knocked out the center span of a bridge only a mile and a half from downtown Hanoi, a main rail and highway link with Red China. In recent weeks the White House had forbidden attacks within ten miles of Hanoi.

The stepped-up action was attributed in part to a report brought back to President Johnson by two special emissaries—Gen. Maxwell Taylor, former JCS Chairman and Ambassador to South Vietnam, and Clark Clifford, a veteran presidential adviser—that leaders of four Southeast Asian nations with whom they conferred had expressed approval of US raids against North Vietnam.

One potential leader who may not entirely share that view is Nguyen Van Thieu, South Vietnam's present

chief of state and leading candidate for president. He announced that if he is elected, one of his government's first tasks will be to invite peace talks with North Vietnam. To that end, he said, he would consider asking the US to stop the bombings, "if I learned privately that this would bring a good response" from Hanoi.

With South Vietnam's elections scheduled for September 3, President Johnson and military advisers could have decided to hit North Vietnam hard in the meantime to reduce as much as possible the flow of goods and men to the South before the newly elected leaders may request a bombing pause. In view of the sustained efforts by the US to promote free elections in South Vietnam, it could be embarrassing to ignore such a request.



In last December's issue (page 37), this magazine reported on an F-105 pilot in Thailand who had just completed 100 missions over North Vietnam but instead of coming home had chosen to volunteer for a second tour. The pilot was 1st Lt. Karl W. Richter, who had shot down a MIG-21 in September 1966. Twenty-three years old at the time, he was the youngest US pilot to score a kill in Vietnam.

Lieutenant Richter had only two more missions to go on his second hundred when his plane was hit by enemy fire over North Vietnam on July 28, and he was forced to eject. Only twenty minutes later an HH-3E rescue helicopter penetrated heavy cloud cover to pick him up. But the young lieutenant who had flown 198 missions over North Vietnam, more than any other USAF pilot, had landed on the side of a mountain and sustained severe injuries when he fell or was dragged by his chute over a cliff. A pararescueman, SSgt. Charles D. Smith, was lowered 150 feet to

where Lieutenant Richter lay unconscious. He was hoisted into the helicopter, but died en route to the recovery base.

A 1964 graduate of the Air Force Academy, Lieutenant Richter went on to pilot training and was assigned to the 388th Tactical Fighter Wing in Thailand in April 1966. Despite his junior rank, he was often selected to lead raids against significant targets in the heavily defended Hanoi area.

Born in Holly, Mich., October 4, 1942, Lieutenant Richter was the son of Mr. and Mrs. Ludwig Richter of Holly. He was unmarried.



Townsend Hoopes, Deputy Assistant Secretary of Defense (ISA), will succeed Norman S. Paul as Undersecretary of the Air Force upon the latter's retirement on September 30.

Mr. Hoopes, forty-five, is a native of Duluth, Minn., and a graduate of Yale and the National War College.



—Wide World Photos

Maj. Bernard F. Fisher, right, who became the first US Air Force Medal of Honor winner for heroism in Vietnam, receives the 1966 Cheney Award from Gen. John P. McConnell at a Pentagon ceremony on August 10. The award is presented annually for an outstanding act of valor in connection with aircraft.



First Lt. Karl W. Richter, the youngest pilot to shoot down a MIG over Vietnam, died in an HH-3E rescue helicopter after his plane was hit by enemy fire over North Vietnam. Lieutenant Richter, an F-105 Thunderchief pilot, was flying his 198th mission—just two from completion of his second tour.

AFA President Bob Smart receives Legion of Merit from USAF Chief of Staff Gen. J. P. McConnell on retirement as Air Force Reserve brigadier general. Meanwhile, Smart has just been elected a vice president of North American Aviation.



Twenty years ago he served as an assistant to the first Secretary of Defense, James V. Forrestal. Before returning to the Pentagon in 1964 as deputy for Near East-South Asia affairs in DoD, he was a partner in a New York City management consulting firm.

Mr. Paul became Air Force Undersecretary in October 1965, after more than four years as an Assistant Secretary of Defense.

In other high-level Pentagon changes, Paul R. Ignatius has been appointed Secretary of the Navy. His former post as Assistant Secretary of Defense for Installations and Logistics went to Thomas D. Morris, who had been Assistant Secretary for Manpower. Mr. Morris is no stranger to his new assignment, for he preceded Mr. Ignatius in that post.



Reports that the combat readiness of Minuteman II missiles, now replacing Minuteman I in SAC silos, is suffering from excessive component failures, particularly in guidance systems, were answered recently by Air Force Secretary Harold Brown.

He admitted problems are being encountered, but said they are to be expected.

Any weapon system is subject to periods of "down time," while repairs are being effected, he said. As a new and more advanced system, Minuteman II "has initially had a higher rate of component replacement and, therefore, a lower alert rate than the relatively mature Minuteman I." He added, however, that "the percentage of the over-all Minuteman force which is maintained on alert is substantially higher than that of other missile systems or bombers."

As the "learning process," both in manufacture and maintenance, rises, he explained, "components are being replaced less frequently, and the number [of missiles] on alert is going up."

Besides, he said, "the effectiveness of a missile depends not only on its alert rate but on the reliability and

accuracy with which it will fly to its destination and place its payload on a predetermined target. The over-all performance of Minuteman II when fired from alert status has been outstanding by any standard." Of thirty-nine launches from USAF test ranges, he declared, all but two have been successful.



Reversing a recent USAF trend, only colonels—or lieutenant colonels who have been selected for promotion—will be eligible to attend the senior service schools—Air War College, National War College, Industrial College of the Armed Forces, and comparable schools of sister and allied services during FY 1969, USAF has announced. The maximum age criterion has been increased by two years, to age forty-eight.

In selecting officers for attendance at intermediate service schools, such as Air Command and Staff College, time-on-station requirement for officers in CONUS assignments except on stabilized tours has been reduced to twelve months. For those in stabilized assignments and on long tours overseas, the requirement is cut to twenty-four months. Officers in short-tour overseas areas, notably Vietnam, must have a return date coinciding with the date school starts.

Two main objectives are served by these changes—first to offset the losses

Chief Master Sergeant of the Air Force Paul W. Airey receives his AFA membership card and pin from AFA Executive Director James H. Straubel. Airey joined upon accepting invitation to serve as adviser to AFA's Airmen Council.



in student enrollment because most pilots below colonel are required elsewhere; and, second, to get eligible officers through school now so that more spaces will be available later for Southeast Asia returnees.



War has been declared by pilots of the USAF Tactical Fighter Weapons Center at Nellis AFB, Nev., against those of the Tactical Air Reconnaissance Center, Shaw AFB, S. C.

The conflict flared up over an article by Maj. Robert W. Pitt, published in the *Tactical Air Reconnaissance*



Townsend Hoopes, a native of Duluth, Minn., and Deputy Assistant Secretary of Defense (ISA), will become Air Force Undersecretary upon retirement of Norman S. Paul September 30.

Digest, in which he noted that "an extremely wise philosopher once defined reconnaissance pilots as fighter pilots with brains. . . . Today's tactical reconnaissance training," said Major Pitt, "certainly lends validity to the premise. . . . If there are, perchance, some pilots who still don't accept the hypothesis of the wise old philosopher, there is yet hope that they, too, may
(Continued on page 30)

Living Under the Sea: A report from General Dynamics

The public address speaker screams, "Dive, dive!" In the flickering light of a dank interior, sweaty bearded sailors tumble to battle stations. . . .

This Hollywood image of a submariner's life was, even during World War II, largely stereotype. It is a far cry from life in today's United States Navy nuclear submarines.

Even though about three-fourths of the ship's interior is taken up by machinery, weapons and stores, there's also room for up to 136 men to eat, sleep, relax, work efficiently and remain alert. The sailors who man these submarines on continuously submerged patrols for two months at a time lead a surprisingly comfortable life.

Here's a fairly typical day for nuclear submariner Bill Reilly, Electronic Technician Third-Class.

0700 hours. ET/3 Reilly is awakened by a shipmate. Along his bunk's 6'6" length—long, wide and deep enough for comfortable sleep—recessed fluorescent fixtures dispel the night. Another "day" has begun.

30,000 meals:

0715 hours. Reilly's baritone bounces around the private stall shower. He need not worry about quick sudsing and rinsing; nuclear submarines can distill an ample supply of fresh water.

0730 hours. Breakfast time. More than 30,000 individual meals will be served during the ship's extended patrol—prepared in a galley smaller than the kitchen of an average suburban home. The galley has been laid out to a careful time-space-motion plan. Provisions are stored for easy accessibility in planned sequence. Meat is pre-trimmed; chicken deboned to save precious space. Ice cream cones—by the thousands—are tucked into odd crannies.

0800 hours. Reilly's first four-hour watch begins. His job: monitoring a navigation computer.

All around him the ship stirs with action as crew members go about daily chores (just as Reilly will between his regular watches)—inspecting, cleaning, maintaining.

"Scrub, burn and filter":

Nuclear submarines do not need to surface to get air for their engines, but Reilly's still a deep breather. Carbon dioxide, exhaled by the crew at the rate of 110 cubic feet each hour, is removed by "scrubbers" before it can build into a dangerous concentration. Oxygen,

manufactured by water electrolysis, is fed back to the ship's atmosphere. Over 300 potential contaminants are removed by filtration, electrostatic precipitation or catalytic burning.

Revitalized air, purer than that breathed by city dwellers, is recirculated throughout the submarine, conditioned to a comfortable humidity and 70° temperature.

1200 hours. Lunch. On today's menu: chicken cacciatore.

Off-watch:

1250 hours. At the ship's laundromat, Reilly drops off his coveralls, made of lint-free polyester to eliminate one potential irritant from the atmosphere; he stops at the 2,000-volume library to pick up an electronics textbook he's studying for college credit.

1315 hours. Alarm signal! Reilly double-times to his duty station. This time it's a fire drill. It might have indicated a potential enemy's presence or a dozen other contingencies. Alarms are sounded at unscheduled times, day or night, throughout the patrol to keep the crew on its toes.

1415 hours. He routinely checks one of his alternate drill stations, then works off some lunch calories with a session on the exercise bicycle.

1600 hours. Reilly spends the next hour making some minor adjustments to one navigation computer that is temporarily "down." Each man on a nuclear submarine is responsible for the performance and maintenance of the equipment that he operates.

As he moves about the ship he continues to study its 110 miles of complex wiring, a requirement for many crew members so a fault can be quickly traced if necessary.

Versatile mess:

1700 hours. At one end of the mess, a checkers tournament is going on. At the other, Reilly—with one shipmate posing and two others kibitzing—is finishing off a watercolor.

The mess is the most versatile room on the submarine. At various times it becomes movie theater, gym, game room, lecture hall and music room. Two days from now, Sunday, it will become a chapel.

1800 hours. Dinner; lobster—a reminder that today is Friday. Last night the cooks surprised everyone with a Hawaiian luau. The night before, it was roast beef. Food on a submarine is a

major morale factor for the crew.

Leftovers are inevitable. Garbage is compacted into a container, weighted, and blown into the sea, where it sinks to the bottom.

1900 hours. The mess has now become a movie theater—tonight Reilly and some of his shipmates enjoy a new James Bond picture, well before it's been released to the general public.

In the unseen world above the surface it is dusk. On extended submerged patrol, every effort is made to make life as comparable as possible to surface duty. The control room is "rigged for red," that is, switched to a dull red illumination; ordinary lights are dimmed to remind the crew that another day is passing into night.

Shhh!:

Despite 007's noisy battles—or later the sound of hi-fi music—nuclear submariners live in a quiet world. Sounds are muted by vinyl tile decks and acoustic tile overheads. Vibrations are minimized. Turbines, fans and other moving equipment are surrounded by special sound-deadening material.

2000 hours. Bill Reilly begins his second four-hour watch. Others, who are now off-watch, are relaxing, reading, getting ready to bunk down—and some are still sleeping before being awakened later.

2400 hours. Midnight. The ship is quiet. His watch over, Reilly bunks down, draws the curtains for privacy, turns on the overhead fluorescent and reads for a while. He yawns, adjusts the air vent at the head of his bunk, switches off the light. He is asleep.

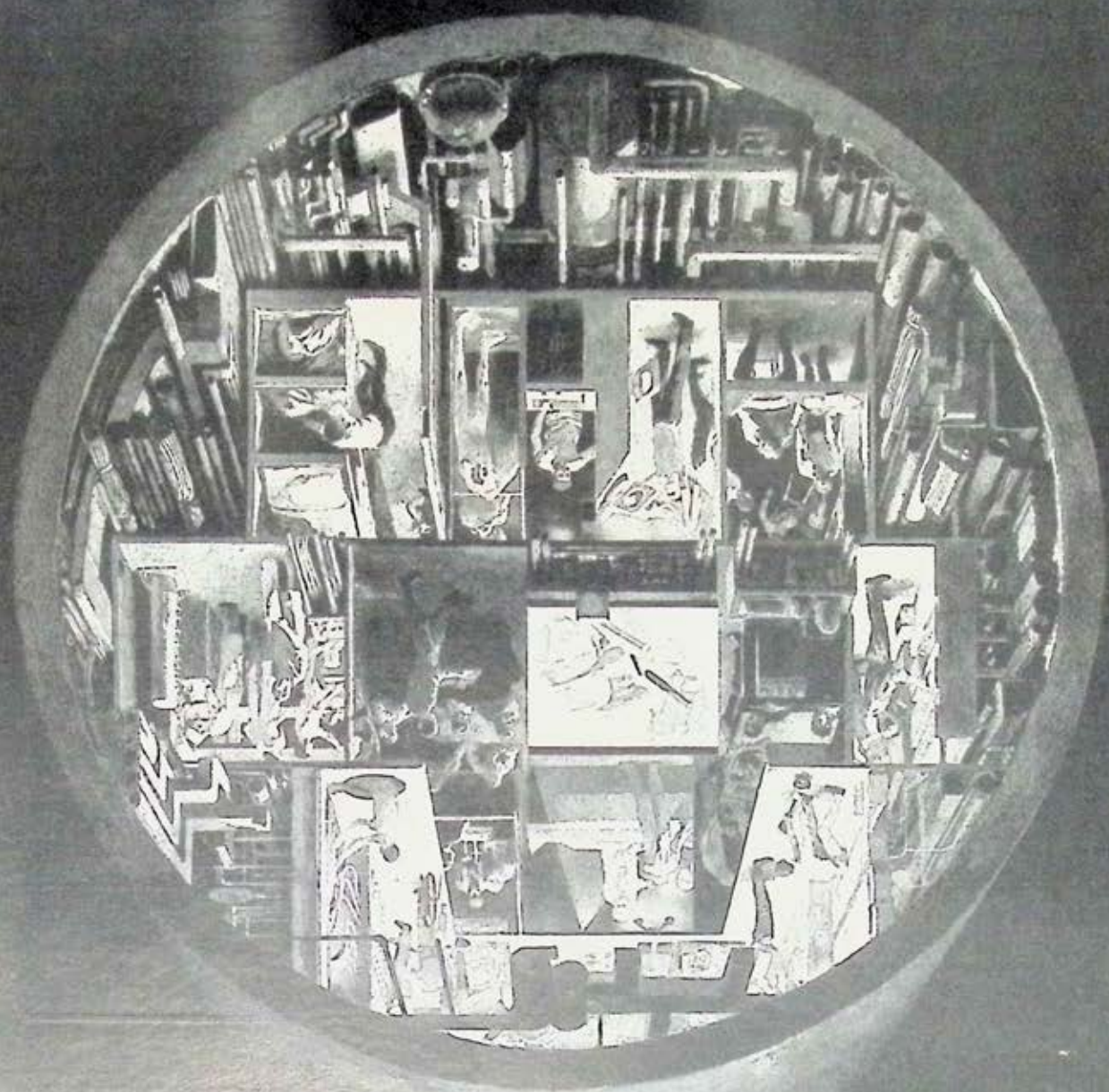
In building almost 300 submersibles—including the prototypes of most American nuclear submarines—habitability has been a prime concern of General Dynamics designers and engineers since 1900 when the company delivered the United States Navy's first.

General Dynamics is a company of scientists, engineers and skilled workers whose interests cover every major field of technology, and who produce: aircraft; marine, space and missile systems; tactical support equipment; nuclear, electronic, and communications systems; machinery; building supplies; coal, gases.

Reprints of this series are available.

GENERAL DYNAMICS

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soon become fighter pilots with brains."

Whereupon the editor of the *Fighter Weapons Newsletter*, Maj. Rezk M. Mohamed, threw down the gauntlet, citing what he called Major Pitt's "flatulent" quotes and rallying his colleagues to retaliate—but not in kind.

"Great Encouragement for Fighter Pilots," he headlined an announcement in Olde English script in his *Newsletter*:

"All Gentleman Fighter Pilots who have a mind to distinguish themselves in the Glorious Cause of the Service, and make their Journalistic Fortunes, an opportunity now offers within the pages of the *Fighter Weapons Newsletter* whose main office is situated at the Centre for Tactical Weaponry in

the State of Nevada. The *Newsletter*, in the Opinion of Fighter Pilots Worldwide, is looked upon as the sounding board for professional controversy, and it is there that cold, calculated, controversy has arisen by an assemblage of those perpetrators of the advanced art of Aerial Tintyping used in the medium of Reconnaissance. . . .

"Any Gentlemen Volunteers who have a Mind to take up the Challenge can do so by sending their written draughts to the *Newsletter*."

Major Mohamed added that "the Centre for Tactical Weaponry shall enter into publication the best draught which does justice to the controversy and does so free of surly language and abuse."

NEWS NOTES—Lt. Gen. Thomas S. Moorman, Superintendent of the US Air Force Academy, who had been scheduled to retire next July, has been authorized to remain in that post to July 31, 1970. By that time, he will have served in the post for five years, the longest of any Air Force Academy head to date. The exception to normal retirement provisions was approved in keeping with a recommendation of the board headed by the late Gen. Thomas D. White, which, in investigating Academy cheating scandals and other problems in 1965, suggested the Superintendent be granted a term longer than the normal military tour.

Training of pilots who will fly the General Dynamics F-111A in combat

NEW BOOKS IN BRIEF

Ace of Aces, by René Fonck. A look backward through the eyes of the top French fighter ace of World War I, who was credited with seventy-five victories but believed his true total was 127 German aircraft. His conversational style conveys great personal warmth, and his abbreviated and factual descriptions show both modesty and confidence in his own ability. Included with this personal journal are photographs, drawings, and comprehensive listings of other war aces. Doubleday, N. Y. 164 pages. \$4.95.

The Battle for Italy, by W. G. F. Jackson. Emphasis on World War II in Europe has usually focused on the D-Day landings and the ensuing sweep of Germany or on the Russian campaign, giving little account of the battles waged in Italy. A British general now releases a history of battles in that area. Illustrated with photographs and diagrams of attack plans. Harper & Row, N. Y. 371 pages. \$8.50.

The Billy Mitchell Affair, by Burke Davis. Any well-written biography of such a controversial figure would be a good recommendation, but this book also incorporates newly released material, including Mitchell's personal military record, that had not been available before. Just enough detail, just enough intuition colors this thorough piece of research. Random House, N. Y. 373 pages. \$7.95.

From Atlantic to Pacific, A New Intercoastal Canal, by Immanuel J. Klette. A timely discussion of the prospects for a new canal through Central America which President Johnson predicts will be necessary sooner than expected. Chapters examine the relevant economic, political, and security problems and the question of nuclear construction. This broad view makes good background reading on a subject that will be in the news for many years to come. Harper & Row, N. Y. 143 pages. \$4.50.

Incredible Victory, by Walter Lord. The author of *A Night to Remember* now vividly recreates the June 1942 Battle of Midway, in which an outnumbered American carrier force whipped the Japanese Imperial Fleet and turned the tide of the war in the Pacific. Along with competent descriptions of military maneuvers and the strategy behind them are accounts of personal heroism—all retold as if the reader were present for every action. Harper & Row, N. Y. 331 pages. \$5.95.

The Last Fathom, by Martin Caidin. Another fanatical Russian plot for world domination is foiled, this time by Mr. Caidin's "hydro space" hero, who pilots a submarine

to the bottom of the oceans with skill, daring, and melodrama. Some interesting undersea descriptions break up the dialogue. Meredith Press, N. Y. 312 pages. \$5.95.

Pax Americana, by Ronald Steel. The "accidental empire" which the United States now finds itself supporting and defending is too thankless a monster to please Mr. Steel. He examines the events that have produced it, and suggests that national interests may be better served by more attention to domestic problems. His criticisms are forceful and well supported. The Viking Press, N. Y. 371 pages. \$6.95.

Space Frontier, by Dr. Wernher von Braun. The Director of the George C. Marshall Space Flight Center here presents a simplified description of our space program—what it requires and what it hopes to accomplish. The chapters are derived from updated essays written for a popular magazine, and are geared to the general reading public. Illustrated with photographs and drawings. Holt, Rinehart and Winston, N. Y. 216 pages. \$4.95.

—MARIA T. ESTEVEZ

The Institute for Strategic Studies in London is publishing an interesting and useful series of six studies. The series is entitled "Defense, Technology, and the Western Alliance." Individual study titles are:

I. *European Co-operation in Defence Technology: The Political Aspect*, by John Calmann.

II. *The European Armaments Base: A Survey*, by C. J. E. Harlow. Part 1. Economic Aspects of Defence Procurement. Part 2. National Procurement Policies.

III. *Standardization and Common Production of Weapons in NATO*, by Robert Rhodes James.

IV. *Atlantic Technological Imbalance: An American Perspective*, by Arnold Kramish.

V. *The Requirements of Military Technology in the 1970s*, by Brigadier K. Hunt.

VI. *The Implications of a European System for Defence Technology and Production*, by Alastair Buchan.

Numbers I through V have been published. Number VI is scheduled for October publication. Price for the series is \$15 postpaid; for Number II only, Parts 1 and 2, \$5. Order from the Publications Department, Institute for Strategic Studies, 18 Adam St., London W. C. 2, England.

tests in Southeast Asia beginning early next year is now in full swing at Nellis AFB, Nev. Nine planes have been delivered to the 4520th Combat Crew Training Wing. Training of F-105 pilots is being shifted to McConnell AFB, Kan., when the present Thunderchief class graduates at Nellis.

A modern-day counterpart to the chewing gum that old-time flyers used to repair their planes has been developed for USAF aircraft hit by small arms fire in Vietnam. Devised by materials engineers of the Air Force Systems Command, a superstrength epoxy adhesive, which can be mixed in the field, is applied to patches large enough to cover bullet holes. The patch is impervious to salt or lubricants and so strong that a one-inch square can withstand up to 6,000 pounds of pressure.

Eight more Titan IIIC standard space launch vehicles have been ordered by the Air Force. With four of the original seventeen Titan III vehicles still to be flown, the follow-on order is expected to support mission requirements through 1971. Titan IIIC has been used to launch a variety of satellites, most recently in July when it put six satellites into near-

synchronous earth orbit at an altitude of 18,200 nautical miles.

The US would stage an International Aeronautical Exposition not later than 1969, under provisions of a bill introduced by Rep. L. Mendel Rivers (D.-S. C.), Chairman of the House Armed Services Committee. Main purpose of the exposition, which would be comparable to the Paris Air Show, would be to show US developments in "military and related aviation and equipment," Mr. Rivers said.



SENIOR STAFF CHANGES

B/G Gordon F. Blood, from Chief, Objective Plans & Programs Div., JCS, to DCS/O, 7th AF, Saigon, Vietnam, replacing B/G William D. Dunham . . . B/G Carroll H. Bolender, from Director, Apollo Mission, NASA, Washington, D. C., to Program Director for Lunar Excursion Module, with duty station Missile Space Center, NASA, Houston, Tex. . . . M/G Wendell E. Carter, from DCS/Comptroller, Hq. AFSC, Andrews AFB, Md., to Dep. Asst Secretary of Defense (Information), OASD (Compt.) . . . M/G Lucius D. Clay, Jr., from Director of Plans, (Continued on following page)

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Cartoon by Whitney Darrow, Jr.



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Even in grammar school he was always the kid who responded to the tough challenge. Really tough. Like making a large balloon with bubble gum while doing a head stand (no hands). Or giving a guy a hot foot while the teacher's in the room. Stuff like that.

We've often wondered what happened to Hard Way Charlie. We thought maybe he became an astronaut or a frogman or secretary general at the U.N.

But last week we found his emotional twin. He's the guy in charge of "make-or-buy" decisions at Hydro-Aire.

His job is to spot the most complex components that require closest tolerances, the most sophisticated manufacturing techniques, the most advanced equipment and skills—and keep them *in-house*.

Literally, that is the policy. Because these same components must be controlled in manufacture to assure reliability and delivery. Because Hydro-Aire is fundamentally a group of problem solvers—in engineering as well as manufacturing. And because the perfectionist problem solver not only designs and develops the solution—he also follows through to *make sure it works*.

Random example:

A vital component in our Hytrol anti-skid aircraft braking systems is a slide and sleeve assembly of rather exacting dimensions: I.D.'s and O.D.'s within 10 millionths of an inch, roundness within 5 millionths and concentricities within 10 millionths.

"We were told," explains Hard Way Charlie's double, "that this kind of precision grinding could be done only by master craftsmen whose 'feel' somehow judges the result. Instead we pioneered in advanced air gaging and electronic gaging to really measure these tolerances."

As a result, Hydro-Aire now has a Refined Grinding Department with custom built equipment that turns out one thousand of these gizmos each month.

But that was yesterday's challenge. Today, Hard Way Charlie's double is concerned with ultra-sonic cleaning; new advanced Clean Room facilities; chemical milling; magnaforming; laser machining; instant wave soldering of circuit boards. Things like that.

What about the easy stuff? Nuts. Bolts. Washers. Standard housings. He suddenly looks a little sleepy.

"We buy 'em. From very good vendors. Gee, I wonder what those fellows do for a real challenge?"

Maybe they try for a bubble gum balloon while doing a head stand?

DCS/Plans and Operations, to Director of Aerospace Programs, DCS/Programs and Resources, Hq. USAF . . . B/G Ernest T. Cragg, from Ass't to Cmdr., ATC, to DCS/O, Hq. ATC, Randolph AFB, Tex., replacing M/G William C. Lindley.

M/G William T. Daly, from Chief, US Military Supply Mission, India, to DCS/Operations and Intelligence, Allied Forces Central Europe . . . M/G Jack N. Donohew, from Director, Inter-American Defense College, Fort Leslie J. McNair, Washington, D. C., to Cmdt., AWC, Maxwell AFB, Ala., with add'l duty as Vice Cmdr., AU . . . M/G William D. Greenfield, from DCS/O, ADC, Ent AFB, Colo., to Cmdr., Central NORAD (CONAD) Region with add'l duty as Cmdr., 10th AF, ADC, Richards-Gebaur AFB, Mo., replacing M/G T. K. McGehee.

M/G John B. Henry, Jr., from Director, Personnel Council, Hq. USAF, to Director, Inter-American Defense College, Fort Leslie J. McNair, Washington, D. C., replacing M/G Jack N. Donohew . . . B/G Stephen W. Henry, from Co-Director, Special State-Defense Study Group, OSD, to Director, J-2, US Southern Cmd., Albright AFB, C. Z., replacing B/G William K. Skaer . . . Dr. Robert Kahal, from Institute for Defense Analyses, to Director, SHAPE Technical Center, The Hague, Netherlands . . . B/G Leo A. Kiley, from Dir. of Science and Technology, DCS/Research and Development, to Dep. Dir. of Development, DCS/R&D, Hq. USAF . . . Mr. John H. Kunsemiller, from Supervisory Procurement Analyst, DCS/Procurement and Production, Hq. AFSC, to Ass't for Procurement Evaluation, Directorate of Procurement Policy, DCS/S&L, Hq. USAF.

Mr. Robert Lew, from the RAND Corp. to Chief, Defense Studies Group, SHAPE Technical Center, The Hague, Netherlands . . . M/G William C. Lindley, from DCS/O, Hq. ATC, Randolph AFB, Tex., to Det. 1, Hq. 7th AF, PACAF . . . Dr. Alan M. Lovelace, from Chief Scientist, to Director, AF Materials Laboratory, AFSC, Wright-Patterson AFB, Ohio . . . B/G William P. McBride, from Dep. for Ops, 9th AF, TAC, Shaw AFB, S. C., to Cmdr., 7th AF Task Force, PACAF . . . B/G Everett A. McDonald, from Dep. Dir. of Plans for War Plans, DCS/P&O, Hq. USAF, to Co-Director, Special State-Defense Study Group, OSD, replacing B/G Stephen W. Henry.

M/G Thomas K. McGehee, from Cmdr., Central NORAD (CONAD) Region with add'l duty as Cmdr.,
(Continued on page 37)



From an original painting for Chandler Evans by Keith Ferris

MAIN FUEL PUMPS by Chandler Evans

Lockheed's SR-71 is a Mach 3, long-range, strategic recon aircraft. Carrying a wide variety of advanced observation equipment, it is capable of 2,000 m.p.h. speeds at altitudes of 80,000 feet for the USAF. The SR-71 is powered by two Pratt & Whitney Aircraft J58 turbojets equipped with main fuel pumps engineered and precision-produced by Chandler Evans.

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Navigating the Atlantic... eight years before "Lucky Lindy."

Nearly overshadowed by the glory surrounding Charles A. Lindbergh's famed solo flight in May, 1927, is the fact that a transatlantic flight was made eight years earlier by Lieut. Arthur W. Brown and Captain John Alcock. On June 14, 1919, the former RAF fliers took off from St. John's, Newfoundland, in a Vickers-Vimy with Alcock at the controls. Brown, the navigator, was equipped with a few crude maps, sextant, compass and a shortwave radio that failed shortly after takeoff. Nearly 16 hours later, after battling the fury of the North Atlantic elements, Alcock and Brown landed in an Irish bog, claiming for England title to the first nonstop flight between North America and Europe.

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the weather's reach, will streak across the Atlantic in a few hours. They will be guided by navigation systems of incredible accuracy. Like AC Electronics' "Miniature Carousel." This system uses microminiaturized electronics, an advanced airborne digital computer and advanced inertial instruments to provide precise, all-weather navigation for supersonic or subsonic aircraft.

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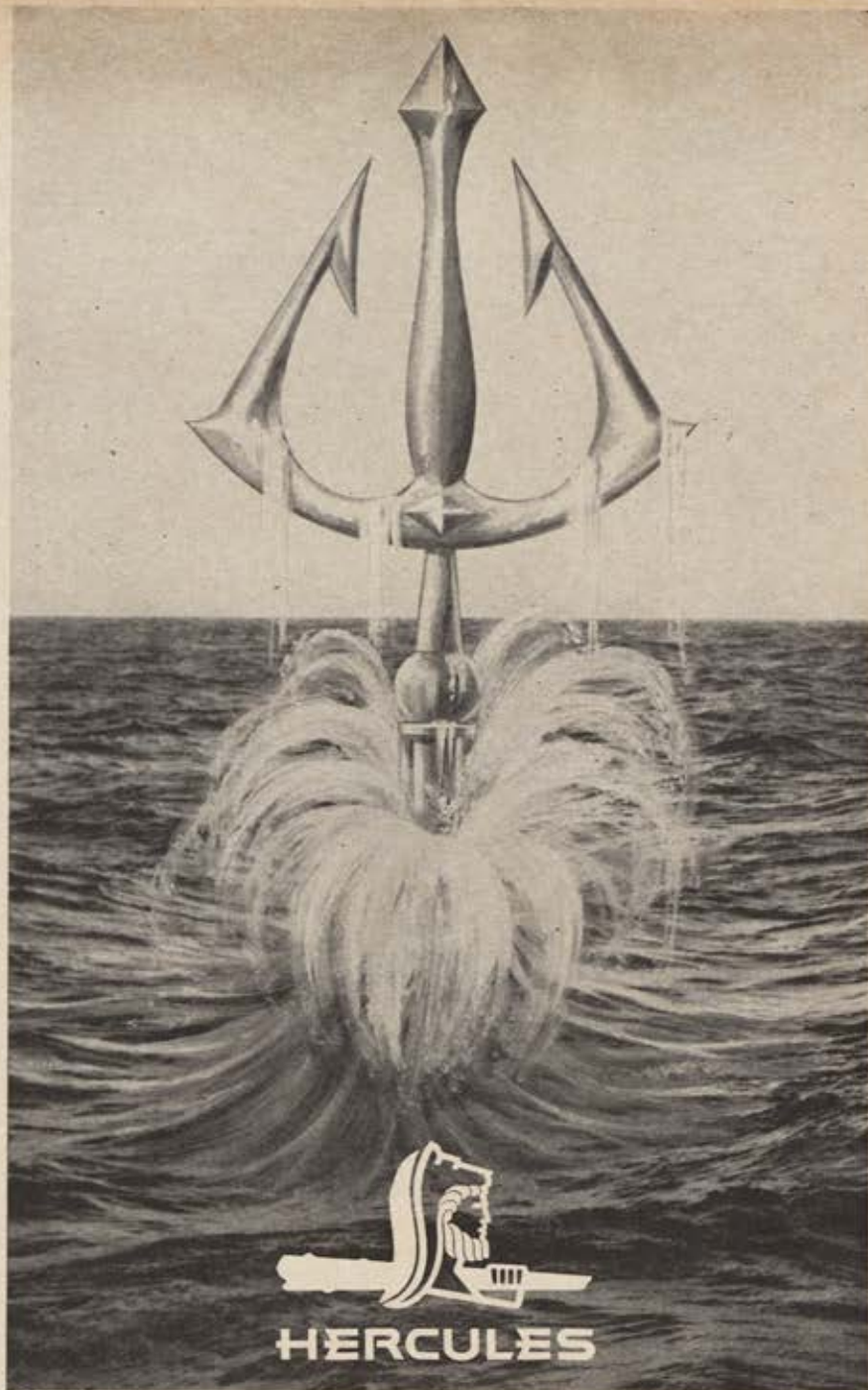
Maj. Gen. Jack N. Donohew is new Commander of Air War College and Vice Commander of Air University. He formerly served as Director, Inter-American Defense College in Washington.

10th AF, ADC, Richards-Gebaur AFB, Mo., to Ass't DCS/Programs & Resources, Hq. USAF . . . **B/G John M. McNabb**, from Chief of Staff, Hq. ATC, Randolph AFB, Tex., to Cmdr., Sheppard Technical Training Center, ATC, Sheppard AFB, Tex., replacing M/G Edward H. Nigro . . . **B/G Lester F. Miller**, from DCS/P, to Chief of Staff, ATC, Randolph AFB, Tex., replacing B/G John M. McNabb . . . **B/G Henry C. Newcomer**, from Dep. Standing Group Rep. for Policy, Operations and Annual Review, NATO, Casteau, Belgium, to Director, Near East-South Asia Region, OASD (ISA).

M/G Edward H. Nigro, from Cmdr., Sheppard Technical Training Center, ATC, Sheppard AFB, Tex., to Dep. Director of Plans, DCS/Plans and Operations, Hq. USAF . . . **Dr. James N. Pepper**, from Miami University to Director, Pacific Overseas Dependent Schools, PACAF . . . **M/G Harry J. Sands, Jr.**, Cmdt., Air Command and Staff College, is relieved from add'l duty as Acting Vice Cmdr., AU, Maxwell AFB, Ala.

B/G Richard M. Scott, from Chief, Nuclear Plans Section, SHAPE, to Dep. Ass't to Secretary of Defense (Atomic Energy) . . . **B/G Harold C. Teubner**, from Dep. Dir. of Budget, Hq. USAF, to DCS/Comptroller, AFSC, Andrews AFB, Md., replacing M/G Wendell E. Carter . . . **Mr. Kenneth V. Woolsey**, from Supervisory Mathematician to Director, Mathematical Services Laboratory, AFSC, Andrews AFB, Md.

RETIREMENTS: M/G Walter E. Arnold, M/G Richard D. Curtin, B/G Allman T. Culbertson, M/G Hubert S. Judy, B/G William K. Skaer.—END



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Filling in the Blanks

BY JOHN F. LOOSBROCK

Editor, *AIR FORCE/SPACE DIGEST*

IT IS a temptation to wax sentimental on an anniversary. We are going to succumb to that temptation on the occasion of this twentieth anniversary of the United States Air Force, to which this issue of our magazine is respectfully dedicated.

In the pages that follow we have attempted to put together a review, in text and pictures, of those first twenty years, together with a brief look at the forty that preceded them. We make no pretense that the material in this issue is a definitive history. The perspective is too short and the events too recent for that kind of assessment.

Rather, we have tried to be evocative—to convey the flavor of “this is how it was.” We have used a kind of reader-participation approach by which memories are jogged, high points are relived, and perhaps old wounds may even be reopened. We recognize that there are blanks, and we expect that our readers will fill them in, each in his own way.

One blank we’re aware of, which we must mention here, involves the Air Force Association itself. A year older than the independent Air Force, AFA has, over the past two decades, provided a counterpoint to the main theme: the continuing development, the change and growth, of the Air Force. There was the postwar fight for a separate service, which the young Association took on as its first major challenge. There was the struggle to build a modern and meaningful jet force around the bare-bones remnants of the mighty Air Force of World War II. There were painful technological transitions to nuclear weaponry, the jet engine, the ballistic missile, space.

There were the Berlin Airlift and Korea, when thousands of AFA members, even entire units, were recalled to active duty; and then the cold war, and the technological war, and Cuba. And now there is Vietnam, a kind of war undreamed of during most of these past twenty years—a war of iron bombs in a time of multi-megaton nuclear weapons, of prop-driven aircraft in a jet age, of jungle guerrilla combat when the arrival of the first Americans on the moon is but a few years away.

In this recounting, memories crowd upon memories. We joined the staff of this magazine in 1951. (We still tend to show our Freudian slip by saying “Korea” when we mean “Vietnam.”) Our ancient quarters on K Street were not air-conditioned, and a giant exhaust fan used to suck copy paper off desks clear across the room. We put out our first anniversary issue that year—128 pages, twice the size of a “normal” issue.

In those days, AFA membership records were on thousands of 3 x 5 cards in dozens of wooden filing drawers. Yet they were only about half the number now handled by our computer tapes. Fifty thousand copies was a big print order for the magazine in those days. Now we print as many as 120,000 copies for a special issue like this one.

There were some satisfying “firsts” along the way: the first story on the race for the intercontinental ballistic missile; the first article on the Soviet hydrogen bomb; the first documentation that captured American flyers were being brainwashed in North Korean prison camps. We ran a piece on development planning in the Air Force, the prime source being an up-and-coming colonel named Schriever. There was the golden anniversary issue of ten years ago, a journalistic tour de force in which the entire magazine was devoted to a fifty-year history of the Air Force from its Signal Corps beginnings in 1907. That issue was a 462-page monster and still holds the record as the largest single issue of any magazine ever put out by the McCall Corporation, our printers. The issue was later published as a hardback book by the D. Van Nostrand Co., and is still a standard reference work.

Other books have come out of the pages of this magazine.

There was *Space Weapons*, based on a special issue of October 1958, later published as a book by Frederick A. Praeger. And *The Wild Blue*, an anthology covering forty years, published by G. P. Putnam’s Sons. And *Speaking of Space*, published by Little, Brown. And the *History of the USAF Ballistic Missile Program*, based on our issue of May 1964, published by Praeger.

Our personal involvement has naturally been deepest in the publishing activities of AFA. But we look back



Just ten years ago, the theme of AFA's National Convention in Washington, D. C., was the Golden Anniversary of the Air Force. One of the highlights was the assembling, for an "anniversary portrait," of a group of men and women who represented a cross-cut of American aviation history. Their ranks have thinned with the passage of time, and there have been other changes as well. From left to right (bottom row): the late Dr. Theodore von Kármán, great aerodynamicist, who died May 6, 1963; MSgt. Horst Tittel, in 1957 USAF's oldest noncom, now retired; Gen. Nathan F. Twining, then Chairman, Joint Chiefs of Staff, now retired and living in Arlington, Va.; Brig. Gen. Frank P. Lahm, first American military pilot, who died July 7, 1963, at the age of 85; Air Cadet Dennis LaFarlette, who received his wings that day from General Lahm and served in USAF until September 1962; Mrs. Henry H. Arnold, widow of the great "Hap," who recently celebrated her eightieth birthday in Sonoma, Calif.; Gen. Carl A. Spaatz, first Chief of Staff of the independent Air Force, retired and living in Chevy Chase, Md.; Maj. Charles E. Yeager, who broke the sonic barrier in the Bell X-1 in 1947, now a colonel commanding the 405th Fighter Wing, PACAF, Clark AB, the Philippines. (Second row): Brig. Gen. Erik Nelson who piloted the Douglas World Cruiser New Orleans in the 1924 first round-the-world flight; the late Lt. Col. James Jabara, first jet ace, later a colonel, killed in an auto crash last year in Florida; Gen. George C. Kenney, top AF commander in the Pacific, World War II, later President and Board Chairman of AFA, retired and living in New York City; Jacqueline Cochran, famous flyer who represented women in aviation; the late Gen. Thomas D. White, then Chief of Staff, USAF, who died on December 22, 1965; Capt. Edward Rickenbacker, top American ace of World War I, then president of Eastern Air Lines; the late Col. Oakley Kelly and Col. John Macready, who made the first nonstop flight across the US in the T-2 in 1923. (Third row): Col. Francis S. Gabreski, USAF's top living ace, with victories in WW II and Korea, currently commanding the 52d Fighter Wing, ADC, Suffolk Co. AFB, N. Y.; the late Miss Edna M. Adkins, longtime secretary to USAF Chiefs of Staff; Sen. Stuart Symington, first USAF Secretary, now senior Senator from Missouri; the Hon. James H. Douglas, then Air Force Secretary, currently practicing law in Chicago; the late Maj. Gen. Claire Chennault, WW II commander of the Flying Tigers, who died July 27, 1958; Maj. James G. Gallagher, pilot of the Lucky Lady II on the 1949 first nonstop round-the-world flight, a recent graduate of the National War College, now awaiting assignment to Headquarters Command. (Top row): Col. Paul W. Tibbets, pilot of the B-29 Enola Gay that dropped the A-bomb on Hiroshima, now retired, living in Switzerland; Col. Bernt Balchen, pioneer Arctic flyer, now retired, living in Chappaqua, N. Y.; Lt. Gen. William H. Tunner, then Commander, MATS, ran the "Hump" and Berlin Airlifts, now retired and living in Ware Neck, Va.; the late Brig. Gen. Thomas DeWitt Milling, one of the earliest military pilots, died in 1960; the late J. H. "Dutch" Kindelberger, then Chairman of the Board, North American Aviation, veteran airframe builder, died in 1962; Gen. O. P. Weyland, top air commander in Korea, now retired and living in Pebble Beach, Calif.; and Roscoe Turner, famous racing pilot of the 1920s and '30s.

as well on a number of programs and special events which employed different, yet effective, means of reaching both specialized and general audiences on great aerospace issues. Pre-Korea there was AFA's Air-ability program, designed to upgrade the nation's airport system. There were the Air Logistics Conference of 1954 and the national Jet Age Conferences of 1956 and 1957. The week-long First World Congress of Flight in Las Vegas in 1959 provided an international platform for every segment of aviation and space technology. The series of symposia last year on "The Coming Revolution in Aeronautics" had national impact. Dozens of important forums have ventilated the hot topic of the moment at AFA National Conventions. Typical was "The Air War in Vietnam" at San Francisco last March.

AFA has had a long and fruitful association with the Arnold Air Society over more than fifteen years. AFA educational activities have expanded, too, through the Aerospace Education Foundation, now deeply involved in the new and exciting field of educational

technology. AFA's effectiveness as the voice of Air Force people has grown immeasurably in the last few years, due largely to an effective system of advisory councils—Reserve, Air National Guard, Civilian Personnel, Retired Personnel, Medical Advisory, and, perhaps most important, the Airmen Council and the Junior Officers' Advisory Council.

The personal attachments arrived at over these years provide, of course, the most rewarding memories of all. But we have become personal enough in these reflections as it is. We hope we are forgiven. We have filled in our own blanks. We hope you fill in yours as you go through these years of Air Force history.—END

Our thanks to the many people in USAF who helped make possible this special issue of AIR FORCE Magazine. Special credit is due the two men who wrote most of the text: Dr. M. Hamlin Cannon, USAF Academy Historian; and Col. W. H. Ruenheck, Special Assistant to the Academy Chief of Staff.—THE EDITORS

Chapter I

The Formative Years— 1907-1940

FROM a technological point of view, man advanced further in the twentieth century than in the entire span of his previous existence. Probably the most significant chapter in that advance deals with the emergence of aerospace power and the growth of its influence.

The dream of flying is as old as mankind. It remained no more than a dream until 1783. In that year a young Frenchman, Jean François Pilâtre de Rozier, flew over Versailles in a balloon invented by two brothers named Montgolfier. In the years that followed, balloon ascensions became common, and during the American Civil War balloons were used for observation by both armies.

But the achievement of powered and directed flight in a heavier-than-air vehicle had to wait for another pair of brothers. As did other experimenters in America and Europe, Orville and Wilbur Wright first worked with gliders. Then, in their bicycle shop in Dayton, Ohio, they designed and constructed an airplane driven by a gasoline engine. On December 17,

1903, on a typical windy day at Kill Devil Hill near Kitty Hawk, N. C., Orville Wright made the world's first successful powered flight, traveling 120 feet in twelve seconds.

The US government was slow to recognize the revolutionary implications of flight by a heavier-than-air machine, even though there was great interest in Europe in the first years of the new century. Not until August 1, 1907, did the US Army establish an Aeronautical Division in the Signal Corps. It consisted of one officer, Capt. Charles de F. Chandler, and two enlisted men. One of the latter soon afterward went "over the hill," thereby reducing the enlisted strength of the air arm by fifty percent. The specifications issued by the division in 1908 for its first plane called for it to be able to carry two persons at a speed of at least forty miles an hour, and fly for 125 miles. It also had to be capable of being dismantled and carried in a standard Army wagon.

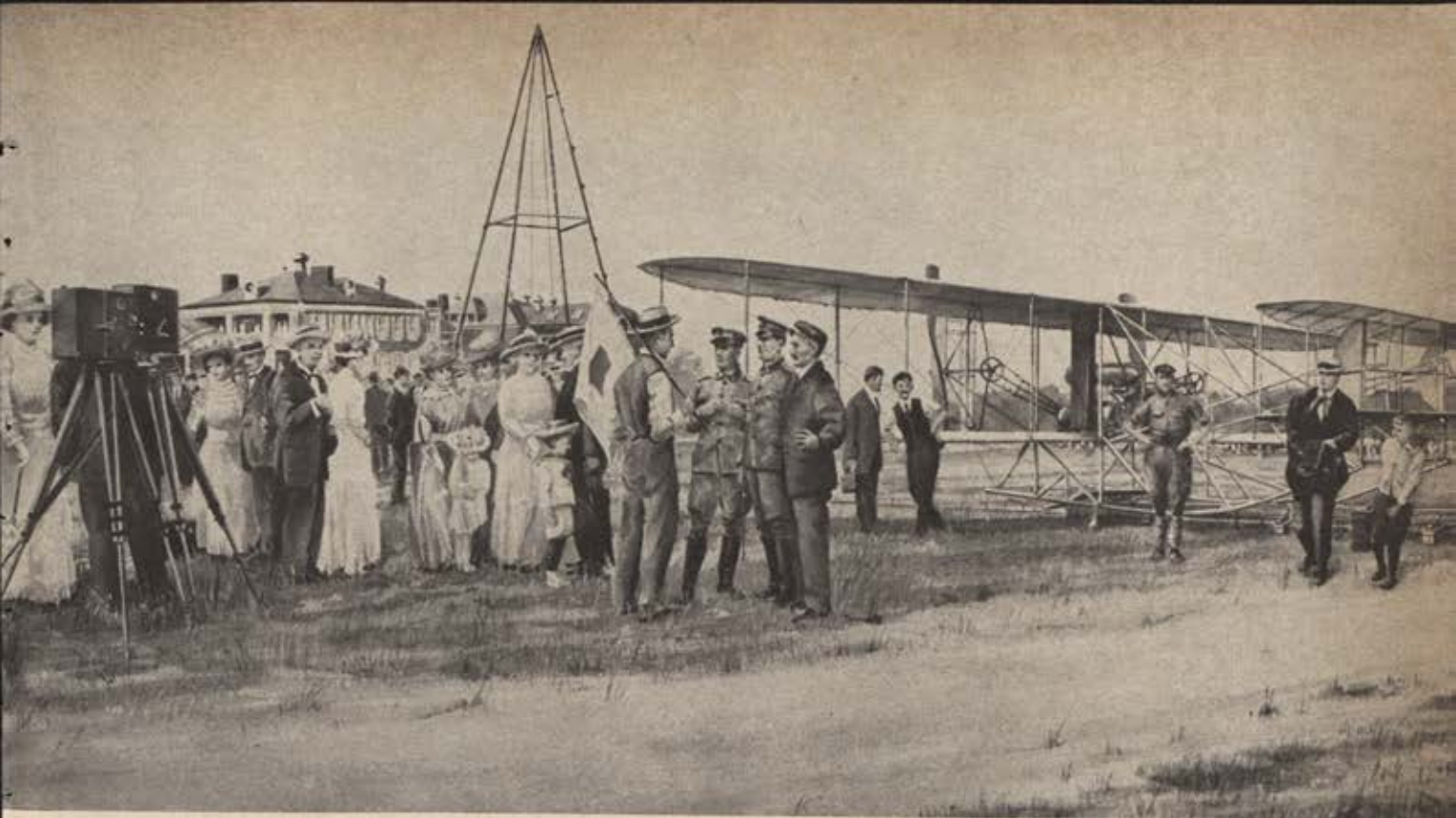
The Wright brothers, who won the competition, also trained the first Army flyers, among them Frank P. Lahm and Frederic E. Humphreys. By November 1912 the Army's first flying school, at College Park, Md., had a complement of fourteen flying officers, thirty-nine enlisted men, and nine airplanes, including two hydroplanes based on the Potomac at the Army War College.

In 1913, as trouble flared on the Mexican border, the few personnel and airplanes of the Aeronautical Division were assembled at Texas City, Tex., and organized as a provisional unit—the 1st Aero Squadron. But the squadron's first taste of combat operations was to come later. In March 1916, the 1st Aero was ordered to Columbus, N. M., to support Gen. John J. Pershing's punitive expedition against Pancho Villa. The squadron's operations were a near-fiasco but served to demonstrate the need for a greatly improved air arm.

Almost at the same time, the famed Lafayette Escadrille, made up of American pilots, was organized by the French Air Department on March 21, 1916. The
(Continued on page 42)

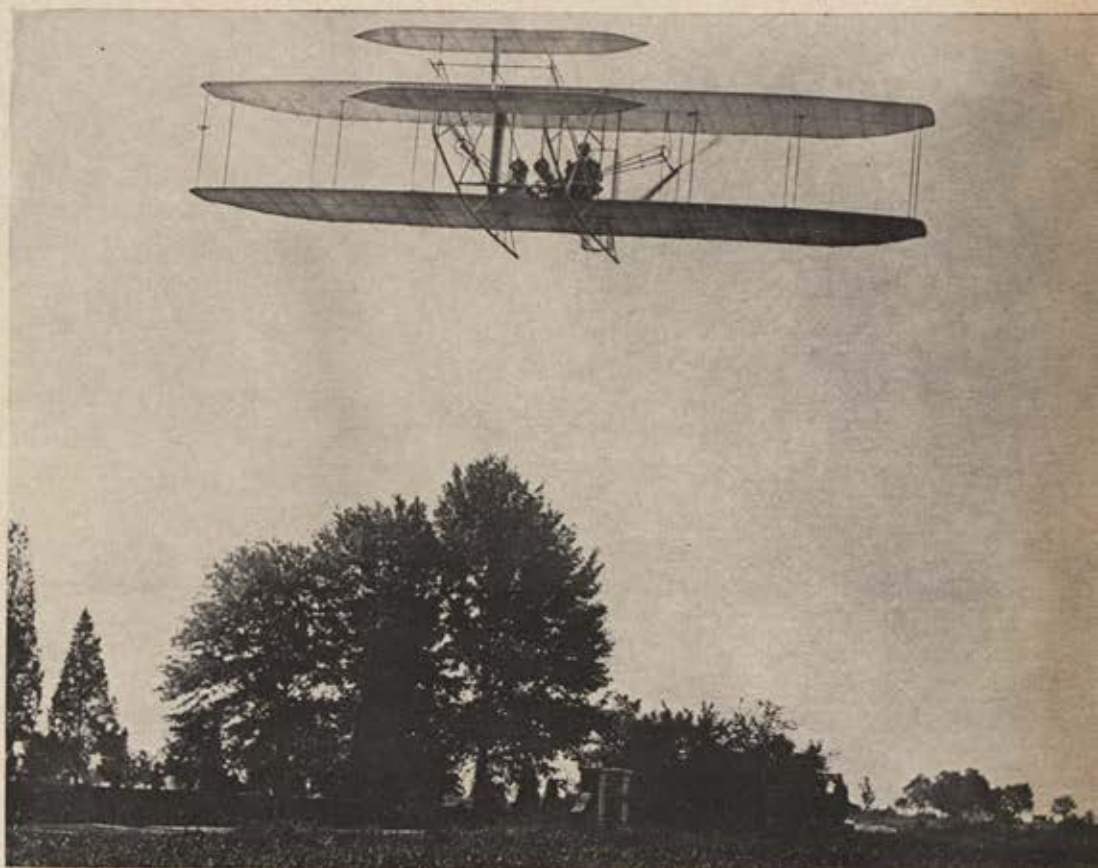


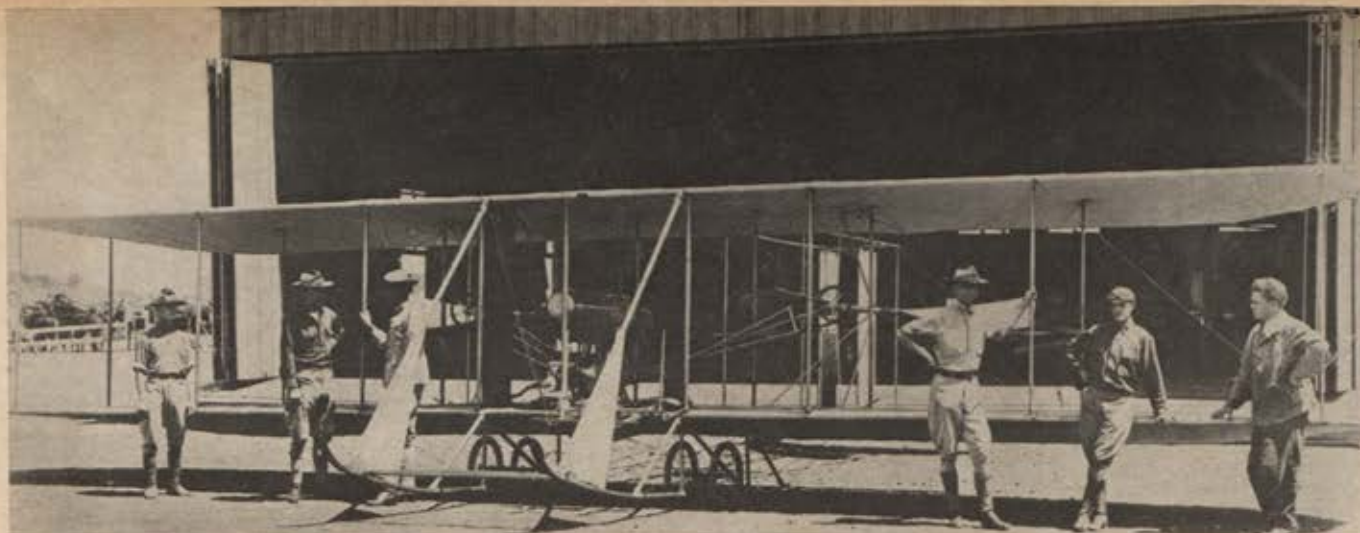
The beginning of it all, the balloon in which de Rozier made first manned flight in 1783. French formed world's first air force in 1794—the Aerostatic Corps—which served with distinction in several campaigns against Austrians. Napoleon disbanded Corps in 1798, perhaps his first big mistake. It would have come in handy at Waterloo.



Artist John T. McCoy's painting, "The Wright Brothers at Fort Myer, Virginia—July 30, 1909." Occasion was final test flight of Wright Flyer before Army acceptance, marked by flight to Alexandria, Va., and back, Orville Wright, pilot, Benny Foulois, observer.

Earlier tests at Fort Myer (Orville Wright at controls, right) ended tragically on September 17, 1908. Crash killed Lt. Thomas E. Selfridge, early Army air enthusiast riding as passenger. Orville was severely injured. Later tests (see above) were so successful the Wrights were paid a \$5,000 bonus on contract price of \$25,000, first incentive earned by an airframe contractor. Army accepted Wright plane on August 2, 1909. It was dubbed "Aeroplane No. 1, Heavier-than-Air Division, United States Aerial Fleet," by Washington Evening Star.





Army's first Wright Flyer landed and took off on skids, with elevators in front of wings. Wheels were added and elevators moved to rear in 1910 modification. Photo was taken at Ft. Sam Houston, Tex., where the infant air arm wintered in 1909-1910. Lt. Benny Foulois, shown with original ground crew, taught himself to fly by mail, getting instructions from the Wrights at Dayton, Ohio. Foulois, second from right, later was Chief of Army Air Corps, retired as major general, died at age of 87 on April 25, 1967.

members of the Escadrille were the first Americans to see combat in World War I. By April 6, 1917, when the United States entered the war, US aerial strength consisted of 131 officers, nearly all of whom were pilots and student pilots, 1,087 enlisted men, fewer than 250 planes, and five balloons. By European standards none of the American aircraft could be considered more than trainers. America, however, dreamed of great air armadas. Brig. Gen. George O. Squier appealed to his fellow Americans "to put the Yankee punch into the war by building an army in the air, regiments and brigades of winged cavalry on gas-driven flying horses."

Maj. William Mitchell, better known as Billy, went to the front as an observer. He visited airfields, depots, and headquarters, and flew over the front lines. Based on these observations, he submitted to General Pershing a plan for two distinct forces. One was to be composed of squadrons attached to the ground armies, corps, and divisions and under the control of the ground armies. The other force would consist of "large aeronautical groups for strategical operations against enemy aircraft and materiel at a distance from the actual line." This latter force, made up of bombardment and pursuit formations, "would have an independent mission . . . and would be used to carry the war well into the enemy's country." Mitchell's plan, and the fact that it was not adopted, clearly foreshadowed the airpower controversy that was to be a

(Continued on page 44)

Dayton, Ohio.

The Chief Signal Officer, U.S.A.

13 May, 1911

Sir:- I have the honor to report the following progress made by me in learning to operate a Wright Aeroplane: During the week I have made twelve flights with an instructor and one flight by myself. My instruction under the personal supervision of the instructor in the machine is finished and from now on all my flights will be made alone for experience.

Very respectfully
Henry H. Arnold,
2nd Lt, 29th Inf.

Paperwork was simple before the typewriter, carbon paper, and the mimeograph took over. Lt. Henry H. Arnold, 20th Infantry, reported in longhand to the Chief Signal Officer (to whose Aviation Section he had been detailed) on his progress in learning to fly. Lieutenant Arnold, of course, went on to five stars and glory as the World War II leader of the Army Air Forces. Yet, although he was graduated from West Point in the class of 1907, he was not aware of what the Wrights had accomplished while he was still a plebe at the Military Academy.

Army flying before World War I centered around the service's first official flying school at College Park, Md. Capt. Charles de F. Chandler served as school commandant in addition to his duties as Chief, Aeronautical Division, Army Signal Corps.

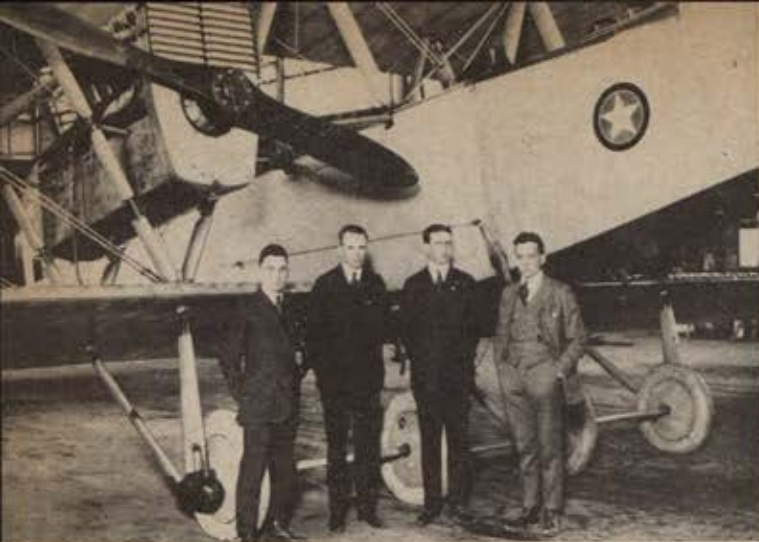
College Park housed such pioneer airmen as Capt. Paul Beck and Lts. "Hap" Arnold, Tommy Milling, and Roy Kirtland. There were daring experiments in cross-country flying (as far as Frederick, Md.), aerial photography, altitude flying (to 4,167 feet by Arnold), and bombing. Lewis low-recoil machine gun was successfully fired (right, with Chandler and Kirtland) from an airplane, but only the one gun could be obtained for experiments because the Army had not adopted the Lewis gun as standard armament.



World War I recruiting posters screamed "Join the Army Air Service. Be an American Eagle!" But it took a while for the fledgling eagles to feather out. The 1st Aero Squadron, under Maj. Ralph Royce, arrived in France in September 1917. Not until April 1918 were American flyers in combat. Eventually they gave a good account of themselves. Painting by artist John T. McCoy captures the flavor of the intricate maneuvering during a dogfight high above the trench-bound ground armies at the front.



By early summer of 1918 American names were being added to the list of aces (five or more aerial victories). Top ace Eddie Rickenbacker (in his French-built Spad, above) was a former auto racing driver who flew to fame and later fortune with the 94th "Hat in the Ring" Aero Squadron. Rickenbacker got his first kill on April 29, his sixth on May 30. An ear infection hospitalized him through July and August. In September and October he bagged 20 more and wound up with a total of 26.



Those who got in the airplane business early gave their names to future giant companies. Here Glenn Martin (second from right) poses in front of his Martin MB-1 bomber in 1918. With him were staffers Lawrence Bell, Eric Springer, and Donald Douglas. Soon Douglas formed his own company. Its first plane, the Cloudster, was the first to lift its own weight in payload.



In its day, 1919, the Thomas-Morse MB-3A could hit a top speed of 152 mph. Powered by a 340-horsepower Hispano-Suiza engine, the stubby MB-3A measured 26 feet in wingspan, only 20 feet from propeller to rudder. The Army liked it well enough to buy 54 copies from the now-defunct Ithaca, N. Y., firm.

Early bomber development in post-World War I era disappointed those who saw the eventual domination of warfare by the airplane. Hardware could not keep pace with theory. Triplane Barling bomber (XNBL-1) weighed an impressive 42,000 pounds but could not coax enough power out of its six Liberty 12A engines to fly even 100 miles an hour or get high enough to fly the 400 miles from Dayton to Washington over the Appalachian Mountains. Engineers learned a lot from the Barling, but it was hardly the answer to Billy Mitchell's prayer.



divisive force in the American Army for many years.

America entered World War I with pitifully few trained men—either as pilots or ground crews. Of almost 15,000 cadets entering primary flying schools in America, 8,688 received the Reserve Military Aviator's rating. Others received training overseas, so that more than 10,000 pilots were trained during the war.

The Air Service, American Expeditionary Forces, began building its own schools in France in August 1917, and by November 1918 the American schools could give about 2,000 pilots a month their final or "refresher" training. In all, more than 8,000 pilots and observers had received some form of flying training in France, of whom almost 1,700 pilots and 850 observers had graduated from American Air Service schools there. About 500 Americans received all or part of their pilot training in Great Britain, and a few hundred more at two schools in Italy. American mechanics and ground crews were trained in American factories and technical schools and at French and British airfields and factories.

Statistically, the American combat record in the skies over Europe was not too impressive. On Armistice Day, November 11, 1918, the American-operated planes in squadrons at the front totaled only 740, a little more than ten percent of the total Allied aircraft strength. American airmen flew 150 bombing missions, dropped 138 tons of bombs, and penetrated as far as 160 miles into enemy country. Losses in combat were 289 planes and forty-eight balloons, including fifty-seven planes piloted by officers flying with the British, French, and Italian services. Some of the 237 American officers and men killed in action could have been saved if they had used parachutes. The aviators themselves rejected parachutes because of a pilot fetish that to wear one was a sign of cowardice and lack of confidence in one's ability and equipment.

Although few in number and late in getting into battle, the American airmen wrote a brilliant page in our military history. They had confirmed claims of 781 enemy planes and seventy-three balloons shot

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A flamboyant falcon of a man, Col. Billy Mitchell had been a general officer in World War I, planned and led the biggest air operation of that war. His ardent advocacy of airpower, documented by the spectacular bombing of battleships, brought down the wrath of his superiors. A self-made martyr, Mitchell courted and won a court-martial, here listens to charges read by Assistant Judge Lt. Col. Joseph McMullen at his trial.

—Wide World Photos



Billy Mitchell saw airpower rather than seapower as the future defender of America's coasts. To prove his point his bombers sank three expropriated German warships off the mouth of the Chesapeake Bay in July 1921. Among them was the so-called "unsinkable" battleship Ostfriesland, shown here wallowing under the blast of bombs from Army aircraft flying out of Langley Field, Va. Many people were convinced, but not the right ones.



Far above the political battles which were settling the fate of airpower, Army flyers went doggedly about the business of proving what they and their machines could do. On April 6, 1924, four Douglas World Cruisers set out to fly around the world, beginning and ending at Seattle, Wash. Two of them, the Chicago and the New Orleans, made it, logging 26,345 miles in under six months, landing in Seattle on Sept. 28. Pilots and mechanics pose at triumphal end of round-the-world trip.



Beloved entertainer and political satirist Will Rogers was an early aviation enthusiast and a close friend of Mitchell. Here they are together after a flight from Bolling Field, Washington, D. C. Rogers was killed in 1935 in a crash in Alaska together with the famed round-the-world flyer one-eyed Wiley Post.



Charles A. Lindbergh's solo flight from New York to Paris in May 1927 was a watershed in aviation history. It was an epic feat by any standard—piloting, navigation, flight planning, or sheer determination and courage. But most of all it captured the imagination of the peoples of the world and focused their attention on the potential of aviation in a way that no more prosaic demonstration ever could. Lindbergh and his Spirit of St. Louis, the inseparable "We," had conquered time and space in a more dramatic way than ever before, or probably since. The world would never be quite the same again.

Central to the concept of airpower as visualized by its early prophets was the idea of long-range bombardment, of carrying a war to the heartland of the enemy. Any opportunity to demonstrate the capability was eagerly seized upon. One such opportunity was the flight of ten B-10 bombers to Alaska in 1934, led by Lt. Col. Hap Arnold. The 8,290-mile round trip, much of it nonstop over water, was to test the idea of reinforcing outlying possessions, but the implications ran much deeper.



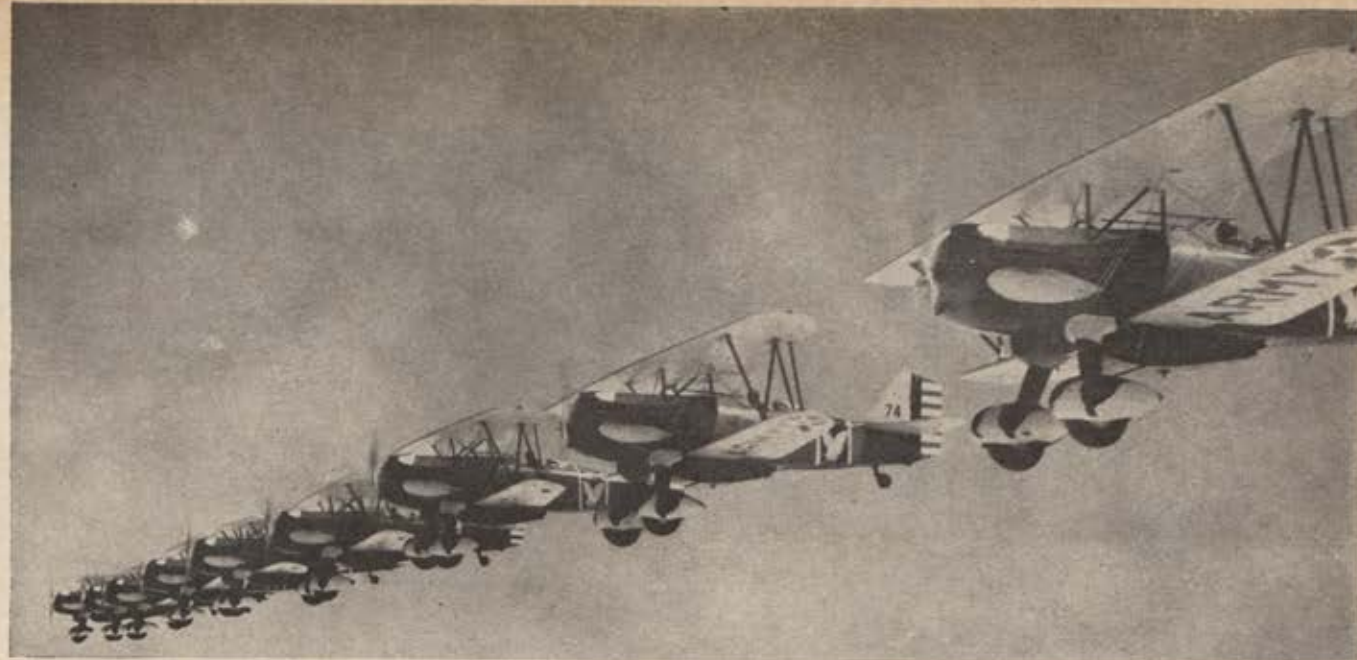
down, but the true total was less because of duplicate claims. Maj. Raoul Lufbery, Capt. Eddie Rickenbacker, Lt. Frank Luke, and 114 others who qualified as aces by shooting down five or more enemy aircraft gave the nation one more great tradition.

The coming of peace was the signal to emasculate the nation's armed forces, quickly and without plan. Orders for planes and engines were almost immediately canceled. By 1920, the Air Service had been reduced from 200,000 men to 10,000, and ninety percent of the aircraft industry which had come into being during the war had been liquidated. For more than ten years the Army Air Service would continue to use planes and engines of World War I vintage.

The 1920s were years of both frustration and hope. Brig. Gen. Billy Mitchell struggled to obtain for the air arm a major role in national defense. In July 1921 his bombers sank three German vessels, including the "unsinkable" battleship *Ostfriesland*. Two years later they sank the obsolete US battleships *Virginia* and *New Jersey*. Unable to persuade his superiors of the importance of aviation, Mitchell harangued against "the arch conservatives who stood in the way of reform and progress." Courting a martyr's crown, he denounced the high command of the Army and Navy as guilty of "incompetency, criminal negligence, and almost treasonable administration of the National Defense." Although a court-martial found Mitchell guilty, his views were to have a profound influence upon American air doctrine.



Another "stunt" which proved a point was the 1929 flight of the Army Fokker C-2 Question Mark. The trimotored monoplane stayed aloft over Los Angeles for a total of 150 hours, 50 minutes, was finally forced down by engine trouble. Commander was Maj. Carl A. Spaatz, later to become first Chief of Staff of an independent Air Force. Chief pilot was Capt. Ira Eaker and the crew included Lt. Elwood Quesada, later to head the Federal Aviation Agency. The Question Mark flew 11,000 miles, was refueled in midair forty-three times with more than 5,000 gallons of fuel, furnishing a preview of things to come.



The Curtiss P-6E Hawk was one of the classic biplane pursuit aircraft of the early 1930s. It cruised at 175 miles per hour, climbed at the rate of 2,400 feet per minute, had a service ceiling of 24,700 feet and a range of 570 miles. Armament consisted of 2 fixed forward-firing .30-caliber machine guns. Production order was placed on July 8, 1931, and 45 of the 46 aircraft ordered had been delivered by the end of 1932. Photo shows pilots of the 17th Pursuit Squadron, based at Selfridge Field, Mich., on formation flight.



Randolph Field, Tex., the "West Point of the Air," was dedicated on June 20, 1930. In the following year it became the headquarters of the Air Corps Training Center and site of the primary flying school. The advanced school was nearby at Kelly Field. Almost as it opened, the depression cut Randolph's yearly quota to 150 cadets. These BT-9Bs came a few years later.



If any one airplane shaped the long-range future of the Air Force it was the B-17. Its advent in 1935 coincided with the creation of the GHQ Air Force, able to operate independently of ground forces. Here an early B-17 (1937) flies over Dayton, Ohio.

The 1920s should not be regarded as the Dark Ages of American aviation. The major efforts went into long-distance and endurance flights, designed to prove men and machines and to make headlines at the same time.

Lt. John A. Macready and Lt. Oakley G. Kelly flew nonstop from New York to California in 1923. On June 23, 1924, Lt. Russell L. Maughan made a dawn-to-dusk flight from New York to San Francisco. In the same year, Air Service flyers made the first round-the-world flight in 175 days. In May 1927, Capt. Charles A. Lindbergh made his immortal transatlantic flight from New York to Paris. Maj. Carl Spaatz, Capt. Ira C. Eaker, and Lt. Elwood R. Quesada were among the crew who set the world's endurance record of 150 hours, fifty minutes, in 1929, flying a Fokker trimotor called the *Question Mark*.

In July 1926, the Army Air Service became the Army Air Corps, "thereby strengthening the concept of military aviation as an offensive, striking arm rather than an auxiliary service." In June 1930, Randolph Field, Tex., the "West Point of the Air," was dedicated. In 1935, the emergence of the heavy bomber coincided with the advent of the General Headquarters Air Force. As late as Munich, however, Air Corps officers had still to convince the General Staff of the tactical and strategic importance of the heavy bomber.

Probably the most important single event of the 1930s was the naming of Maj. Gen. Henry H. Arnold as Chief of the Army Air Corps in September 1938. General Arnold was to guide the destiny of the air arm brilliantly in World War II. Already, in the distance, Nazi planes could be heard roaring through darkening skies over the face of Europe.

Chapter II

Airpower Comes of Age— World War II

ON SEPTEMBER 1, 1939, the tanks and planes of Adolf Hitler crossed the border into Poland and launched the greatest war in history. Armies fought in steaming jungles and in frozen tundras, over and under every sea, and on and over the great land masses of the world. In every sense of the word, World War II was a global conflict.

In the two years between the invasion of Poland and the bombing of Pearl Harbor, the German juggernaut rolled unchecked over the continent of Europe. Only the island fortress of England remained undaunted, unconquered, and uninvaded. America, in those critical days, was the Arsenal of Democracy. Planes, tanks, ships, and weapons of war ran off her assembly lines in ever-increasing numbers.

Official recognition was given early to the decisive

importance of airpower in national defense. In August 1940, Secretary of War Henry L. Stimson told a joint congressional committee, "Airpower today has decided the fate of nations. Germany with her powerful air armadas has vanquished one people after another. On the ground, large armies have been mobilized to resist her, but each time it was the additional power in the air that decided the fate of each individual nation."

In March 1941, Secretary Stimson placed the Army's air arm under a single commander. Shortly afterward, the Office of Assistant Secretary of War for Air was reactivated with Robert A. Lovett as the incumbent. Lovett directed his energies toward increasing aircraft production and streamlining organization. On June 20, 1941, the Army Air Forces was created, with Gen. Henry H. Arnold as Chief. General Arnold was made directly responsible to the Army Chief of Staff and was given the responsibility for establishing policies and plans for all Army aviation activities. It was virtual autonomy within the framework of the War Department. On December 7, 1941, Japanese aircraft struck the American installations at Pearl Harbor, sinking or damaging every American battleship. Only seventy-nine of 231 Army Air Forces' aircraft remained usable; of 169 naval aircraft on Oahu, eighty-seven were destroyed. On December 11, Germany and Italy declared war on the United States.

The United States was somewhat better prepared for World War II than for previous wars. As early as February 1940, the War Department had created the Air Defense Command to integrate the defenses of the United States against air attack. In mid-May, President Roosevelt called for the production of 50,000 planes a year. Bombardier training began in the following July, and in November 1941 navigator training started.

On March 9, 1942, the War Department was reorganized. The Army Air Forces, Army Ground Forces, and the Services of Supply were established on equal footing. Air Force officers, headed by General Arnold, made up about one-half of the General



—Wide World Photos

Where once pleasure cars had rolled from the nation's motor capital, now the tools of war were forged. General Arnold, Army Air Forces chief, took time when he could to see the production in action, met with industry leaders like Henry Ford.



This reproduction of a painting by John McCoy depicts one of two B-17s which succeeded in taking off at the height of the Japanese attack on Pearl Harbor on the morning of December 7, 1941. It was piloted by Capt. Brooke Allen, who rose to major general before his retirement in 1965. Though Allen and his crew failed in their objective to find and bomb the enemy carrier task force, their daring exploit helped rally the garrison below to halt the spread of flames and begin the task of rebuilding military strength.

Staff. An early decision was made that, although the war would be waged simultaneously against the European members of the Axis and their Japanese partner, the defeat of Italy and Germany would receive top priority.

Even so, for many months after Pearl Harbor, the unfortunate plight of their forces in the Pacific held the attention of the American people and forced their government to divert much of its strength to the Far East. In the summer of 1942, the Germans were sweeping over Russia. The Russians wanted an immediate

Anglo-American offensive to ease the pressure. Also, the British wanted aid for their battered Eighth Army, which had been driven back by the German Afrika Korps to El Alamein, the last defensible position short of the Nile. On November 8, 1942, the Allied invasion of North Africa was launched. The fighting was bitter, but once the Allies secured mastery of the air the issue was no longer in doubt. The enemy was forced to withdraw most of his planes to Sicily. In May 1943, Allied aircraft, sometimes flying as many as 2,000

(Continued on page 51)

More than any other factor, it was the nation's enormous productive capacity that brought on the eventual defeat of the Axis powers in World War II. When President Roosevelt in 1940 called for "50,000 planes a year," the goal seemed incredible, but by 1944 US plants were able to turn out 96,000 planes, including these

B-29 Superforts being assembled in the same Marietta, Ga., plant now initiating production of the huge C-5A Galaxy transport.





B-25 of Lt. Col. Jimmy Doolittle's Tokyo raiders takes off from USS Hornet on April 18, 1942. Chance encounter with Japanese fishing vessel which might have reported Hornet's position forced the sixteen bombers to depart several hours early. All succeeded in attacking their targets, but ran out of gas before reaching friendly bases in China. Raid caused little physical damage, but forced Japanese to strengthen home defenses, reducing their forces available for combat in South Pacific.



B-25s of Fifth Air Force drop fragmentation bombs by parachute in low-level attack on Japanese airstrip at Dagua, New Guinea, in February 1943, destroying or damaging several Tony fighters and Helen bombers. Attack on Dagua was intended to weaken Japanese forces defending major base at Lae, 350 miles southeast. A month later, in Battle of Bismarck Sea, US and Australian planes attacked 16-ship convoy seeking to reinforce Lae. Only four destroyers escaped, signaling beginning of end for Japanese in New Guinea.



—Wide World Photos

On his return from China after leading raid on Tokyo, Jimmy Doolittle, now a brigadier general and recipient of Congressional Medal of Honor, was summoned, with his wife, to White House to receive congratulations from President Roosevelt. With them are General Arnold, left, AAF Commander, and Gen. George C. Marshall, Army Chief of Staff.

Chinese by the thousands helped build airfields to bring US airpower within striking distance of Japan. Straining shoulder to shoulder, they pull heavy rollers to smooth out runways made of rock they had crushed with primitive tools.





The Axis enemy got a never-to-be-forgotten taste of American airpower in action in August 1943 as 177 Liberators blasted oil fields in effort to cripple the Nazi war machine. This is how Ploesti, Romania, looked as the Liberators flew low and wrought disastrous damage. The attack was costly to both sides, with 54 of the B-24s lost, but strategic bombing planners learned lessons that were put to good use in latter days of war over Europe.



Stories old airmen tell to friends at reunions: how we bailed out over Northern Italy after our Liberator was hit by flak (defenses are expected to be light, they told us) and we lost one wing. This 15th Air Force B-24 had its picture taken in mid-disaster, with no possibility of coming in on a wing and a prayer. It crashed, but two crewmen were able to bail out and make it safely to the ground.

sorties a day, pried the Germans from their entrenched positions in the Tunisian hills. Penned against the sea, 270,000 Axis troops surrendered.

Following the African victory, the Allied offensive pushed on. The bombing of the small island of Pantelleria, midway between Africa and Sicily, paved the way for the conquest of Sicily. For more than two weeks, aircraft of the US Ninth and Twelfth Air Forces and British units pounded at enemy harbor installations, airdromes, coastal batteries, and gun emplacements. More than 5,000 sorties were flown and 6,200 tons of bombs dropped. On June 11, as Allied assault craft neared Pantelleria, its defenders ran up the white flag. Air action alone had decided the battle.

Following an aerial bombardment that put out of operation all but a handful of Sicily's thirty-one airfields and destroyed 1,000 enemy planes, the American Seventh Army and the British Eighth Army went ashore on July 10, 1943. An allied airborne operation failed miserably. However, American aircraft helped beat back a German threat to the beachhead. After a short but sharp campaign, the Nazis pulled out and evacuated their troops to Italy.

The Allied seizure of Sicily and the aerial bombardment of the Italian peninsula proved too much for the government of Mussolini, who was forced to resign. His successors signed an armistice on September 3, 1943. However, the Germans were determined that Italy should not fall into the hands of the Allies. At the same time that the armistice was signed, the British Eighth Army landed on the lower coast of Italy. Six days later the American Fifth Army landed at Salerno. The advance of the Allies in Italy was agonizingly slow as they inched their way northward.

Meanwhile American aerial doctrine was being hammered out on the forge of experience. A pyrrhic victory was achieved against the German-held oil fields in Ploesti, Romania; fifty-four of the 177 B-24s
(Continued on following page)



By September 1944, when this B-17 raid picture was taken over Ludwigshafen, the strategic air offensive had mounted to a crescendo of destruction. Fighter opposition was dwindling as were US bomber losses, but the flak was heavy and war still hell.



Air Transport Command began using women pilots to ferry aircraft in the US and Canada in September 1942. These Women's Air Force Service Pilots (WASPs) also towed targets and flew cargo, weather, and administrative missions under leadership of Jacqueline Cochran. Peak WASP strength was 1,500 pilots.



Fifth Air Force planes in the Pacific took heavy toll of Japanese shipping, hit hard at overextended Japanese supply lines. In this raid of November 2, 1943, Rabaul Harbor was virtually swept clean, nearly every ship being heavily damaged or sunk by 1,000-pound bombs from attacking B-25s of Gen. George Kenney.

making the raid were lost. Similar bombing raids against the ball-bearing factories at Schweinfurt, Germany, were equally costly. In one raid thirty-six bombers were lost—in another, sixty. The Americans were finally convinced that unescorted bombing assaults against heavily defended targets were not feasible.

General Arnold, however, urged his commanders to press the offensive and win air superiority as a prerequisite to the projected invasion of Fortress Europe. On December 27, 1943, he told them "This is a MUST. . . . Destroy the enemy air force wherever you find them, in the air, on the ground, and in the factories."

In the middle of December 1943, P-51 Mustangs arrived in England and proved to be the answer to the long-range escort problem. The AAF and RAF stepped up the tempo of the bombing attacks. Between February 20 and 25 in 1944 the AAF flew 3,800 bomber sorties against German aircraft factories, while the RAF made five massive night attacks. Fighters flew some 3,500 sorties in support of the AAF bombers.

The AAF then went after Berlin. On March 6 and 8, more than 1,000 bombers struck the city. The fighters then switched their tactics; flying ahead of the bombers, they sought out the enemy fighters and destroyed them. By the end of March, the Americans had won air superiority. The way was now open for an assault against Nazi-occupied Europe.

In preparation for the invasion, the Allied Air Forces isolated the proposed landing area in Normandy from German ground and air reinforcements. Seventy-six thousand tons of bombs were dropped on French railroads and bridges, blocking the movement of German reserves to Normandy. Allied aircraft then pounded enemy forward airfields for three weeks to prevent their use by the Luftwaffe on D-Day. Concurrently, raids were made on enemy coastal defenses and radar-warning stations. Just ahead of the assault on the beaches, Allied air units dropped paratroops of three airborne divisions. On D-Day the Eighth and Ninth Air Forces flew 8,722 combat sorties from the United Kingdom. On June 6, 1944, the Allied Ground Forces, under a huge fighter cover, successfully landed on the European continent.

A stubborn German defense bottled up the Allied ground troops. To break the impasse, some 2,400 American planes pounded five strategic points near St.-Lô on July 25, destroying enemy communications and shattering his morale. Third Army tanks, supported by Ninth Air Force fighters, moved out of Normandy into Brittany. The German units fled across France, hotly pursued by Allied aircraft. In one last desperate effort, the Germans counterattacked through the Ardennes Forest of Belgium in December 1944, when bad weather had grounded Allied aircraft. But when the skies cleared, initial German successes were wiped out, isolating the Nazi troops from their fuel and food. The German gamble had failed.

Two German technical developments had come too late to alter the course of the war. The V-1, a small guided missile, pulse-jet powered and carrying a ton of explosives, caused great damage in England in the summer of 1944, but did not interfere with Allied progress on the continent. In September the Germans fired the more effective supersonic V-2 rocket against



Large-scale airborne operations were part of every major invasion. From a cost/effectiveness point of view their value was often dubious and control of the air was always a clear prerequisite to what success was achieved. Here troop carrier C-47s of the 12th Air Force fill the sky with parachutes over the coast of Southern France, somewhere between Nice and Marseilles.



An Air Force is many kinds of men, and there are more who do not fly than there are those who do. Behind every ace stood a conscientious crew chief and every flying cadet put his life and fortune into the hands which twisted the wrenches and twirled the screwdrivers. And one more look never hurt anybody.



An army travels on its stomach but an Air Force lands and takes off on its wheels. Stacks of landing-strip matting sit at a supply depot somewhere in England, waiting to be carried cross-channel to repair bombed-out runways and build new ones. Pace at which air support kept up with ground troops was key factor.

England and Antwerp, but again it was too late. On May 7, 1945, the Nazis surrendered unconditionally. The war in Europe was over.

Meanwhile, the war in the Pacific continued with unabated fury. The Japanese aerial attack on Pearl Harbor was part of a larger plan that included the conquest of Malaya, Sumatra, and Burma. In addition to the attack on Pearl Harbor, the Imperial Navy was to launch operations in the Philippines, Borneo, Celebes, Java, Northern New Guinea, the Bismarck Archipelago, and out to the Gilbert Islands. By the end of the fourth month of the war, the Japanese had achieved substantially all of their initial objectives.

On April 18, 1942, sixteen AAF B-25s, under Lt. Col. James H. Doolittle, launched an attack from the US Navy aircraft carrier *Hornet* against Tokyo and other targets in Japan. All aircraft were lost in bad

(Continued on following page)



The idea was to fly overloaded aircraft at altitudes they weren't quite designed to handle and on schedules that any self-respecting transport pilot would have the good sense to avoid. The idea was to fly the "Hump." And Army Air Forces Air Transport Command types did it, over and over again, some of them pledging to themselves that come the end of the war they'll take the train every time, with a drawing room. This is a view of the Himalayas from a C-87 out of Jorhat, Assam, India.



Circa 1944. The bomb-filled air over Rangoon, Burma, as B-29s flying out of India plastered a large Japanese depot. Japan had a year or more to go before her collapse under the weight of US airpower, but she could already taste her coming defeat.



Where once the gallant Royal Air Force had flown alone against the Nazi Luftwaffe, now the Americans were helping, and a joy to behold over the skies of England were US aircraft like this flight of scrappy and deadly North American P-51 Mustangs.

weather over China, but most of the crews were saved. The damage was slight, but sagging American morale got a tremendous boost.

The raid also spurred the Japanese to extend their perimeter still further in order to keep the Americans beyond reach of the home islands. Accordingly, a new plan provided for an advance into the Solomons and Port Moresby, New Guinea, to be followed by a further advance into New Caledonia, Samoa, and the Fiji Islands, the capture of Midway, and the temporary occupation of the Aleutians. If successful, the program would have cut the line of communications between the United States and Australia, reduced any threat from Alaska, and denied the United States any staging areas more advanced than Pearl Harbor. As it happened, Japan overextended her line of advance, committed herself to an expensive and exacting supply problem, delayed the fortification of the perimeter originally decided upon, jeopardized her economic plan for exploitation of the area already seized, and made herself vulnerable to an early counterattack in far advanced and still weak positions.

In May 1942, the Japanese forward advance was checked in the Coral Sea by aircraft from US Navy carriers. The following month American carrier-based aircraft badly mauled Japanese carriers in the Battle of Midway and achieved a balance of naval airpower in the Pacific. By the end of 1942, the Americans, through bitter fighting on land, sea, and in the air, had eased the threat to Australia. The way was now open for offensive action.

There would be two advances toward the Japanese home islands. American forces under Adm. Chester W. Nimitz would drive west through the Central Pacific, seizing strategically important Japanese-held islands. Another American force under Gen. Douglas MacArthur would drive northwest along the backbone of New Guinea. Both assaults were to be made under the cover of American aircraft.

The inevitable became a matter of time. The over-extended Japanese, although courageous, were no
(Continued on page 57)

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The pipe-smoking officer in the center is the then-Maj. Gen. Curtis E. LeMay, 20th Air Force Commander in 1945. General LeMay, Brig. Gen. Lauris E. Norstad, left, and Brig. Gen. Thomas S. Power, right, shown talking over the results of devastating 300-plane B-29 raid on Tokyo, all did rather well in post-World War II careers. LeMay, after running SAC, served as AF Chief of Staff. Power headed SAC after LeMay, and Norstad became NATO Supreme Commander.

—Wide World Photos



—Wide World Photos

Maj. Richard I. Bong, who scored 40 air victories in the Pacific and won the Medal of Honor, got a charge out of meeting his wartime boss, Hap Arnold, who signed a "short-snorter" bill for AAF's top ace. Major Bong lost his life in an F-80 crash back home in the States, only a few days before V-J Day.

match for the overwhelming American resources of men, materiel, and weapons. US forces bypassed many Japanese strongpoints, leaving them to wither on the vine, and hit weakly held positions instead. These then became powerful air bastions from which land-based aircraft could assault the next enemy position further north and west.

The two lines of the American advance merged on October 20, 1944, when the Sixth Army went ashore at Leyte in the Philippines. The Sixth Army consisted of Admiral Nimitz's XXIV Corps and General MacArthur's X Corps. For the first time in the long drive, General MacArthur went ashore without first having secured air supremacy. For the first five days, the ability of the Sixth Army to hold the island was uncertain, but the arrival of elements of the Fifth Air Force tipped the scales. Japan gambled heavily on Leyte, sending in reinforcements, risking her fleet in what was to become the greatest naval engagement of all time, and risking her Air Force. All of this was to no avail. The Philippine campaign greatly weakened



Both these officers were destined for important postwar jobs. Gen. Dwight D. Eisenhower, shown here pinning Oak Leaf Cluster on DSM of Lt. Gen. Carl Spaatz, was to be Army Chief of Staff, before going on to even greater things. Spaatz was to add a fourth star and become first USAF Chief of Staff.

the Japanese Navy and speeded up the tempo of American operations. Also, the Japanese were now denied oil, rubber, tin, and other strategic materials from the south.

Meanwhile, American strategy in the China-Burma-India Theater was directed toward the defense of India and the development of a supply line into the interior of China. A series of guerrilla campaigns in the jungles of Burma pushed the Japanese out of that area. Operations depended heavily on air transport. Flying the "Hump" from India to China followed a perilous route over uncharted areas of the Himalayas, through passes 14,000 feet high in wild winds. Nevertheless, AAF transports, primarily C-54s, lifted more than 12,000 tons of supplies a month during the first

(Continued on following page)

End of the affair—East. Stolid in defeat, Japanese delegation arrives at Ie Shima off Okinawa on the first leg of their journey to Manila for surrender arrangements. Second from left, Japanese Lt. Gen. Kawabe Takashiro, Vice Chief of the Imperial Staff, who led the 16-man group. Ie Shima was the place where Ernie Pyle, the correspondent who wrote so warmly about the American GI, was killed.



End of the affair—West. Russia's representative at the Reims, France, surrender ceremony, signs document of German capitulation. At his left, General Spaatz. Airpower had helped mightily to destroy the supposedly "invincible" Nazi juggernaut.



The apocalyptic scene over Hiroshima as history's first atomic bomb was dropped. Smoke billows 20,000 feet into the air and 10,000 feet across the base of the mushroom cloud. Two aircraft took part in the mission—and changed the world. But Japan, in its anguish, vowed to fight on. Three days later a second A-bomb destroyed Nagasaki, and the war was over.

half of 1944 and reached a peak of 71,000 tons in July 1944. Without air transport China could not have remained in the war.

As 1945 opened, Japan was a beaten power in every way except psychologically. The fanatic dedication of the Japanese defenders of Iwo Jima and Okinawa, exemplified by the kamikaze pilots, caused American strategists deep concern. The island fortresses eventually fell, but the invasion of the Japanese homeland, it was feared, would be costly both in blood and in treasure.

Military targets in Japanese cities proved highly vulnerable to incendiary attack. On March 9, 1945, 334 B-29s of the Twentieth Air Force destroyed one-fourth of all the buildings in Tokyo. Despite this and other heavy and destructive bombing, plus an

effective naval blockade of the islands, influential groups of Japanese militarists pressed to continue the war. The AAF had organized and trained a special combat unit, the 509th Composite Group of the Twentieth Air Force, to deliver an atomic bomb and had modified the B-29 to carry the new weapon. On the sixth of August the B-29 *Enola Gay* dropped the first atomic bomb employed in warfare on the industrial center of Hiroshima, destroying 4.7 square miles of the city. A second atomic bomb, dropped on Nagasaki three days later, convinced the Japanese government of the futility of continuing the war. The decision to surrender followed on August 10. On September 2, Japanese envoys signed the terms of surrender aboard the battleship *Missouri*.

The greatest war in history had ended.



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Chapter III

V-E and V-J Days



A couple of crew members of an 8th Air Force bomb group in Europe read all about it. The war in Europe was over, and these two airmen would remember that the 8th had made more than fair share of contribution to getting the job done.



In their Paris billet, Army WACs line up for their copies of Stars and Stripes which carries a story about Japan's awaited offer of surrender. Story, published August 10, 1945, turned out to be unofficial but true. Japan's offer was later confirmed.



This quartet of pilots, members of 8th AF's famed 56th "Wolf-pack" Fighter Group in ETO, racked up total of 94½ air-to-air victories. From left: Group Commander Col. Hubert Zemke, 19½ kills (now retired); Lt. Col. David Schilling, 22½ (killed in an auto accident in England in 1956); Lt. Col. Francis Gabreski, 31 (now a colonel and, with 6½ MIG kills in Korea, USAF's top living ace); and Capt. Fred Christensen, Jr., 21½ victories.



Where do you go in London when something really big happens? You go to Piccadilly Circus because that's where everyone else goes. And that's where the crowd gathered on August 14, 1945, when the news of the surrender of Japan reached England. It was time for civilians and servicemen, including the American allies, to shake hands warmly, and even do a bit of drinking. World Wars don't end every day. Scene was universal.



If you were in New York City when the news of the Japanese surrender was announced, you went of course to Times Square. People danced in the streets, some of them got drunk, some of them wept, some of them simply smiled, and everyone felt warmly toward his brother. This was the scene in Times Square on August 14, 1945. America and her Allies had smashed Japan.



Morning clothes served as "mourning clothes" for Japan as Foreign Minister Mamoru Shigemitsu, in top hat, cutaway, striped trousers, and spats, led Japan's surrender delegation aboard the battleship Missouri for the capitulation ceremony. Gen. Yoshijiro Umezu of the Imperial Staff signed document after Shigemitsu, and tears came to the eyes of one of the General's aides.



With the death of President Franklin D. Roosevelt in April 1945, the Allied Big Three lineup changed. America's new leader, Harry S. Truman, represented us now, and met the Soviet dictator, Josef Stalin, for the first time just before the Potsdam meeting. England's Churchill was to be replaced by Clement Attlee.



The high point, without question, in the long and colorful life of Gen. Douglas MacArthur: On Sept. 2, 1945, after the long and bloody Pacific War, the General, as Supreme Allied Commander in the Pacific, signs the surrender document aboard the Missouri anchored in Tokyo Bay. At left is Lt. Gen. Jonathan Wainwright, who had spent 1,201 days as a Japanese prisoner of war after leading the defense of Corregidor in 1942.



A smiling German officer, Maj. Gen. Erich Elster, makes arrangement for the surrender of no fewer than 20,000 troops of Hitler's once-feared Wehrmacht. The German officer at left seems to find the occasion more solemn. The scene is Romorantin, France, and helping to do the honors on the American side is US Army Lt. Col. Bertram Kaliech. By this time, this kind of thing had become an everyday occurrence, and the job was to care for defeated enemy.

Chapter IV

The Day Billy Mitchell Dreamed of



Billy Mitchell fought, and lost, his battle for an independent air arm, but the dream he so ardently pursued later came true.

BEFORE World War II, US airmen had developed a distinctive doctrine for the employment of airpower which, except for details, is still regarded as authoritative by the United States Air Force. Inevitably, air doctrine clashed with ground force doctrine, which held, in general, that the main role of the air elements was to support ground operations. Consequently, the air arm, from the days of General Mitchell to post-World War II eras, sought legislative approval for separate and autonomous status.

Following Pearl Harbor, there was a brief surge to obtain an independent air force, but General Arnold and his advisers discouraged it on the grounds that a changeover in wartime would be not only difficult but also hazardous. Periodically, during the war years, members of Congress introduced bills calling for an independent air force and a national military establishment. These received scant attention.

In May 1944, the Joint Chiefs of Staff appointed a committee of outstanding Army and Navy officers to examine the postwar military establishment. Should it be two departments—War and Navy; three departments—War, Navy, and Air; or one department—Defense?

Following ten months of study and travel in every theater of war, including interviews with fifty-six military and naval leaders, the committee, in March 1945, recommended establishing one Department of Armed Forces with three coordinate branches. The committee believed prompt action would be necessary in order to prevent reversion of the air arm to its pre-World War II status and to hold the gains made since 1942 in efficiency and cooperation.

Between September 1945 and March 1947, the American nation, with unseemly haste, dismantled the greatest war machine the world has ever known. American forces pulled out from China, India, the Middle East, North Africa, and many other areas of the world, leaving power vacuums that the Communists rushed in to fill. Only in Germany, Japan, and a

(Continued on page 64)



The Big Three—Truman, Attlee, and Stalin, with their staffs—met at Potsdam in July 1945 to plan Germany's postwar administration and to conclude the war against Japan. The conference was largely a failure. Though the second objective was attained soon afterward, Russia was able to gain a voice in Japanese armistice terms by declaring war on Japan on August 6, Stalin having learned at Potsdam that the US would employ the atomic bomb. It was at Potsdam that the Allies agreed to partition Berlin and to set up an Allied Control Council to administer all of Germany. The Council was scuttled almost immediately—first by France, miffed because it had not been a party to the agreement, then by the fast-expanding rift between the Western powers and the USSR.

As Allied troops raced across Europe in the closing days of the war, nothing was more rewarding than to free fellow GIs in German prisoner of war camps. Life in World War II POW compounds was harsh and sometimes brutal, but generally far more humane than the treatment accorded US prisoners in subsequent conflicts—certainly more humane than in Korea, and from most accounts, today in North Vietnam.



When war ended, just about everyone in uniform was anxious to turn in his gear and head for home. From a V-J Day strength of 2,253,000, the Army Air Forces dropped to 303,000 by May 1947. Just a few months before the US Air Force was to come into being, only two of its fifty-two groups were operational.



To keep up public interest, the Air Force staged several long-range flights immediately after the war. Here General Arnold, second from right, greets Maj. Gen. Curtis LeMay, Brig. Gen. Emmett O'Donnell, and Lt. Gen. Barney Giles, on arrival in Washington by B-29s from Japan, with fuel stop in Chicago.

Lt. Gen. J. Lawton Collins, later to become Army Chief of Staff, was the first of a string of military witnesses to testify in Congress on proposals for an autonomous Air Force. In October 1945, he submitted a plan for a Department of Armed Forces.



Fleet Admiral William D. Leahy, who served in the White House from 1942 to 1948 as personal Chief of Staff to Presidents Roosevelt and Truman, followed Navy line in opposing unification, even though it was favored by President Truman and the JCS.

President Truman persisted in prodding Congress to act on unification. "Airpower has been developed to a point where its responsibilities are equal to those of land- and seapower," he told Congress. His decision to establish unified commands overseas prior to passage of the bill helped bring about its enactment.



few strategic outposts like Okinawa did America leave garrisons, but even these were token forces.

From a strength of 2,253,000 men on V-J Day the Army Air Forces had shrunk to 303,000 by the end of May 1947. On V-J Day, aircrew personnel strength was 413,890. By June 1947 this had fallen to 24,079. At the end of October 1946 only eighteen percent of the combat aircraft were combat-ready. The number of effective combat units had dwindled from 218 groups on V-J Day to two groups in December 1946. The books showed a total of fifty-two groups, but fully fifty of these were ineffective.

By 1947 the postwar confrontation with Communist erstwhile allies required action. The Truman Doctrine provided for military aid to nations threatened by communism while the Marshall Plan began to pump economic aid into war-ravaged Europe.

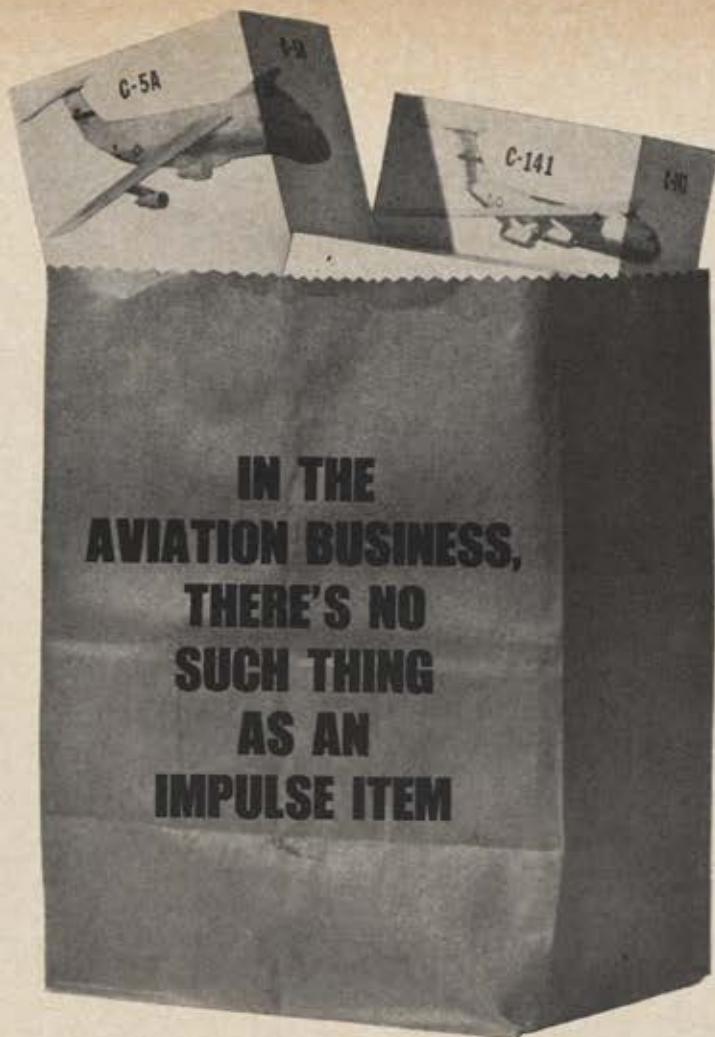
In October 1945, the War Department, with Lt. Gen. J. Lawton Collins as its representative, presented to the Senate Committee on Military Affairs a proposal for a single Department of Armed Forces including branches of Army, Navy, and Air Force. In the same month, Senator Edwin C. Johnson (D.-Colo.) offered a bill for a single Department of Military Security containing six divisions, each with its own Undersecretary: for Scientific Research and Development, Army, Navy, Air, Procurement, and Military Intelligence. Meanwhile, in January 1945, Senator Lister Hill (D.-Ala.) had introduced a bill providing for a single Department of Armed Forces.

The Senate Committee on Military Affairs began hearings on the unification bills of Hill and Johnson. War Department representatives, both military and civilian, generally favored unification. Navy spokesmen, including Fleet Adm. William D. Leahy, personal Chief of Staff to the President, were opposed. The Committee concluded its hearings in December 1945, but failed to submit a report on either bill. At this point, President Truman asked Congress to pass legislation combining the War and Navy Departments into "one single Department of National Defense" organized along the lines proposed by the JCS and General Collins. The President wanted parity for the air arm. He told Congress, "Airpower has been developed to a point where its responsibilities are equal to those of land- and seapower, and its contribution to our strategic planning is as great. Parity for airpower can be achieved in one department or in three, but not in two. As between one department and three, the former is infinitely to be preferred."

In response to the President, a subcommittee of the Senate Committee on Military Affairs began working on unification legislation. The Navy continued its opposition, as it felt that consolidation of the national military forces would "silence the Navy's voice in military affairs."

In mid-May 1946, the President asked the Secretaries of War and Navy, Robert P. Patterson and James V. Forrestal, to get together and identify their areas of agreement and disagreement. Their report noted eight points of general agreement, including

(Continued on page 67)



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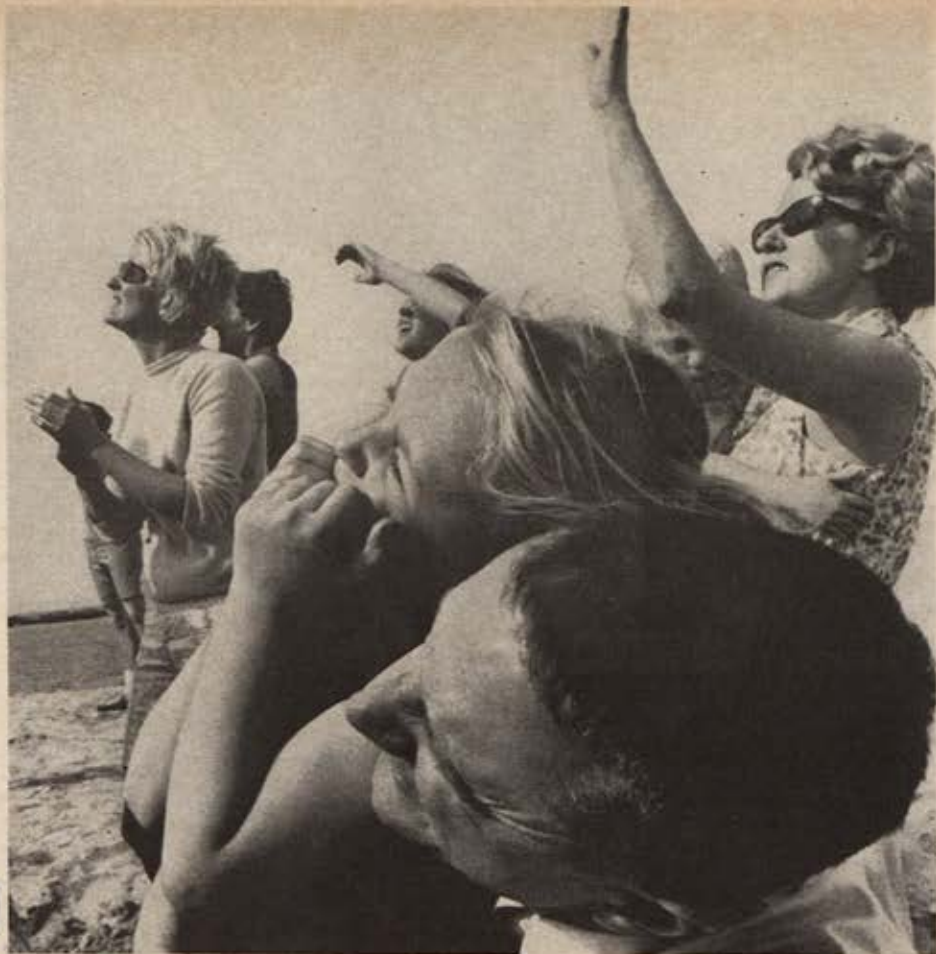


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the elimination of the proposed single Chief of Staff. However, they were unable to agree on three major points: the creation of a single department of national defense, the over-all status of military aviation, and the position of the Marine Corps.

President Truman had hoped that Congress would be able to move on unification legislation, but the differences between the Army and Navy were too deeply rooted. Consequently, the President presented his own compromise. There would be a single Department of National Defense, but each of the coordinate branches, Army, Navy, and Air Force, would retain its integrity, and the position of Chief of Staff of Common Defense would be eliminated. Naval aviation would be afforded every "opportunity to develop its maximum usefulness," but Air Force personnel would man land-based planes for naval reconnais-



Secretary of War Robert P. Patterson was asked by President Truman in May 1946 to meet with Secretary Forrestal of the Navy in settling their differences over the bill. They were able to agree on eight points, but remained apart on three more—a single Defense Department, status of military aviation, and position of the Marine Corps.



In November 1946, Navy Secretary James V. Forrestal took the lead in reexamining points of disagreement and drafting the bill which eventually was enacted. Partly to mollify continuing Navy objections, President Truman appointed him the nation's first Secretary of Defense.



Maj. Gen. Lauris Norstad of the Air Force, above, was designated to work with Vice Adm. Forrest Sherman under Forrestal's direction to hammer out compromises which could form a basis for legislation. As a first step, they recommended that the President appoint unified commanders in five overseas theaters.

sance, antisubmarine warfare, and protection of shipping. The Navy would retain the Marine Corps.

Late in June, the Senate Committee on Military Affairs revised the bill, but the Navy adherents, especially the Marines and the naval aviators, still voiced disapproval. Unification died by default. The President proposed in September that a new bill be drawn up that could win the approval of the next Congress.

In November, Secretary of the Navy James V. Forrestal took the lead in reexamining the problem of unification. Maj. Gen. Lauris Norstad and Vice Adm. Forrest P. Sherman were assigned the task of working out an agreement to be offered as a basis for the legislation.

They quickly decided that the most pressing question was that of unified commands in overseas theaters. They recommended to the Joint Chiefs of Staff a system whereby a single commander would be responsible for the operations of the land, naval, and air forces in that area. The program received the strong support of the Joint Chiefs and President Truman. The President promptly ordered the establishment of five such commands: the Far East Command, Pacific Command, Alaskan Command, the Northeast Command, and European Command. Plans also were made for the creation of the Caribbean and Atlantic Commands.

Norstad and Sherman also agreed on functions and general organization of the military departments in a draft bill which received the strong approval of President Truman. The climate on Capitol Hill was favorable. In an administrative reorganization Congress had merged the committees on naval affairs and military affairs into a single committee on armed services in each house. On March 18, 1947, the Senate

(Continued on following page)

On September 18, 1947, the US Air Force was born as Stuart Symington, who had been Assistant Secretary of War for Air, was sworn in as the first Secretary of the Air Force by Chief Justice Fred Vinson. Witnessing the historic ceremony were, from the left, Secretary of the Army Kenneth C. Royall, Defense Secretary James V. Forrestal, and Secretary of the Navy John Sullivan.



Secretary Symington and Gen. Carl Spaatz, newly designated as USAF's first Chief of Staff, met the press on October 1, 1947, to announce the Air Force's new military structure. The day Billy Mitchell dreamed of had dawned at last.

Committee on Armed Services started hearings on S.758, National Security Act of 1947. The hearings ended on May 9. The House Committee on Expenditures in the Executive Departments held hearings from April 2 to July 1. The majority of the many witnesses favored the bill and urged its adoption.

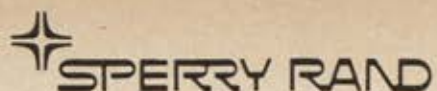
Fear was expressed that a "Super Secretary" might wield dictatorial powers over the Departments of Army, Navy, and Air Force. The act finally passed represented a compromise between extreme points of view. On July 26, the National Security Act of 1947 became law.

The Act was prefaced by a Declaration of Policy: "to provide a comprehensive program for the future security of the United States; to provide three military departments—the Army, the Navy (including naval aviation and the Marine Corps), and the Air Force; to provide for their coordination and unified direction under civilian control but not to merge them; and to provide for the effective strategic direction and operation of the armed forces under unified control." The National Military Establishment would be under a civilian Secretary of Defense. Under the civilian Secretary of the Air Force, the military Chief of Staff was to command the US Air Force.

In the broadest terms, the Act stated the composition and mission of the Air Force. "In general the United States Air Force shall include aviation forces, both combat and service, not otherwise assigned. It should be organized, trained, and equipped primarily for prompt and sustained offensive and defensive air operations. The Air Force shall be responsible for the preparation of the air forces necessary for the effective prosecution of war except as otherwise assigned, and, in accordance with integrated joint mobilization plans, for the expansion of the peacetime components of the Air Force to meet the needs of war."

President Truman named James V. Forrestal as the first Secretary of Defense. Stuart Symington became the first Secretary of the Air Force, on September 18, 1947. Gen. Carl Spaatz became the first Chief of Staff of the United States Air Force on September 26 of the same year.

At long last, the dreams of airmen from the days of Billy Mitchell through the heroic days of World War II had become a reality. The Air Force was now an equal partner with the Army and Navy in the defense of the United States. Airpower was now recognized as "the nation's first line of defense and its chief hope for deterring war."



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Chapter V

The New Air Force Takes Shape— Organizational Patterns

IN ANTICIPATION of autonomy, Air Force project officers, long before September 18, 1947, had been preparing plans for the organization of the United States Air Force when it should come into being. Thus, when Gen. Carl Spaatz succeeded General Arnold as the Commanding General of the Army Air Forces, he had available an Air Staff program for rebuilding the AAF. The plan called for the reorganization of AAF

headquarters and the field commands, and the creation of a seventy-group combat force and twenty-two specialized squadrons with sufficient supporting units. The concept of seventy combat groups was to remain unchanged until the Korean War altered the requirement.

Fortunately the AAF was able to reorganize its field structure without encountering the formidable obstacles, primarily lack of funds, that impeded the



Before the Air Force became a separate service and gained a new birthday, it had traditionally observed Air Force Day on August 1, marking the date in 1907 when the Aeronautical Division of the Signal Corps was created. Here President Truman signs a proclamation to celebrate, on August 1, 1946, the thirty-ninth anniversary of the Army Air Forces. With him are Gen. Carl Spaatz, AAF Commanding General, and his Deputy, Lt. Gen. Ira C. Eaker. By the following year the unification bill had been enacted and, although August 1 remains a historic day in USAF annals, Air Force personnel around the world were looking forward to celebrating a new "day."

simultaneous effort to expand to seventy groups. The proposed organization had been battle tested in World War II. AAF leaders were confirmed "in their belief that airpower was global in nature and that long-range bombers must be the hard core of American airpower." While demobilization was still under way, General Spaatz, anticipating an independent Air Force, grouped the combat air forces in the United States, including the numbered air forces, under three new functional commands. Created March 21, 1946, these commands—Strategic Air Command, Tactical Air Command, and Air Defense Command—provided the fundamental framework for the new Air Force.

Strategic Air Command was to be prepared to deter any possible aggressor and conduct long-range retaliatory operations in any part of the world at any time. Tactical Air Command's mission was to maintain a capability and develop plans for tactical air operations in any area of the world, independent of or in conjunction with other air, naval, and/or amphibious forces. Air Defense Command was charged with the responsibility for the detection, identification, interception, and destruction of enemy air weapon systems.

The remainder of the Army Air Forces structure consisted of five supporting commands in the United States and five overseas commands that followed the pattern of the theater commands of World War II. Preeminent among the overseas commands were the United States Air Forces in Europe and the Far East Air Forces, which represented most of the air combat strength outside the United States. This organizational framework was carried over, unchanged, into

the US Air Force in September 1947. The following important new commands were added after 1947: the Air Research and Development Command, Continental Air Command, Air Materiel Command, and the joint Military Air Transport Service. (Still later, in 1961, research, development, and procurement were rearranged into the Air Force Systems Command and the Air Force Logistics Command.)

Early in June 1947, the Army and the Air Force began to prepare in final form a plan for the orderly transfer of functions to the Department of the Air Force. On September 26, the Secretary of Defense approved the transfer of military and civilian personnel of the Army Air Forces to the Department of the Air Force. The transfer was completed on July 22, 1949, and included almost every area of staff and command activity: personnel, administration, intelligence, training, operations, research and development, procurement, supply, and fiscal.

The Air Force differed from the Army and Navy in that it had no congressional authority for its composition and organization. On such matters, the National Security Act provided only very broad classifications, permitting great flexibility in organizing both the headquarters and the field structure. The Air Force naturally was willing to profit from the organizational experiences of her older sister services. It created a streamlined functional structure that operated smoothly enough to invite from the Army and Navy the sincerest form of flattery—a considerable degree of imitation.

However, there were also advantages to having
(Continued on page 73)



By 1949 these were the men who headed the newly formed Air Force's major commands. The photo was made in the Pentagon in April 1949 at a Commanders' Meeting. Seated, from left, Lt. Gen. George E. Stratemeyer, CG, Far East Air Forces; Gen. George C. Kenney, CG, The Air University; Gen. Hoyt S. Vandenberg, USAF Chief of Staff; Lt. Gen. Ennis C. Whitehead, CG, Continental Air Command; Lt. Gen. John K. Cannon, CG, USAF in Europe. Standing, from left: Gen. Muir S. Fairchild, Vice Chief of Staff; Brig. Gen. Frank A. Armstrong, Jr., CG, Alaskan Air Command; Maj. Gen. William E. Kepner, CG, Air Proving Ground; Lt. Gen. Benjamin W. Chidlaw, Deputy of Air Materiel Command; Brig. Gen. Robert F. Travis, CG, Pacific Air Command; Maj. Gen. Gordon P. Saville, CG, Air Defense Command; Maj. Gen. Robert M. Lee, CG, Tactical Air Command; Maj. Gen. Willis H. Hale, CG, Caribbean Air Command; Maj. Gen. Laurence S. Kuter, CG, Military Air Transport Service; Maj. Gen. Robert W. Harper, CG, Air Training Command; Lt. Gen. Curtis E. LeMay, CG, Strategic Air Command; Maj. Gen. Leon W. Johnson, CG, 3d Air Division, England; and Col. Sydney D. Grubbs, Jr., Commanding Officer, USAF Headquarters Command, Bolling AFB, D. C.



Tragic fate of the crew of the B-24 bomber, *Lady Be Good*, which failed to return to its North African base from a 1942 raid on Naples, remained a secret for seventeen years until a party of oil prospectors found the relatively undamaged plane in the Libyan desert, 440 miles southeast of Benghazi, in 1959. Returning in bad weather at night, the crew missed sighting their base and flew on and on until they ran out of fuel and parachuted into the desert. They died far from any possible aid.

—United Press International Photo



A crew led by Col. (later Lt. Gen.) Clarence E. Irvine set a world nonstop long-distance record in the B-29 bomber, *Pacusan DreamBoat*, flying from Hawaii to Egypt over the North Pole in 1946. Besides calling attention to the threat over polar routes, the flight produced valuable navigational data.



Visiting Bikini Atoll in the Pacific for early US atom bomb tests in 1946 were, from left, Brig. Gen. William F. McKee, Maj. Gen. Curtis LeMay, and Maj. Gen. Earle E. Partridge. They are shown here around a scale model of the test layout being briefed on test objectives and Air Force participation.



Less than a year after Hiroshima and Nagasaki, we were testing nuclear bombs at Bikini Atoll in the Pacific. This was the first—Able—day of the historic series. The radioactive cloud boiled up to a height of some 35,000 feet. The date was July 1, 1946, and the United States became the world's first nuclear power.



Baker Day at Bikini, and tons of water thrown out of the lagoon showered down on the Operation Crossroads target fleet. Photos were taken by automatic cameras at safe distance. Although there were some public misgivings about the tests, it was decided to run them. Data on what bombs could do was vital.

legal sanction for its organization. Consequently, the Air Force sought legislative underpinning for its organizational structure. Passage of the Army and Air Force Authorization Act on July 10, 1950, was the first step in this direction. Ironically coming two weeks after the outbreak of the Korean War, the Act authorized "a peacetime air force of 502,000 officers and men and 24,000 serviceable aircraft, organized into a maximum of seventy combat groups plus separate squadrons."

It was not until September 19, 1951, that the internal organization of the Air Force was established by law. Under the Air Force Organization Act of 1951, the Secretary of the Air Force was made responsible for all Air Force affairs and given the necessary authority and assistance to discharge these responsibilities. The Act provided for "the Air Staff organization consisting of the Chief of Staff, Vice Chief of Staff, not more than five Deputy Chiefs of Staff, and such additional military and civilian members as the Secretary may find necessary." The Chief of Staff was to exercise command jurisdiction over the major commands and supervise all other portions of the Air Force.

The Secretary of the Air Force was given broad discretionary authority, including that of setting up new commands and organizations when necessary. He could abolish or consolidate the three major commands (Strategic Air Command, Tactical Air Command, and Air Defense Command) or establish new ones in time of emergency or war. This flexibility enabled the Air Force to avoid the rigidity of organization that sometimes had impeded the activities of the Army and the Navy in the past. The Air Force could change and strengthen its organization as circumstances might dictate.

Headquarters USAF had remained basically the same as it had been under Army Air Forces. Most of the functions were grouped under a few key officers. The Chief of Staff, relieved of administrative detail, could concentrate on major Air Force problems with the assistance of the Vice Chief and Assistant Vice Chief of Staff.

At highest staff level under the Chief of Staff were four Deputy Chiefs of Staff—Personnel and Administration, Operations, Materiel, and Comptroller. Subsequently added were the Office of the Inspector General and the Deputy Chief of Staff, Research and Development. Two other offices, Installations and Reserve Forces, were placed at the Assistant Chief of Staff level and made directly responsible to the Chief of Staff.

One of the most significant developments affecting the making of policy at headquarters was the creation of the Air Force Council in 1951. The Council, composed of the Vice Chief of Staff, the five Deputy Chiefs of Staff, and the Inspector General, was charged with preparing Air Force policies and objectives, reviewing and preparing programs, and providing guidance to the Air Staff. The Chief of Staff thus was able to devote more of his time to interservice and international problems.



One of the most dramatic planes of the postwar era was the jet-powered Northrop YB-49 Flying Wing. First test-flown in 1947, it boasted a speed of 520 miles per hour and could carry a 36,000-pound bomb load. But stability problems doomed it.



First US-built jet was the Bell P-59, powered by two 2,000-pound-thrust General Electric J31 engines. It was first flown in October 1942, piloted by Col. (later Lt. Gen.) Laurence C. Craigie. Sixty were built, but none was employed in combat.

First operational
USAF jet was P-80
Shooting Star.
Commander of first
P-80 squadron was
Col. Bruce K.
Holloway, now
USAF Vice Chief
of Staff.



Although Professor Robert H. Goddard had successfully fired guided missiles in the early 1930s, it was not until the Germans had demonstrated their combat potential in World War II that US armed forces entered into missile development, initially experimenting with captured German V-1s and V-2s, latter of which is shown here. By 1947, Convair had built a forerunner of the Atlas, but budget cuts put it in limbo until the early 1950s.

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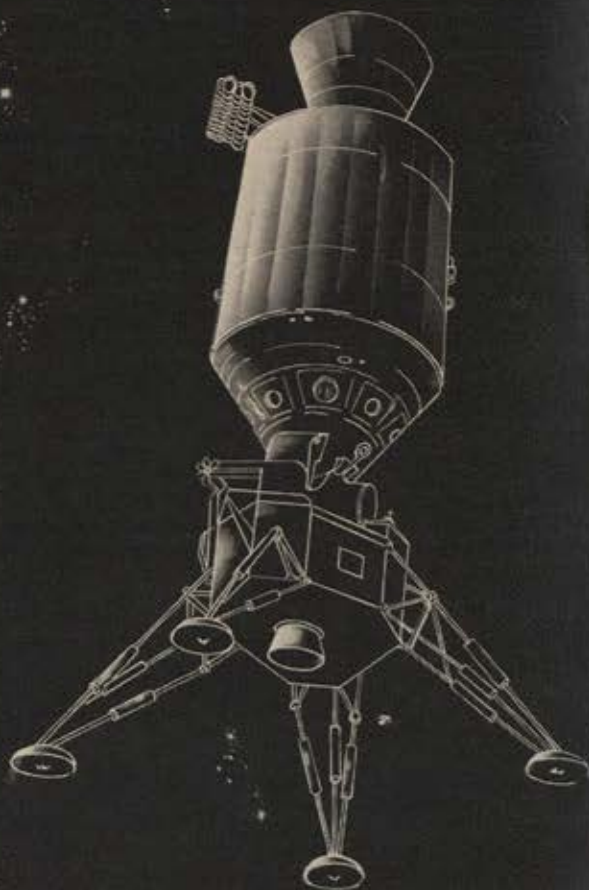
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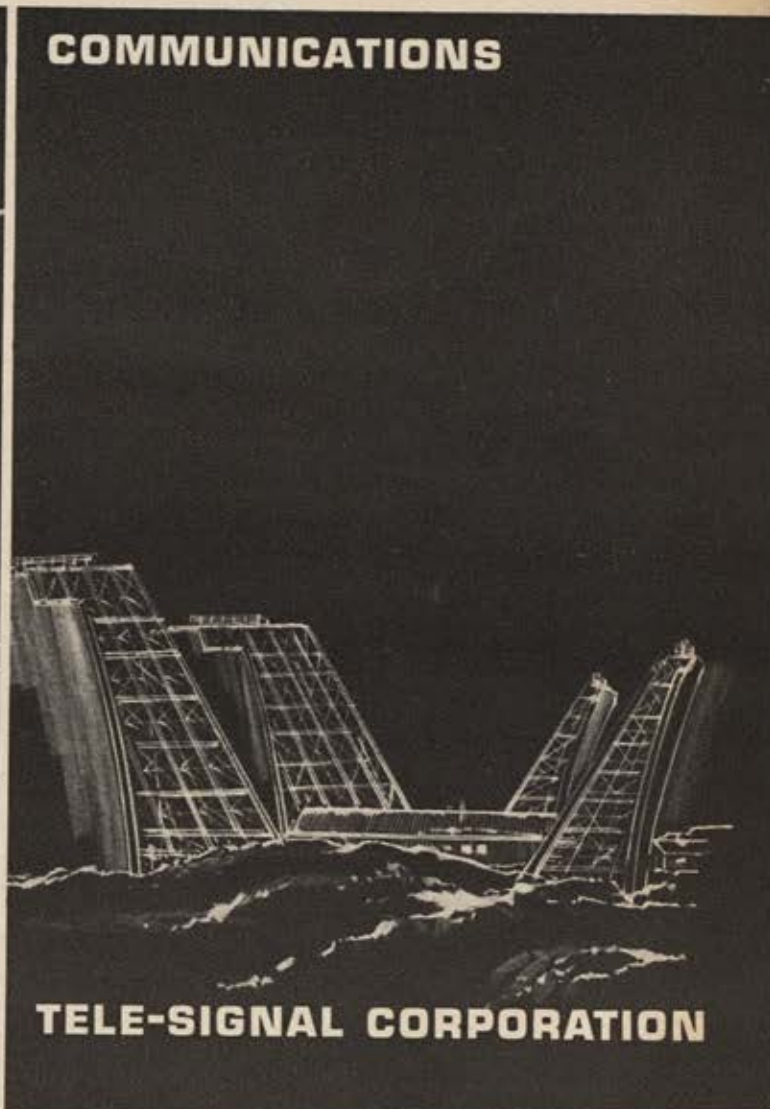
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Chapter VI

The Starving Revolution— 1947-1950



The B-36, with its pusher props and nuclear wallop, became the nation's first line of defense as the newly formed Strategic Air Command, under the leadership of Lt. Gen. Curtis E. LeMay, started the buildup that was to lead to today's jet and missile fleets. Above, President Harry S. Truman reviews a B-36 flyover.



Above all, the B-36 was big, its very bigness attracting crowds wherever it was shown. Its bomb bay held as much as three freight cars, its deicing system could have heated a 600-room hotel. Crewmen moved between fore and aft sections via a tunnel.

UNIFICATION and the new organization did not choke off debate as to the proper role of the Air Force. Forrestal stated it simply when he asked, "What is to be the use, and who is to be the user, of airpower?" This uncertainty can be attributed in large measure to the changing nature of warfare itself, the tremendous technological advances of the past, and the promise that in future wars the air would be the controlling element. The Navy, aware of the limitations of its air mission, would make the aircraft carrier its prime weapon. The Army also wanted to share in the airpower mission that promised to be the weapon of the future.

The Air Force and the Navy differed over the role of strategic airpower. Navy planners doubted the capabilities of the long-range bomber and, on occasion, the very concept of strategic bombing itself. The Air Force leaders believed large carrier task forces could not accomplish long-range strategic air operations. These dissensions were heightened by competition for limited funds.

The Air Force emerged from World War II convinced that seventy groups were necessary for national security. But by the latter part of 1948, it became apparent that future military budget limitations would require the Air Force to reverse its buildup trend, substituting a schedule of cutbacks. In order to minimize as much as possible the effect of these quantitative reductions, the Air Force diverted its activities toward two major goals.

The first was an increase in qualitative capacity, so as to be able to perform more effectively as a member of the land-sea-air team, under the strategic concept of the Joint Chiefs of Staff. The second aim was to increase management efficiency, so as to obtain maximum value from the funds appropriated.

Virtually all Air Force actions up to the middle of 1950 were affected by program revisions and retrenchment. In addition, the Berlin Airlift soaked up an unusual amount of Air Force resources which had been earmarked for other purposes.

The Army Air Forces leaders came out of World War II convinced that their faith in strategic bombing had been vindicated by the record. The United States Strategic Bombing Survey sustained this opin-



The B-36, most powerful bomber of its time and a silent veteran of the Air Force-Navy bomber-vs.-carrier controversy, was never flown in combat. After useful life as America's prime deterrent it ended up in the airplane graveyard, with many of its parts salvaged for use in the craft that took over its vital role.



The Boeing B-47, shown in its experimental XB-47 configuration, was one of the B-36's successors in the SAC air fleet. With its ultrathin wings supporting 6 jet engines in double nacelles in-board and singly near the sweptback wingtips, its design was striking for the time. It, too, like the B-36, was never used in war.

ion, saying: "Allied airpower was decisive. . . . It brought the economy which sustained the enemy's armed forces to virtual collapse. . . ." The air leaders' first step was the creation of the Strategic Air Command (SAC) on March 21, 1946. The command's mission was to be constantly prepared to conduct long-range operations in any part of the world at any time, although, in 1946, SAC's ability to fulfill this mission was largely theoretical.

From the outset, SAC received top, but not overriding, priority among the Air Force's combat commands. It lacked planes, bases, equipment, and trained men. So did the rest of the Air Force. In October 1948, Lt. Gen. Curtis E. LeMay became the Commander of SAC. Overseas bases were acquired
(Continued on following page)



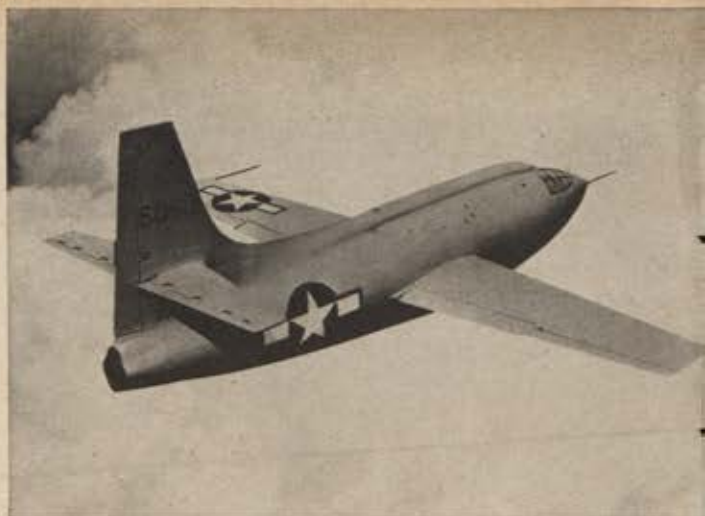
They do it more elegantly now, but the idea is the same—filling up with petrol in the middle of the air. This was the airborne scene as the Lucky Lady II B-50 was being refueled by a B-29 during a training mission in the late 1940s. The training was for the history-making round-the-world nonstop flight that ended on March 2, 1949, at Carswell AFB, Tex., after 94 flight hours.

Twenty-five years separated the 1924 globe-girdling flights of the Douglas World Cruisers and the Lucky Lady II nonstop epic of 1949. It seemed like a good idea for the crews of both to get together for the dedication, at Santa Monica, Calif., of a plaque commemorating the two events. In different eras, both flights had made the same point. Airpower is a global factor. Santa Monica was chosen as site for plaque because it was there that the 1924 World Cruisers had been built. Capt. James Gallagher, pilot of Lucky Lady II, is standing at left.





They said it couldn't be done—or at least some of the experts said it couldn't be done—but Capt. Charles E. Yeager, USAF, on October 14, 1947, became the first man to exceed the speed of sound in level flight, in the Air Force's Bell-built X-1 craft.



Early jet engines were not powerful enough to push an aircraft through the so-called "sonic barrier," which turned out not to be a barrier at all. The Bell X-1 was powered by a solid-rocket engine, had to be carried aloft and launched from a B-29.



Lt. Col. Frank Everest was one of the major contributors to the advance of flight. In the Bell X-2 in 1956, the Colonel set a speed record during tests exploring the thermal barrier. His colleague, Capt. Milburn G. Apt, was killed in the same craft after reaching the incredible speed of more than 2,100 mph.

from which SAC's B-29 and B-36 bombers, flying night and day with atomic payloads, could strike at the vital heart of the enemy wherever he might be. A sense of dedication and mission marked SAC's people, military and civilian. For many of them, the inspiration was that without SAC the nation might not endure.

The danger of an air attack on North America seemed remote at the end of World War II, as only the United States had the atomic bomb and the means of delivering it. However, Air Force leaders realized that this advantage was temporary. They wanted a protective air shield over all of North America. So the Air Defense Command (ADC) was created in March 1946 and assigned a variety of missions. One of the most important was "the organization and administration of the integrated air defense of the United States." To fulfill this assignment ADC would need an early-warning radar network and weapons to intercept and destroy attacking bombers.

SAC, the Air Force's striking arm, naturally had top priority on limited manpower and materiel. ADC, under Lt. Gen. George E. Stratemeyer, had only four understrength fighter squadrons and a single training unit equipped with a few World War II radar sets. Perforce then, Stratemeyer's role had to be one of training and planning.

In the latter part of 1947, Headquarters USAF approved the "Supremacy" plan, which provided for an aircraft control and warning network of 411 radar stations for the United States and Alaska. It was quickly apparent that Congress would not approve the nearly \$400 million involved, and a modified program was submitted late in 1948. The new plan, utilizing obsolescent radar sets on hand and others of a more advanced design on order, called for the construction of seventy-five early-warning radar stations and ten control stations in the United States and Alaska, to be operational in 1952. Congress approved funds for the compromise program in 1949.

Meanwhile, the United States was almost defenseless. To provide temporary protection, the Air Force

The Air Force's RB-45C had the distinction of being the first jet-bomber-type aircraft to be refueled in flight. This is how the maneuver looked as jet fuel was transferred in flight from a KB-29P tanker. Midair refueling was seen early as crucial to the long-range capability SAC needed for its deterrent operations.



requested permission to divert money appropriated for other purposes to construct an interim network known as "Lashup." It would embrace California and the northeastern and northwestern sections of the nation.

The explosion of an atomic device by Russia in August 1949 spurred greater air defense activity. The need for an around-the-clock system was obvious. The Air Force, in the early part of 1950, gave priority to the manning and equipping of fighter and radar squadrons and the extension of the operating hours of its system. The fighter-interceptor squadrons were dispersed over more bases. By the middle of 1950 the forty-four stations of the Lashup system had been rushed to completion.

In World War II, American tactical airpower had controlled the skies over many a battlefield, and had aided ground troops by isolating the combat area through attacks on railroads, bridges, and other lines of communications, cutting off enemy supplies and reinforcement.

On March 21, 1946, the War Department established the Tactical Air Command (TAC), under Maj. Gen. Elwood R. Quesada. The three pillars of modern American airpower, TAC, ADC, and SAC, thus came into being on the same day.

In December 1948, the Air Force reduced TAC to an operational and planning headquarters under the

newly created Continental Air Command. From 1946 to 1950 the size and strength of TAC ebbed and flowed. SAC received most of the limited supplies of men and money. Forced to restrict TAC's activities sharply in the pre-Korean years because of lack of money, the Air Force kept in mind the high importance of tactical airpower in the defense of the nation.

An important step in the spreading of the defense dollar was the establishment, on June 1, 1948, of the Military Air Transport Service (MATS) by combining the Air Force's Air Transport Command and the Naval Air Transport Service. MATS was both a major Air Force command and a Department of Defense agency. It provided global air transport service for authorized government agencies as well as supporting air communications, weather, rescue, and flight services.

Nearly all of the training and education of Air Force military personnel in the starving years was centered around the Air Training Command and the Air University. The former sent a steady flow of skilled men into every USAF unit. The Air University, established in September 1946, directed the professional education of the Air Force officers. In 1948, the Air Force established the Extension Course Institute, which offered many professional, technical, and academic courses that officers and airmen could take during off-duty hours.



But the Air Force had other jobs, too, like helping Western farmers save their herds in the wake of snow disasters. This was Operation Feedlift, an Air Force effort using C-82 Flying Boxcars to airdrop sustenance to some 165,000 sheep and 45,000 cattle stranded in snow-covered ranges across Nevada and Utah.



Operation Feedlift, according to the cattlemen who were benefited, was "100 percent effective." This was the scene inside the aircraft as an airman awaited order to pitch a bale of hay to starving cattle. Deterrence and all that may have seemed rather abstract to crews on this mission, but the job was worthwhile.

Chapter VII

The Berlin Airlift— Airpower in Action

AFTER V-J Day, the victorious powers had divided Germany into four sectors, each with a French, British, Russian, or American army of occupation. Berlin, which lay in the Russian Zone, was divided into East and West sections, West Berlin to be governed by the Western powers and East Berlin to be controlled by Russia. Free air access to Berlin would not be denied to any of the powers.

By early 1948, the Russians had adopted an extremely bellicose manner. In March, they threatened to curtail the air rights of the Western nations into Berlin, but backed off when the Western Allies stood firm. Continuous and heavier harassment on roads and railways into Berlin followed. By June 22, 1948, the Russians had cut off all rail, barge, and highway

traffic into that part of Berlin occupied by the Americans, British, and French. The Western powers had the alternative of withdrawing their forces and abandoning West Berlin to the Russians, or going to the air and trying to supply the minimum daily needs in subsistence and fuel to the military community and to more than 2,000,000 Germans by air transport—through three twenty-mile-wide air corridors.

There was only one acceptable answer. Some way, somehow, the Berlin garrisons and the people of Berlin would receive their food and fuel by air. The Americans and British pressed into service all available aircraft. The Army and Navy pitched in to assure the success of the operation. Initially, it was estimated that a daily minimum of 4,500 tons would be required to support the population of West Berlin. This was



—United Press International Photo

Weather constituted the greatest single threat to the success of the Berlin Airlift. Aircraft above, grounded by fog and rain, were stranded at Tempelhof Airfield in Berlin for 17 hours. Although bad weather seldom closed a field, it did necessitate instrument flying, which meant fewer completed flights. Air Weather Service furnished long- and short-range forecasts to all bases.



—Wide World Photos

From the cockpit of the first C-54 Skymaster to fly the cargo airlift to Berlin, pilot waves as he lands at Tempelhof Airport. C-54s were the backbone of the fleet; as many as 319 out of 400 in active service joined the airlift, replacing C-47s.



—Black Star Photo

C-54 on airlift mission flies over destroyed buildings in the aftermath of war. The dependable and rugged C-54s had been designed for passenger and not cargo transport, but through ingenuity and improvisation they performed new tasks efficiently.

revised upward to a minimum-comfort requirement of 5,620 tons per day, broken down as follows:

Cargo	Tons
For the German Populace	
Food	1,435
Coal	3,084
Commerce and Industrial Supplies	255
Newsprint	35
Liquid Fuel	16
Medical Supplies	2
SUBTOTAL	4,827
For US, British, & French Military	763
Three Passenger Flights (US and French)	30
TOTAL COMBINED	5,620

In "Operation Vittles," as it was soon named, the diversity of commodities needed to support a city presented special handling and loading difficulties because of variations in weight, shape, size, density, or physical properties. In order to reduce these difficulties to a minimum, special-type cargo was handled from only two airfields.

In the beginning, hauling coal seemed comparatively simple, since it could be compactly sacked and roughly handled. It turned out to be the toughest problem. Sharp, abrasive coal dust sifted into the inner fuselage, wings, and engines. A partial solution was the use of multiwall paper sacks, combined with a thorough sweeping of each aircraft after unloading. The paper sacks lasted from three to five trips, and their cost was not prohibitive when balanced against the additional payload their use made possible.



These three-and-a-half-ton C-47s, in the unloading line at Tempelhof, carried an enormous variety of cargo, from engine crates to milk bottles. In "Operation Vittles," unloading crews had to be prepared to handle the unexpected with the same alacrity with which they discharged standard sacks of coal and flour.



A 200,000-watt lighting system assisted in landing of USAF transport planes on "Operation Vittles," during periods of poor visibility. Above, forty red and yellow lights in two twenty-light parallel rows mark a 3,000-foot approach to the main runway at Tempelhof and outline extension of the width of the runway.

Food was second highest in tonnage hauled to Berlin—sacked grains, vegetables, frozen meats, fish, dairy products, and fresh fruits. Dehydrated foods were used where possible to get the maximum caloric value out of every ton. Frozen foods traveled well, without spoiling, because of rapid handling.

In the beginning, liquid-fuel products were hauled in fifty-five-gallon metal drums. But the heavy drums ate up tonnage and had to be steam-cleaned for return shipment. The British contracted for a fleet of commercial tanker aircraft capable of delivering 550 tons a day of liquid fuel, and airlift of all liquid fuels was assigned to this fleet.

Existing airfields in the Western sectors of Berlin had to be improved and another one built. Heavy construction equipment and material had to be flown in. Some had to be cut into sections and welded back

(Continued on following page)



—Wide World Photos

Two pilots wait at the door of their plane as a truck moves up to receive cargo at Tempelhof. Average time for unloading an aircraft was forty-nine minutes. Army Transportation Corps was responsible for the loading and unloading activities.



—United Press International Photo

Firemen at Tempelhof Airfield attempt to extinguish fire caused by the crash of a C-54 Skymaster. The plane, carrying coal, overshot the runway and crashed into a fence a few minutes before picture was made. Crew escaped before the plane caught fire.

together in Berlin. C-82 aircraft were used to carry unusually shaped construction cargo. Asphalt in 400-pound drums was hauled in to provide paving material for the new base and runways.

Medical supplies posed other problems. Ether, for example, because it is so volatile, had to be packed in very small containers and handled as fragile cargo. Since the minds of Berliners required food also, hundred-pound rolls of newsprint, loaded by forklifts and unloaded by chutes, were carried regularly.

On September 30, 1949, Operation Vittles, which had formally started on June 29, 1948, ended. The last C-54 left Rhein-Main for Berlin at 1845 hours, ending the monumental airlift.

Historically, the Berlin Airlift was the nation's first important peacetime use of airpower as an instrument of national policy. Operation Vittles achieved its purpose—defeating the land blockade of Berlin without the use of military force. Winston Churchill summarized the result when he said, "Time, though dearly bought, has been gained for peace. . . . The airlift has fully justified itself."

The combined Airlift Task Force delivered more than 2 million tons of supplies to Berlin and carried more than 70,000 tons of cargo out of the city. In more than 500,000 hours of flying, thirty-six American aircraft and thirty-one American lives were lost—a safety record comparing favorably with normal Air Force operations in the United States.

The over-all value of the airlift was incalculable. In addition to accomplishing its diplomatic purpose, the airlift set an inspiring example of united effort of the Army, Navy, and Air Force working in close cooperation with other departments of the United States government as well as with France and Great Britain. It was also a severe but beneficial field test of the operational efficiency of the Air Force, particularly flying techniques and logistical support—supply, maintenance, communications, weather service, etc. It has been said that the intensity of Operation Vittles telescoped a decade of air transport experience into one year.



—Wide World Photos

Berlin children surround airlift pilot Lt. Gail S. Halvorsen at Tempelhof to thank him for dropping candy to them from his plane by handkerchief parachute. Halvorsen dropped candy regularly on his flights while bringing other supplies to Berlin.

During "Operation Vittles" a ground controlled approach unit, the AN/CPN-4, was installed; the entire unit, weighing 12.5 tons, could be dismantled and moved from one field to another by air in a few hours. Above, a Douglas C-54 flies past the then-new unit, which could be operated by one specialist instead of two required in old unit.





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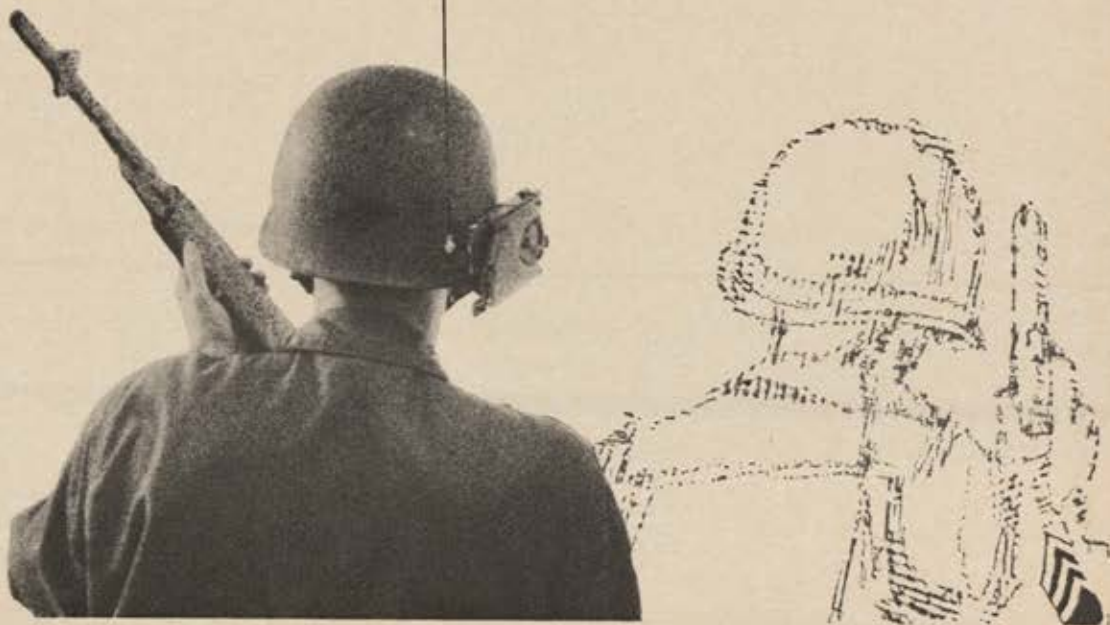
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MARK OF EXCELLENCE



Chapter VIII

The Aerospace Age Begins



Although, happily, it did not affect the outcome of World War II, the Nazi V-2 used against England was the world's first true strategic missile. After the war, US military extracted all the information they could on German ballistic missile achievements. They tested V-2 missiles in the Southwest desert, using the knowledge and services of German missile scientists.

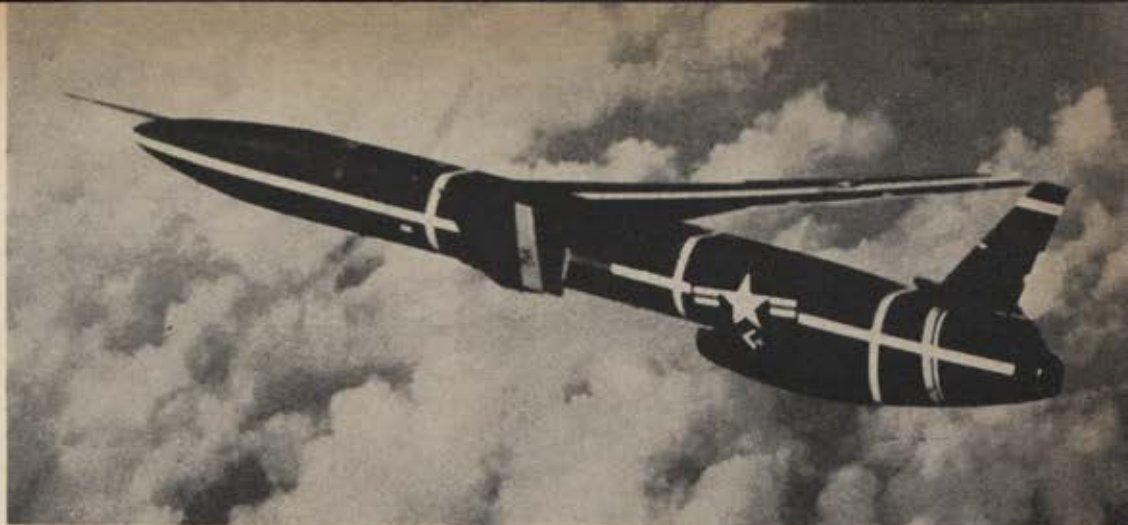
IT HAS been pointed out that the first ballistic missile was the rock which primitive man hurled at an enemy. The first true strategic ballistic missile, however, was the V-2 rocket used by the Germans during the last year of World War II. Undeniably an important achievement, this missile delivered less than a ton of explosives and was neither a long-range weapon nor a highly accurate one. But it was a start, and if developed earlier could have wrought havoc on the preparations for the invasion of Normandy.

During the war the US Army Air Forces began missile research and development, which continued during the early postwar years and throughout the 1950s. Four types of missiles were studied: (1) air-to-air, later known as the guided aircraft rocket (GAR), to be launched from an interceptor against hostile aircraft or from a bomber against enemy interceptors; (2) surface-to-air, which became the long-range interceptor missile (IM) for defense against enemy bombers; (3) air-to-surface, afterward called guided aircraft missile (GAM), to be directed at a strongly defended enemy target by a bomber attacking from a distance; and (4) surface-to-surface, which was either a tactical missile (TM) for the support of ground forces or a long-range strategic missile (SM).

In the period immediately following World War II, the Air Force began to develop two long-range, air-breathing missiles, known then as pilotless bombers—the SM-62 Snark and the SM-64 Navaho. The Snark was to serve as a subsonic intercontinental weapon. With its operational versatility and high accuracy, the Snark could enter the target area from any direction and at either high or low altitudes. Its guidance system could bring the Snark's warhead to its target even if the missile were deliberately launched off course. Although the Navaho was designed to fly faster than the Snark, it did not come as far along in development. However, its guidance system was chosen for more advanced ballistic and air-to-surface missiles.

The design of the V-2 engine served as a starting point for the development of the Air Force rocket engines. The 1950s witnessed the growth and development of American ballistic missiles and the commencement of the aerospace age.

At first, postwar Air Force emphasis was on the development of the long-range air-breathing missile, called the pilotless bomber. Subsonic SM-62 Snark, which went through production and deployment stages, served as an interim weapon while the Air Force worked on ballistic missiles.



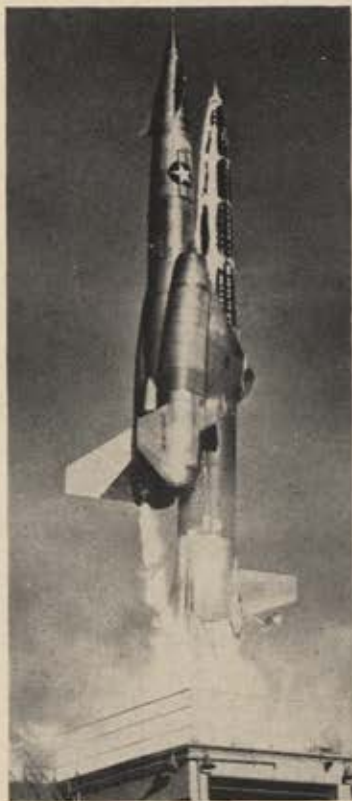
The ballistic missile, guided during the upward part of its trajectory, becomes a free-falling body during the latter stages of its flight. In 1945-46, the Army Air Forces let contracts for the study of ballistic missiles, but these were canceled in June 1947 because of lack of funds. However, significant advances were achieved during the early postwar years.

In 1950, the Air Force channeled its efforts toward larger, lighter, and more powerful liquid-propellant rocket engines. This phase of North American's Navaho program paid heavy dividends, as it facilitated the rapid development of strategic ballistic missiles for both the Army and the Air Force.

Prior to 1954, the Air Force did not have a warhead small enough and powerful enough to make it operationally profitable to use long-range ballistic missiles. Also, scientists had not found a way to shield the warhead from the intense heat which would be encountered upon reentry into the earth's atmosphere. Existing guidance and propulsion systems were also inadequate.

In January 1951, Convair (now a division of General Dynamics Corp.) was given an Air Force contract to develop the intercontinental Atlas missile. In 1952-53, a milestone in the development of ballistic *(Continued on following page)*

Follow-on pilotless bomber to Snark was Navaho. It never reached deployment stage because of advances in ballistic missiles. Navaho would have been much faster than Snark. Although it never became a weapon system, Navaho yielded much valuable data on guidance and propulsion which was put to good use later in the ballistic missile program.



Thanks to persistence of USAF's ballistic missile advocates, the true ballistic missile concept was proved out with Atlas, shown here being launched in combination with Agena payload from Cape Kennedy, Fla. Atlas not only showed its stuff as the country's first operational intercontinental missile, but also serves as space-booster workhorse.



missiles was reached—the thermonuclear breakthrough, which made it possible to build smaller and at the same time more powerful warheads.

One of the persons most interested in the development of the intercontinental ballistic missile was Trevor Gardner, then Special Assistant for Research and Development to Air Force Secretary Harold E. Talbott. In June 1953, Mr. Gardner was appointed chairman of a Department of Defense Committee to review all missile programs. In October he in turn established the Strategic Missiles Committee, popularly known as the Teapot Committee, composed of distinguished scientists and headed by Dr. John von Neumann.

The Teapot Committee met for the first time on November 9, 1953, and submitted its report in February 1954. Both the Committee and Trevor Gardner believed that the nation was in mortal danger and that only a "quantum jump" could prevent disaster in the 1959-60 time period. They, therefore, urged a massive effort that would secure an effective intercontinental ballistic missile (ICBM) as soon as possible. Three months later the Air Force gave this program the highest priority. The President, in September 1955, placed the highest national priority on the development of the intercontinental ballistic missile.

In order to carry out its intensive ballistic missile effort, the Air Force created a unique organization at Inglewood, Calif. The Western Development Division of Air Research and Development Command (ARDC) (redesignated the Air Force Ballistic Missile Division three years later) was formed to control the entire ballistic missile research, development, and production program. Brig. Gen. B. A. Schriever headed the organization. The Ballistic Missiles Center of Air Materiel Command was set up for procurement, production, and logistical support. In Septem-

Trevor Gardner, Air Force R&D civilian chief in 1950s, was convinced of validity of ballistic missile concept, was willing to stake his career and reputation on it. He set up Teapot Committee of top scientists who urged top-priority ICBM effort.



—United Press International Photo



A leading scientific light of the early USAF missile program was the Hungarian-born genius, Dr. John von Neumann. Von Neumann headed the Teapot Committee, which helped obtain highest priority for ballistic missile program from President Eisenhower.



What eventually evolved into an enormous development project, the USAF crash program to build the nation's needed ballistic missile capabilities, started quietly and small in this abandoned schoolhouse facility in Inglewood, Calif., the first headquarters of the old Air Research and Development Command's Western Development Division. A brigadier named Schriever led WDD.



A decade later, this vast complex at El Segundo, Calif., the Los Angeles Air Force Station, dedicated in 1964, became the new home of the Air Force Space Systems Division, charged with development of military space boosters and satellite systems. The Air Force had come a long way from WDD schoolhouse days, when USAF officers wore mufti to avoid undue notice.



Air Force head of the massive ballistic missile development program was Bernard A. Schriever, who rose to full general and direction of the Air Force Systems Command, which in 1961 became officially the prime military space development agency after USAF was designated the prime military service for space.



The face-to-face conference eliminated a lot of paperwork and the name of the game was speed. Above, General Schriever, William Holaday, who had been designated Director of Guided Missiles for the Defense Department, and Dr. Simon Ramo, one of the principal architects of program, talk over some problems.



A high priority requirement, from the military point of view, was the ability to obtain data from space. This would be crucial to such systems as military reconnaissance satellites, already being tested in 1960. The Air Force managed to develop retrieval techniques, and the achievement was important enough to earn the attention of the White House. President Eisenhower was briefed on the feat by Generals Schriever and Thomas D. White and viewed first package recovered by the USAF from orbit.

ber 1954 the Air Force selected Ramo-Wooldridge Corp. (and in November 1957 its subsidiary, the Space Technology Laboratories) to furnish systems engineering and technical direction of the associated contractors who made up the development team.

Some statistics illustrate the magnitude of the Air Force's ballistic missile program. By 1959 it was approaching an annual cost of \$2 billion per year. It was utilizing the services of almost 14,000 scientists and technical experts from universities and industry, as well as 1,500 Air Force administrative officers. Also participating were an additional 76,000 people representing twenty-two industries, including twenty-five major prime contractors and 200 major subcontractors. As a result, by the end of the 1950s the American ballistic missile program had got off the drawing boards and had become an integral part of America's defenses.

The first Air Force ICBM was the SM-65 Atlas. Called the "Beast" by its creators, the missile was some eighty feet long, nine feet in diameter, and weighed 195,000 pounds at launching. The first successful flight of slightly more than 500 miles occurred on December 17, 1957. Both the Atlas and the follow-on ICBM, the SM-68 Titan, were powered by liquid-propellant rockets and were guided first by a radio-inertial system and, on later models, an all-inertial system. A fully equipped Atlas made a historic flight on November 28, 1958, when it went the full programmed distance of 6,325 miles from launch pad to target area in the South Atlantic. Contractor was the Astronautics Division of General Dynamics, powerplant by North American Rocketdyne, radio-inertial

(Continued on following page)



As early as 1948, development efforts were under way in the ballistic missile field. At left, a Conqair MX-744 prototype ICBM firing. Unfortunately, this Air Force-sponsored effort was cut back to save funds that were needed for the pilotless bomber program. It was only after Teapot Committee supported ballistic missile concept that we got back on the right track—concentration on ICBMs.



Follow-on to the Air Force Atlas ICBM was the first of the Titan series, Titan I, shown during a 1960 installation and checkout. Titan represented a major improvement over Atlas, was designed to be launched from underground silos, protected against enemy attack. Martin headed industry Titan team.

guidance by General Electric and Burroughs, all-inertial guidance on later models by Arma.

In March 1956, the Air Force had contracted for the Titan. It soon became evident that the two-stage Titan would be a more advanced missile with great potential. Its performance requirement called for a flight of 15,000 miles per hour for a distance of 5,500 nautical miles. The knowledge gained in previous missile development was applied to the Titan, giving it increased range and greater load-carrying capacity. This missile was designed to be launched from underground sites to protect it against nuclear attack. The first successful launching of the Titan took place in February 1959. Contractor was Martin/Denver, powerplant by Aerojet-General, guidance by AC Spark Plug/General Motors, reentry vehicle by General Electric.

In February 1958, the Department of Defense directed the Air Force to begin the development of a third ICBM, the SM-80 Minuteman. Since the Minuteman had a solid-propellant rocket engine, it had significant advantages over the Atlas and the Titan: it was smaller, lighter, more easily dispersed and hardened, as well as cheaper. Furthermore, it required fewer people for operation and maintenance and could be fired by remote control upon a few seconds' notice.

Meanwhile, and concurrently with the development of Atlas, the Air Force designed, developed, and produced an intermediate-range ballistic missile (IRBM)—the SM-75 Thor—in a shorter time than any other large and highly complex weapon system. The development contract was let in December 1955, and in less than two years, in October 1957, a Thor flew 2,400

nautical miles, exceeding its designated range by 900 miles. The Thor's rapid development can be attributed to the fact that it used as its powerplant part of the booster combination for the Atlas and took its nose cone and guidance system directly from the intercontinental ballistic missile program. Contractor was Douglas, powerplant by North American Rocketdyne, guidance by AC Spark Plug.

In April 1957, the 1st Missile Division was activated, and in January 1958 was placed under the control of Strategic Air Command (SAC). SAC then activated its first IRBM squadrons—one for the Thor and the other for the Army-developed Jupiter. In the following April, SAC established its first ICBM squadrons. In January 1959, SAC placed under the operational control of the Fifteenth Air Force two strategic missile wings, one equipped with the Titan, the other with the Atlas.

Brief mention might be made of the air-to-surface missile, the North American-built Hound Dog, which used the design basis of the Navaho. The Hound Dog is a supersonic missile designed to carry a nuclear warhead with great accuracy for hundreds of miles.

In 1950 the Air Force began development of the Boeing IM-99 Bomarc surface-to-air missile to supplement the interceptor force of the Air Defense Com-

(Continued on page 91)



But as in all complex development programs there were spectacular failures. This Titan blow-up is still remembered by denizens of the Cape Kennedy, Fla., area, where missile-watching became a popular sport during developmental era. After early troubles, Titan racked up success record, joined the USAF arsenal.



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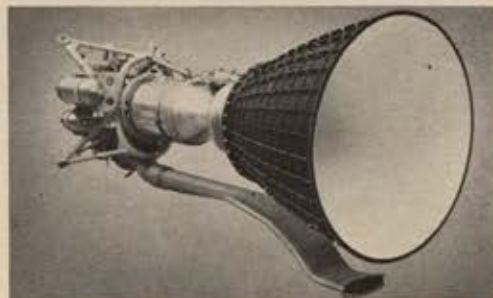
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Although they have long since been retired as weapons deployed overseas, Thor IRBMs, sited in England, helped deter aggression for several years. This was scene at Vandenberg AFB, Calif., as Royal Air Force crews, trained in the US, achieved first operational launch of the Thor. Thors still, in modified configurations, serve as highly useful boosters for a number of space programs.



As Commander in Chief of Strategic Air Command, Gen. Thomas S. Power, now retired, was both an airman and a missileman. During an inspection of Vandenberg AFB, where his SAC crews learned the missile-launching trade, the General swapped his regulation cap for a hard hat. It went well with the missileman's badge he wore on his uniform pocket.



After troubles that had plagued the early phases of its development program, Titan I showed its quality in 1959. This was how the Atlas' successor looked during its first test launch from Cape Canaveral in February of that year. With range beyond 6,000 miles, Titan added wallop to the USAF Strategic Air Command missile deterrent force.

Minuteman, the US Air Force's first solid-fueled intercontinental ballistic missile, provided instant retaliatory capability. Numbered the SM-80, Minuteman, with its characteristic whoosh and puff of smoke at launching, further strengthened Air Force missile inventory. First successful test launch occurred at Cape Canaveral on February 1, 1961.



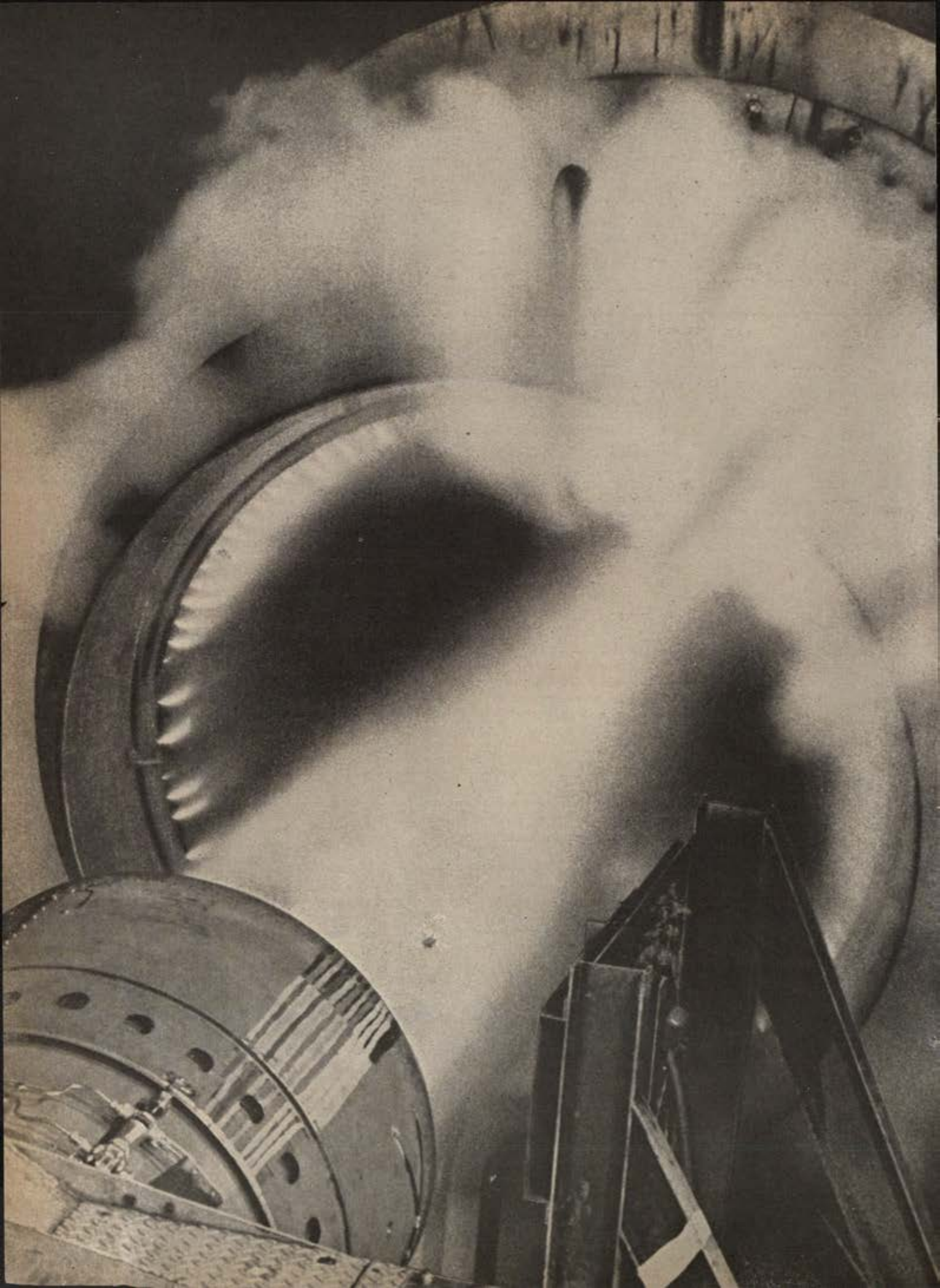
mand. The Bomarc is a long-range guided missile designed to destroy enemy aircraft and missiles 200 to 400 miles away and over 60,000 feet up. The Bomarc became a part of the vast and complex SAGE system, which can warn of an attack in seconds. The Bomarc can be fired on orders from a SAGE control center nearly 1,500 miles away and will seek out and destroy enemy aerial targets.

A deadly air-to-air missile is the Hughes Falcon, which flies a true collision course to its target, despite evasive maneuvering, with an electronic guidance system making all the necessary corrections. It can also be launched from below an enemy and will streak upward toward the target.

The Air Force utilized the Navy AIM-9 Sidewinder, an air-to-air missile built by Philco-Ford. The Sidewinder seeks out its target by homing in on the heat generated by the enemy plane. One of the most significant advances in air defense since the coming of radar was the utilization of nuclear warheads. On the 19th of July 1957, an F-89 fired an MB-1 Douglas Genie unguided air-to-air rocket with a nuclear warhead, to collect data for the development of other atomic-armed rockets.

The Air Force's operational tactical missile, until 1962, was the TM-61 Martin Matador. This missile was powered by an Allison J-33 jet engine and was launched from the ground by a booster rocket. It was controlled electronically in flight by men on the ground. The Matador, whose first flight was in December 1950, had a range of several hundred miles, a speed of 650 miles an hour, and an altitude of over 35,000 feet. The Air Force, in October 1951, organized and equipped with Matadors its first operational missile units. Called the 1st Pilotless Bomber Squadron, Light, it was renamed the 1st Tactical Missile Squadron in 1955. The Matador was the first missile to be sent overseas. In 1962, it was replaced by the Mace.

By the end of the 1950s, missiles had become a vital part of America's arsenal. The United States Air Force was operating the most sophisticated system of weapons yet devised by man. Yet this arsenal was dedicated to the preservation of the free world, not to world domination.



The Spey in military mood

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Chapter IX

KOREA—

A Shoestring Air Force Goes to War



Flying one of 485 sorties directed at a Communist supply depot at Suan, North Korea, on May 8, 1951, a Lockheed F-80C Shooting Star adds to the destruction in what was to that time the biggest single air strike of the Korean War. Though the Far East Air Forces were designed primarily for air defense when Korean War broke out, they quickly adapted to tactical roles.

WHEN the US had withdrawn its troops from the Republic of Korea in mid-1949, the Communists saw the move as evidence that the United States was giving up interest in the area. About the same time, Louis Johnson, then Secretary of Defense, was in the midst of an economy move "to remove the fat without hurting the muscle." This combination of events offered an irresistible temptation to the Communist North Koreans. Thus, on June 25, 1950, North Korean infantry, spearheaded by Russian-built tanks, crossed the thirty-eighth parallel into South Korea. The surprise attack caught the world unprepared. World War III might have begun. Fortunately, Russia had walked out of the United

(Continued on page 96)



When Chinese Communist intervention in November 1950 brought MIG-15s into the air war, they clearly outclassed FEAF's P-80s and P-51s. These Republic F-84s of 27th Fighter Escort Wing, Bergstrom AFB, Tex., were rushed to Korea for ground attack missions, along with F-86 Sabrejets of 4th Fighter Wing of New Castle Airport, Del., for air-to-air intercept.



Within days after the North Koreans attacked, Gen. Hoyt Vandenberg, USAF Chief of Staff, right center, was on the scene to confer with his senior commanders, Lt. Gens. Earle E. Partridge, Fifth AF Commander, and George E. Stratemeyer, Commander of Far East Air Forces, and members of their staffs. General Vandenberg promised that FEAF's requests for more air strength would be met as soon as airfields were readied to handle them.

—Wide World Photos



In Korea, as in North Vietnam today, railroad marshaling yards were important targets to reduce flow of military equipment to battle zones. These fire blossoms were produced by napalm dropped near Wonsan by B-26 Invaders of 452d Bomb Wing. In early days of war, US planes roamed at will, but enemy opposition soon forced B-26s to operate at night.



Enemy production resources were also prime targets. Here a napalm fireball wreaks destruction on North Korean zinc mine. These attacks had some effect on enemy military operations, but it soon became evident that North Korean army was receiving major support from Communist China, whose productive resources were across the Yalu and off limits to US airpower.

Boeing B-29 Superforts were widely employed in the Korean

War where their heavy payloads could be delivered effectively. Enemy airfields were one such target, particularly at night or when bad weather kept their planes grounded. Here a Superfort crew bombs through cloud cover by radar.

The technique was relatively new, and not too successful at first, but crews got better with practice. Before long US Army units on front lines were calling for B-29 raids on nearby enemy positions almost nightly.



—United Press International Photo

Nations in protest against the UN's refusal to seat Red China. This gave the UN an opportunity to act on the Korean question without the threat of a Russian veto.

Meanwhile, the United States had to support the Republic of Korea until the UN could reach a decision. President Truman immediately committed his country's resources to halting the aggression. USAF, the most flexible striking arm of the United States, was quickly ordered into action. On June 26 the Air Force was ordered to provide cover for evacuation of dependents by sea; on June 27 it began air evacuation of dependents. Once this mission was successfully completed, the Air Force was directed to support the Republic of Korea but was to keep south of the thirty-eighth parallel.

Lt. Gen. George E. Stratemeyer, then commanding the Far East Air Forces, had been concerned about the developing situation in the Far East, and there was a contingency plan. As soon as hostilities began, F-82s of the Fifth Air Force were operating out of Itazuke, Japan, to support the initial evacuation.

Within a week it became clear that the first desperate task was to establish a line that could be held and from which a counterattack could be launched. To support this holding operation, the Air Force had to gain air superiority and interdict the enemy's supply lines. Two of the Strategic Air Command's B-29 groups were dispatched to the Far East and, on July 8, 1950, were organized as the FEAFF Bomber Command (Provisional), commanded by Maj. Gen. Emmett O'Donnell, Jr. These groups were ordered to operate within the battle area in support and bridge-busting missions. Due to limited logistics and shortages of airfields and equipment, the Air Force was operating on a shoestring. But the Pusan perimeter, at the southern tip of the Korean peninsula, held. Throughout this touch-and-go period, the Air Force provided close air support for ground forces and hit enemy supply lines.

With the Pusan perimeter secured, the Air Force

(Continued on page 98)



Four-man B-26 Invader crew huddles for final briefing before boarding their light bomber for another strike against Communist targets in North Korea. Flying at night, B-26s sought out enemy vehicle convoys and rail traffic, plus known or suspected troop concentrations near battle zone. Toward end of the war, Martin B-57 Canberra bombers were replacing B-26s.



Fragmentation bombs nestle in B-26 bomb bay looking as neat as thermos jugs on a warehouse shelf. On interdiction missions, B-26s operated in hunter-killer teams with flare planes. Hunter dropped variety of bombs on roads to block traffic, flare plane lighted up area, and killer planes bombed and strafed backed-up vehicles.



Armament technician supervises workmen unloading fragmentation bombs for fighter strikes. Because of its extended range, F-51 Mustang proved effective in early part of Korean War. F-82 Twin Mustangs were equally useful, but were soon withdrawn because they were in short supply and their all-weather capability was vitally needed for theater air defense.



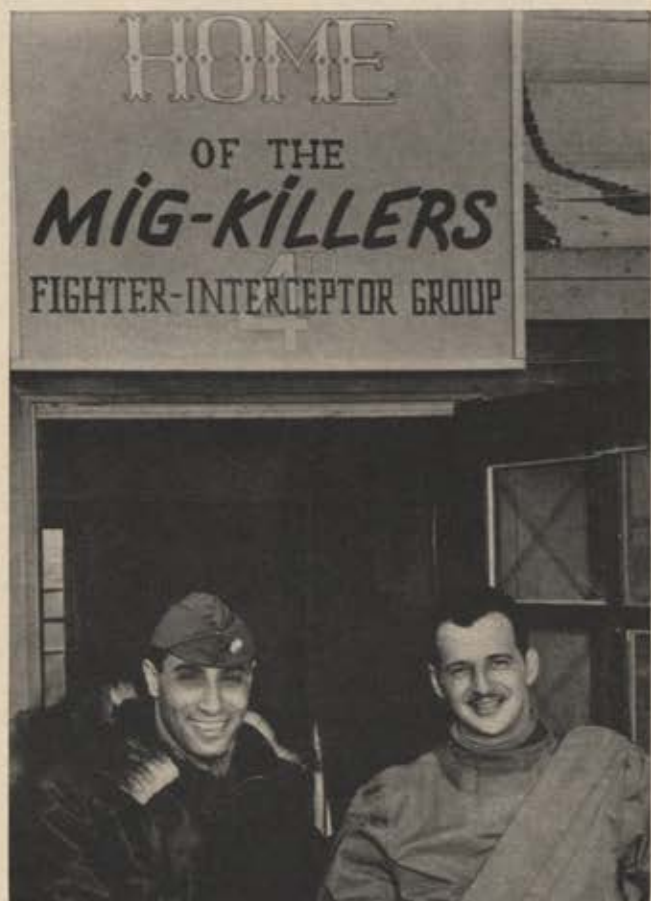
C-119 airdrops tons of rations and gasoline to United Nations troops near Chungju in January 1951. This was perhaps the low point in Korean War, as Red Chinese troops poured down from the Yalu, driving UN elements before them. When snow and guerrillas cut ground supply lines, 314th Troop Carrier Group's C-119s dropped 460 tons to embattled defenders.



Employment of helicopters in air rescue was relatively untried before the Korean War. When United Nations troops were surrounded by Red Chinese at Chipyong-ni in February 1951, USAF's 3d Air Rescue Squadron flew fragile H-5 helicopters through high winds and snowstorms to deliver blood plasma and medical supplies and also to evacuate badly wounded soldiers.



All hands turn out to help retrieve the bundles as cargo planes drop food and supplies to hilltop outpost of the 502d Tactical Control Group. These sites proved useful in controlling friendly planes, but the heavy radars then in use were too short-ranged to provide adequate warning of enemy aircraft approaching through Korea's many valleys or above 40,000 feet.



Maj. James Jabara, left, and Capt. Manuel J. Fernandez, Jr., waged fierce battle in MIG Alley to become top US jet ace. Fernandez's score stood at fourteen and one-half when he went home on May 19, 1953. Jabara, just back for second combat tour, had only seven then, but racked up eight more in next two months to rank second behind Capt. Joe McConnell, Jr.



Top MIG killer was Capt. Joseph McConnell, Jr., who shot down sixteen in 110 missions before USAF ordered him home in May 1953, along with Captain Fernandez. He was killed in August 1954 at Edwards AFB, Calif., while testing later model of F-86 Sabrejet. Of three top Korean jet aces, only Fernandez survives. Jabara died in an auto crash in Florida last year.

turned its attention to the enemy's overextended forces. B-29 strategic bombers, using high-explosive bombs, began to strike strategic targets in North Korea. Between the end of July and the middle of September 1950, almost all industrial military targets in North Korea had been destroyed.

As the tide of battle began to turn, Gen. Douglas MacArthur, Commander of the Far East Command, planned an amphibious operation to encircle the North Korean ground forces. This operation, under the command of Maj. Gen. Edward M. Almond, was directed at Inchon. The Air Force had responsibility for maintaining air superiority over the landing area, for furnishing aerial logistics support, and for carrying out an airborne operation with the 187th Airborne Regimental Combat Team. Maj. Gen. William H. Tunner was placed in command of the newly organized FEAF Combat Cargo Command (Provisional). Aircraft involved were mainly C-54s and C-119s. The amphibious operation at Inchon on September 15, 1950, helped turn the tide of battle, and North Korean forces began their retreat northward. As the thrust of the campaign switched from defense to offense, the Air Force continued to interdict enemy supply lines while furnishing logistical support to the advancing ground forces.

During the initial phases of the conflict, it was significant that the Air Force was operating with many planes of World War II vintage. The only jet-type aircraft that was in the Far East at the outbreak of hostilities was the F-80C Shooting Star.

With the collapse of the North Korean ground forces it appeared the war could be resolved quickly by again dividing the peninsula north and south. However, as the UN forces moved to annihilate the North Koreans, Red Chinese forces poured across the Manchurian border on November 26, 1950. The whole complexion of the war changed—and for the worse.

Again hard pressed and outnumbered, UN ground forces owed their successful withdrawal to the Air Force, which flew close-support missions to protect exposed flanks and to close gaps that developed as the ground retreat continued. Other Air Force units flew interdiction and supply missions. An air evacuation from Yonpo Airport that started on December 14, 1950, flew out more than 4,000 passengers and more than



Familiar terrain to F-86 Sabrejet pilots streaking north to engage MIG-15s were these rugged Korean mountains. When war ended, Sabre pilots had claimed 792 MIG-15s, while losing seventy-eight. US pilots acknowledged that in some ways MIG-15 was better, but adjusted tactics to overcome its advantages.



—Wide World Photos

Maj. George A. Davis, left, was leading jet ace with eleven MIG-15s and three TU-2 bombers when he was shot down on February 10, 1952. He was posthumously awarded the Congressional Medal of Honor. With him are Col. Ben Preston, 4th Fighter Group Commander, and Maj. Winton Marshall, also an ace.

Certain evidence of MIG kill appears in this gun-camera film showing enemy pilot ejecting from his crippled plane. Sabrejet pilot who got credit for victory was 2d Lt. Edwin E. Aldrin, Jr., now a lieutenant colonel and NASA spacewalk champion. Flying in Gemini-12 mission last November with Navy Capt. James Lovell, Aldrin spent more than five and a half hours outside spacecraft during four-day flight.



When the F-86 Sabres came on the scene in Korea the balance of airpower quickly changed, and the MIGs started falling out of the sky like leaves in the fall. At left are four of the many aces that USAF produced, who between them had shot down 21 Korean aircraft and damaged two. Left to right are 1st Lt. James F. Low, Capt. Robinson Risner, Col. Royal N. Baker, and Capt. Leonard W. Lilley.



Signing of armistice on July 27, 1953, is saluted in appropriate fashion by USAF armament technician. Through a policy of increasing pressure on Communist air force while peace talks dragged on, Sabre pilots severely mauled North Korean interceptor units. In the fall of 1952, Sabres had destroyed 63 MIGs in one month, at a cost of 6 of our aircraft. When enemy fighters reappeared in May 1953, Sabres shot down 56 MIGs and in June destroyed 75 more to end the MIG Alley war.

20,000 tons of cargo before it ended on December 17. As the Chinese moved southward they began to feel the pinch of lengthened supply lines, and by the end of January 1951, the tide of battle had again turned in favor of UN forces.

As 1950 came to an end, UN forces faced the problem of Russian-built MIG-15s, which began to make life miserable for the B-29s and B-26s. Daylight bombing was cut off, and the B-29s flew at night from Japan, Guam, and Okinawa. At the same time, Korea-based B-26s flew night-intruder missions.

Early in 1951, F-86 Sabres challenged the MIGs and the balance of airpower quickly shifted back to the UN. In MIG Alley (between the Yalu and Chongchon Rivers) the Sabrejets and their precision-trained pilots—Davis, Fischer, McConnell, and Jabara, to name a few—established a kill ratio of almost fourteen to one over the MIGs.

As the peace talks, which began in June 1951, dragged on, the war on the ground deteriorated into a bloody exchange of real estate. To counter the enemy's numerical superiority, the Air Force flew close-support missions with F-84 Thunderjets. Their bombing was precise and their ability to cover the battlefield from low altitude stopped many Chinese attacks in their tracks. At the same time, F-84 attacks against the enemy's supply lines forced the Chinese and their North Korean partners underground during daylight hours and forced them to move under cover of darkness.

When the war finally ended in a negotiated peace in 1953, the record showed the Air Force had successfully carried out its primary missions of denying the enemy an opportunity to exploit his numerical superiority on the ground and of maintaining air superiority over the battlefield.

The Korean campaign ended in a stalemate and a compromise peace. The *status quo ante bellum* was restored and the Republic of Korea was maintained as a political unit.

The Korean War was fought by a makeshift Air Force that performed superbly under severe handicaps of organization, equipment, and geographic restrictions. The Fifth Air Force and the 4th and 51st Fighter-Interceptor Wings had created a new legend in the skies over Korea.

Chapter X

Changing Times— Korea to Kennedy

BEFORE hostilities ended in Korea, the USAF was deeply committed to a crash buildup, designed to expand its capabilities to meet ever-increasing worldwide commitments. The size of the Air Force would be doubled. America's deterrent was going to be the threat of massive retaliation and the Strategic Air Command was going to be the instrument of delivery. All Air Force Commands were to be developed and expanded into balanced forces designed to supplement and support SAC. This forced-draft increase in size and capability pushed budgetary requirements of the Air Force to the point where its share of the defense dollar was larger than that of either the Army or the Navy. Just seven years after attaining its independence the Air Force outstripped the other services in expenditures. The instrument designed by the Wright brothers, advocated by Billy Mitchell, and sharpened by World War II had come of age.

Shortly before the end of the Korean conflict a new Administration took office, and a new era in foreign relations dawned. John Foster Dulles, the new Sec-

retary of State, outlined the shape of things to come. SAC was kept on constant alert, and emergency re-deployments and readiness exercises took heavy toll of men and machines. Airpower became the hand-maiden of diplomacy and von Clausewitz's dictum about military force being an extension of diplomacy now pertained specifically to the striking power of SAC.

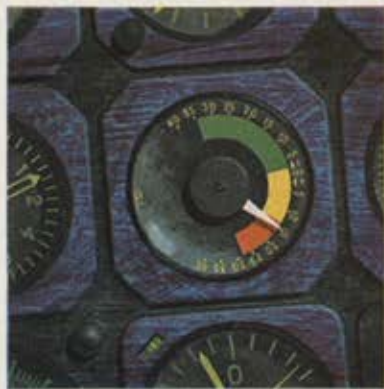
The 1950s marked a significant Air Force milestone in a different but basic area. On April 1, 1954, a long-cherished dream came true, when the United States Air Force Academy was born. For many years air pioneers and enthusiasts had pushed for an Air Academy designed to produce trained air officers capable of meeting the challenge of the twentieth century. In the '30s Randolph Field was called the "West Point of the Air," but farsighted airpower advocates were not satisfied. They wanted an educational institution comparable to (or better than) Annapolis and West Point.

With the organization of a separate Air Force in 1947, the proponents of a third service academy be-

(Continued on page 103)

In the 1950s, the Air Force was increasingly faced with the need to broaden its capabilities to meet expanding worldwide commitments. Central to this requirement was global mobility for SAC, hence the 600-mph KC-135 jet Stratotanker which can refuel jet bombers in midair. At right, the first KC-135 to enter service rendezvousing with a B-52 over central Washington State.





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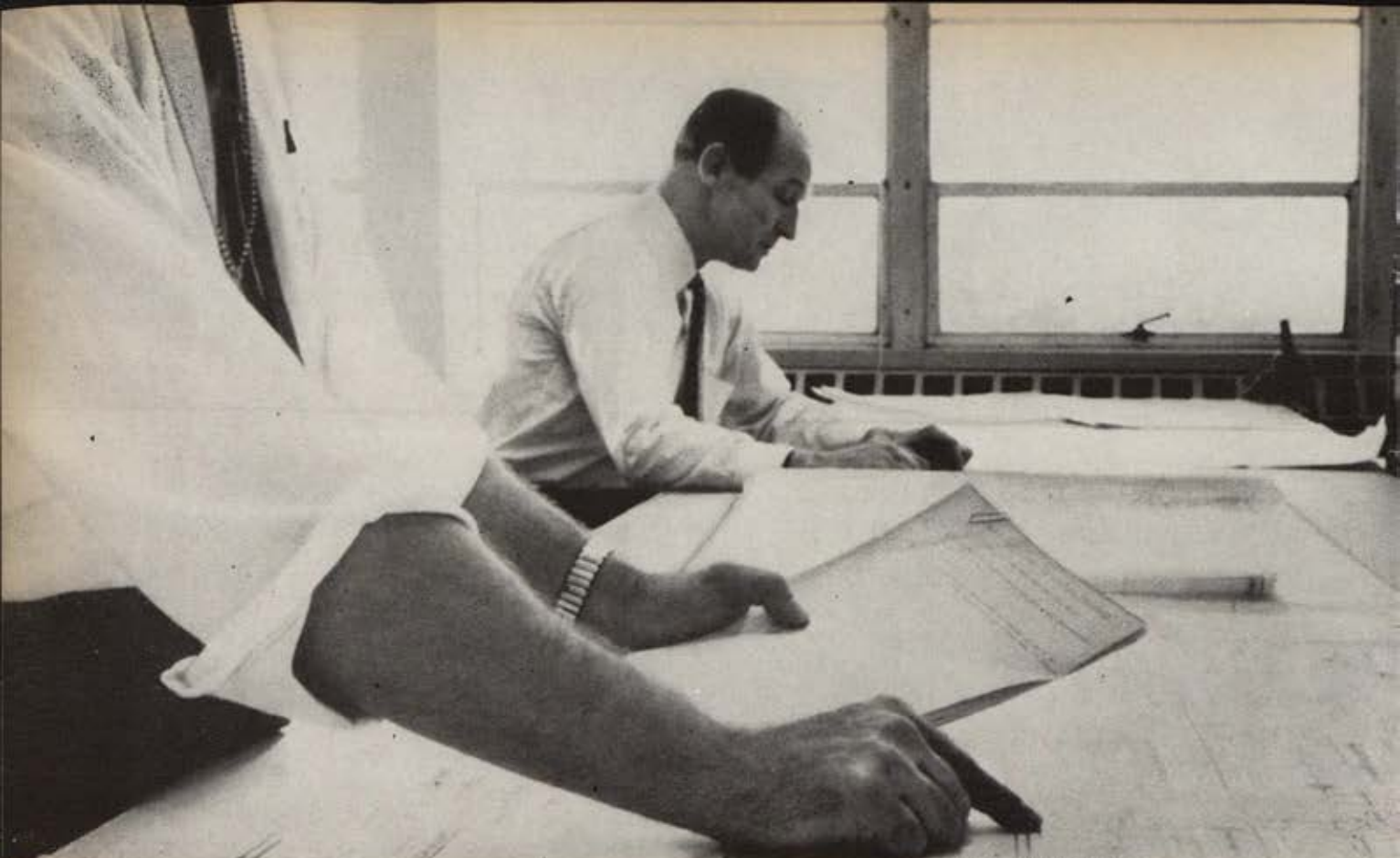
...and we provided a flight test configuration two weeks after go ahead. This system automatically prevents unsafe flight attitude. It senses aircraft angle of attack and gathers data on flap setting, mach number, attitudes and rates. It then computes stall margin and V/V_{stall} . It indicates flight conditions by flashing lights, control-column shake, warning

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ARM'S LENGTH



—Wide World Photos

The committee which picked the site for the AF Academy: from left, Dr. Virgil Hancher, U. of Iowa; Merrill C. Meigs, Hearst Corp.; Gen. Carl A. Spaatz, first AF Chief of Staff; Charles A. Lindbergh; and Lt. Gen. Hubert R. Harmon, Special Assistant to Chief of Staff. Colorado Springs, Colo., was the winner.



President Eisenhower congratulates Air Force Secretary Harold Talbott after signing act creating AF Academy in April 1954. Others are, from left, Rep. Carl Vinson, Gen. Nate Twining, Rep. Dewey Short, Air Force Undersecretary James Douglas, and General Harmon, named Academy's first leader.

came more vocal, and a comprehensive study was made by the Stearns-Eisenhower Board. Feasibility was established. All that was left was to do it. The question became when and where, not if. A site was finally selected north of Colorado Springs, and once the necessary implementing legislation had been passed, the Air Force moved quickly. Instead of waiting until the permanent site was ready, a temporary location was established at Lowry Air Force Base near Denver, Colo., and it was here that the first class of Air Cadets reported in the summer of 1955. This first class (the Class of 1959—their graduation date) consisted of 306 cadets chosen from throughout the United States.

The idea was to take the best of the other service academies and to graft thereon the flexibility and initiative available to a new institution. After three profitable years at Lowry AFB, it was decided to move the

Academy to its permanent site near Colorado Springs in the summer of 1958 so that the first class would be graduated there. The move was complicated by the fact that construction was not completed, and make-shift arrangements had to be made, but school year 1958-1959 was precedent-shattering and successful. In June 1959, the Academy graduated its first class (206 were commissioned, 205 for the Air Force, one for the Marine Corps). The new second lieutenants received their diplomas and commissions from Secretary of the Air Force James Douglas. Behind them at the Academy were the Classes of 1960, 1961, and 1962, while the new Class of 1963 had already been selected and was waiting to report. The Air Force Academy had produced its first product.

In the fall of 1957 the free world was rudely awakened when the Russians put Sputnik into orbit. For
(Continued on following page)

Academy Class of 1969 stands at rigid attention in retreat formation in honor of 1st Lt. Donald D. Watson, second Academy graduate killed in Vietnam action. Cadets develop a high sense of duty and honor through their close association with other Cadets and officers, and the loss of a graduate is a personal loss for all members of the Corps of Cadets.





USAF's answer to "limited" wars is TAC's Composite Air Strike Force (CASF), which contains all elements of a modern air force and is capable of rapid deployment to any area of the world. Above is example of an early variety of CASF aircraft. A KB-50 tanker refuels an F-100 Supersabre; also pictured are a B-66 tactical bomber, F-101 tactical fighter, and two C-130 Hercules.



The XB-70, pictured above in rollout ceremonies at North American, Palmdale, Calif., in May 1964, was conceived in 1954 as supersonic follow-on to the B-52. The Mach 3 intercontinental aircraft, originally designed to carry more than 20,000 pounds, never was ordered into production. One prototype crashed on June 8, 1966, after a midair collision at Edwards AFB, Calif.



In December 1956, USAF's Military Air Transport Service airlifted Hungarian refugees from their troubled homeland to safety in the US. At left, a refugee family wave as they prepare to board the Columbine, President Eisenhower's personal plane, for a Christmas-time flight to US. C-118s and C-121s participated in the massive "Operation Safe Haven."

the first time, man was challenging the stars, and the US, which produced rocket pioneer Dr. Robert H. Goddard, was left standing at the post. The US reacted strongly and began to play catch-up in the space race. A review of the space program reveals the pooling of the resources of the National Aeronautics and Space Administration and the armed forces. It is also clear that the major support for the space program was being furnished by the Air Force through its ballistic missile capability.

When it came to putting a manned craft into space the Soviet Union again won the race, but our accelerated Astronaut program was rapidly cutting down the lead enjoyed by Russia's Cosmonauts.

Probably the key decision made in America's space effort was to put major emphasis on the development of guidance controls and miniaturization instead of immediately attempting to match Russia's bigger thrust capabilities. This decision was made on the assumption that American technology would be able to produce increased thrust as needed, while the more critical problem of weight could be better solved by developing a more sophisticated vehicle. As the manned space program progressed, new heroes came to the public's notice and in the forefront were a cavalcade of Air Force officers who joined with the Navy's Alan Shepard and the Marines' John Glenn in capturing the imagination of the American people. Old mythological names—Mercury, Apollo, Atlas, and Titan—took on new meanings, and television enabled most Americans to follow vicariously the pioneer penetrations into the reaches of space.

As the decade of the '50s came to a close the Air Force was in the process of reorganization. Old aircraft were being phased out and new and more effective manned and unmanned delivery systems were being developed.



More efficient and effective aircraft characterized the late 1950s. USAF, outstripping the other services in expenditures, pushed for bigger and better equipment to meet its new responsibilities. At left, Maj. Adrian Drew is shown after setting a speed record of 1,207.6 mph in the McDonnell F-101 Voodoo in December 1957. Today the F-101 is used in fighter, interceptor, and reconnaissance roles. Extensively employed in Vietnam, it has a top speed approaching Mach 2.



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Chapter XI

USAF in National Crises— The Brushfire Wars

DURING the uneasy years between the Korean and Vietnam conflicts, world peace was repeatedly disrupted by a series of "brushfire" crises.

Time and again airpower proved that it could make a major contribution at any level of aggression, including insurrection and other limited forms of conflict. By its selective employment, it was brought to bear in many ways.

The hope for world peace following the Korean armistice was shattered by a series of events in late 1956, including the brutal Soviet crushing of the Hungarian revolt, the Suez Canal crisis, and the attempted Communist takeover of Jordan in 1957.

Again, in the summer of 1958, the threat of protracted warfare erupted in the Middle East with the assassination of King Faisal II and rebel seizure of the Iraqi government. US air, ground, and naval forces, including elements of USAFE's "Tactical Air Force," were rushed to Lebanon at the latter government's request. Prompt action localized the threat and forestalled the overthrow attempt. Within a month the US began withdrawal of its forces.

Hoping to capitalize on the Middle East crisis, the Chinese Communists almost immediately began a heavy bombardment of the islands of Quemoy and Matsu, off the China coast. Again, the United States took prompt action. The 7th Fleet was ordered to the



In 1958, the Middle East was the scene of what could have become a lengthy conflict when extremists assassinated King Faisal II of Iraq and took over the government. Across the border in Lebanon, Communist forces likewise threatened the government of President Camille Chamoun. When Chamoun issued an urgent plea to the US for assistance, Tactical Air Command responded immediately and established a Composite Air Strike Force (CASF), which was deployed to Incirlik Air Base near Adana, Turkey. At left, a squad of US paratroopers leave their C-130 Hercules at Beirut Airport after arriving from Adana. US transports flew into Beirut every ten minutes with infantry and Marine reinforcements.

—Wide World Photos

Formosa Straits. Elements of PACAF, known as the "Mobile Strike Force," together with US-based "Composite Air Strike Force" units of TAC, were deployed to Taiwan to help contain the threat.

With the arrival of the '60s, new threats erupted. The focus shifted to the Congo in mid-1960 and one of the longest airlift operations in history. More than a dozen years had passed since the 1948 Berlin blockade. In that time airlift had become truly strategic in scope, global in range, with high-speed mobility its fundamental ingredient.

In the fourteen months following July 1960, MAC-United Nations' Congo airlift operations under USAF control flew 77,000,000 ton-miles, airlifting 26,000 UN troops and 20,000,000 pounds of cargo. Each round-trip mission from Europe to the Congo was equal to forty-four flights through the air corridor from West Germany to Berlin.

In mid-1961 a new crisis erupted when East Ger-

(Continued on following page)



National Guard F-84 Thunderjets were a segment of the largest overseas deployment of a tactical fighter force since World War II. Recalled by TAC in November 1961, F-84s above wait at Harmon AFB, Newfoundland, to take off for Europe. To conserve fuel, aircraft were towed to takeoff position. More than 200 TAC fighters were moved to Europe in military buildup.



One of the longest airlift operations in history was conducted in 1960-61 when MATS (now MAC) flew hundreds of tons of US supplies and 26,000 UN troops into the Congo during her first turbulent months of independence. The policemen above were brought into Leopoldville, Congo, from Ghana by MATS aircraft. In fezzes and shorts, they line up before moving out.



USAF, charged with "keeping the peace" in trouble-ridden areas around the world, moved to bolster air strength in the Far East by dispatching elements of a TAC strike force in August 1958. Above, Col. Arlie J. Blood, Commander of the 388th Tactical Fighter Squadron, is shown with his F-100 Supersabre at George AFB, Calif., prior to transpacific flight to Taiwan and Okinawa.



Pilots and crewmen of the 151st Fighter-Interceptor Squadron streak for their F-104 Starfighters in the alert hangar at Moron AB, Spain. The 151st was one of the Air National Guard units which served with USAF when East Germany closed the borders between East and West Berlin in 1961, and eleven ANG squadrons were deployed to Europe in an unparalleled buildup.



—United Press International Photo

An aerial photo of Soviet-built MRBM site at San Cristobal, Cuba, is discussed by Defense Department official John P. Hughes at press conference in early 1963. At left is Secretary Robert McNamara. In October 1962, US military units assumed peak alert status after Russian missiles in Cuba were discovered.



Shown in this low-level photo of the San Cristobal site is extensive vehicle trackage, missile shelter tent, camouflage netting over ten trucks at two separate locations, missile erector draped with canvas, and a second missile shelter tent. Range of these missiles is between 1,000 and 1,100 nautical miles.

many closed the border between East and West Berlin and constructed the wall which still divides that city.

Once again the US was swift to respond, this time with an unparalleled peacetime buildup. Air National Guard and Air Force Reserve units were called to active duty in the wake of the Soviets' cancellation of their pledge not to conduct atomic tests and the challenging of our air access to Berlin.

Within a month after activation, eleven ANG squadrons had deployed to Europe with their single-engine tactical fighters and supporting elements.

Few threats, however, could equal that revealed by President Kennedy on October 22, 1962. In a dramatic report to the nation the President told how US Air Force reconnaissance photos had clearly shown that Cuba was being armed with offensive missiles by the Soviet Union.

Military units were alerted to a high state of readiness. A naval quarantine was employed against the shipment of further aggressive weapons.

Meanwhile, Air Force men and equipment were rapidly deployed. The fighter-bomber potential of TAC; the supersonic interceptors of ADC; the missile,

bomber, and tanker crews of SAC; the cargo- and troop-carrying capacity of MAC—all of these reached peak alert status.

TAC, SAC, and Navy reconnaissance aircraft provided around-the-clock observation and photographs of all missile sites. More than ninety-three percent of the more than 14,000 recalled Air Reservists were on active duty, and seventy-five percent of their 423 aircraft were fully combat ready in less than twelve hours.

The display of military might, and determination to use it unless the Communists dismantled their rockets and removed aggressive equipment, choked off the threat.

Just as our refusal to back down in Berlin did, even against what appeared to be overwhelming odds, our action in the Cuban crisis reaffirmed our resolve to protect our basic freedoms. Once again the superiority of our aerospace power in global nuclear delivery capability deterred aggressors from the risk of general war.

The ability of the United States to employ air and surface power at critical times and places during the time between Korea and Vietnam proved to be decisive. The brushfires were kept under control.



—United Press International Photo

President Kennedy watches a flyover at Homestead AFB, Fla., while on tour of the South Florida military bases during Cuban crisis. In hours, 93 percent of 14,000 Air Reservists had reported for duty and 75 percent of their aircraft were ready.



In Operation Big Lift in October 1963, the largest transoceanic Army-Air Force deployment ever made by air, demonstrated effective strategic mobility in reinforcement of NATO forces. This center controlled flights from US bases to Europe.



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Chapter XII

USAF in Space

FOR almost half of its twenty years as a separate service, the Air Force has been deeply involved in space. It has, in fact, been anchor man for the national space team, which includes the Army and Navy, the National Aeronautics and Space Administration, the Advanced Research Projects Agency, the Office of Aerospace Research, and the Atomic Energy Commission.

The Air Force has provided the greater part of the basic foundation of the national space effort. Some sixty-seven percent of all launch vehicles used since the space program began have been USAF systems launched by Air Force crews.

The bulk of the launch environment—Eastern and Western Test Ranges at Patrick and Vandenberg Air

Force Bases, as well as other smaller and more specialized facilities—are all under cognizance of the Air Force.

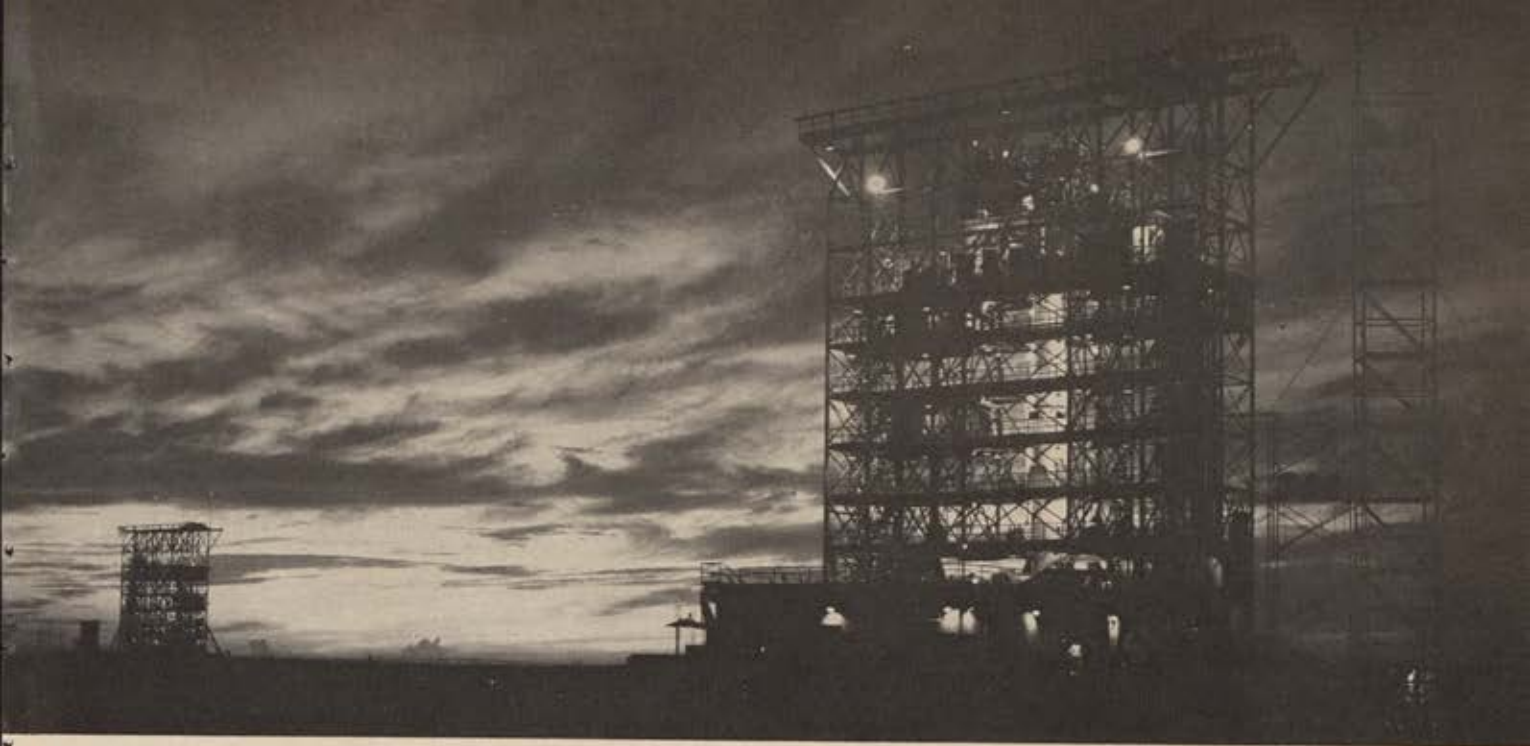
Approximately ninety-five percent of post-launch tracking and control of United States space systems is accomplished by a network of ten USAF facilities located around the world, which send several thousand commands a month to the increasing number of US satellites now circling our globe in a variety of orbits on a diversity of missions.

The development of the ballistic missiles (*see Chapter VIII*) is, in a very real sense, an integral part of the story of the Air Force in space, since the missiles provided the vital initial launch capability. In fact, it was not until 1961 that formal recognition was given to the

High hopes back in 1958. After the shock of Sputnik, the Air Force and the Army both got the green light for military rocket-boosted probes to the moon. The Air Force made national and world headlines with its Pioneer 1, which made the deepest penetration of space yet recorded at that time, some 71,000 miles. Pioneer 1 and its companions of that period were the ancestors of today's Rangers, Surveyors, and Lunar Orbiters.



Nearly a decade later, the Air Force is still working away at the job of building on its missile capability for advanced space programs. A major effort has been the Advanced Ballistic Reentry Systems (ABRES) program. At left, the 6595th Aerospace Test Wing at Vandenberg AFB, Calif., the Air Force's West Coast space base, tests experimental reentry vehicles, using Atlas ICBM boosters, now phased out of active inventory.



Thor-Able combination, which had boosted Pioneer I a third of the way to the moon at a time when that sort of feat seemed nearly miraculous, developed into a highly reliable booster for a wide variety of space missions. This was the spectacular night scene as a Thor-Able III was readied for the National Aeronautics and Space Administration Explorer VI satellite launch on August 7, 1959.

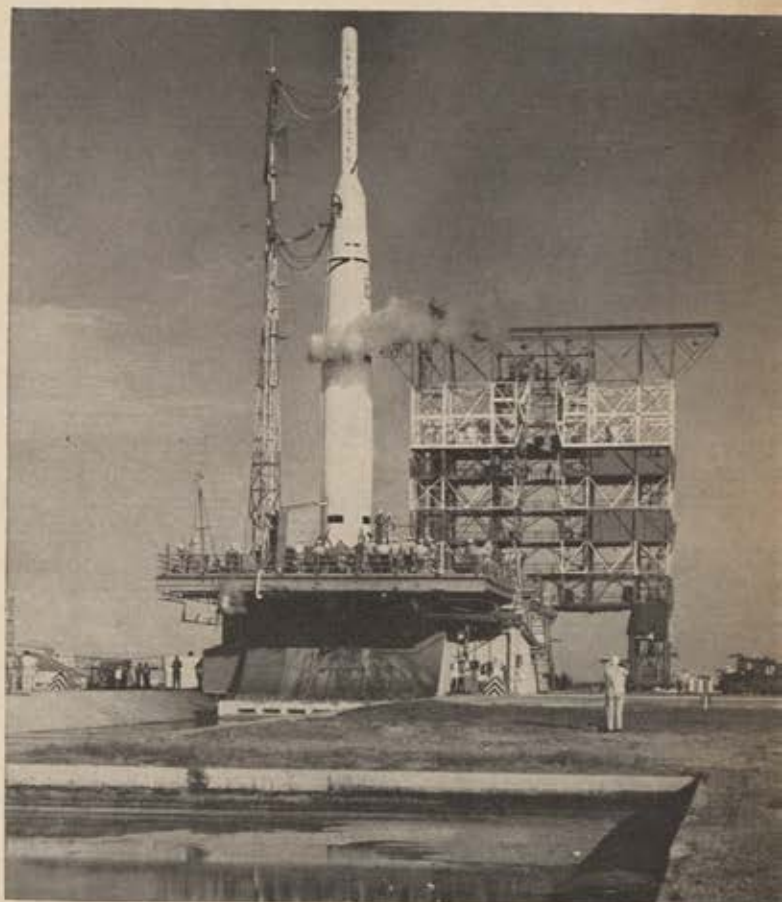
fact that the military space effort had become a separate and distinct program in its own right. On April 1 of that year, in a major Air Force reorganization, the parallel Ballistic Systems and Space Systems Divisions were created, under the Deputy Commander for Aerospace Systems of the newly formed Air Force Systems Command.

A more accurate date, however, to mark the debut of a clearly defined USAF space program is almost three years earlier. On October 11, 1958, an Air Force Thor-Able launch vehicle, in the first of many successes to come, blasted the Pioneer I some 71,000 miles toward the moon in the deepest penetration of space achieved by man up to that time. Two months later, on December 18, an Air Force Atlas B put the Advanced Research Projects Agency's SCORE, the first communications satellite, into orbit. For thirteen days it broadcast President Eisenhower's Christmas and New Year's greetings to the world.

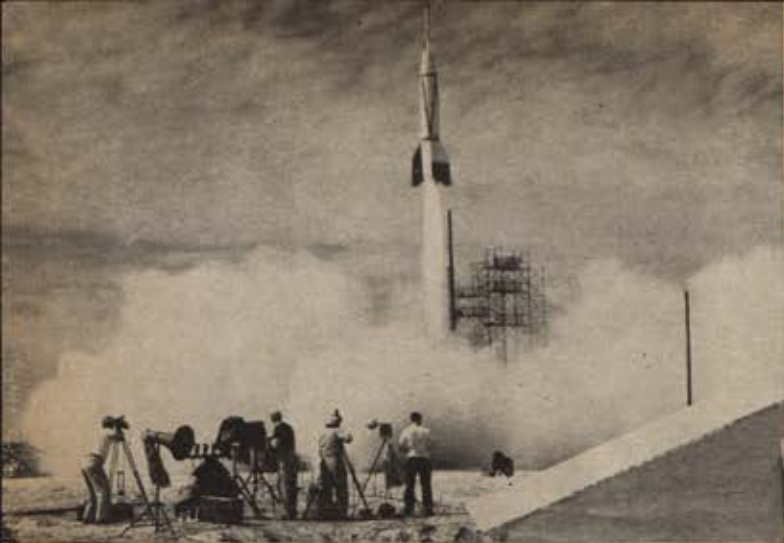
Indeed, by the time the Space Systems Division was established in Inglewood, Calif., as headquarters and nerve center for the Air Force space effort, the USAF had already transformed the Thor and Atlas ballistic missiles into highly reliable space-launch systems. It had designed and developed an additional space-launch vehicle, the Scout, SLV-1A, and created a series of upper-stage vehicles still in use today—the Able, Agena, and Star.

By 1961, the Air Force had behind it a record of some forty-six space launches—an early and disheartening struggle against repeated failures, and then, slowly, but steadily, increasing reliability. It had built up an impressive list of firsts—the first satellite placed in polar orbit, the first photographs of the earth taken

(Continued on following page)



The same scene, with a closeup of the booster on the launch pad at Cape Canaveral, Fla. In those days, the public often seemed a little startled at success. But as experience piled up, the successes began to outrun the failures. The country didn't know it, but two years later we'd be committed to a moon landing.



The first missile fired from what was then Cape Canaveral and now is Cape Kennedy, Fla., was this modified German V-2, with a "Bumper" second stage. The time was July 1950. These were the caveman days of USAF's missile and space effort, and only a few newsmen were on hand. This small band had only faint idea they were firing a shot eventually heard around the world.



Where once practically all launches were from Cape Canaveral, it soon became necessary for the Air Force to develop a West Coast missile and space launching site. The place chosen was an old Army camp named Cooke in California. The base was renamed Vandenberg AFB, after the second USAF Chief of Staff. And before long it became one of the busiest shooting galleries in the world. A major Vandenberg plus: its ability to be used for firing spacecraft into polar orbits.



One of the most important jobs in any launching is that of the range safety officer. His job is to make sure that the missile flies the course programmed for it, since any deviation might damage life or property. The range safety officer gets plenty of help from his expert, experienced team of tracking personnel.

from space, the first meteorological satellite, the initial navigation satellite, the first ocean and midair capsule recoveries. It had also begun the infinitely painstaking exercise in reliability known as "man-rating" the Atlas, which laid the groundwork for the USAF/NASA partnership in putting man into space.

A little more than ten months after the Space Systems Division came into being, a man-rated Air Force Atlas D boosted the first US manned orbital mission in the Mercury program. Astronaut John Glenn in the *Friendship 7* was safely recovered after three orbits and 4.9 hours in space. Three other successful manned flights followed in the next fifteen months, all Atlas boosted, before the program concluded with the Mercury-Atlas 9 flight of May 15, 1963.

For the second stage of the man-in-space program, the powerful Titan II was chosen to boost NASA's two-man Gemini capsule, and the long, meticulous job of man-rating began again.

Meanwhile, the Atlas-Agena, Thor-Agena, and Scout had continued to launch dozens of other projects—the Ranger moon probe series; the Tiros series of meteorological satellites; the Mariner Venus probes; Alouette, Canada's first satellite for gathering ionospheric data; Anna 1B and the Transit series for the US Navy; Discoverer for ARPA; Vela I and II, nuclear detection satellites, still orbiting at this writing; and the oldest man-made satellites still continuously providing useful data; Echo, passive communications satellite and first joint space project with the USSR.

On March 23, 1965, after the new booster and capsule had been tested in two initial unmanned flights, a Titan II launched the first two-man Gemini flight, with Astronauts Air Force Lt. Col. Virgil I. Grissom and Navy Commander John W. Young aboard, for three orbits, 4.9 hours.

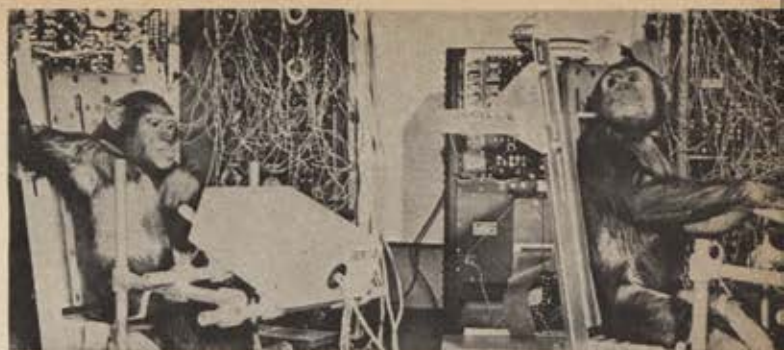
The Gemini program was probably the brightest and most-publicized single program in the United States space effort to date. In nineteen months of 1965 and 1966, ten flights, carrying a total of twenty men, were launched by Air Force Titan IIs with a 100 percent safety record. The astronauts walked in space and explored the difficulties of working there. They rendezvoused with Air Force Agena D targets, parked in orbit by Atlas SLV-3 launch systems. They docked with the target vehicles and, using their propulsion systems, soared to two world's record altitudes of 470 and, subsequently, 850 miles. The end of the program came with the four-day flight of Gemini 12 beginning on November 11, 1966, when Air Force Astronaut Maj. Edwin E. Aldrin, Jr., set a world's record for extra-vehicular activity, remaining outside the spacecraft for a total of five and one-half hours.

Gemini was a liberal education in the performance of men and machines in space. It closed the early gap between the space experience of the United States and the Soviet Union. For vital Air Force support of the Gemini program, Maj. Gen. Paul T. Cooper, Commander of the USAF Space Systems Division, received the NASA Public Service Award, and the Commanders of the 6555th Aerospace Test Wing, the Gemini Launch Vehicle division, and the Gemini and Agena program officers were also decorated.

Gemini was not the only space program, however, in

Retrieval of data capsules from space was no easy task, but USAF space planners figured out how to do it. Discoverer XIII's capsule, first one brought back from an orbiting vehicle, was examined by then Lt. Gen. B. A. Schriever and Chief of Staff Gen. Thomas D. White, in 1960. Ike saw it later.

—Wide World Photos



These two chimpanzees, who earned their astronautical diplomas at the Air Force's space-simian school at Holloman AFB, N. M., earned fame as live astronauts. Ham, at left, survived a ballistic flight, and Enos, at right, was the first chimpanzee to orbit the earth. Both flights took place in 1961. For some reason, the Russians used dogs instead of chimps. There was an outcry in the free world against Soviet use of man's best friend in space.

which the Air Force was involved. Four additional, improved Vela nuclear-detection satellites were launched by the Atlas-Agena D combination, by now an "old reliable." Rangers 8 and 9 took closeup photos of the moon before impact. Canada's Alouette II and NASA's Nimbus weather satellite were put in orbit by the Thor. Development and testing was completed on the largest and most powerful, and the smallest and most economical, boosters yet developed in the space program—the huge Titan IIIC, with a liftoff thrust of 2,400,000 pounds, and the Burner II upper stage, less than six feet long, but with a thrust that substantially increased the performance of most launch vehicles. Two improved versions of the Thor also entered the inventory of operational launch vehicles—the Thrust-Augmented Thor (TAT) and the Long-Tank Thor.

A four-phase experimental program to develop a maneuverable lifting body vehicle, capable of both orbiting in space and being "flown" within the atmosphere, was initiated. The first phase, entailing six launches and primarily concerned with materials development and configuration, was completed in February 1965. The second, involving experiments in maneuvering an Atlas-launched, flatiron-shaped reentry vehicle known as PRIME (for Precision Recovery Including Maneuverable Entry), has just ended with three, instead of the four projected flights, because all test objectives were successfully met in the first three flights.

In June of 1966, a Titan IIIC set a record when it put into individual circular orbit eight satellites 18,200 nautical miles above the equator. The launch was the first in a series designed to establish a ring of communications satellites in equatorial orbits to give the Department of Defense a global military communications system. The initial launch, and a second successful multiple Comsat launch in January 1967, also marked a significant advance in the capability for launch and precision orbiting of multiple payloads.

Also in June of 1966 the Atlas SLV-3 demonstrated its versatile reliability. In a span of eleven days it achieved five highly successful launches, including a Surveyor for a soft landing on the moon, an Agena Target Docking Adaptor for the Gemini 9 mission, and

(Continued on following page)

The whole world watched on February 20, 1962, as Marine Lt. Col. John H. Glenn, oldest of the 7 original NASA Mercury astronauts, blasted off into orbit, becoming the first American to match the Soviet feat of a year before. Russia's Yuri Gagarin had become, on April 12, 1961, the first human being to achieve orbital flight. An Air Force Atlas provided the lift for Colonel Glenn.



First successful manned Gemini flight came in 1965. USAF Lt. Col. Virgil Grissom and Navy Commander John Young achieved three orbits in the 2-man craft, and after their successful touchdown at sea and inevitable debriefings they got the Washington treatment. From left, Senate Majority Leader Mike Mansfield, Grissom, Vice President Hubert Humphrey, Young.



Although after Sputnik the spotlight was very much on missiles and space-hardware development, there was interest, too, in man in space. This man in space, USAF Capt. Joseph Kittinger, Jr., on August 16, 1960, made the highest altitude jump in history. The automatic camera recorded the instant the captain bailed out of his balloon gondola. Kittinger fell an incredible 16 miles before his chute opened, taking him safely to the ground.



Somewhat lost in the cloud of publicity that attended the missile/space boom of the 1950s and early 1960s were the achievements of the Air Force's X-15 rocket-airplane research program. Carried along under the wing of a specially modified B-52, the X-15 soared, rocket-powered, to enormous altitudes, producing vast amounts of data on human and machine parameters of controlled, manned flight—data fed into many on-going programs.



—Wide World Photos

After Sputnik and in the wake of Soviet achievements in the field of intercontinental ballistic missiles, there was no lack of interest on Capitol Hill in the question of where we stood vis-à-vis the Russians. Testifying in 1960 before the Senate Preparedness Subcommittee, headed by then Sen. Lyndon Johnson, were two Air Force officers very much up on the subject, SAC chief Gen. Thomas S. Power; ARDC's Gen. B. A. Schriever.

the NASA Orbiting Geophysical Observatory carrying twenty-one experiments.

A further noteworthy indication of the growing reliability of Air Force launch support was provided by the Thor. By early 1967, this first Air Force space booster had been used for more than 200 launches, with an over-all flight success ratio of ninety-six percent. Since the fall of 1963 no Thor launch has failed. On March 22, 1967, the Thor passed a remarkable milestone with the completion of its 100th consecutive successful launch. The score of successes has continued to grow since that time.

The 1965-66 period yielded steady progress, too, in research and development of basic technologies and techniques with promise for increased future space capabilities. The drive for increasingly powerful propulsion systems, for instance, continued. In February of 1965, in the last of a series of tests to demonstrate the feasibility of developing extremely large, solid-propellant motors, a 156-inch solid-fuel motor, consisting only of absolutely basic fundamentals, developed more than 3,000,000 pounds of thrust, twice as much as any rocket motor previously tested in the free world. Subsequent tests in 1965 and 1966 of 156-inch flight-configured, solid-propellant motors have further demonstrated the practicability of the large solid-fuel motors and the predictability of performance and costs.

A number of other Air Force projects in advanced space research are presently under way. Indeed, space programs constitute three-quarters of the Air Force advanced development effort.

One such program is the Manned Orbiting Laboratory. Principal constituents of the MOL program are a Titan III space booster, a Gemini spacecraft, a laboratory vehicle, and supporting equipment.

The MOL booster is the Titan IIIM, a more powerful version than the Titan IIIC. The Gemini B spacecraft will be specifically modified and the laboratory vehicle specifically designed for the MOL program. Objectives are threefold. The first is to determine in greater detail the capabilities of man in space, par-

(Continued on page 117)



**"As for fixing the time
of a surprise attack,
it is best to
carry it out at night."**

—Mao Tse-tung on Guerrilla Warfare

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The last of the Gemini flights was numbered "12" and featured the exploits of one Air Force major, Edwin Aldrin, Jr., left, and one Navy captain, James Lovell, right, shown here being fitted into their vehicle prior to launch. Major Aldrin set a record for time spent in space outside of capsule. Date was November 11, 1966, and the astronauts were boosted into space by an Air Force Titan II rocket. After Gemini comes Apollo, the manned flight to the moon, scheduled before end of the '60s.

ticularly with respect to defense applications. The second goal is development of equipment and technology that will contribute to future manned and unmanned spaceflights. Finally, the program will investigate the potential of the new equipment developed and of varied applications of technological advances.

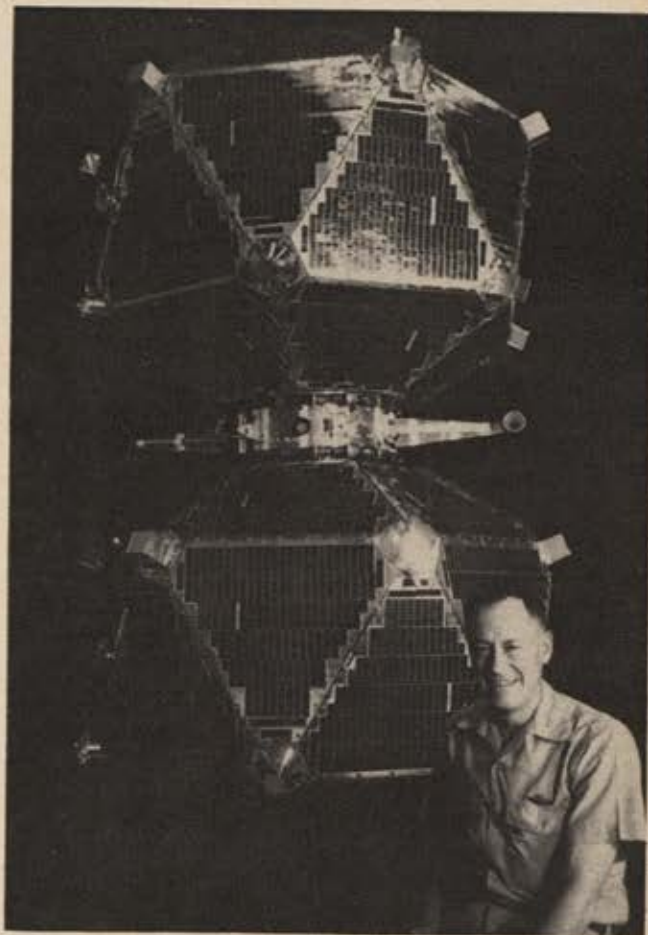
Air Force directions in space for the immediate and long-term future are probably most reliably indicated in Secretary of Defense Robert S. McNamara's January statement to the Congress on "Military Authorizations and Defense Appropriations for Fiscal Year 1968."

A large share of resources for space R&D will be allocated to the MOL program, now moving into the engineering development stage. Contractors have been selected and the fabrication of flight hardware will be started in FY 1968, working toward a first manned flight in calendar year 1969 or 1970.

Work will continue on Defense Satellite Communications programs. The Initial Defense Communications System was completed by another multiple Titan IIIC launch, which occurred on June 28, 1967. Present calculations of life expectancy for these satellites, some of which have been operating since June of 1966, indicate that replenishments will be needed in 1968. Among other communications satellite programs also under development is the Tactical Satellite Communications program (TACSATCOM) intended for use by land, sea, and air forces in the field. Success of the 1967-68 experimental effort will determine future growth of this program.

The Air Force inventory of the Titan III family of space boosters will continue to grow, increasing the capability for launch of heavy and multiple payloads. Work will also be undertaken to increase the capability of the standard Agena D for the heavier satellite payloads now projected.

The last flight of the Prime small maneuverable lifting body having been completed, the next phase of the program, Project Pilot, investigation of maneuver (Continued on following page)

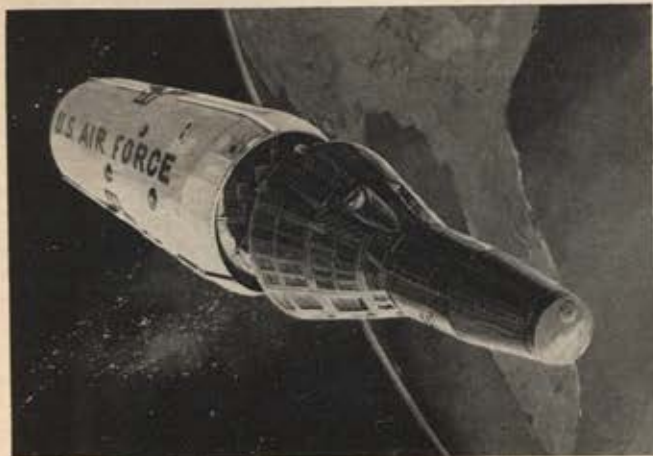


The Air Force has made a major contribution to peacekeeping through space technology in the Vela satellite program. The Vela, tossed into deep orbits by Titan III boosters, patrol space for telltale violations in space of the nuclear test-ban treaty. DoD's Advanced Research Projects Agency runs program. Shown with Vela is USAF project officer Col. S. M. Sherrill.

Large payoffs from space technology are evidenced by this montage of photos taken by NASA's Nimbus meteorological satellite. The montage shows several days' weather over the entire continental United States photographed from 700 miles out in space. This kind of capability not only has obvious benefits for the civilian economy but also is highly useful to military planners. Already, weather satellites have helped provide flight planning data for strike aircraft in Southeast Asia. And this is only the beginning.



Defense Secretary Robert S. McNamara has publicly acclaimed the Titan III development program one of the best managed of such programs in history. From such a stickler for detail, that is a compliment. This is the spectacular look of a Titan III launch. Titan III, with its strap-on solid rockets, can be tailored to various payloads, providing high degree of versatility.



After a very long period of study, analysis, and coordination, the Administration, in 1965, okayed planning for an Air Force Manned Orbiting Laboratory to explore the utility of military man in space. The MOL will be boosted by Titan III. This, how the artist sees MOL, is the only official MOL picture extant.

verability of the X-24A configuration in the low, supersonic, transonic, and subsonic regimes, will follow.

In the area of general technology, the large solid-propellant motor project will be completed with the end of calendar year 1967. However, a variety of programs are planned in advanced liquid-rocket technology. Among these is an investigation of an advanced engine capable of many applications including use in clusters as versatile launch vehicles with power tailored to specific payloads, and a high-acceleration rocket engine for maneuverable space propulsion. Other areas which will receive particular emphasis are advanced space guidance and the Air Force Spacetrack, a ground-based satellite detection, tracking, and identification system.

Today, approaching the ninth anniversary of its first successful space launch, the Air Force can claim a record of impressive space accomplishments. It has made excellent progress in improving the effectiveness and reliability of its space launch vehicles and payloads. Out of its initial period of more or less random exploration of a totally new dimension it has emerged with firm and clear guidelines for the selective development of those technologies, techniques, and systems with the best promise for accomplishing defense responsibilities in space; and it is following those guidelines, within the limitations of its resources, with vigor and imagination.

Most significant of all, perhaps, the Air Force has achieved an unprecedented and infinitely fruitful working partnership with all other elements of the Defense Department contributing to the space effort and with the National Aeronautics and Space Administration charged with the development of civilian space capabilities. It is a partnership which has prevented costly duplication of efforts, has facilitated maximum "cross pollination" of space technology and the most productive use of all available resources, and has created the kind of genuinely integrated and unified national space program that affords the best possible opportunities for optimum future progress.

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The Garrett-AiResearch T76 military turboprop, mated with

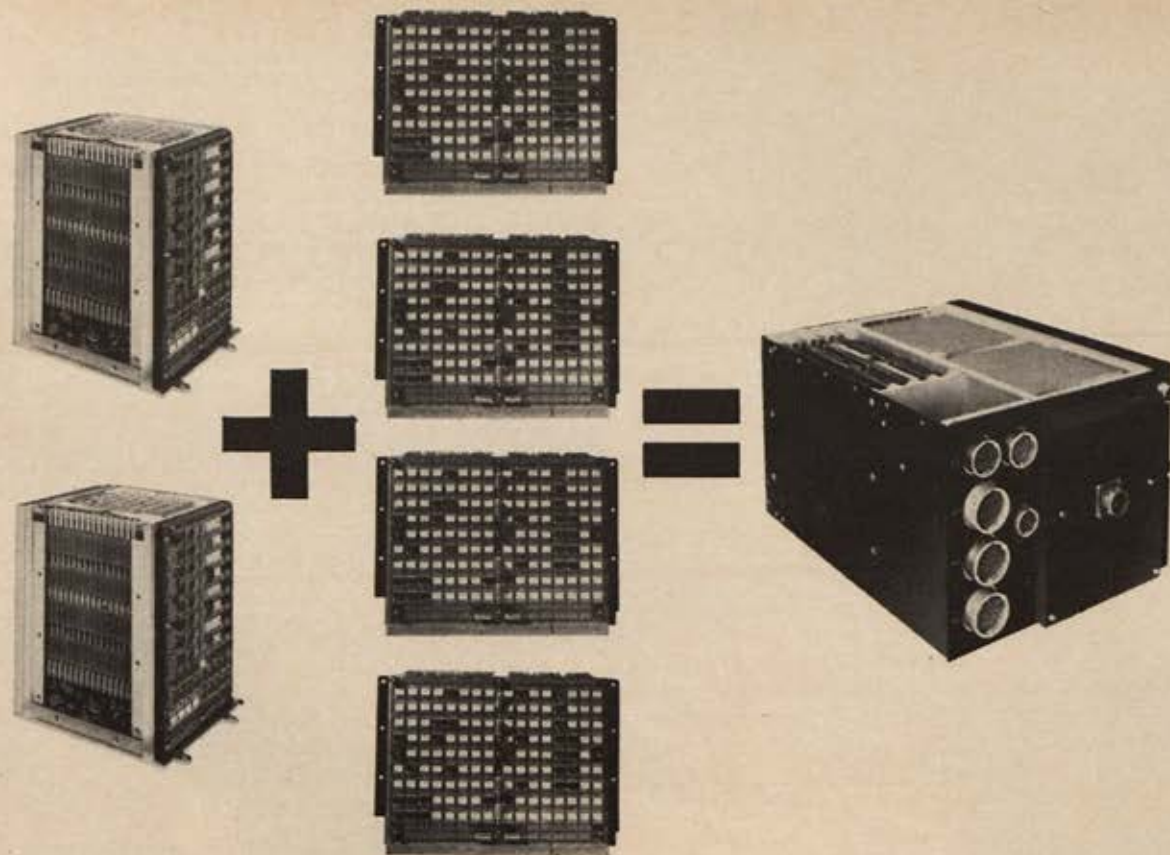
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Chapter XIII

The Brushfire Burns Hot— VIETNAM

IN JULY 1954, a nine-nation conference in Geneva, Switzerland, ended an eight-year struggle between France and the people of its colonies in Indochina. The Geneva agreements freed completely the countries of Laos and Cambodia; left the Communist Vietminh, under the leadership of Ho Chi Minh, in control of northern Vietnam (above the seventeenth parallel); and placed the southern part of that country in non-Communist hands, subject to an election in July 1956 on whether to unite with the North.

South Vietnam's legacy of war was political, economic, and social chaos. Thousands of guerrillas roamed the countryside, and several private armies controlled

sectors of the country. The chaos was compounded by a major refugee problem. The Geneva agreements allowed the people to select between the two regions, and some 900,000, most of them Catholic, moved from the North to the South. About 80,000 elected to move from the South to the North.

With US aid and under the leadership of a Vietnamese Nationalist, Ngo Dinh Diem, some semblance of order soon began to emerge. Appointed Prime Minister of the southern half of Vietnam in July 1954, Diem was elected President on October 26, 1955, following a referendum. On the same day he proclaimed the establishment of the Republic of Vietnam. Rem-
(Continued on following page)

Combat airlift was important in World War II and Korea, but it's the only way to go in Vietnam. Air Force transport and troop carrier planes are almost as prevalent in Vietnam as taxis in New York City—and, what's more, the troops can always count on them during the rush hour. The dust never settled on this narrow airstrip at Dau Tieng in Tay Ninh Province while USAF C-123 Provider crews airlifted supplies and troops into Operation Attleboro last November. During one peak period, C-123s landed with troops and cargo every seven minutes.





Probably the most often shot at planes in Vietnam are the C-123 Providers that spray defoliation chemicals to deprive Viet Cong forces the sanctuary of jungle canopy. Chemicals themselves are harmless to humans, animals, soil, and water, but enemy guerrillas know all too well that when leaves wither on tree and vine to expose their position, they'll have to move before fighter-bombers zero in to make life unbearable.



Among the lessons learned in Vietnam is that for some categories of combat aircraft speed and maneuverability are not as important as payload, loiter capability, and rugged construction. The ancient Douglas A-1E Skyraider, shown here acquiring a fresh bomb load, has won new respect from friend and foe alike.



Because T-28 trainers were plentiful and had excellent range, USAF added guns and bomb racks to give them combat potential. They proved unsuited for tactics required against well-defended targets, but Vietnamese pilots employ them effectively on armed reconnaissance and escorting road or rail movements.

nants of French aid, largely in the form of a military mission, were terminated at Diem's request during 1956 and 1957. Thereafter, the United States assumed complete responsibility for the training and equipping of the South Vietnamese forces, then numbering about 150,000 men.

Despite considerable progress in extending political and military control of the South and in reviving its economy, the Diem regime faced severe internal problems. Insurgent groups, consisting of former members of the Vietminh and sympathizers, continued to defy the government. Several harsh measures adopted by Diem alienated other segments of the populace. Diem refused to hold the 1956 elections on the grounds that the Hanoi government violated the Geneva agreements, that it could not hold impartial elections, and that the South had not signed the agreements. The indigenous opposition, labeled the Viet Cong, soon began to receive aid from the North as it saw its opportunity to win the South by ballot vanish.

As the insurgency grew in size, the United States, in 1959 and 1960, began to provide more economic and military aid. In late 1961, President John F. Kennedy ordered the deployment of more US military advisory forces and equipment. This included an Air Force "Farmgate" special air warfare unit of 151 officers and men equipped with T-28s, C-47s, and B-26s. The Army dispatched Special Forces troops and helicopters to give the South Vietnamese armed forces more mobility.

The Farmgate unit reached South Vietnam in November 1961 with the principal mission of teaching the fledgling Vietnamese Air Force counterinsurgency tactics and techniques. During 1962 through 1964 additional US advisory units were sent to help the Saigon government. To strengthen its combat advisory mission the Air Force, in June 1964, began replacing its B-26 and T-28 aircraft with A-1E Skyraiders. More air-lift, reconnaissance, and other type aircraft also were dispatched.

Meanwhile, political and religious difficulties racked the Saigon government, culminating in the overthrow

B-57 Canberra light bombers were about to be flown home from Japan for transfer to Air National Guard when North Vietnamese patrol boats fired on US Navy destroyers in Tonkin Gulf in August 1964. They went instead to Vietnam where they have performed exceptionally well in close-support missions. Diminishing inventory may bring on their retirement in 1968.



USAF Forward Air Controller writes mission report. FAC system in Vietnam is greatly improved over that in World War II or Korea. Communications are better and faster, aircraft more numerous, but most important is FAC himself who lives with his customers, knows their needs, and talks pilot's language as well.



Improvisation has been another USAF characteristic in Vietnam. Outstanding example is the AC-47 Dragonship—the quarter-century-old Gooney Bird, now embarked on another new career as an attack plane, outfitted with three 7.62-mm Miniguns firing at the combined rate of 18,000 rounds per minute.

and assassination of President Diem on November 1, 1963. A succession of military juntas were unable to cope with internal disorders or the task of running a war-torn government, with the result that the military effort faltered. Simultaneously, North Vietnam stepped up its assistance—both materiel and manpower—to the Viet Cong. By early 1965, after a number of incidents directed primarily at the Americans, President Lyndon B. Johnson prepared to increase the military pressure on both Hanoi and the Viet Cong. At his direction, on February 7, Navy carrier and Air Force planes began bombing North Vietnam military targets. This was followed in March with the dispatch of US combat troops to South Vietnam. They first secured military installations and then took to the field to assist the hard-pressed South Vietnamese forces.

In midyear, large-scale US air, ground, and naval units began pouring into the country. The buildup was rapid: from about 23,000 US advisory personnel at the beginning of 1965 to 184,000 combat and support forces by the end of the year. More arrived in 1966, and by mid-1967 they totaled 460,000.

Concurrent with the ground buildup, the Air Force role grew by leaps and bounds and its first-line aircraft—the McDonnell F-4C Phantom, the North American F-100 Supersabre, the Northrop F-5 "Skoshi Tiger," the Lockheed F-104 Starfighter, and the Republic F-105 Thunderchief—were soon operating in South Vietnam against the elusive Communist ground forces and in North Vietnam against the lines of supply and the mushrooming antiaircraft and SAM sites. Two nonjet Air Commando A-1E squadrons continued their close support missions. An innovation of the tactical effort was the refueling by Boeing KC-135 tankers of many of the fighter-bombers on their way to North Vietnam.

On June 18, 1965, Boeing B-52s entered the fray. Flying from Guam and also refueled by the KC-135s, they have rained thousands of tons of bombs on known or suspected Communist hideouts in South Vietnam. The giant bombers have even performed close support

(Continued on following page)



USAF flies more close-support missions in South Vietnam with North American F-100 Supersabre than with any other plane. Although it is twelve years old, the F-100's attributes of range, firepower, speed, maneuverability, and ability to survive punishment are well balanced to fight this kind of jungle warfare.



No less important than intratheater airlift in Vietnam is the airlifting of personnel and critically needed supplies from the US to Southeast Asia. Here a MAC C-124 takes off from Pleiku AB in Vietnam's central highlands after airlifting elements of US Army's 3d Brigade from Hawaii in December 1965.



Crew member of Air Force C-7A Caribou is silhouetted in rear cargo doorway during aerial resupply of a Special Forces camp. USAF acquired de Havilland C-7As in January 1967 as result of agreement in which Army gave up its fixed-wing transports while USAF acknowledged Army's right to armed helicopters.



Three members of USAF combat control team guide planes carrying Vietnamese paratroopers to drop zone in operation against Viet Cong near Saigon. The team's mission is to parachute into target area ahead of combat troops, mark the landing zone, and establish radio contact with crews of incoming aircraft.

missions, the first in November 1965. In April 1966 they made their first strike on a North Vietnamese target. The Air Force's Chief of Staff, Gen. John P. McConnell, sees the use of the B-52s for interdiction as a form of "strategic persuasion" to encourage the Reds to break off their aggression. Prisoner of war reports attest to the morale-shattering effect of the B-52 strikes. By June 18, 1967, two years after beginning their assaults, the bombers had flown more than 1,000 missions and dropped more than 190,000 tons of bombs on the Communists.

In every modern war the most dramatic battles are the air-to-air duels, and the war in Southeast Asia has produced its share. In air strikes over the North, American air supremacy has been tested by MIG-15s, -17s, and -21s. But as in World War II and in Korea, the US Air Force and Navy have prevailed, both scoring heavily against the Soviet-built aircraft. For the Air Force the F-4C and the F-105 have downed at least sixty enemy aircraft, with the F-4C emerging as the principal "killer" of the highly touted MIG-21. Maj. Bill Gilmore and copilot Bill Smith can claim for the Air Force the honor of downing the first of numerous MIG-21s that have tried unsuccessfully to challenge US airpower over the North. Currently, Col. Robin Olds, a World War II ace, and his copilots have four confirmed MIG kills, the highest to date (see page 38, July 1967 AIR FORCE/SPACE DIGEST).

A variety of special air warfare and other USAF air-



Member of USAF's 8th Aerial Port Squadron meets C-130 Hercules transport on arrival at Bien Hoa base near Saigon. His job is to check manifest of incoming cargo and route it to its destination, then assist Hercules loadmaster in taking on cargo for any of seventy other bases open to C-130s in Vietnam.



Since February 1965 when US began bombing North Vietnam targets, three-fourths of USAF strikes have been made by F-105 Thunderchiefs. Though enemy defenses shot down less than one percent per 100 sorties, some 200 Thunderchiefs have been lost in past year, leaving less than 400 in the USAF inventory.



Last moments of North Vietnamese MIG-17 are recorded by F-105 gun camera shortly before the MIG was blasted by Thunderchief's 20-mm cannon. F-105 carries heavier bomb load than any other single-engine fighter, but began life as an interceptor.

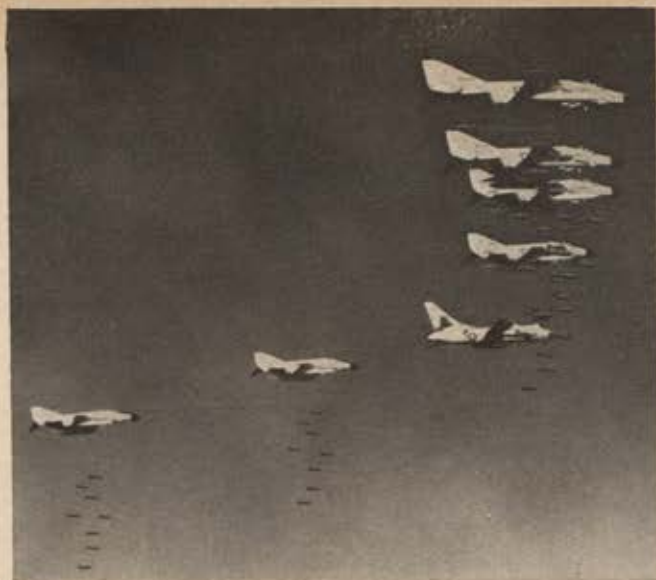
craft have also participated. For close air support and armed reconnaissance missions in South Vietnam, scores of Cessna O-1 aircraft performed visual reconnaissance and airborne forward air control. Older aircraft have been adapted to perform new functions. A number of Douglas C-47s, dubbed "Puff the Magic Dragon," are armed with 7.62-mm Miniguns to help defend outposts and hamlets, support friendly forces, escort convoys, and supplement strike aircraft. Other C-47s and Helio U-10s perform psychological warfare flights, dropping leaflets and broadcasting messages to the insurgents. C-47 and C-123 flare ships fly airborne alerts over certain areas to assist friendly forces in warding off night attacks; and modified C-123s, converted to spray aircraft, defoliate dense jungle growth to reduce the danger of Viet Cong surprise attacks and hamper Communist supply movements.

The Air Force's air-sea rescue service plucks downed pilots from land or sea with specially equipped helicopters or seaplanes, often in a hail of enemy fire. And with most of South Vietnam's road or rail lines cut or too hazardous for travel without heavy guard, logistic aircraft play an extremely important role in resupplying not only US and South Vietnamese forces but portions of the Vietnamese civilian populace as well. For in-country airlifts there are three workhorses: the Fairchild C-123 Provider, the Lockheed C-130 Hercules, and the Canadian-built de Havilland C-7A Caribou

(Continued on following page)



Members of Air Force Tactical Air Control Party assigned to US Army's 1st Air Cavalry Division submit requests for air support to Direct Air Support Center. Under Army-USAF jointly developed system, most requests are for preplanned strikes, but network is geared to respond quickly in case of emergency.



Under radar control of USAF EB-66 electronic warfare plane, a flight of F-4C Phantom II aircraft releases bombs on target in North Vietnam. Phantoms, which hold a big lead in destroying enemy MIG-21s and -17s, are also taking over an increased share of bombing in North as F-105 strength declines.



Phosphorous bomb explodes in white-hot spray over cluster of Viet Cong structures hidden along canal in Phong Dinh Province. Vietnamese A-1E Skyraider which dropped this bomb is visible banking away above the blast. This kind of target is identified and marked by Forward Air Controller prior to strike.



The Boeing B-52 Stratofortress, shown here releasing string of bombs on enemy position in Vietnam, is the most-feared weapon in the US arsenal, according to Viet Cong prisoners. Flying at 20,000 feet or above, often over cloud layers, B-52s give little or no warning before each drops up to 60,000 pounds of bombs in precision pattern. SAC planes were based on Guam, some 2,000 miles away, when they began bombings in June 1965, but now the bombers also operate from U Tapao Airfield in Thailand.

(transferred from the Army to the Air Force at the beginning of 1967.) From Air Force bases in California, Texas, Delaware, and elsewhere in the United States, the Military Airlift Command transpacific cargo service centers around the Lockheed C-141 StarLifter supported by the Douglas C-124 Globemaster and C-133 Cargomaster, and MAC C-130s. Civilian carriers under contract to MAC carry most of the personnel and about a third of the military cargo from the US to Southeast Asia. From December 1965 to June 1967, when the airlift backlog was cleaned up, MAC also relied on transports of the Air Reserve

Forces. A special feature of the airlift efforts is the Red Ball Express. Begun on December 8, 1965, it is used principally for the priority delivery of parts and equipment to the US Army in South Vietnam. Deliveries are made in 168 hours or less from the time the Army unit in the field places the request. More than 100 such tons have been handled in a single day.

Both air combat and air logistic support for the gigantic effort in Southeast Asia rests on ten major air bases in South Vietnam and eight in Thailand. In addition, there are several dozen smaller airfields in both

(Continued on page 129)

One of our mechanics won the FAA safety award for an invention that will never get off the ground.

The mechanic: Winnifred R. Gilliland, a veteran mechanic with American Airlines over 20 years.

His invention: an on-the-ground test of the servo that controls the horizontal stabilizer trim on Boeing 727 jets. His procedure closely duplicates actual flight conditions.

Winnie's work is on the ground. But what happens at 30,000 feet is his constant concern.

Winnie, you make us proud.

American Airlines



The five Northrops.



Aircraft.

We make the F-5 tactical fighter, which is operational or on order for the air forces of 15 Free World nations. It is also fighting in Vietnam for the U.S. Air Force. Our T-38 is the world's only supersonic trainer, the safest trainer in USAF history. We make portions of all Boeing 707 and 720 commercial aircraft and will make major sections of the giant Boeing 747 and the SST supersonic transport.



Communications.

Our subsidiary Page Communications Engineers designs and installs communications networks of every kind and size on every continent. Customers range from newly emergent nations to the U.S. Department of Defense. Page is also leading the world in the design and technology of mobile earth stations for satellite communications.

We hold a one-third interest in the United States Underseas Cable Corporation. We recently acquired the Hallicrafters Corporation, a leading manufacturer of short-wave transmitting and receiving equipment.



Weaponry.

Our activity in developing advanced weapons is mostly secret but is broadly based. It covers such areas as airborne countermeasures systems, missile and rocket launchers, warheads, battlefield illumination, underwater demolition, rockets, and chemical warfare items.



Electronics.

Our work in electronics covers a broad range of advanced technology. We have pioneered in the development of automatic test systems, electro-optical trackers, inertial sensors, inertial guidance and navigation systems for missiles, aircraft and surface ships; airborne computers, information display systems, and voice warning and monitoring systems.



Space.

We have designed and built two wingless research aircraft to test landing concepts for tomorrow's space vehicles. We are responsible for the structure and mechanical subsystems of the 1969 Mariner Mars spacecraft. We are designing and building a third OV-2 satellite for the U.S. Air Force, and we have many support responsibilities for the National Aeronautics and Space Administration at Huntsville, Houston, and Edwards Air Force Base.

We make the parachute landing systems that bring all U.S. manned space vehicles down to earth.

Though it can be devastating to an enemy, airpower also saves lives through rapid air evacuation of injured personnel from the combat zone to well-equipped hospitals. Here an Air Force nurse and medical technician care for a patient aboard a 315th Air Division C-130 en route from a remote Vietnam airstrip to a hospital in Saigon, the Philippines, or Japan. From there, those who require specialized treatment can be flown by MAC C-141 StarLifter directly to a Stateside medical facility, often arriving there within twenty-four hours of the time they were wounded. Swift air evacuation and intensive care en route have helped reduce to only one percent the fatalities among US personnel wounded in Vietnam.



This Sikorsky HH-3E Jolly Green Giant rescue helicopter moves in to refuel from Lockheed HC-130P over the South China Sea. In-flight refueling enables HH-3Es to remain on alert for longer periods, and to respond sooner whenever an airman is downed.

countries that play important roles in the air war.

To avoid a wider war, as well as to minimize civilian casualties, American airpower in Southeast Asia functions under a large blanket of "do's" and "don'ts." Yet, despite the restraints, airpower has exceeded expectations. General McConnell has observed that a few years ago not many people would have predicted that conventional airpower would assume a dominant role in a counterinsurgency-type war as currently fought in Vietnam. At best, it would have been considered "useful." But experience now shows, he asserts, that, from

(Continued on following page)



Photo reconnaissance plays an important part in campaign to interdict enemy supply routes. Repeated bombings have destroyed two bridges and cratered roads, forcing North Vietnamese to build bypass fords. Photos like these brought in by RF-101s and RF-4Cs indicate when targets should be hit again.



Numerous acts of heroism have been recorded by rescue air-men, who often descend into hostile terrain to find and assist downed crewmen. Some have died fighting off enemy while injured pilots were hoisted to safety; others have had to be abandoned when helicopters were hit by intense ground fire.

"useful," airpower has become "indispensable," and air support has become "air-to-ground combat." Ground field commanders would agree.

In June 1965, the close support provided by USAF's 2d Air Division (now Seventh Air Force) pilots in the battle at Dong Xoai, South Vietnam, prompted Gen. William Westmoreland to write General Moore that airpower "turned the tide of battle." A senior Marine adviser called the 2d Air Division's close air support during a battle at Duc Ho in August 1965 "outstanding" and "the decisive factor in a significant victory." Other ground commanders have recounted similar experiences. Said Secretary McNamara in January 1967: "The close air support requirements of the land forces have been met in full." The massive B-52 strikes against Communist units in jungle areas have regularly and repeatedly been credited with breaking up troop concentrations and spurring the defection rate. And, despite the many restrictions on the use of airpower against North Vietnam, virtually all observers agree with Secretary McNamara's assessment that the armed reconnaissance and interdiction sorties have increased "substantially" the costs of North Vietnam's infiltration of men, arms, and supplies to the South.

When the final history of the war in Southeast Asia is written, there can be no question that historians will agree that airpower was the decisive factor in preventing a Communist takeover.



These Northrop F-5A Freedom Fighters were transferred to the South Vietnamese AF in June 1967, after an extended combat test by USAF pilots. Vietnamese pilots and ground crews were trained in US to operate and maintain the light but potent fighter, which is also flown by 13 other free world air forces.



Interdependence of men in combat is well illustrated by this personal equipment technician, to whom aircrew personnel literally entrust their necks. He describes his Air Force career as "twelve years of lifesaving."



Air Force security policeman and his German shepherd dog turn to watch F-4 Phantom II land at Cam Ranh Air Base. USAF is employing dog and handler teams more widely in Vietnam than ever before, as part of vigorous effort to reduce infiltration raids which have proved costly in lives and materiel.

Decca is with the Hueys 100%

Huey 1 D helicopters in Vietnam work round the clock evacuating casualties from the battle zones swiftly and efficiently. Decca is proud of the role their equipment plays in this humane work. These U.S. Army helicopters are 100 per cent equipped with the Decca Navigator. The wounded can't wait, and navigation must be utterly reliable and absolutely accurate—something in which Decca leads the world.

DECCA - for pin-point navigation

DECCA SYSTEMS INCORPORATED, 1707 L STREET NW, WASHINGTON D.C. 20036



Chapter XIV

Where We Stand— The Global Air Force, Circa 1967



Fastest bomber yet developed for Strategic Air Command is the B-58 Hustler, here refueled by a KC-135 tanker. One-third of the size of a B-52, the B-58 can exceed Mach 2 at 35,000 feet. It carries nuclear weapons but is not readily adaptable to a conventional-weapon payload so has not been used in Vietnam. Despite capabilities, the B-58 is scheduled for phase out by 1970.

TODAY, the strategic missiles and aircraft of the Air Force—its defense aircraft and missiles—its tactical fighters—its tactical and strategic airlift forces—its reconnaissance aircraft—its global communications, electronic warning, and detection devices—its experts in all kinds of aerospace warfare provide this nation with aerospace power second to none in the world.

The Air Force is a huge organization. As an instrument of national policy, its operations are worldwide. The Air Force furnishes the great bulk of NATO airpower and, in addition, each year provides thousands of allied students with flying and technical training through the Military Assistance Program.

Air Force personnel and Air Force weapon systems are positioned on more than 200 major installations in the United States and twenty-four friendly countries. Overseas, and in the United States, the Air Force participates significantly in Unified and Specified Commands. There are Air Force components in Pacific Command, Atlantic Command, European Command, Alaskan Command, US Southern Command, Strike Command, and the North American Air Defense Command. The USAF Strategic Air Command is a Specified Command.

The Air Force is comprised of twenty major commands and separate operating agencies. More than 1.4 million people are directly involved in doing the Air Force job. This includes 900,000 active-duty military personnel, 340,000 civilian employees, and 223,000 Air National Guard and Air Force Reserve personnel.

Secretary of the Air Force Harold Brown has stated: "Our most important defense task remains unchanged—detering general nuclear war. Fundamentally, de-
(Continued on page 134)



This painting, called "Global Power," by artist Dean Fausett symbolizes the scope of USAF operations. The US Air Force organization extends around the world as far and as high-reaching as the aircraft it flies. Twenty major commands and separate operating agencies, with 1.4 million people in US and twenty-four foreign countries, perform the many jobs assigned to the Air Force worldwide.

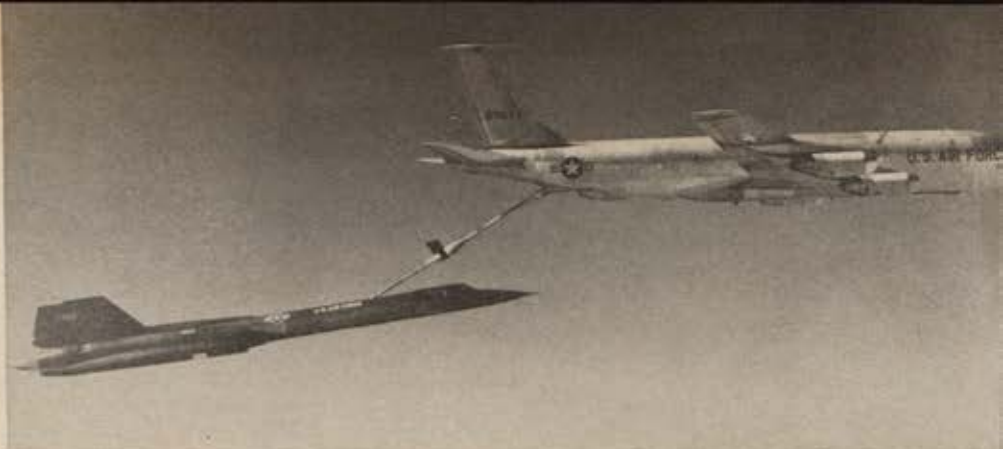


Security has always been a watchword at SAC. Elite guards stand watch as Air Force Secretary Harold Brown, left, and Gen. John P. McConnell, AF Chief of Staff, emerge from SAC's command post, deep underground at Offutt AFB, Neb.



Gen. John D. Ryan was Commander in Chief of the Strategic Air Command when he had this talk with Vice President Hubert Humphrey. SAC's globally deployed forces are tied in tightly with backup communications to guarantee instant response.

Sixty thousand square miles of land or ocean can be surveyed every hour by the advanced strategic reconnaissance SR-71 aircraft at right, being refueled by KC-135. This Mach 3, long-range plane is capable of both pre-attack and postattack recon missions and was developed for SAC by Lockheed in only two years.



The backbone of Strategic Air Command's operational missile force is the Minuteman. Above, Ogden Air Materiel Area technicians put finishing touches on a Minuteman that has been returned to Ogden from the silos for repair. USAF has achieved its goal of six Minuteman wings with a total of 1,000 missiles.



Both TAC and SAC will use versatile F-111, first aircraft to employ both variable-sweep wings and turbofan afterburning engines. It is designed to fly from under 100 knots to Mach 2.5 at altitude, with supersonic low-level dash, and holds unofficial range record for tactical fighter using only internal fuel.

terrence rests on a capability to assure the destruction of any aggressor nation which attacks us." (Statement before a Joint Session of the Senate Armed Services Committee and the Senate Subcommittee on Department of Defense Appropriations, February 2, 1967.)

The Air Force now makes the major contribution to this deterrence. To help prevent general war, or anything likely to lead to one, the Air Force depends on a mixed force of manned bombers and missiles.

The strategic bomber force includes Boeing B-52 Stratofortresses and Convair B-58 Hustlers. Some of the early models of the B-52 will be replaced by the General Dynamics FB-111, a bomber version of the F-111 tactical fighter. Buildup of a force of FB-111s and phase out of the B-58s are programmed for the early 1970s.

Our nation has strategic missiles in its operational force. This includes the Air Force's Minuteman and Titan II ICBMs and the Navy's Polaris missiles.

The first Minuteman II missile wing became operational in 1966, and the Air Force is moving toward an ultimate strength of 1,000 Minuteman II and III missiles. The earlier model Minuteman I missiles are being phased out. The Minuteman III will have an improved third stage, increasing the payload and allowing it to carry more penetration aids to counter an antiballistic missile defense.

These strategic forces—both bombers and missiles—are always ready to strike, if called upon to do so by
(Continued on page 143)



Ready for launch is this ten-story-tall Titan II intercontinental-range missile on 150-foot-deep underground launch pad. Titan II is silo-launched in less than a minute, has thrust, range, and payload greater than any other US ICBM. Employed by SAC and AFSC, Titan II was also launch vehicle for Gemini.

An illustration in a sketchy, hand-drawn style. Two men are in a control room or laboratory. The man in the foreground is seated, wearing glasses and a suit, looking down at a control panel with many buttons and switches. The man in the background is standing, also in a suit, looking towards the control panel. To the left, there are large racks of electronic equipment with many cables connected. The overall style is that of a technical or industrial illustration.

An Aerospace
Capabilities
Report On
Beech Aircraft
Corporation

BEECH
AEROSPACE ORIENTED
RESEARCH AND DEVELOPMENT
FACILITIES

One out of every 14 Beechcraftsmen is an engineer with one or more degrees. These men need good tools, an encouraging environment and the work of expert craftsmen and technicians to accomplish their missions. They have them. Of nearly 2,000,000 square feet of floor area, one in nine is devoted to laboratories, engineering and tooling.



R&D. Basic and Applied



Models are installed on this 40-foot-high range tower for measurements of radar, antenna and passive radar augmentation patterns.



Every Beech activity associated with aviation and aerospace is backed by complete laboratory facilities.

The Electrical and Electronics laboratory provides laboratory and consultant service for engineering projects at all levels. With nearly a thousand different special and standard electronic testing devices, it is staffed by personnel well experienced in metrology and instrumentation techniques. Areas covered include electrical standards, microwaves, vibration, acoustics, radio interference, structural test, wind tunnel test, aircraft and missile flight test and high speed sled testing.

The Electronics Development laboratory is staffed by a group of engineering and technical specialists experienced in the development of advanced electronic missile systems. These talents are applicable to many other developmental tasks.

The chemical laboratory is presently using this new x-ray diffraction machine. The new machine allows a more accurate and faster analysis of materials by bouncing x-rays off the structural planes of elements.

By recording the pattern of the x-rays, a chemist can determine the elements included in the test material as well as any changes or flaws in the crystalline structure.

The Metallurgical laboratory, staffed by talented metallurgists supported by modern precision equipment, provides the technical knowledge and skills to solve metallurgical problems encountered. These capabilities include metal joining and heat treating.

The Structural Test laboratories (four of them) are used to perform complete structural testing and research on items ranging in size from small component parts to assembled airplanes and missiles.

Mechanical Test Group facilities perform functional, endurance, qualification and environmental tests on various systems and components. In addition, major testing is performed on reciprocating, turboprop, jet and rocket engines.

The Metal Bonding laboratory is staffed and equipped to perform experimental metal bond fabrication and special developmental and environmental testing on adhesive and ablative materials. In addition, it is responsible for physical testing of all production bonding.

The Engineering Computer facility occupies 1,600 square feet of operating and office space. Its facilities include advanced digital, analog and data processing computers. In addition, the company maintains a lease agreement for use of a conveniently located IBM 7090 computer and two IBM 1401 satellite computers. Work done in the computer center falls primarily into the following categories:

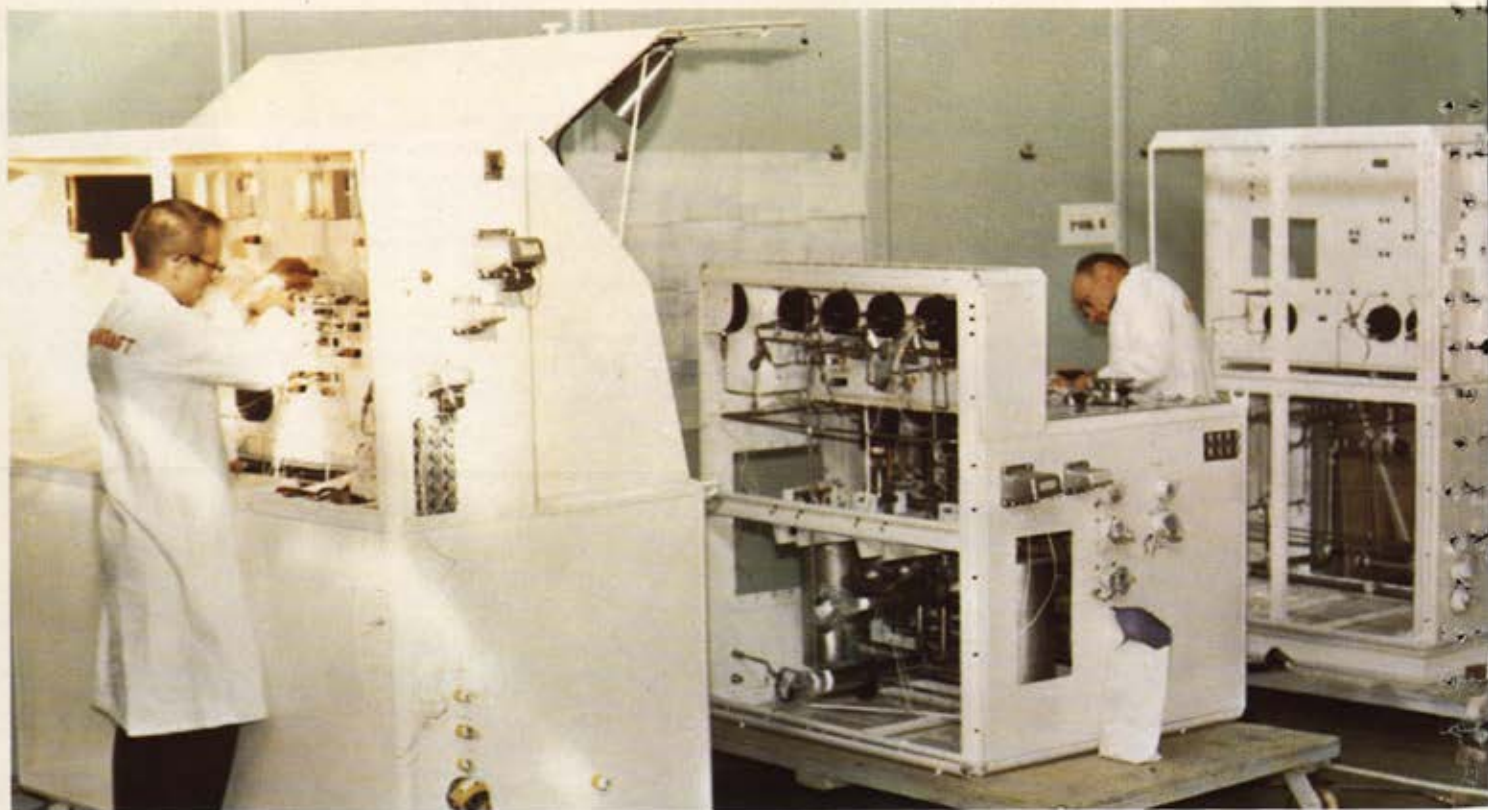
- Missile Trajectory Analysis
- Missile and Aircraft Stability and Control Analysis
- Missile and Aircraft Autopilot Design
- Missile and Aircraft Structural Analysis
- Missile and Aircraft Flight Test Data Reduction
- Missile and Aircraft Propulsion System Analysis
- Missile Aerodynamic Calculations
- Reliability Analysis
- "PERT" Network Analysis
- Aircraft and Missile Dynamics and Flutter Analysis
- Weight Control Calculations
- Calculations on the Economics of Aircraft Utilization



Beech has mastered the techniques needed to fabricate this huge tank of hard-to-work titanium.



Production welding of .012" titanium was pioneered and perfected at Beech. The hemispherical heads on each end of this huge tank were chemically milled in a complex pattern to extremely close tolerances. Beech metallurgists were first to discover—and prove—titanium "creep." This is only a single example of Beech Research and Development applied to fabrication and metallurgy.



Complete control systems for the transfer of liquid hydrogen and oxygen are manufactured at Beech. These control consoles and control boxes are being readied for Gemini shots. To design and build these intricate systems required advanced R&D capabilities in such diverse fields as electronics, pneumatics, metering and sensing.

Beech Applied R&D for Outer Space

At Boulder, Colorado, aerospace systems and components can be ground tested under all temperature conditions encountered from launch to "burnout"—and data collected electronically so that it can be applied to future design problems. At the Beech Transient Heat Laboratory, basic data can be acquired on heat transfer and sink, aerodynamic heating, boil-off and residual vapor, stratification and other fuel conditions, design criteria, tank system operation and complete transient heat information.

Temperatures involved range from minus 423° F to plus 1500° F; measurement and control of liquid hydrogen flow up to 1800 gallons per minute are accomplished.

Flight simulation, high energy fuels, system design, environmental testing, and fabrication of cryogenic support equipment are only a few of the advanced aerospace research and development activities currently in progress.



This radiant heating reflector assembly stands vertically inside a 20-foot high vacuum bell—part of the Beech Transient Heat Facility used for thermal studies of rocket and missile propellant tank systems and components.



By sub-cooling liquid hydrogen to an icy slush, Beech engineers here are testing the feasibility of further reducing hydrogen volume to boost fuel loads without increasing tank size and weight.





Beech has facilities for complete test and evaluation "under one roof"

At Boulder, Colorado, Beech has developed an exceptionally complete aerospace oriented test facility. It includes wide capability in vibration, shock, pneumatics, hydraulics, cryogenics and electronics. The instrumentation for support and data acquisition is traceable to the Bureau of Standards certification.

These Beech laboratories are particularly well equipped for the simultaneous evaluation of multiple environments such as vibration, space vacuum, radiant heat and cold wall, while the component or system is subjected to operating conditions. At any phase of design, aerospace hardware can be tested and evaluated. Most recently completed is a facility for hazardous testing of cryogenic subsystems and components for use with liquid hydrogen and oxygen.

Beech testing capabilities at Boulder include:

Shock—to 500 G's and up to 1,000 lbs.

Vibration—to 22,000 force pounds.

Heat Tower—for aerodynamic or re-entry heat simulation.

Sustained Acceleration—up to 15,000 G-pounds.

Space Simulation:

Bell Jar—with temperature range -320°F to $+200^{\circ}\text{F}$. Vacuum level— 1×10^{-7} Torr.

Explosion Chamber

Space Simulation Chamber—temperature range -320°F to $+140^{\circ}\text{F}$. Vacuum level— 1×10^{-6} Torr. Sinusoidal and random vibration to 8,000 force pounds.

High Vacuum Chamber—Vacuum level, 1×10^{-6} Torr. Black body thermal shroud with temperature range from -50°F to $+200^{\circ}\text{F}$.

Ultra-high Vacuum Space Simulation—ultimate vacuum level— 5×10^{-10} Torr. Thermal shroud and mounting plate. Temperature range from -320°F to $+200^{\circ}\text{F}$.

Environmental Chambers:

Temperature Chambers—from -320°F to $+400^{\circ}\text{F}$.

Salt Fog Chamber

Humidity Chamber

Sand and Dust Chamber

Rain Chamber

Fungus Chamber

Pneumatic Capability to 10,000 psig. with 20 cu. ft. water volume storage.

Hydraulic Capability to 70 gpm @ 4,000 psig.

Cryogenics—19,000 gallon LH_2 storage, 5,000 gallon LOX storage, 4,500 gallon LN_2 storage, 1,500 gallon Roadable LH_2 Dewars, 500 and 200 gallon portable LH_2 Dewars, 500 and 200 portable LOX Dewars, 750 and 300 gallon Roadable LN_2 Dewars.

Calibration—meets MIL-Q-9858, Quality Control System Requirements and USAF Specification Bulletin No. 520.

Data Acquisition and Reduction

Support Facilities:

Machine Shop

X-Ray

Physical Test

Chemical Laboratory

Photographic and Duplication

Personnel—Reliability engineering groups for planning and analysis.

Quality Control

Cleaning Laboratory—includes inspection, cleaning, certification and documentation.

The Broad Scope of Aerospace Capabilities at Beech

Listed below are Technical Areas of Capability by Division only, along with Beech Spheres of Interest. This information is similar in organization to the various Research and Development Source Information and Survey forms, such as DD Form 558-2 issued by the Department of Defense and ASFC Form 220, but in capsule form. Complete information on all Area of Capability Titles by section, unit and sub-unit may be obtained by contacting:

R. H. McGregor
Vice President
Aerospace Marketing and Contracts
Beech Aircraft Corporation
9709 East Central
Wichita, Kansas 67201

DIVISION CODE NO.	RESEARCH	EXPLORATORY & ADVANCED DEVELOPMENT	PRODUCT ENGINEERING	AREA OF CAPABILITY TITLE
1.	X	X	X	Aircraft and Flight Equipment
3.		X	X	Chemical Warfare Equipment and Materials
4.	X	X	X	Chemistry
5.		X	X	Communications
6.		X	X	Detection
7.		X	X	Electrical Equipment
8.		X	X	Electronics — Electronic Equipment
9.	X	X	X	Fluid Mechanics
10.	X	X	X	Fuels and Combustion
11.	X	X	X	Ground Transportation Equipment
12.	X	X	X	Guided Missiles
13.		X	X	Installations and Construction
14.	X	X	X	Materials (Non-metallic)

DIVISION CODE NO.	RESEARCH	EXPLORATORY & ADVANCED DEVELOPMENT	PRODUCT ENGINEERING	AREA OF CAPABILITY TITLE
15.		X	X	Mathematics
16.	X	X	X	Bioastronautics and Life Sciences
17.	X	X	X	Metallurgy
18.		X	X	Military Sciences and Operations
19.	X	X	X	Navigation
21.		X	X	Nuclear Propulsion
22.	X	X	X	Ordnance
23.		X	X	Personnel and Training
25.	X	X	X	Physics
27.	X	X	X	Propulsion Systems
30.	X	X	X	Research and Research Equipment
35.	X	X	X	Spacecraft and Space Equipment
36.		X	X	Range Operations and Studies

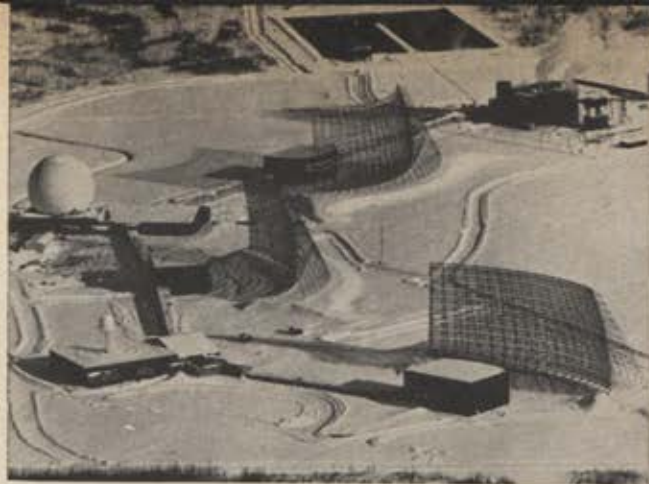
*For Research, Development
and Testing...*

***Look to Beech
Capabilities***

For full information about how you may take advantage of Beech's experience in systems management and proven capabilities in designing, developing, manufacturing and testing of components for aviation and aerospace projects, write, wire or phone Contract Administration, or Aerospace Marketing, Beech Aircraft Corporation, Wichita, Kansas 67201, U.S.A.

Beech *Aerospace Division*

WICHITA, KANSAS — BOULDER, COLORADO



Antennas cast long shadows as well as long radar beams over a 3,000-mile span from the top of the world. This NORAD Ballistic Missile Early Warning System (BMEWS) at Clear, Alaska, would spot an ICBM strike against America and alert NORAD's Combat Operations Center. BMEWS also logs satellite data.



NORAD's Space Defense and Combat Operations Center are both located here inside Cheyenne Mountain near Colorado Springs, Colo. In their underground stronghold, these men at Space Defense Center receive data from global network of space-watching devices, cataloging man-made objects in orbit.



Some F-104 Starfighters of the Air Defense Command serve in aerospace defense of North American continent, but more than 1,000 F-104s are operational in various air forces of the world. As air-to-air interceptors, close-support fighters, and nuclear fighter-bombers, F-104s are a mainstay of NATO, but are soon to be retired from active service in US Air Force.



These radar domes at an installation in Canada police the air- lanes, not only detecting and tracking unidentified aircraft but guiding fighters to targets in case an air attack should ever be launched against North America. Blips on radarscopes under the domes are translated into tracks flashed on the faraway plotting board in NORAD's main Combat Operations Center.

the President. Day and night, a percentage of the bombers are on fifteen-minute alert, ready to react well within the warning time provided by the early-warning system. Some are airborne at all times, always within range of enemy targets. All operational ICBMs are on continuous alert. Hardening of missile sites has greatly increased the survivability of these strategic forces.

Commenting on the future value of a strategic mixed force, Air Force Secretary Brown said in a statement before a joint session of the Senate Armed Services Committee and the Senate Subcommittee on Department of Defense Appropriations, February 2, 1967: "Recent Air Force studies have confirmed the value of a mixed ballistic missile/bomber force through and beyond the 1975 period. By having a mixed force of missiles and bombers, we can complicate and make more expensive the Soviet defense problem, thus reducing the resources they can expend on offensive capabilities."

The Air Force's Air Defense Command provides about seventy percent of the personnel and facilities for aerospace defense of the North American conti-

nent. Aerospace defense forces include the McDonnell F-101B Voodoo, Convair F-102 Delta Dagger, Lockheed F-104 Starfighter, and Convair F-106 Delta Dart interceptors, plus Bomarc B surface-to-air interceptor missiles. The supersonic jet fighters are armed with an arsenal of air-to-air missiles and rockets ranging from the large, nuclear Genie to the Sidewinder, with its heat-seeking guidance system and conventional explosive.

During the past several years aerospace defense forces have shown marked improvement:

- The Ballistic Missile Early Warning System (BMEWS) is fully operational. It provides an electronic cover extending 3,000 miles over the Eurasian land mass and assures up to fifteen minutes' warning of a ballistic-missile attack across the northern approaches to the North American continent.

- The huge underground North American Air Defense Command (NORAD) Combat Operations Center in Cheyenne Mountain, Colo., is now operational. From within this vast complex of steel buildings, mounted on shock-absorbing springs and protected by 1,200 to

(Continued on page 145)



In support of US Strike Command, the Military Airlift Command (MAC) fleet airlifts men and machines over long distances. At left, a 2 1/2-ton truck is offloaded from a MAC C-124 Globemaster during GOLDFIRE I exercise in Missouri in November 1964, in which an entire Army brigade was transported and supplied completely by air.



Approaching low over the Fort Bragg, N. C., treeline, an F-4C Phantom loaded with ordnance demonstrates its varieties of speed, load-carrying capabilities during Strike Command's joint tactical demonstration Blue Chip 5. An M-48 tank waits its turn to show its capabilities in the Army-Air Force exercise.



US Strike Command (USSTRICOM) is composed of units from the Continental Army Command and USAF's Tactical Air Command. It provides the US with an integrated, mobile, highly combat-ready force, available within hours for use anywhere in the world. Above, troops leave their transports, ready to engage in combat exercises testing their ability to react swiftly in crisis.



XC-142A transport, built by Ling-Temco-Vought in a triservice project, is designed for both vertical and short takeoff. V/STOL could open whole new areas of the world to aerial transportation, needs no runways. XC-142 is now being used to investigate the future of V/STOL operations. One potential use is rapid delivery of troops and essential supplies to remote areas.



Paratroopers fill the skies after stepping from their aircraft to strike an "enemy" during a typical Strike Command exercise. This new force, geared to cope with all wars from the use of primitive to atomic weapons, helps give the US a wider choice than, in the words of President Kennedy, "humiliation or all-out nuclear attack."



Visiting Vietnam, the scene of a modern "limited" war, Gen. John P. McConnell, USAF Chief of Staff, right, pauses to talk with two Republic of Vietnam Air Force (VNAF) officers before leaving Da Nang AB. McConnell visited Tan Son Nhut, Bien Hoa, Nha Trang, and Da Nang in a fast-paced tour in 1965.



—United Press International Photo

New method of rescue is demonstrated by unidentified but gutsy man in special flight suit. Simulating an astronaut returned from space, he dangles in midair as he is reeled into HU-16 Albatross. The plane first drops a rescue kit containing the special suit and a balloon to carry lines into the sky. Plane then circles back to snatch the line and reel in astronauts returned from space.



With the Empire State Building as a backdrop, a trio of F-101 Voodoos flies over New York City. Employed by six Air Force commands, F-101s are used on fighter, interceptor, and reconnaissance missions, the latter being extensively flown in Vietnam. Six cameras on the recce version can take close-up photos at 1,000 mph or cover 20,000 square miles at high level.

1,750 feet of mountain granite, the aerospace defense of the North American continent is directed.

- Fourteen Back-Up Interceptor Control (BUIC) II sites have been completed and work is under way on nineteen enlarged BUIC III stations. BUIC, a high-speed surveillance-and-control system using electronic computers, is a standby monitor system which automatically takes over air defense tasks if the primary Semi-Automatic Ground Environment (SAGE) system becomes inoperative.

In addition to providing warning to alert forces, implementing civil defense plans, protecting US retaliatory forces, and limiting damage to the nation, aerospace defense introduces uncertainty into the enemy planner's job.

The Air Force has increased its tactical fighter strength to a new high of twenty-three wings. Total authorized strength now exceeds 1,600 aircraft. Tactical Air Command's (TAC) supersonic jet force of fighters includes the North American F-100 Super-sabre, Republic F-105 Thunderchief, and McDonnell F-4C/D Phantom II.

Many of these tactical fighters are located at various bases overseas, giving visual evidence of this nation's intent and ability to support its commitments.

The number of F-4 aircraft—the newest, fastest, and highest-flying operational fighter in the Air Force in-

ventory—continues to increase. When acquisition of this remarkable aircraft is completed, the tactical fighter inventory will include about 1,000 F-4s.

The role played by tactical air forces within the framework of the US Strike Command (USSTRICOM) points up the increasing importance of airpower as an instrument of national military policy. USSTRICOM, composed of units from the Continental Army Command and the Air Force's Tactical Air Command, provides this nation with an integrated mobile, highly combat-ready force, available within hours for use in remote areas anywhere in the world.

Another way in which the Air Force is meeting its responsibilities at the lower levels of conflict is with the Special Air Warfare Center at Hurlburt Field, Eglin AFB, Fla. At this Center, pilots and support personnel learn to combat guerrilla warfare activities. Special air warfare units are sent to many free world nations to train their air forces in counterinsurgency operations.

A combat applications group at the Center develops new ways and better weapons to discourage or fight guerrilla warfare. Use of the Douglas A-1E Skyraider and A-26 aircraft has improved the Air Force's capability to provide close air support in this kind of war.

Gen. John P. McConnell, USAF Chief of Staff,
(Continued on following page)



USAF can seldom pick time or place for its operations. Consequently, it employs aircraft that will operate in any weather under almost any conditions. This C-130 Hercules in Antarctica is an example. Ability of the C-130 to land and take off at sites deep in the interior of Antarctica, coupled with its capacity for outsize, heavy cargo and all-weather flying, has opened the Antarctic to study and exploration by man on a broad scale.

pointed up the value of airlift in a statement before the Senate Committee on Armed Services and the Subcommittee on Department of Defense Appropriations, February 2, 1967: "Military airlift continues as a matter of increasing importance to this nation. Very nearly every type of military operation today requires airlift.

"At one time, the prime justification for airlift was that it would ensure our ability to respond rapidly in time of crisis. Today the struggle in Vietnam is dramatically confirming the importance of airlift in sustained military operations."

The nation's global military airlift forces include more than 1,700 aircraft assigned to both active and Reserve airlift units. Included in this inventory are the Lockheed C-130 Hercules, Douglas C-133 Cargomaster and C-124 Globemaster, Boeing C-135 Stratolifter, and Lockheed C-141 StarLifter aircraft.

The C-141—the latest all-jet aircraft to enter the Military Airlift Command's airlift inventory—can deliver 60,000 pounds of cargo more than 4,000 miles, or 30,000 pounds over 5,800 miles, nonstop at a speed of 500 mph.

In 1966 a force of C-141s, C-133s, and C-124s, performed the longest combat airlift in military history when the Army's 3d Brigade (Infantry) was moved from Hawaii to Vietnam. Military Airlift Command crews flew more than 200 missions, carrying 3,000 troops and more than 4,000 tons of cargo.

"Since 1961," Secretary Brown states, "our airlift capacity has more than doubled, as we have introduced the C-135, C-130E, and C-141 into the Military Airlift Command. Our present capability will again double by 1970, and almost quadruple by 1972 when the C-5A will be operational. The bulk of this expansion is in strategic airlift, which through rapid worldwide deployment and support capability multiplies the effectiveness of our ground and air forces."

The ability to augment active-duty forces by calling on Air Reserve Forces units is essential in this day of frequent crises. The present "ready now" status of the



The Air Force's range of research has been far-reaching. A small group of AF personnel and a few scientists lived on a floating island about 100 miles from the North Pole in 1952. Shown here are Lt. Col. Joseph O. Fletcher, officer in charge of the research expedition, and Lt. Col. William C. Benedict.

Reserve Forces is the result of steady progress since the end of the Korean War.

Combat-ready Air Reserve Forces are available to carry out their global responsibilities by providing additional troop carrier wings, fighter wings, air refueling squadrons, tactical reconnaissance wings, and tactical control units. The Reserves can provide these forces—anytime—anywhere. Air National Guard and Air Force Reserve airlift units have performed admirably in augmenting the Military Airlift Command in support of the war in Vietnam.

Aerospace weapon systems are not restricted by natural barriers. And recent technological progress has added greatly to the inherent characteristics of Air Force weapon systems—characteristics which provide this nation advantages in range, mobility, flexibility, speed, penetration ability, and firepower delivery.



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UNITED STATES AIR FORCE

Chapter XV

Meanwhile, Back at the Drawing Board . . .

A Look Ahead

GEN. Hap Arnold's philosophy following World War II, voiced at a time when airpower and atomic energy had joined to win a decisive victory and form a convincing force for peace, was, "Our proper business is to be thinking about what kind of an Air Force we'll have in twenty years."

Along with Arnold, others recognized that the atomic bomb or the strategic-range four-engine bomber were not "ultimate" weapons. One of these was another founding father of the modern Air Force, Dr. Theodore von Kármán. In the mid-1940s, he concluded his *Toward New Horizons* report with these words:

"The men in charge of the future Air Force," he

wrote, "should always remember that problems never have final or universal solutions, and only a constant inquisitive attitude toward science and a ceaseless and swift adaptation to new developments can maintain the security of this nation through world air supremacy."

Today, the legacy of this "look-ahead" attitude, coupled with the unparalleled technological aptitude acquired during the past two decades, has positioned the US Air Force at the forefront of world aerospace progress. Nevertheless, the problems of preserving the peace still have not yielded any "final or universal solutions," as Vietnam has demonstrated. Safeguarding the security of the nation and the free world demands a continued unrelenting emphasis on research and development.

After two decades of technological revolution and evolution, the Air Force is back at the drawing board—thinking about the Air Force of next year, twenty years from now, and the years in between.

This drawing-board approach to the future must consider two factors: the dangers that will confront the United States and the free world, and the strategies, technologies, and weapons best qualified to counter or combat those dangers.

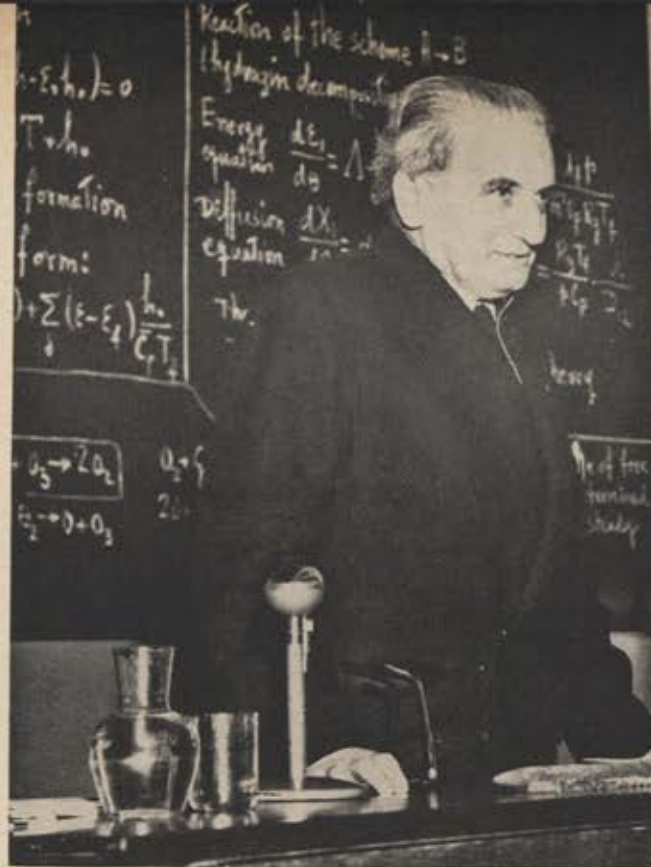
The threat is no longer the singular one of nuclear attack. The situation in Southeast Asia has demonstrated graphically the need to maintain a versatile, flexible force adaptable to any foreseeable eventuality requiring military action. As Air Force Chief of Staff Gen. John P. McConnell has said, "A proliferation of threats throughout the world and the rapidity with which they could develop will compel the United States to maintain a powerful military establishment."

To be powerful or persuasive, the US military structure must be technologically up to date in both the tactical and strategic modes. The Air Force's future ability to support this national commitment depends heavily on deliberate advances along the entire horizon of new technologies, together with the timely application of these advances into systems, weapons, or weapon components.

Contrary to opinions expressed a few years ago, aircraft are not on the way out, and air-breathing propul-



"Hap" Arnold, shown here in 1943 visiting an air base in China with then Col. Jacob Smart (a postwar Vice Chief of Staff), had the vision and wisdom to see that the A-bomb and strategic bomber were not necessarily "ultimate" weapons. Arnold put scientists to work exploring the frontiers of military technology.



"Only a constant inquisitive attitude toward science and a ceaseless and swift adaptation to new developments can maintain the security of this nation through world air supremacy." This was the dictum of Dr. Theodore von Kármán in the milestone report, *Toward New Horizons*, commissioned after World War II to take a long look ahead at US Air Force of tomorrow.



Two decades later the Air Force job is even more complex. As Gen. John P. McConnell, USAF Chief of Staff, put it recently: "A proliferation of threats throughout the world and the rapidity with which they could develop will compel the US to maintain a powerful military establishment" operating on a global scale.



Still the backbone of the airborne US nuclear deterrent is the B-52, and the Air Force's view of the future includes a successor in the form of the Advanced Manned Strategic Aircraft (AMSA), which could serve both general-war and limited-war purposes, just as the Stratojet has done in Vietnam. Contrary to some opinions, aircraft will have an important future.



Coming down the development pike is the FB-111, an interim B-52 successor, an admittedly controversial aircraft which, in different versions, will be flown by both the US Navy and the Air Force. This artist's conception of the FB-111 shows it loaded down with bombs under its wings. Secretary of Defense Robert S. McNamara claims the FB-111 can carry 50 750-pound bombs with performance comparable to B-52. Fleet of 210 is planned.

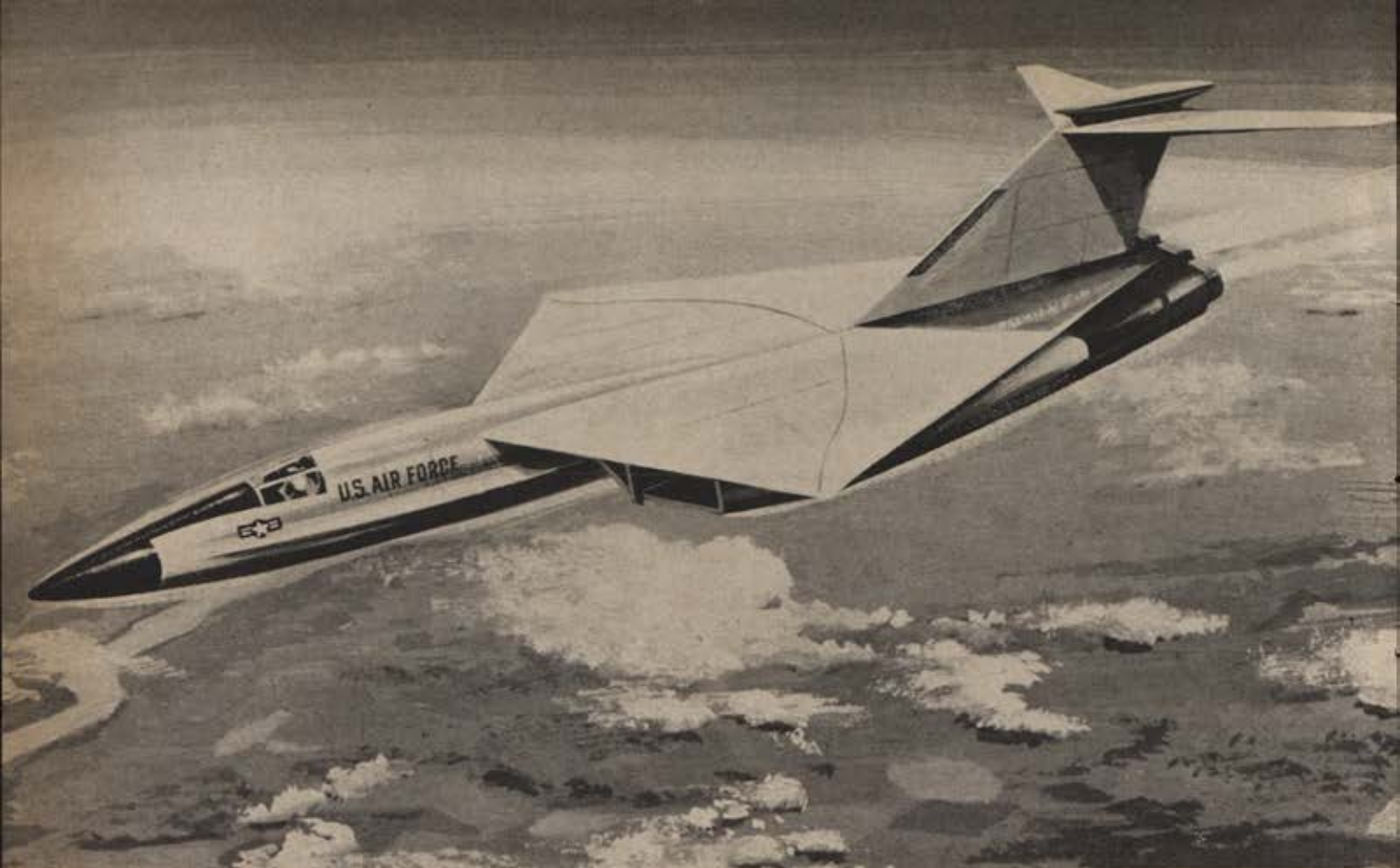
sion systems have not reached the limits of efficiency. The Air Force's outlook on the future includes a variety of aircraft and forecasts substantial improvements in jet engine capabilities.

As replacements for today's B-52s, B-58s, and tomorrow's FB-111 bombers, an Advanced Manned Strategic Aircraft (AMSA) would help maintain the strategic deterrent. In addition, its internal payload of non-nuclear ordnance would be of significant value in any limited-war situation.

The manned interceptor of the near future may have its prototype in the YF-12A, the Mach 3-plus aircraft already successfully tested. The Air Force's requirement for an improved interceptor, like the F-12, is based on the possible threat from enemy advanced air-to-surface missiles and a supersonic bomber.

Anticipated Soviet tactical fighter improvements stress the need for a new US tactical fighter by the mid-70s. This F-X (fighter experimental) aircraft will

(Continued on following page)



If any subject has been studied hard in the planning councils of the Defense Department, it is the Advanced Manned Strategic Aircraft. Most Air Force planners see AMSA, in some form, as crucial to the future of our deterrent. This is one artist's conception of an AMSA ranging over the land at modest altitude. AMSA would probably be larger than the FB-111 but somewhat smaller than today's B-52. Featuring the very latest in avionics and propulsion technology, it would perform roles in general or limited war.

be a superior air-to-air combat aircraft, capable also of carrying out effective air-to-ground strikes. This successor to the F-111 will undoubtedly feature the variable-sweep wing or the double-delta fixed wing and new improvements in engines and avionics.

A new relatively inexpensive close air support aircraft and an improved tactical transport to be used in the limited-war environment are two other Air Force aircraft in the planning stages.

Engine advances which, along with avionics, constitute the highest research and development requirements, are also vital to global mobility capabilities. Performance of the new C-5A, the jet-powered, cavernous transport which will be able to airlift fifty tons 6,300 miles in twelve and a half hours, depends on improvements in jet-propulsion systems which were once thought impossible.

During the twenty years of jet-engine developments, for example, turbine inlet temperatures were increased from 1,400 to 1,800 degrees, and 2,200 degrees appeared to be the ultimate. Yet the demonstrator engine for the C-5A already has exceeded 2,200 degrees. It produces 40,000 pounds of thrust, has an improved thrust-to-weight ratio, and a significantly lower specific fuel consumption. The growth potential for the jet engine now appears to be far greater than all the developments accomplished since its inception. These

improvements will be reflected successively in the coming generations of Air Force aircraft.

The first of these, the C-5A, will revolutionize the nation's airlift capabilities. A fleet of C-5As will enable the United States to respond quickly to confrontations anywhere in the world. Without this mobility, the US might have to maintain large standing forces in many distant locations.

Despite its size (243 feet long, wingspan 223 feet) and load-carrying capacity (265,000 pounds over a 3,100-mile range), the C-5A will use half the runway lengths required for present-day jetliners and will be able to operate on sod fields. The giant transport is designed to carry entire combat units to any point on the globe in twenty-four hours.

From the military standpoint, therefore, airlift has evolved in recent years from a system that provided intratheater tactical mobility to one which now offers strategic mobility on a global scale. For the future the Air Force is thinking in terms of strategic *maneuverability*—the ability to shift military forces and support them logistically anywhere in the world.

In today's exploratory development, technologies have been identified which could produce future aircraft three to four times more efficient than the C-5A. These technical advances include new high-strength materials, high-temperature alloys, laminar-flow con-

trol, and new engine designs. Major breakthroughs in the materials area alone are predicted to produce weight savings ranging from twenty-five to forty percent, which could revolutionize aircraft design.

Another high-promise area is vertical takeoff and landing. In the flight-test and development stages today, VTOL and V/STOL aircraft of the future could greatly improve battlefield mobility and facilitate logistics support. On the basis of current knowledge and experience, there appear to be vast technological potentials that could make VTOL aircraft efficient even for cruise speeds ranging from high subsonic to supersonic.

The discipline that connects flight in the atmosphere to spaceflight is certain to have a major influence on future aerospace capabilities. Single-stage-to-orbit launch systems, aerospace planes, or reusable boosters are possibilities of the near future. Any or all of these concepts could dramatically affect the economy and practicality of space operations, and could figure significantly in the military utilization of space for protective purposes.

The unmanned and manned lifting-body configurations being tested in the START (Spacecraft Technology and Advanced Reentry Tests) program could lead to a maneuverable reentry system, replacing today's ballistic type of return from space and canceling

the large and costly recovery forces presently required.

In addition to an AMSA, the Air Force's strategic systems blueprinted for the next decade include the Minuteman III, to succeed the current Minuteman I and II ICBM systems, and a follow-on ballistic missile, as yet unnamed.

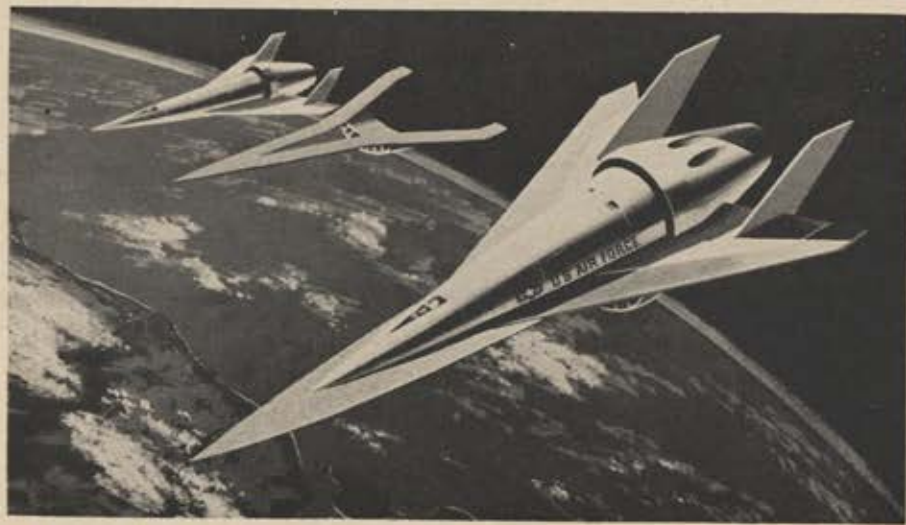
The Minuteman III will provide an increased capability through the development of an improved third stage. This improvement will provide an additional throw-weight capacity which will enable the Minuteman III to carry more penetration aids to counter an antiballistic missile defense. These and other technological improvements will substantially increase the Minuteman's accuracy, survivability, targeting flexibility, and ability to penetrate target defenses.

Beyond the Minuteman family, the Air Force envisions a larger missile with a greater intercontinental-range throw-weight. The increased payload capability will permit increased flexibility to meet changes in technology or in the Soviet target structure and associated defensive system.

A solution to the ballistic missile defense problem should certainly materialize in the not-too-distant future. The Air Force concept calls for a defense-in-depth capability, comparable to the protection traditionally provided against the bomber threat. Aerospace

(Continued on page 155)

For those who can remember the old and overloaded days of the Air Transport Command, the expected capabilities of the oncoming Lockheed C-5A are simply staggering. It will carry 50 tons 6,300 miles in 12½ hours, or hundreds of fully equipped troops. This kind of performance will revolutionize global air transport, and it may well be only the beginning of even greater airlift capabilities in the 1980s—both military and civil.



Aerospace is indivisible, and future technology may permit such realities as single-stage-to-orbit launch systems, and such fantastic hardware as these artist-depicted SCRAMJET hypersonic aerospace craft, which would be hybrids of airplane and spacecraft. There are few limits, many planners believe, to aerospace technology, so long as materials and propulsion systems can be made to follow the basic laws of physics.



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Minuteman I and Minuteman II (left) themselves major advances over the earlier, more unwieldy, liquid-fueled rockets, will be succeeded by the oncoming Minuteman III, which will carry more penetration aids to overcome antimissile defenses. But Minuteman III is by no means the end of the missile line. Beyond the power-packed solid-fueled missile, the Air Force envisions a larger missile with even greater payload capability.



Global communications via military satellite systems are already a reality thanks to the boosting power of the Titan III rocket. This is how it looked on the ground as technicians checked out the loading of the Initial Defense Communications Satellite Program (IDCSP) payloads at Cape Kennedy, Fla. Philco-Ford was prime contractor for satellites, which now circle the globe.

technologies are expected to produce answers to some of the critical problems associated with interception and positive area defense.

The emphasis on strategic deterrence and force effectiveness will extend into the 1970s. While no crystal ball is ever crystal clear, the Air Force is convinced that the best prospect for successful termination of any conflict at any level of violence depends on an unquestioned ability to prevail at all of the higher levels.

This quest for sustained technological and weapon superiority at the summit of the threat will be augmented in the years ahead by a continuing improvement in the Air Force's ability to discourage, deter, or defeat aggression at any level.

Research and development efforts will be devoted increasingly to the acquisition of new and better aircraft, tactical missiles and munitions, and various electronic, reconnaissance, and countermeasure devices. Improvements in sensor, communications, and ECM equipment especially are expected to have a major impact during the next decade.

The "Shed Light" program is aimed at the exploration of new techniques, procedures, and operational tactics to provide more effectiveness for night operations.

Over-all, the drawing-board picture of the next decade and beyond outlines an Air Force characterized by greatly improved survivability, flexibility, versatility, and mobility. Remarkable advances in materials,

propulsion, and electronics will translate into new designs, new performance, and new operational capabilities.

The Air Force, along with the other services and all of society, will benefit from the forces of double compression and double expansion at work on technology. The time between major inventions is getting shorter. Challenges are being compressed and new products are being developed faster. The transistor, for example, which took only five years to develop, has already been superseded by the integrated circuit.

Big things are getting bigger, and small things are getting smaller. The Air Force, which sequentially considered the B-29 and the B-36 the ultimate in aircraft sizes, now envisions the C-5A as possibly an incremental step toward still larger designs. At the other end of the spectrum, "micro" is no longer a fully descriptive term for solid-state electronics. With whole circuits no larger than a pinhead, it's now time to talk in molecular dimensions.

The "look ahead" reveals an infinity of opportunities.

Advances in sensor guidance and scanning technologies, which may virtually eliminate weather and darkness as inhibitors to air operations, will permit assured view of a concealed enemy's offensive and defensive forces. In the future it may not be necessary to defoliate jungles for the purpose of locating military targets.

Other technological advances will make all-weather
(Continued on following page)

operations commonplace. A pilot eventually will have the option of complete in-flight operations, including reconnaissance, on-board display of reconnaissance data, attack programming capabilities, and even warning that he is being observed by enemy radar. He will, in other words, be able to seek, find, identify, attack, destroy, and conduct poststrike assessment—while in flight, in real time. Improvements to the integrated armament control system, already developed, will give the pilot full and instantaneous programming control over all the weapons at his command.

In the future the Air Force would like to be free of the airfield. Runways possibly will become relics, convenience items but not necessities. Increasingly, aircraft will be designed for forward area utility, and the VTOL and V/STOL concepts will make almost any area accessible to aircraft operations.

Progress in materials and propulsion, already rapid, will accelerate even more in the foreseeable future. The strength of boron fiber composites has made it cost-competitive for certain airframe structures where great durability is required. Even so, advances in the materials field today have uncovered other substances and composites which are potentially lighter, stronger, and cheaper than boron.

In propulsion, the state of the art theorized just a few years ago as the maximum attainable in certain phases of manufacture already has been surpassed. In engine efficiency, for example, a bypass ratio of six was predicted for 1970; yet eight now appears to be a reasonable possibility.

The vast potentials of the versatile laser are just beginning to be recognized. Its utility as both an illuminator and communicator already have been demonstrated in laboratory tests.

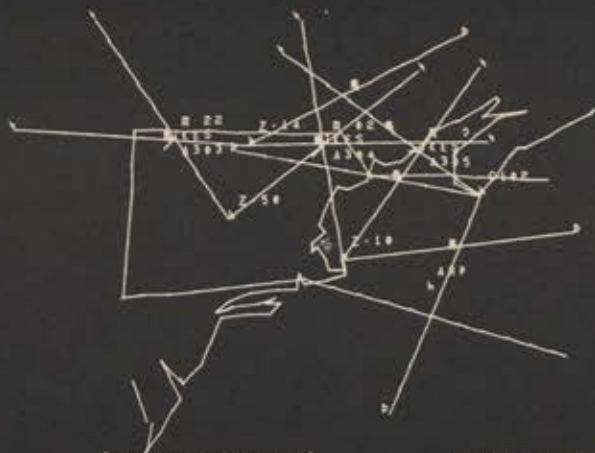
Subsystem and system reliability will improve substantially as molecular-dimension and solid-state electronic devices become simpler and more foolproof. Over-the-horizon radar and sea-launched ballistic-missile warning systems are broadening the US detection capabilities. A new terrain-following radar with no moving parts and, hence, almost infinite reliability is within the state of the art. Satellites orbited three and four years ago are still functioning. Multipurpose space systems are within reach, dependent for their cost/effectiveness on high reliability. Before much longer, mean times between failure may be measured routinely in years rather than in hours.

In looking at the technological future, one factor emerges with great clarity. The Air Force today is not handicapped by any artificial, arbitrary, or self-imposed limits to technological progress. No final or universal solutions have been achieved. In its twentieth year, the Air Force has attained a high plateau but no summit of strategic or technological competence.

The opportunities ahead are greater than the sum of accomplishments behind. The proper business of the Air Force today is to be thinking about the future. That is the challenge of the second twenty. The "look ahead" from the drawing-board vantage point of 1967 indicates that the Air Force of the '70s and '80s will prove equal to the challenge.—END



A promising prospect for future Air Force earth-to-orbit shuttling and back is the lifting body, the wingless craft that derives its lift from its own shape. This is Martin Marietta's X-24A manned supersonic lifting body research vehicle, being used in a USAF-NASA exploration of the capabilities of such unorthodox craft. It was turned over to the Air Force in July after extensive engineering tests.



COMPUTER-ASSISTED MILITARY TRAINING

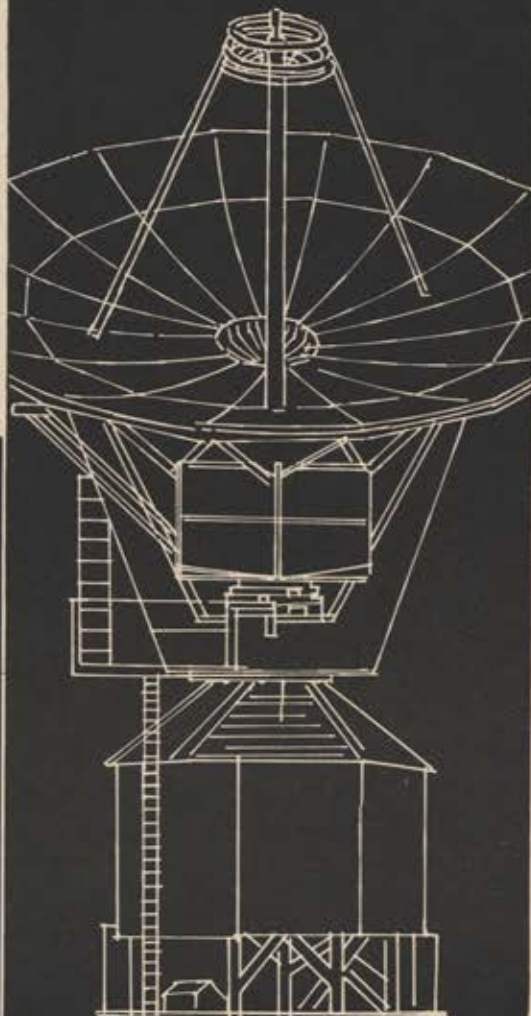
Over the years, the Air Force has been a leader in applying advanced technology to U.S. defenses. At the same time, SDC has been a leader in advancing the development of information technology and the system sciences.

Currently this leadership in technology extends over a range of some fifty Air Force-SDC programs. These include advanced development work in such areas as: ☐ Computer-assisted military training ☐ Military information management systems ☐ Space programs software development.

During the past decade Air Force-SDC technological leadership has helped provide startling advances and rapid growth in the application of information technology and the system sciences. Future developments and applications in this field appear  even more promising.

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There is little question that in the decade since Sputnik we have redeemed our national pledge to wipe out the mortification of that "technological Pearl Harbor." Yet it is ironic that today much of the public views space technology with boredom and even irritation. Part of the reason is the frothy, hoopla atmosphere in which the space program was launched, an atmosphere which hardly allowed for an understanding of the basic relevance to societal advance of the new technology. It is high time now for . . .

Bringing the Space Program Down to Earth

BY WILLIAM LEAVITT

Senior Editor for Science and Education

NEXT month marks the tenth anniversary of the "technological Pearl Harbor" that was Sputnik. Anniversaries are a traditional time for stocktaking, for recalling past glories, regretting past errors, and looking ahead with hope to the future.

Where have we been and what have we accomplished in space since those shattering days of national embarrassment, heated congressional investigations, editorial outcries, and universal recrimination, when the Russians seemed ten feet tall and storming at our technological gates?

We have traveled far and accomplished much, at great cost in time, talent, and money. We have demonstrated our national ability to get under way a large-scale space program, manned and unmanned. We have built, largely on the foundation of the military missile program, a huge government/industry complex, employing hundreds of thousands of people. In a decade this complex has not only built the hardware to orbit men and unmanned weather, communications, reconnaissance, and scientific-observation satellites, but has also brought us to the verge of man's first truly extraterrestrial exploration, a landing on the moon.

There can be little doubt that we have to a great degree redeemed our national pledge, secured with treasure and talent, to wipe out the mortification of Sputnik. No nation has accomplished so much in so short a time.

Yet, there is a growing sense of public disquiet about the whole affair. In the face of war in Southeast Asia, against the background of civil strife at

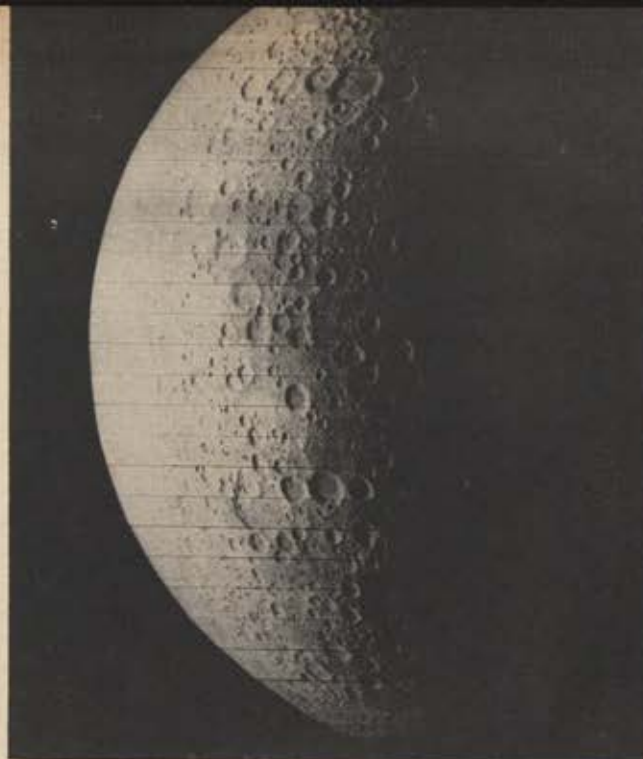
home, and in the aftermath of the shocking Apollo disaster of January 1967, the faceless but vocal "man in the street" is expressing increasing doubts about the worth of the enormous investment that has gone into building the nation's space capability. This public mood finds expression in Congress. Critical and budget-minded legislators have hacked away at space funding, attacked the competence of space planners, and generally questioned the priority of the space program, a singular irony to those observers who can recall the days, not so very long ago, when space was a sacred cow on Capitol Hill.

Why the doubt? Why the collapse of enthusiasm? No one can say for sure, but it is not enough to suggest merely that the public is so fickle that it cannot sustain support for what continues to be an important endeavor with major implications for the whole of mankind. Nor is it enough to say that people are too worried about Vietnam and Detroit to care anymore about our space effort.

There is something deeper, and it has to do with how the US space program has from the start been presented to the American people—as a giant and continuing spectacular, rather than as an effort worthy of standing on its own merits as a three-pronged endeavor serving the national security in a troubled world, the national economy in an increasingly technological era, and world science in a time when men, as never before, are searching the unknown for ultimate answers to questions involving the very nature and origin of life and of our planet and universe. These are the ideas and concepts that should be permeating the public mind, that should be taught in



On a clear day you can see forever. Space technology has dramatically enhanced man's understanding of the universe we live in. This spectacular shot of five-sixths of the earth's surface was relayed by Lunar Orbiter-5 from a distance of 214,806 miles. Continental features are clearly discernible in the photo.



The moon from lunar orbit. The same spacecraft, during its basic assignment of photographing possible landing sites for US Apollo astronauts, sent back to earth this crisp picture of the hidden side of the moon. Lunar features as small as 1,500 feet across are distinguishable, according to NASA scientists.

the public schools, not only in the affluent suburbs but also in the ghettos, and should fill the air on radio and television.

In the large, we have failed to make this presentation, and as a consequence we face the irony of great achievement in space that is poorly understood and weakly supported by the very public that has to pay the bills and stands to benefit so importantly—whether from employment, enhanced national security, improved weather forecasting and communications, or last, but not necessarily least, a deeper understanding of the universe we live in.

This failure has its roots in our own national misconceptions about technology itself.

For too long, we have viewed technology as a kind of shortcut to material achievement, almost as an end in itself, and with scarcely any attention at all to the range of complex side effects, positive and negative, that technology leaves in its wake. Up to a point this approach has been fruitful and has most certainly contributed to our position as the most powerful and affluent nation on earth. But it is a view which no longer warrants, in itself, great investments of money and time and people. Every important technological investment, whether it be to build massive road networks or school buildings or ships to the moon, has enormous social and economic implications for virtually every member of society, implications that need to be examined and sorted out in advance. Somehow, this obvious truth continues to elude us. We continue to operate on a business-as-usual basis, using the ancient tools of salesmanship and hoopla to push forward (when the time seems ripe and with short-run

benefits in clear sight) programs that ought to be examined in long-range terms and in relation to each other.

Which brings us back to the space program and why it presently lives in daily fiscal peril and in a shadow of public disenchantment. The tragedy is that the drumbeat of press-agentry that accompanied the opening of the American space show after Sputnik has never quite been replaced, as it should have been, by thoughtful exposition of the intrinsic worthwhileness of space technology as a broad-fronted national advance.

From the start, we have been caught up with slogans: "space for peace" . . . "man in space" . . . "national prestige" . . . "the American image abroad" . . . and all the rest. Our space planners have had to operate in a goldfish bowl of extravagant publicity, and for the most part, the glamorous aspects of the space program have been advanced and funded at the expense of the more important, socially useful, portions of the program. With all due respect to the courage of the astronauts, we have overly concentrated on their exploits and undervalued the duller and more esoteric unmanned working satellites, which in the long run may do much more to help solve earthbound problems, ranging from air pollution to strategic reconnaissance and control of the arms race, than any grand manned rendezvous in the sky.

The space program has finally begun to pay the price for the frothiness of its publicity. Adult Americans not associated economically or emotionally with the space program have adopted attitudes about the

(Continued on page 162)



Ryan Firebee II

A dramatic, high performance, supersonic jet target to meet the growing challenge of training our armed services, the Ryan Firebee II will soon obsolete every other aircraft of its kind. It is an ultra-sophisticated new relative of a world-famous family of aerial targets. Its predecessors, Ryan's high-performance subsonic Firebees—the most shot-at aerial targets in the world—have an 18-year history of service with the Air Force, Navy and Army. Over 2700 of them have been delivered to date. Every major weapons system in our defense arsenal has been exercised against them.

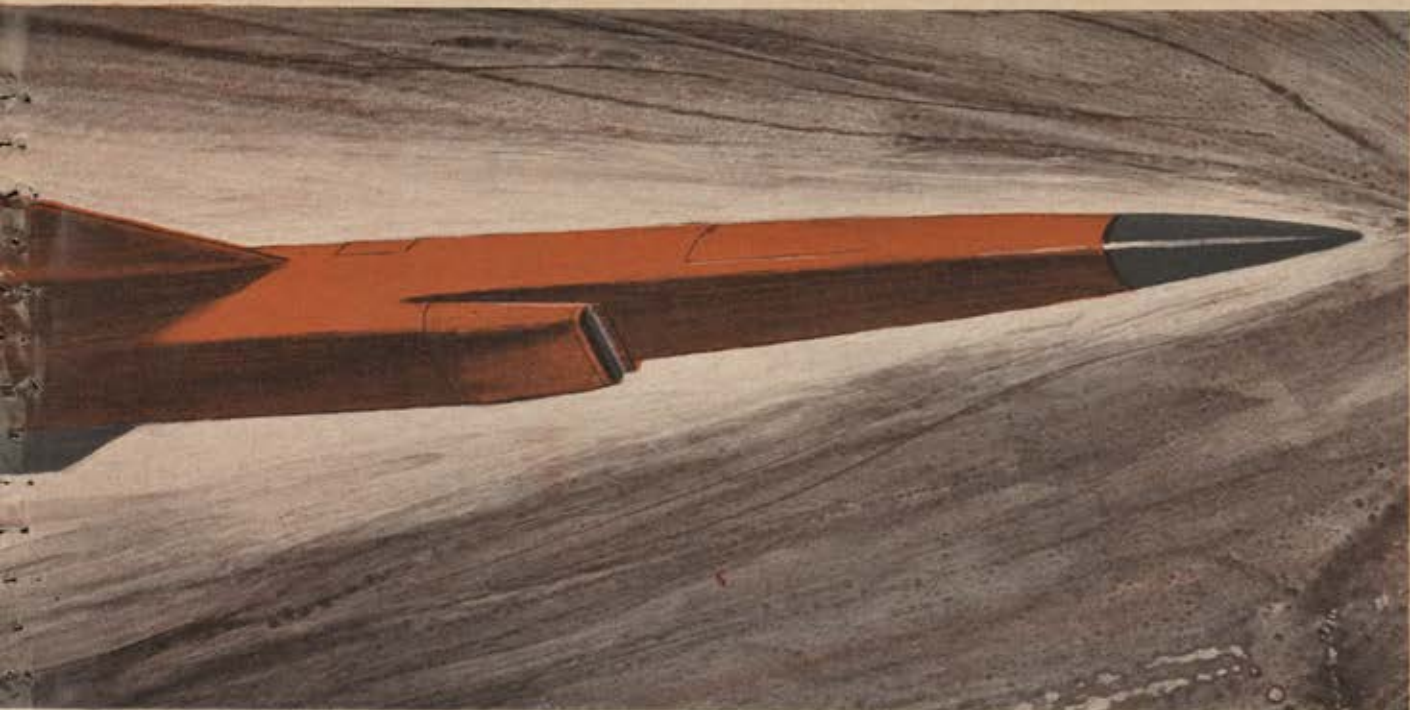
Two decades of Ryan experience in



designing and building jet targets have gone into the development of this new generation Firebee. Its specifications were unusually demanding, requiring

both subsonic and supersonic performance in the same mission profile. With hours of wind-tunnel, static and exacting flight simulation tests behind it, Firebee II will soon be flight-tested at the U.S. Navy's Pacific Missile Range at Pt. Mugu. Test results are expected to be extremely good.

Longer, slimmer, sleeker and faster than its famous subsonic relative, Firebee II is destined to out-perform, out-maneuver any other aerial target in use today. Powered by a Continental YJ69-T-6 turbojet engine which develops 1840 pounds static sea-level thrust, it will be capable of speeds of 1000 miles per



Supersonic

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hour at 60,000 feet. An external fuel pod, slung under the fuselage, will extend subsonic missions, as well. In a typical subsonic-cruise/supersonic-dash mission, Firebee II at Mach .95 will climb to 50,000 feet. After flying subsonic, the pod will then jettison and the target will climb to 60,000, reach a speed of Mach 1.5 and cruise for another 20 minutes. Total mission time will be 1 hour, 15 minutes.

At the completion of a flight mission the recovery parachute will be automatically deployed to lower the target to the ground or water, where it will be retrieved, re-conditioned and returned to

service—a system which will make Firebee II the only re-usable supersonic jet target in existence. Much of the ground support equipment presently employed



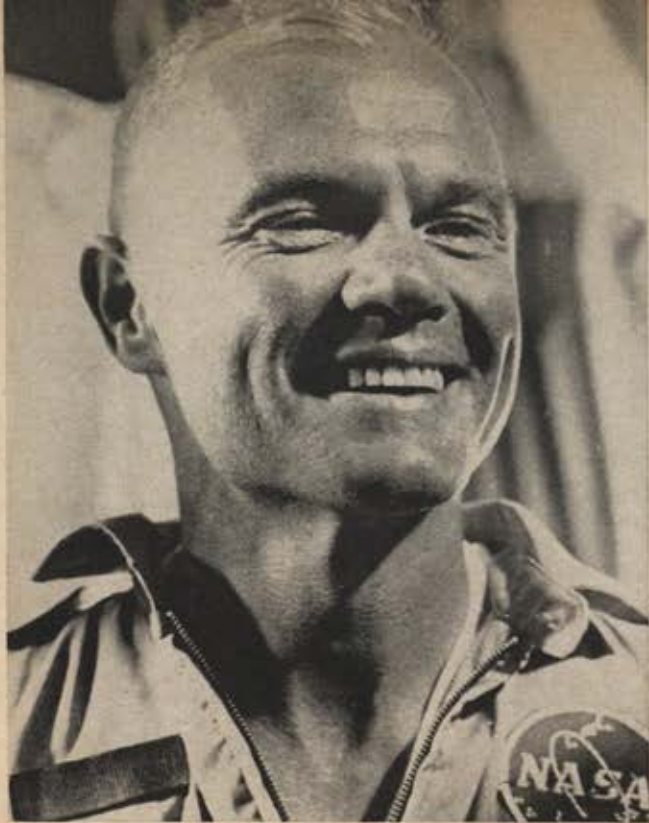
for systems check-out, guidance, and control of the subsonic Firebee will be used with Firebee II.

Remember the name: Firebee II—the first supersonic turbojet aerial target to join the armed services. Another first for the Navy. Another first for Ryan.

Being first is a Ryan tradition!

RYAN

RYAN AERONAUTICAL COMPANY/SAN DIEGO



Americans rode, in spirit, into orbit with Marine Lt. Col. John Glenn, NASA Mercury Astronaut, who on February 20, 1962, achieved the first US manned orbital flight. Glenn's flight was milestone in restoring of US self-confidence in the space race.

program ranging from boredom to irritation. They find the space program somehow irrelevant to their daily lives, and in some cases even consider it an unnecessary and cruel drain on resources that they believe might be better devoted to social and economic enterprises closer to their daily lives.

More and more people, and they are not all in the slums, have this attitude toward the space program. The sum of their indifference and anger is enough to create serious damage not only to the program itself but also to the benefits that they and the rest of the public could derive from the program.

But is the space program irrelevant to societal advance, and if it is not, how can those who do believe in it help restore its public acceptance?

That the program *is* relevant—witness enormous contributions to mundane problems that have already been made by the weather satellites and the rest—should be clear. And those have not been the only positive effects. Even more important is the fact that we can credit the space revolution with helping set off the salutary examination of the quality of American education, a critique that started in the affluent suburbs and has now spread to the poverty-stricken inner cities. Families everywhere in America, using different battle cries, are saying the same thing: that they want their children to be prepared for useful lives and intellectual expansion in a space-age world.

How to restore public confidence and acceptance of the space program is the dilemma. In the face of the headlines that crowd space off the front pages,

even getting the attention of the public becomes a formidable task. Yet the job has to be accomplished if the space program is to survive as something beyond grudging fulfillment of a pledge made by a remembered President to land an American on the moon by the end of the current decade.

It is possible to make some suggestions as to how the problem might be attacked. With the wisdom of hindsight, we can at least be sure of what we ought not to do. We can scrap the Madison Avenue approach, and we can think of planning our future space program in ways that do not put the cart before the horse, a sad example being the decision of 1961 to concentrate heavily on a moon landing in advance of development of long-term, manned orbital capabilities for scientific and military purposes.

We can husband our resources by looking carefully at the question of whether we need two expensive and competitive manned orbital laboratories, one run by the National Aeronautics and Space Administration and one run for the Defense Department by the Air Force (see Col. Richard C. Henry's perceptive article, "Needed—One—and Only One—National Manned Orbital Laboratory Program" in the August 1967 issue of *AIR FORCE/SPACE DIGEST*).

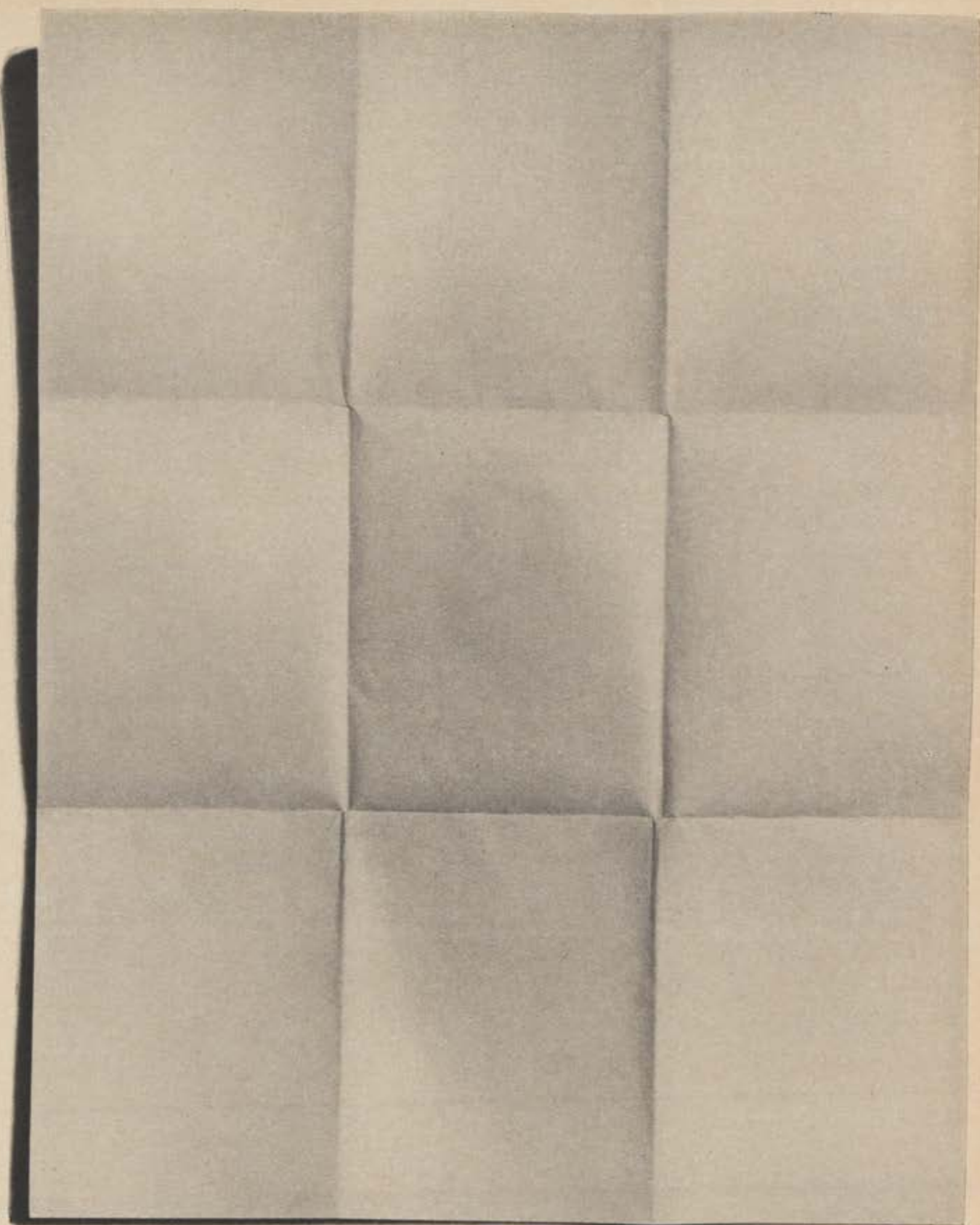
We can increase the funding and sharpen the planning of the unmanned working satellites that have only begun to revolutionize communications, weather observation, and scientific observation. We can begin to look seriously at the potential of aerospace systems analysis and engineering in the solution of nonspace and nonmilitary public problems, with an emphasis on building into these techniques the social, economic, and political factors, the flesh-and-blood considerations that were not so relevant when the problem was merely to develop working ballistic missiles or the first manned and unmanned spacecraft. And we can begin to put to work in our schools, suburban and urban, many of the space-age training techniques that have been a beneficial by-product of the technological age we live in.

All of these approaches—and they are but a sampling—suggest a basic reevaluation of the true value of space technology to our society and a new approach to communicating this worth to society—all of society.

(Continued on page 165)



It was not so long ago that Americans were mortified by, while at the same time admiring, spectacular space feats of Soviet Russia. Left to right, Gherman Titov, second Russian into orbit, Nikita Khrushchev, and Yuri Gagarin, first human in space.



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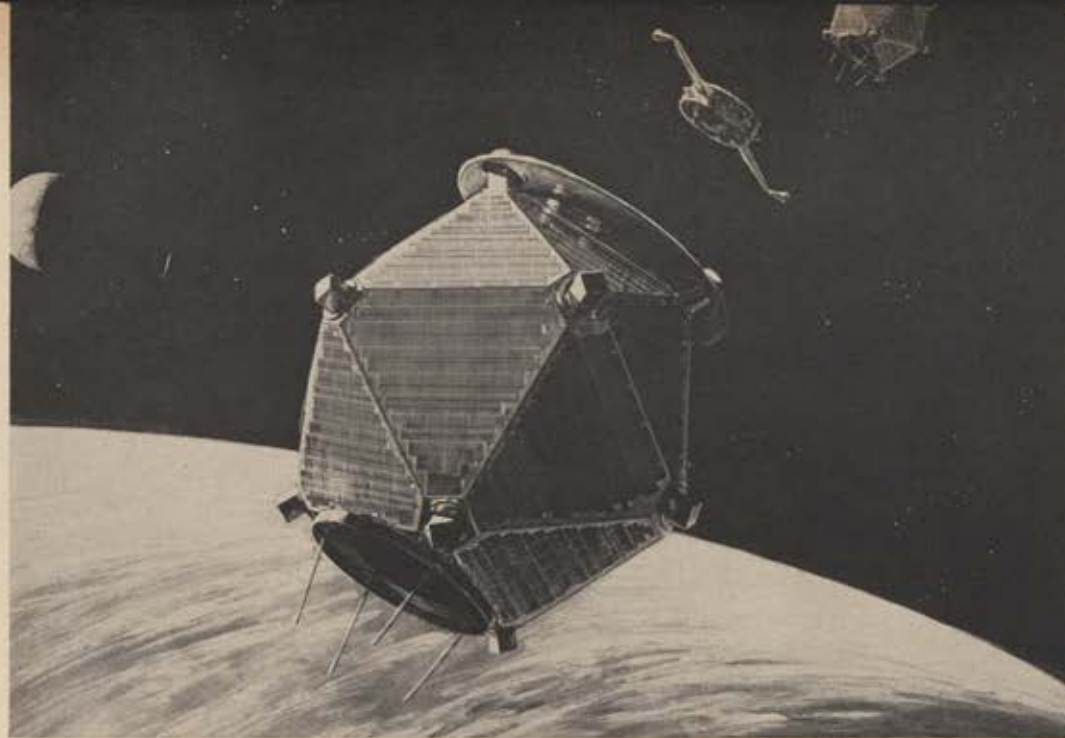
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M

If reading reverse side use old "Hold up to
Mirror" trick.
BURN AFTER READING.



The world has been made a little safer by space technology, thanks to such hardware as space reconnaissance satellites and Vela nuclear-detection spacecraft, shown at left in artist's depiction. The nuclear-detection satellites, which range deep into the void, are designed to watch for violations of the nuclear test-ban treaty, which bars nuclear weapon testing in space.

Space technology has already cost too much in time and treasure to go down the drain now as a TV spectacular that has slipped in its ratings. We can excuse the past and its errors on the grounds of inexperience, but now that a decade has passed and a history of great achievement has been written, we will have only ourselves to blame if the chapters yet to be recorded are scrubby and thin.

Space technology is remote in many ways from man's daily experience. Yet, at the same time, it is closer to his soul and mind than any other human venture. In that it involves man's emancipation from the bounds of earth, in that it has allowed him through the eyes of cameras and the reports of astronauts to look back upon his own world, it advances our understanding of our commonality as travelers together on this spaceship, Earth. In that it has provided new ways to communicate, to foresee natural disaster, to watch from space potential aggressors, it has made life a little safer than it was before. These are only beginnings, the products, for the most part, of even less than a decade. The world will never be the same again. And it could even be better, if the knowledge and new insights that emerge from space technology can steadily be put to work for the public benefit. These are not benefits that should be packaged and sold like so much soap.

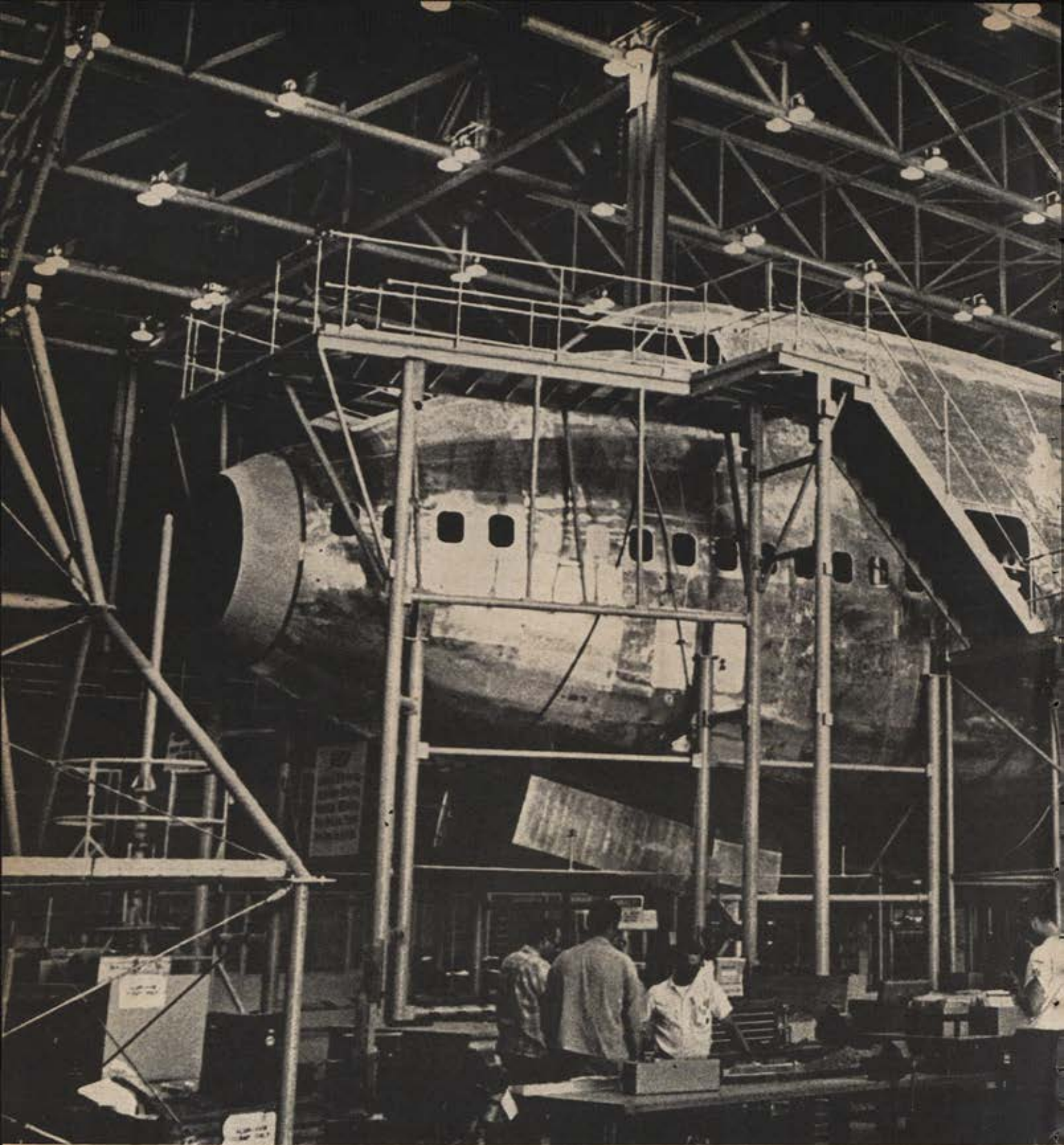
All this is not to suggest that space technology needs to or deserves to be advanced at the expense of other necessary programs. It is rather to suggest that space technology should be acknowledged and defended as a continuing, worthwhile, and socially useful national endeavor, justifiable in terms of its enhancement of man's knowledge, its expansion of his outlook, and its demonstrable improvement of his daily life.

In many ways space technology, as we have practiced it in the past decade, represents the best and the worst of the American style. It has grown like Topsy, and an incredible collection of feats previously un-

dreamed of have been achieved. At the same time, there have been false starts, wasted motion, wrong emphases, too much of the wrong kind of publicity, and not enough attention to the long-range goal of well-founded public understanding of the potential for human betterment through space technology and its allied arts.

Yet, in the main, the effort has been worthwhile and will be even more so. There is more than a passing connection between the earthbound problems of war and peace, progress and poverty, and the achievements of space technology. As Dr. Charles Frankel, the Columbia University philosopher who is now a State Department official, has remarked: "... It is a grave mistake to dismiss science as useless in solving moral and political problems. Objective knowledge of the conditions and consequences of our personal desires or our social institutions does help us to realize the actual nature of the ends we choose to pursue; and in this way we can frequently come to choose our ends and ideals more intelligently. . . . One can . . . take an apocalyptic attitude and assume that the unfamiliar world that is emerging is also going to be unrecognizable, whether for the better or for the worse. But human traits like envy, malice, and egoism are likely to remain no matter what moral medicines the druggist of the future has on his shelves. And once the initial thrill wears off, most honeymooners are probably going to prefer the moon overhead rather than underfoot.

"But if utopia is not around the corner, neither is it inevitable that our powers are unequal to the problems that are appearing. In an age whose problems are almost all signs of mounting human powers, this would be a strange moral to draw. Man is now making his own stars and setting his own impress on the solar system. If these stars are as yet minuscule and only a very little way out in space, they still represent something of an achievement for a creature who is built rather close to the ground."—END



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DISPLAYS FOR COMMAND AND CONTROL

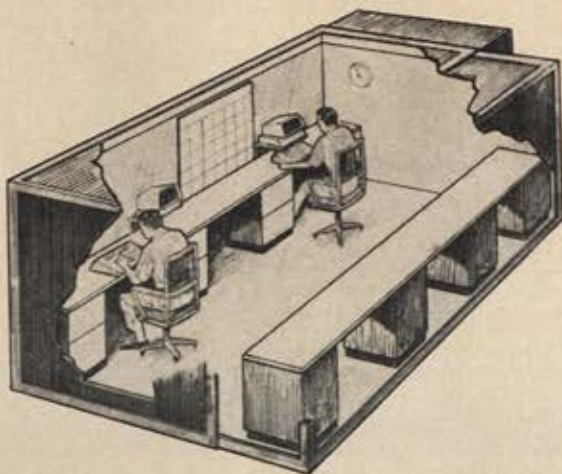
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tional at SAC and are being implemented in the worldwide Air Force Integrated Command and Control System.

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There is an old military cliché which says "the clerks run the Army." It's true to some extent, but the man at the top must always take the responsibility for the decisions made on the advice of his "clerks," which makes it imperative that USAF personnel—from high-level staff officers down to crew chiefs and maintenance men—have an increasingly higher level of proficiency as the political and technical demands on the military man increase . . .

USAF—The Human Side

BY CLAUDE WITZE

Senior Editor, AIR FORCE/SPACE DIGEST

IN his book, *The Uncertain Trumpet*, Gen. Maxwell Taylor, himself a former Chairman of the Joint Chiefs of Staff, has a chapter describing how the JCS does its work. This is the top military council of the United States, the place where the Chiefs of the Army, Navy, Air Force, and Marines sit to cogitate and put together advice they are going to deliver to the Secretary of Defense.

Before each meeting, General Taylor writes, each Chief of Staff receives a briefing from members of his staff on the items of the agenda. The men who give the briefings are called Indians, in contrast to the Chiefs, and General Taylor notes that they exercise considerable influence on the position that will be taken by their bosses.

He says, for example, that each Chief "has to be alert to the danger of becoming a prisoner of his Indians, who are generally able and enthusiastic young officers."

He recalls an Army briefing in which a three-star general was passed a piece of paper from some minor officer sitting outside the major conclave. It said: "If the Chief of Staff tries to change line 2 of page 4, oppose him at all costs." It was signed: "Majors Miller and Mock."

The moral of the story, so far as General Taylor is concerned, is that every Indian is entitled to his own opinion and to prevail with that opinion if it is possible. In today's atmosphere, where the military professional is facing a constant challenge, with his responsibility increased and his authority eroded, there is another moral that did not occur to General Taylor.

It is simply that the Chiefs and the Indians, down to Majors Miller and Mock and the youngest shave-tail, have an overriding requirement for military proficiency. And the requirement is not confined to the officer cadre. The demand, particularly in the Air Force, is no less stringent among the enlisted ranks.

Gen. J. P. McConnell, USAF Chief of Staff, puts almost daily emphasis on the need for competence, and

the retention of that competence once it is achieved.

In a recent address to senior noncommissioned officers, the Chief of Staff stressed career motivation. USAF's task, he said, is to attract and retain young men with a potential for achieving excellence. Mediocrity will not do.

This concern about the retention of competence in the ranks, from airman to general officer, is no new obsession. Air Force publications, congressional testimony, and the oral outpourings from platforms and symposia have added to the plea throughout twenty years of USAF history.

More than ten years ago Gen. Curtis E. LeMay, *(Continued on following page)*



In crises, especially, top military leaders keep their "Indians" nearby, even when they are advising the President. Here, then USAF Chief of Staff Gen. Curtis E. LeMay confers with the late President John F. Kennedy during the Cuban missile crisis of 1962. At his side are, from left to right, Col. Ralph D. Steakley, photo evaluator with the Joint Chiefs of Staff; Lt. Col. Joe O'Brady and Maj. Richard Heyser, reconnaissance pilots.



The man most responsible for planning what the Air Force man of the future will be is Dr. Eugene T. Ferraro, Deputy Air Force Undersecretary for Manpower, right, shown here conferring with members of the Air Force Association's Airmen's Council. With him are A1C James M. Nash and A1C Joseph T. Mazza.

then head of the Strategic Air Command, said this before a Senate subcommittee:

"There is one deficiency which pertains not only to SAC but to the military services as a whole. . . . This is a deficiency in skilled manpower.

"We will never be able to maintain the kind of force in being capable of striking against the enemy on a moment's notice, or of assuming an alert posture which will in any way approach what we ought to be able to do with the money which has been expended against our equipment and facilities, unless we have skilled professional manpower required to maintain and operate a modern weapons system.

"We will fight, and win or lose, with what we have in being at the time. I think the decision as to what the ultimate outcome of the war will be will be decided by the people who are on duty at the time a war breaks out."

The *Air University Quarterly Review* pointed out at the time, in 1956, that General LeMay's statement was echoed by every major command asked to testify. The critical shortage was one of professional airmen.

The phrase had not yet become popular in the Pentagon in 1956, but the Air Force leaders were putting up a case, as they have ever since, for more cost/effectiveness in the use of manpower. Costs have climbed since, but even at that halfway point in USAF history, training for a TAC fighter pilot (F-84F) was tagged at \$160,000. And only one graduate in four showed any willingness to serve beyond the time obligated.

Even at that point, there had been a big change from the days of World War II, when the old Army Air Forces were staffed by hardy pilots in crushed hats and by grease monkeys. These two decades of USAF history have been marked by a revolution in manpower capability easily as big as the one in weaponry.

When Eugene Zuckert retired after serving longer than any other man as Secretary of the Force, he reminisced about the rise of Air Force professionalism. He said most of the men trained between 1942 and 1945 were not professionals. The bulk of the officers and airmen in the late 1940s and early 1950s had come into the service during the war, trained rapidly "in the

minimum skills and attitudes that were essential to fighting that war."

Twenty years ago, when USAF was a junior military service, what military professionals it had came out of the Army and its civilian cadres. USAF's skills have increased, Mr. Zuckert observed, and its attitude has improved. He gives much credit for this to a small nucleus of professionals trained before World War II and during the war.

"If there hadn't been men like Muir Fairchild, Larry Norstad, Tommy White, Curt LeMay, and officers then more junior in responsibility like J. P. McConnell and Dave Burchinal," says Mr. Zuckert, "the Air Force would not be the professional organization it is today."

Mr. Zuckert worked in the Office of the Assistant Secretary of War for Air before USAF was founded in 1947. Then he was Assistant Secretary of the Air Force under Stuart Symington from 1947 until 1952, returning to the top job under President Kennedy in 1961.

He recalls that in 1952, after his first tour in the Pentagon, "the professional skill and precision of the Strategic Air Command still was not matched by equal skill and precision in our planning and programming or in the management of our resources and R&D programs, for example.

"Although formal education is not a complete index of competence, it is significant that only forty-six percent of our officers were college graduates, and nearly half of our airmen had not completed high school. New hardware was welcomed with more enthusiasm than were new ideas in the realms of strategy, concepts, and doctrine."

Well, here in 1967, more than seventy-two percent of USAF's officers have at least one college degree. And more than ninety percent of the airmen have a high school education or its equivalent.

Mr. Zuckert's successor, Dr. Harold Brown, has not failed to point out that fewer than five percent of these degrees came from the Air Force Academy, West Point, or Annapolis. The rest came from civilian colleges and universities. Almost all of 10,000 master's degrees and about 500 doctorates held by USAF officers came from civilian universities.

In an interesting sidelight, Dr. Brown finds some fascination in the fact that the academic community now studies defense affairs as seriously as it does sociology and romance languages. He sees a great benefit here, both for the USAF family and for the general public. Even the man on the street gets a better understanding of national security problems, as a sort of fallout from what the professors are saying.

The present USAF Secretary has spent a lot of time on campuses himself, and he was interested in checking the contents of two widely read volumes of readings on national defense affairs. He found that in one of them eighteen out of twenty-four papers were written by teachers. And in the other, thirty-three out of forty came from universities.

"Kissinger and Schelling," Dr. Brown concludes, "have joined Clausewitz and Mahan in the ranks of military thinkers."

It is the reliance of top Administration policymakers and civilian executives in the Department of Defense on the outpourings of this academic school of strategy that disturbs many professional soldiers of all services. After he retired, Gen. Thomas D. White became one of the bluntest spokesmen for this coterie of unhappy men in uniform. The former USAF Chief of Staff, himself a man of stature as a scholar, decried the injection of too much academic theory into the consideration of strategic and tactical problems. He felt strongly that the multitude of uncertainties involved in any war made experience an essential ingredient of Pentagon decision-making. The computer, he argued, does not digest and consider this ingredient.

One of the best delineations of this disagreement was written for *Foreign Affairs* in 1964 by Col. Robert N. Ginsburgh, USAF, now attached to the office of the JCS.

"It is not too difficult for a military man to accept an adverse decision based on nonmilitary considerations," Colonel Ginsburgh wrote. "It becomes extremely difficult, however, for him to reconcile himself to an adverse decision by his civilian superior based on military considerations. This strikes at the very *raison d'être*

of the military man. It challenges his military professionalism."

Apart from these new strains in the relationship of the military officer to his civilian peers, there is another factor of monumental importance to all of USAF's family from the Chief of Staff down to every airman at a remote base. This is the nature of the cold war itself.

This cold war has been in existence, in varying degrees of intensity, for the entire life of USAF. The Air Force flag has no battle streamers hailing victory on the shores of Tripoli, and there were no bombers with electronic guidance systems roaring over San Juan Hill in 1898. Before USAF was born men went into uniform, won the war, and went back to the farm or the city.

Today our military men represent a force in being. We ask pilots and airmen to live in stuffy alert shacks at the side of their airplanes. They are as ready to fight in the next five minutes as the men of the Royal Air Force were during the Battle of Britain. Yet there is no state of war, as such. If you ask one of these pilots or airmen how they feel about this kind of duty, you will get one simple answer:

"Don't ask me; go into town and ask my wife."

It is a wartime separation, with no war.

General White put his finger on the issue in an essay he wrote for this magazine in 1960.

"In our concentration on hardware we cannot overlook the one common denominator of success in any field—people.

"Individual intelligence, initiative, courage, and judgment have not been outdated by push buttons and fantastic technical performance. It may seem obvious, but it is often forgotten, that the mixed forces of manned and unmanned systems we hear about so often refer to both hardware *and* people.

"It has been repeated time and again—and not only in the Air Force—that to meet the threat we need a 'force in being,' because in case of war there will not be time to produce additional or improved hardware.

(Continued on following page)

Education has become an essential part of the modern USAF. The Air Force Academy fulfills the need for new career officers, but other military universities are needed within the establishment to bring officers to the level of proficiency needed to cope with the political and technical, as well as strategic, problems they face. Here a student at the Armed Forces Staff College, Norfolk, Va., studies at the library which contains 84,000 publications.





The lower ranks as well as the staff officers must now be equipped for technical excellence and to make responsible decisions. Here an Air Force controller guides an aircraft to a safe landing using the RAPCON (radar approach control) technique.

Neither, I might point out, would there be time to develop the trained personnel and leadership we need to use our weapons most effectively.

"In simple terms: We must keep our personnel as ready, alert, and capable as we expect our weapons to be. The need to maintain the edge of training and leadership honed to its keenest over an indefinite period is perhaps the greatest challenge which the United States Air Force has ever faced."

There are more than 1,000 different kinds of jobs in our Air Force. The nature of these is always changing. A commander may have a special requirement. More commonly, it is technological innovation which changes the requirement—a new airplane or missile enters the inventory; a new electronic gadget comes out of development and is rushed into service to ferret Viet Cong killers out of the jungle.

There is no way to measure the amount of effort USAF puts into the task of managing its personnel in this atmosphere of flux. It is enough to know there is not a single corporation in America that faces a comparable management problem. USAF has an active military strength of about 850,000 officers and airmen. American Telephone & Telegraph has 795,000 employees and General Motors 734,600. They are the nation's two biggest corporate employers.

Down at Lackland AFB in Texas there is a Personnel Research Laboratory which is part of the Aerospace Medical Division of the Air Force Systems Command. Its assignments, however, come from the Office of the Deputy Chief of Staff, Personnel, at Hq. USAF.

It is not necessary to review everything done at this laboratory, but the aim is clear: It is to help USAF pick out the most capable people it can find, train them for the jobs for which they are best fitted, and

find out what is required to motivate these people and keep them in USAF.

Further evidence of the intensity of USAF's effort, apart from putting square pegs in square holes, can be found in the record of the Air Force Career Motivation Conference. The third of these meetings was held this year at Langley AFB in Virginia. A thick book of recommendations—about 100 pages of them—resulted from this meeting, and a program of action now is being drawn up by the staff of Lt. Gen. Horace M. Wade, Deputy Chief of Staff, Personnel.

The Langley conference focused on career development and counseling, the art of communication with all USAF personnel, and the mysteries of *esprit de corps*.

Dr. Eugene T. Ferraro, Deputy Undersecretary of the Air Force for Manpower, addressed the conference and suggested some projects that should be pursued. But he put the emphasis on two items: motivation and retention. He said:

"One of the best ways to assure the retention of an individual is to get the right individual in the first place. And this is a cyclical problem, because it's not who you need today that counts when you're recruiting, but who you will need tomorrow.

"A president of one of the large industrial organizations in America once said that the most insane thinking for a board of directors would be to study the characteristics of its present successful president and make him the pattern for the next choice.

"One should examine and look to the future—and the conditions that might or will prevail in the future—and then try to get the kind of leadership that the future environment requires.

"This is true of workers as well as leaders. It is true in the Air Force, as in private business."

What Dr. Ferraro was saying is that the Chiefs and the Indians—and this includes Majors Miller and Mock—must be selected and readied for combat with the same kind of precision that goes into a modern weapon system. If they are not, he could add, the cost/effectiveness of the weaponry is negated.—END



Aircraft mechanics are more technicians than mechanics by far. They are specialists in the highest sense, and it becomes important that not only the right man is picked for the job, but also that he is retained long enough to become highly proficient.



HAIL TO THEE, BLITHE SPIRIT!

And all such spirits . . . passed.
The freedom of the air is gone.
The earth controls the sky.

NATIONAL AIRSPACE SYSTEM

MITRE is currently augmenting its top-flight team of systems men in the suburban Washington, D.C. and Atlantic City, N.J. areas where FAA's prototype Air Traffic Control systems are now under development. Their mission: to provide the system engineering to the Federal Aviation Agency on the new National Airspace System — an air traffic control system for the 1970's. Their job encompasses such technical areas as broad level system analysis, computer program analysis, system specifications, system logical design and system test planning for design verification.

Working on this project you would engage in such activities as: translating system operational objectives into technical requirements for the system's subsystems; synthesizing the technical characteristics of equipment subsystems of balanced reliability, and analyzing alternatives; reviewing and analyzing, at the logic level, design submissions of system hardware contractors; conducting design optimization studies with respect to cost, reliability, and technical suitability; or synthesizing software designs for a multi-processing computer environment.

TACTICAL SYSTEMS

These systems encompass mobile communications systems and operating facilities required for the command and control of

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Richard Bruce is a member of our technical staff. He's defining the atmospheric forces that act on earth satellites. (He calls it "the weather of outer space.") He's had to teach himself nearly everything he knows about the subject. There is no formal curriculum. Even basic facts are hard to get. Very few places have them. Aerospace is one.



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Hq. Stewart AFB, N.Y.



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(until Oct. 1, 1967)
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William D. Greenfield
(after Oct. 1, 1967)

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Pacific Air Forces
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Hq. Fuchu AS, Japan



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Lt. Gen. William W. Momyer
Hq. Tan Son Nhut AB, Vietnam



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Hq. Clark AB, Luzon, P.I.

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United States Air Forces in Europe
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Hq. Lindsey AS, Germany



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Hq. South Ruislip, England



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Hq. Ramstein AB, Germany

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Hq. Scott AFB, Ill.



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Hq. McGuire AFB, N.J.



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Hq. Travis AFB, Calif.



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Hq. Orlando AFB, Fla.

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Hq. Robins AFB, Ga.



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3d Reserve Region
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4th Reserve Region
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Hq. Randolph AFB, Tex.



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1st Strategic Aerospace Division
Maj. Gen. William B. Martensen
Hq. Vandenberg AFB, Calif.



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3d Air Division
Maj. Gen. Selmon W. Wells
Hq. Andersen AFB, Guam



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Alaskan Air Command
Maj. Gen. Thomas E. Moore
Hq. Elmendorf AFB, Alaska



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USAF Southern Command
Maj. Gen. Reginald J. Clizbe
Hq. Albrook AFB, Balboa, C.Z.



Air Force Communications Service
Maj. Gen. Robert W. Paulson
Hq. Scott AFB, Ill.

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European-African-Middle Eastern Communications Area
Brig. Gen. Albert R. Shiely, Jr.
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Pacific Communications Area
Brig. Gen. Anthony T. Shtogren
Hq. Wheeler AFB, Hawaii



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Tactical Communications Area
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Hq. Langley AFB, Va.



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14th Air Force
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Hq. Gunter AFB, Ala.



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9th Aerospace Defense Division
Maj. Gen. Oris B. Johnson
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Air University
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Hq. Maxwell AFB, Ala.

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315th Air Division (Combat Cargo)
Col. Charles W. Howe
Hq. Tachikawa AB, Japan

USAF Security Service
Maj. Gen. Louis E. Coira
Hq. Kelly AFB, Tex.

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Headquarters Command
Maj. Gen. Rollen H. Anthis
Hq. Bolling AFB, D.C.

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The United States Logistics Group (TUSLOG)
Brig. Gen. George V. Williams
Hq. Ankara, Turkey



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86th Air Division (Defense)
Brig. Gen. Richard N. Ellis
Hq. Ramstein AB, Germany



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322d Air Division (MAC)
Brig. Gen. Burl W. McLaughlin
Hq. High Wycombe AS, England



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Air Weather Service (AWS)
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Hq. Selfridge AFB, Mich.



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6th Reserve Region
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Brig. Gen. William W. Wilcox
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Air Reserve Personnel Center (ARPC)
Col. Leland A. Walker, Jr.
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Air Force Logistics Command
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**Ground Electronics Engineering
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Griffiss AFB, N.Y.

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(7 Recruiting Groups)

Basic Military Training
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Technical Training
(5 Centers)

Medical Service School
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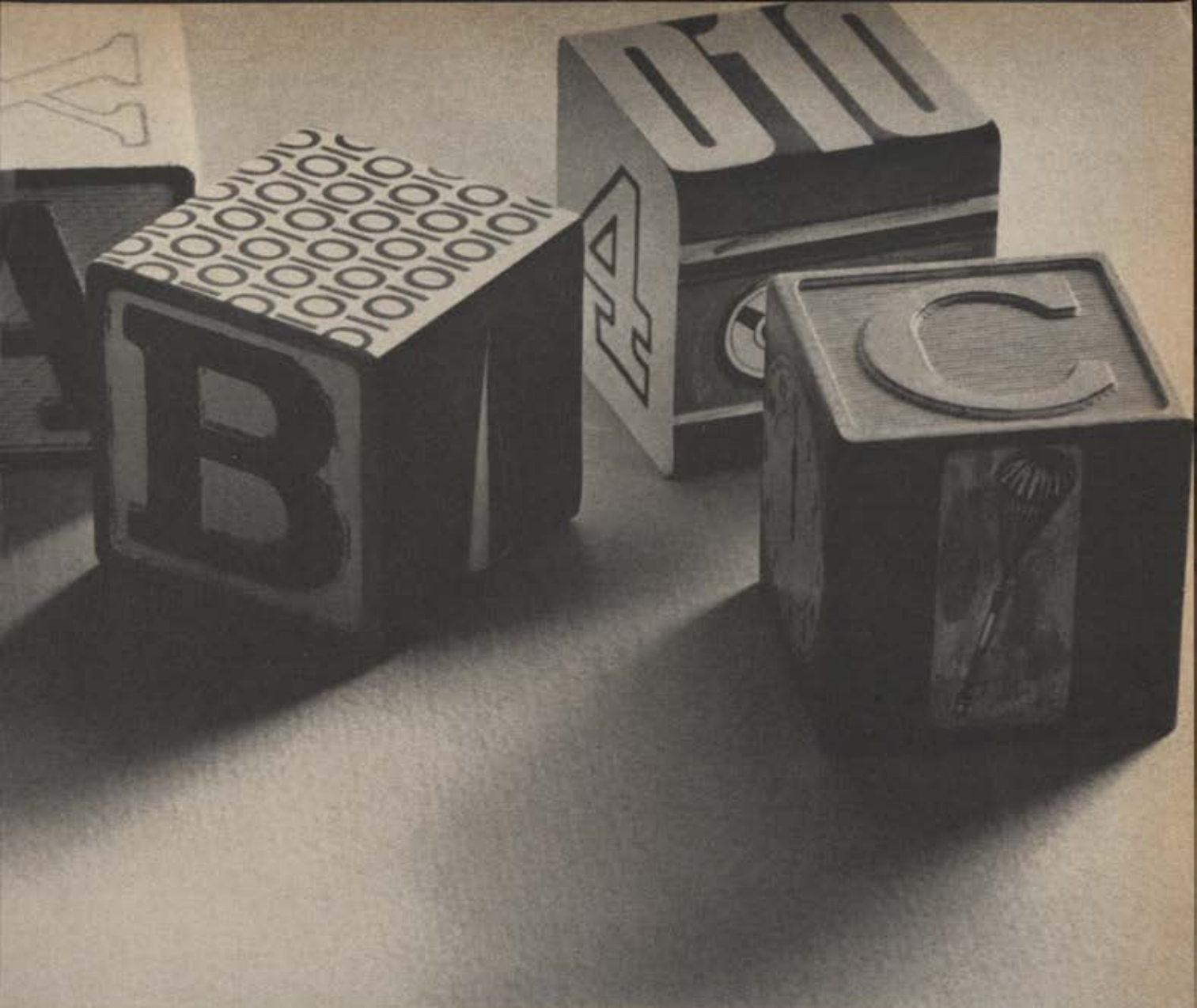
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Eight men have served as civilian head of the Air Force since that day in September 1947 when USAF became a separate service. Similarly, since General Spaatz stepped down as first Chief of Staff of the newly independent Air Force, five other men have succeeded him in USAF's top military post. Below and on the following pages are short biographical sketches of these men. The material comes from the book *US Air Force Biographical Dictionary*, by Flint O. DuPre, published by Franklin Watts, Inc., N. Y. These sketches are reprinted with permission of Mr. DuPre and the publisher.

SYMINGTON, Stuart. Senator (D) from Missouri and first Secretary of the Air Force: born Amherst, Mass., June 26, 1901. Stuart Symington was graduated from Baltimore City College in 1918, enlisted in the Army as a private, and during World War I, at seventeen, was one of the Army's youngest second lieutenants. After the war he earned a B.A. degree at Yale University. Between the two major wars he headed iron, radio, steel, and electric companies and by 1938 was President of Emerson Electric Co. at St. Louis, Mo., his home since then. Early in 1941 he went to England at the request of the War Department to study the new art of gun turrets on military planes. Secretary Symington returned to St. Louis to build the world's largest airplane armament plant, which provided thousands of bombers with protective firepower. After the war he became Administrator of the Surplus Property Board and on January 31, 1946, was appointed Assistant Secretary of War for Air when the AAF was part of the War Department. When the Air Force became a separate service, Stuart Symington became the first Secretary on September 18, 1947, and served until April 24, 1950. He was first elected to Congress in November 1952.

FINLETTER, Thomas Knight. Second Secretary of the Air Force: born Philadelphia, Pa., November 11, 1893. Thomas Finletter served as Secretary of the Air Force from April 25, 1950, to January 20, 1953. He attended the Episcopal Academy in Philadelphia, studied in Paris for a year, and got his B.A. degree from the University of Pennsylvania in 1915 and his LL.B. degree in 1920. In World War I he was with the 312th Field Artillery. He advanced to the rank of captain. A lawyer by pro-

fession, Finletter was Chairman of the President's Air Policy Commission established in July 1947 to draft a national air policy. The report, "Survival in the Air Age," was sent to the President on January 1, 1948, and received wide attention. Mr. Finletter also has written books on this subject. Prior to his tenure as Secretary of the Air Force, he was chief of the Economic Cooperation Administration's mission to the United Kingdom.

TALBOTT, Harold Elsner. Third Secretary of the US Air Force: born Dayton, Ohio, March 31, 1888; died Palm Beach, Fla., March 2, 1957. Harold Talbott attended the Hill School at Pottstown, Pa., and was graduated from Yale University in 1911. He served in World War I as a major in the Signal Corps's Air Service and during World War II as Director of Aircraft Production for the War Production Board. He was associated throughout his life with aviation, being in one of the early companies with the Wright brothers in 1916 and in other companies which produced military airplanes and parts. In the 1930s Mr. Talbott was Chairman of the Board for North American Aviation Company. He was appointed Secretary of the Air Force on February 4, 1953, and served until August 13, 1955. During this period he originated and supported many actions to raise the personal stature, pay, housing, and other advancements for uniformed members of USAF.

QUARLES, Donald. Fourth Secretary of the Air Force and former Deputy Secretary of Defense: born Van Buren, Ark., July 30, 1894; died Washington, D. C., May 8, 1959. Donald Quarles was Secretary of the Air Force from August 15, 1955, to April 30, 1957, when he became Deputy Secretary of Defense until his death. He was graduated from Van Buren (Ark.) High School where he later taught mathematics. He attended the University of Missouri summer school for three years and was graduated from Yale University in 1916 with a B.A. degree. Quarles enlisted in the Army in May 1917, serving two years in France and Germany in the Field Artillery as a captain. Prior to government service he held many key positions in communications, rising to Vice President of Bell Telephone Laboratories. On September 1, 1953, he became Assistant Secretary of Defense for Research and Development. The Secretaries of Defense and Commerce selected him as the first chairman of the reorganized Air Navigation Development Board in January 1954. Two months later President Eisenhower appointed Mr. Quarles a member of the National Advisory Committee for Aeronautics, predecessor of the present National Aeronautics and Space Administration.

DOUGLAS, James Henderson. Fifth Secretary of the Air Force and former Deputy Secretary of Defense: born Cedar Rapids, Iowa, March 11, 1899. James Douglas served as Secretary of the Air Force from May 1, 1957, to December 11, 1959, when he moved up to Deputy Secretary of Defense. He served until January 20, 1961. In 1918, he was an Army second lieutenant at Camp Hancock, Ga. After the war, he got his B.A. degree from Princeton University in 1920, studied at Corpus Christi College at Cambridge, England, for one year, and in 1924 graduated from Harvard Law School. Prior to World War II, Douglas practiced law, except for the period March 1932 to June 1933 when he was Assistant Secretary of the Treasury. He went into the AAF as a major when the war began and rose to colonel. Most of the time he was Deputy Chief of Staff of Air Transport Command, eventually becoming Chief of Staff and earning the DSM. After the war he returned to his law practice. On March 3, 1953, Mr. Douglas became Undersecretary of the Air

Force, serving more than four years before moving up to the top position.

SHARP, Dudley. Sixth Secretary of the Air Force: born Houston, Tex., March 16, 1905. Dudley Sharp was Secretary of the Air Force from December 11, 1959, to January 20, 1961. Prior to that he was Undersecretary, dating from August 3, 1959. He attended public and private schools in Houston, and Gilman Country School at Baltimore, Md. He was graduated from Princeton University in 1928 with a B.S. degree. During World War II he served in the US Navy from 1942-45 as an Executive Officer and Commanding Officer on antisubmarine warfare vessels. He later was on duty in the Navy Office of Procurement and Material in Washington. In 1954-55 Sharp, a businessman engaged in manufacturing and applied physics, was Special Consultant to Air Materiel Command on machine tools. He moved to Washington as Assistant Secretary of the Air Force for Materiel in October 1955, serving until January 31, 1959.

ZUCKERT, Eugene Martin. Seventh Secretary of the US Air Force: born New York City, November 9, 1911. Eugene Zuckert was graduated from high school in New York City, attended Salisbury (Conn.) School, and got a B.A. degree from Yale University in 1933. In 1937 he received his LL.B. from Yale with a certificate for completion of the combined law-business course at Harvard and Yale. He has practiced law in Connecticut, New York, and the District of Columbia, although most of his professional career has been devoted to public service. From 1937 to 1940 Zuckert was attorney for the US Securities and Exchange Commission in Washington and New York. From 1940 to 1944 he instructed in relations between government and business at the Harvard Graduate School of Business Administration, advanced to Assistant Professor, and later to Assistant Dean of the School. While there he served as consultant to the Air Force in developing statistical controls, instructing some 3,000 officers in this field at Harvard and bases throughout the world. During this period he also headed the first advanced management course given at the Harvard Graduate School. In 1944 Zuckert entered the US Navy, serving as a lieutenant (j.g.) in the Office of the Chief of Naval Operations. On September 26, 1947, he was appointed Assistant Secretary of the Air Force under Stuart Symington, the Air Force's first Secretary. Zuckert was appointed a member of the US Atomic Energy Commission on January 21, 1952, serving until June 30, 1954. He returned to law practice as a consultant in the field of atomic energy. Zuckert became Secretary of the Air Force on January 24, 1961, and served until September 30, 1965. He has now established a private law practice in Washington, D. C.

BROWN, Harold. Eighth and incumbent Secretary of the Air Force: born New York City, September 19, 1927. Harold Brown attended Columbia University where he received his A.B. degree in 1945, M.A. in 1946, and a Ph.D. in physics in 1949. After spending a year in post-doctoral research at Columbia, he joined the University of California Radiation Laboratory at Berkeley as a research scientist in 1950. He became a staff member at the E. O. Lawrence Radiation Laboratory in Livermore, Calif., in 1952, and took the position of Director of the laboratory in 1960. Dr. Brown has served as a member of the Polaris Steering Committee, senior science adviser to two US delegations at Geneva test ban talks, and as a member of several defense scientific advisory boards. He also held the position as Director of Defense Research and Engineering for DoD before assuming duties as Secretary of the Air Force on October 1, 1965.—END

The Chiefs of Staff of the United States Air Force

SPAATZ, Carl, General (Retired). First Chief of Staff of the USAF and World War II Commander of Strategic Air Forces in Europe: born Boyertown, Pa., June 28, 1891. Carl "Tooey" Spaatz, one of the great air leaders in the victory over Germany in World War II, was graduated from the US Military Academy in June 1914 and commissioned a second lieutenant of Infantry. He served with the 23d Infantry at Schofield Barracks, Hawaii, for a year until October 1915 when he was detailed to the Air Service at the San Diego school of the Signal Corps, where he learned to fly. He served with the 1st Aero Squadron on the Mexican border as a first lieutenant, with promotion to captain in May 1917, and went to France to train at the famed Air Service school at Issoudun. He flew with the 2d Pursuit Group, and downed three Fokkers over the enemy line. He was promoted to major in August 1918. After the war he returned home for duty in California and Texas. As a major he was Commanding Officer of Kelly Field from October 1920 to February 1921, became Air Officer of the 8th Corps Area and Commanding Officer of the 1st Pursuit Group at Ellington Field, Tex., and later at Selfridge Field, Mich. Spaatz was graduated from the Air Force Tactical School at Langley Field, Va., in June 1925, and went to Washington for duty in the Office of the Chief of Air Corps.

Interested in new tactics and methods, he pioneered in-flight refueling as commander of the *Question Mark* plane January 1-7, 1929, when it stayed aloft over Los Angeles more than six days, or 151 hours, to set an endurance record for sustained flight. The trimotored Fokker, which also carried Capt. Ira Eaker and Lt. Elwood Quesada as crew members, flew 11,000 miles and was refueled forty-three times, nine being at night. Major Spaatz got the DFC for this record operation and was next assigned as Commanding Officer of the 7th Bomb Group at Rockwell Field, Calif.

In October 1931 he held the same position with the 1st Bomb Wing at March Field, Calif., and in June 1933 returned to Washington as Chief of the Air Corps's Training and Operations Division. While attending the Command and General Staff School at Ft. Leavenworth, Kan., he was promoted to lieutenant colonel. In June 1936 he went to Langley Field, Va., for two and a half years, returning to Washington as Assistant Executive Officer to the Chief of Air Corps. Spaatz was promoted to colonel in November 1939.

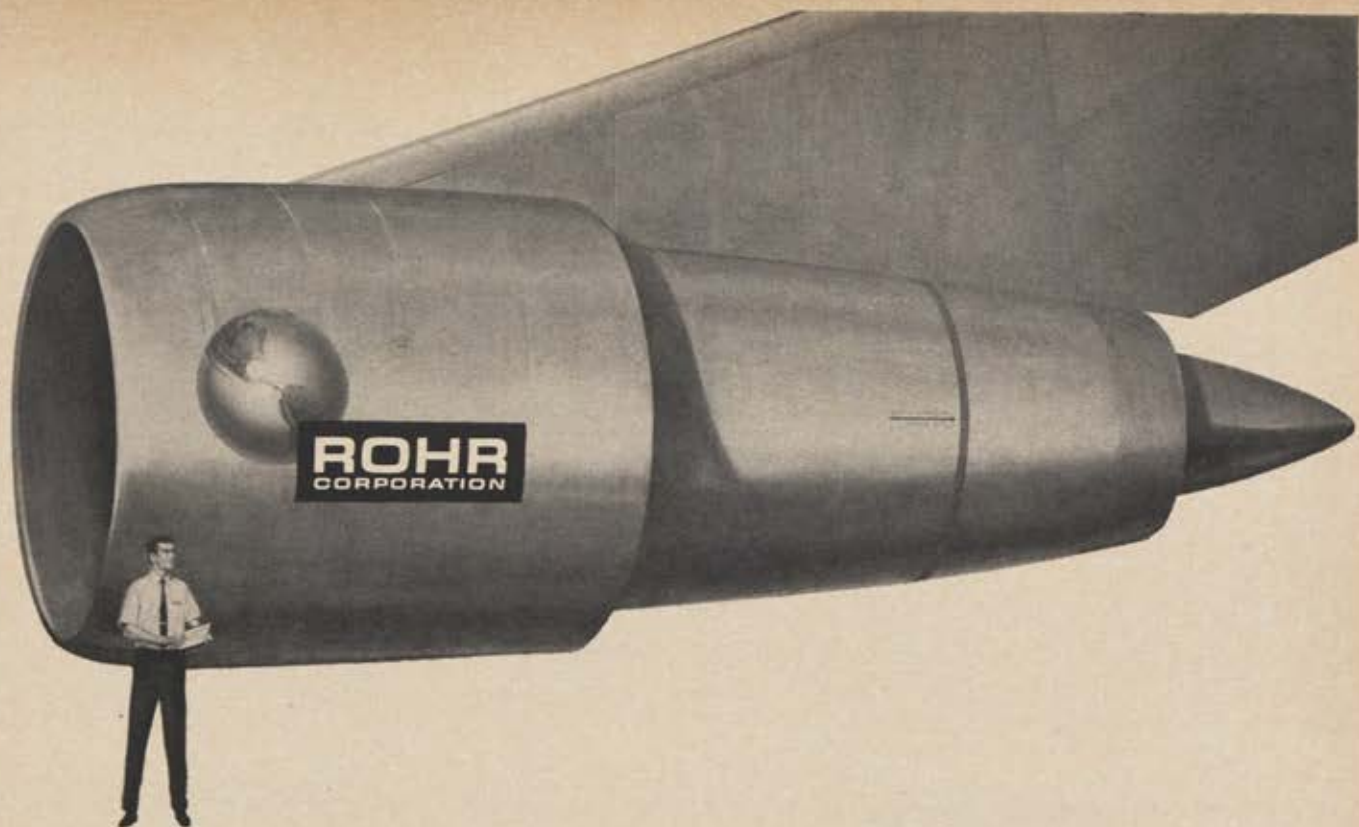
During the Battle of Britain in 1940 he went to England as a special military observer. He moved up to Assistant to the Chief of Air Corps in October 1940 and promotion to brigadier general. He headed the Plans Division and later became Chief of the Air Staff. In January 1942, after the Pacific war began, he became Chief of the AAF Combat Command in Washington and got his second star. In July he went to England as Commanding General of the Eighth Air Force and directed the initial bombing of occupied Europe. On July 7, 1942, he was given additional duty as Commanding General of the US Army Air

Forces in Europe. By December he became Commanding General of the Twelfth Air Force in North Africa, and in February 1943 organized and commanded the Northwest African Air Force, with promotion to lieutenant general in March. After Rommel's Afrika Korps had been driven out of North Africa, and the invasion of Italy was launched, Spaatz became Deputy Commanding General of the Mediterranean Allied Air Forces, including the Twelfth and Fifteenth Air Forces, and the Royal Air Force in Italy. He returned to England in January 1944 to command the US Strategic Air Forces in Europe during the preinvasion period and the campaign which saw Germany fall. Spaatz earned the DSM for his leadership in Africa, and he received the Collier Trophy for his outstanding contribution to the victory in Europe. He was promoted to four-star general on March 11, 1945, and after the war returned to Hq. AAF in June 1945. He immediately went to the Pacific, as Commanding General of the US Strategic Air Forces in that theater, with Headquarters on Guam, and supervised the final strategic bombing of Japan by the B-29s, including the atomic bomb missions on Hiroshima and Nagasaki. As a key combat air leader, he was present at all three World War II signings of unconditional surrender—at Reims, Berlin, and Tokyo. He returned to Hq. AAF in October 1945. In February 1946 Spaatz became Commander of the AAF and in September 1947 was appointed by President Truman as the first Chief of Staff of the new United States Air Force. General Spaatz retired from the service on June 30, 1948. He was Chairman of the Board of the Air Force Association in 1950-51.

VANDENBERG, Hoyt Sanford, General. Second Chief of Staff of the US Air Force, for whom Vandenberg AFB, Lompoc, Calif., is named: born Milwaukee, Wis., January 24, 1899; died Washington, D. C., April 2, 1954. Hoyt Vandenberg, nephew of the late Senator Arthur Vandenberg, grew up in Lowell, Mass. He was graduated from the US Military Academy in June 1923 and commissioned in the Air Service. He took flying training at Brooks and
(Continued on page 189)



General Carl Spaatz (Retired), first USAF Chief of Staff.



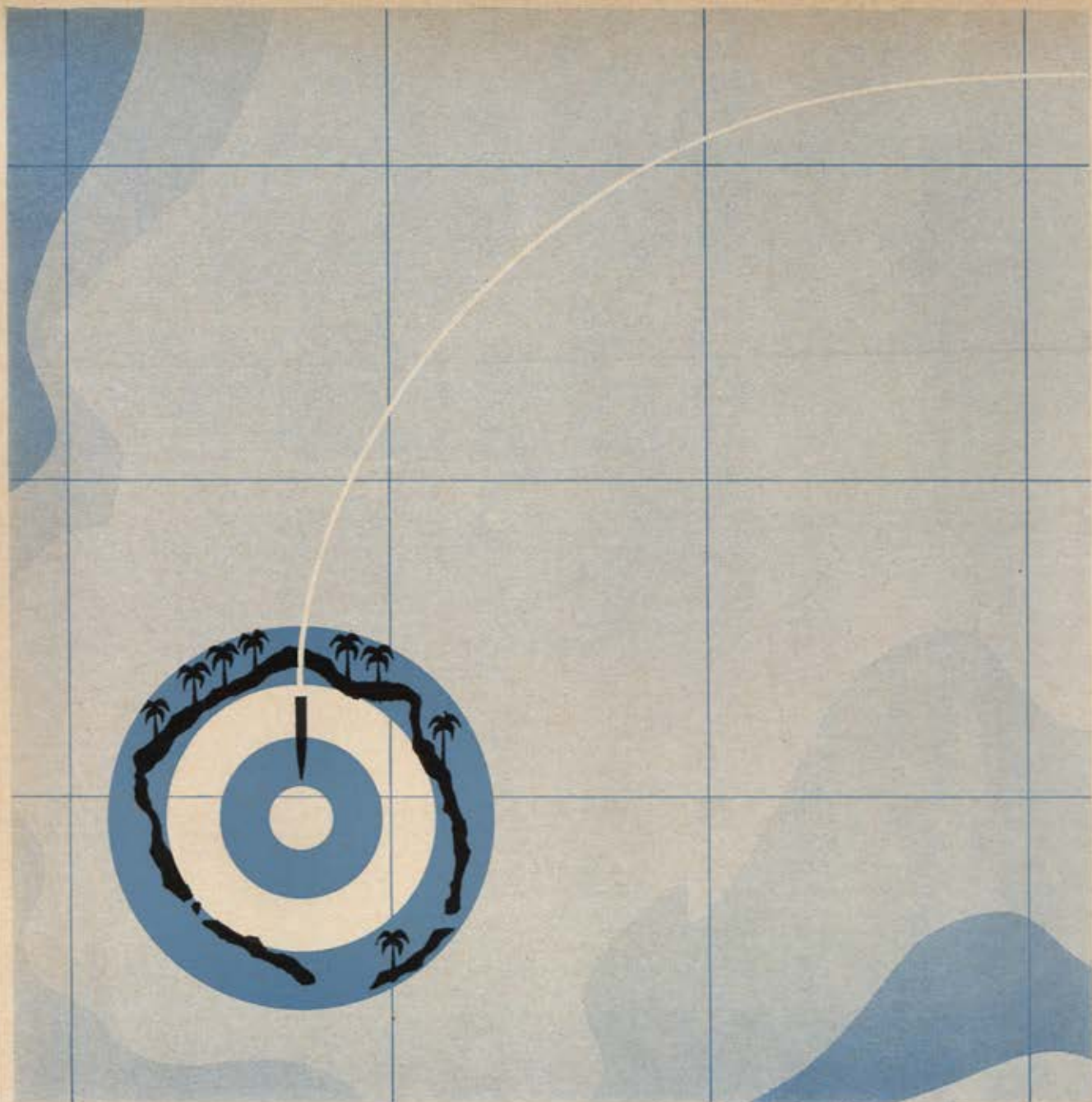
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Kelly Fields, Tex., getting his wings in September 1924 and initial assignment with the 3d Attack Group at Kelly. He was transferred to Ft. Crockett with the Group in August 1926 and became Commanding Officer of the 90th Attack Squadron. He taught flying at March Field, Calif., with promotion to first lieutenant in August 1928, and went to Hawaii in May 1929 with the 6th Pursuit Squadron, becoming its Commanding Officer. In September 1931 Vandenberg returned to Texas for duty at Randolph Field as flight instructor and flight Commanding Officer. He completed the Air Corps's Tactical School at Maxwell Field, Ala., in June 1935 and the Command and Staff School at Ft. Leavenworth, Kan., a year later. He got his captaincy at Leavenworth in August 1935. He returned to Maxwell to teach until September 1938 when he entered the Army War College. In June 1939 he was assigned to the Plans Division at Hq. Air Corps. Vandenberg was promoted to major in March 1940 and to lieutenant colonel in November 1941. When the US entered World War II he became Operations and Training Officer of the Air Staff. In January 1942 he was promoted to colonel and in June went to England to organize the Air Forces for combat duty in North Africa. He got his first star in December 1942 and became Chief of Staff of the Twelfth Air Force, which he helped organize. In February 1943 he was named Chief of Staff of the Northwest African Strategic Air Force. He flew on missions over Tunisia, Italy, Sardinia, Sicily, and Pantelleria while directing the air phase of the North African campaign, earning decorations under fire including the Silver Star, DFC, and Legion of Merit. In August 1943 Vandenberg returned to Hq. AAF as Deputy Chief of the Air Staff. A month later he headed an air mission to the USSR, under Ambassador Harriman, and returned home in January 1944. He was promoted to major general in March, when he returned to Europe as Deputy Air Commander in Chief of the Allied Expeditionary Forces and Commanding General of its American Air Component. In August 1944 he became Commanding General of the Ninth Air Force and received the DSM for helping plan the Normandy invasion. He was advanced to lieutenant general in March 1945 and at war's end returned to Hq. AAF as Assistant Chief of Air Staff. In January 1946 Vandenberg went to the War Department General Staff as Director of Intelligence. In June he became Director of the Central Intelligence Agency. He went back to USAF, and on October 1, 1947, became Vice Chief of Staff of the USAF, with four-star rank. He succeeded Gen. Carl Spaatz as Chief of Staff on April 30, 1948, and headed USAF until his retirement on June 30, 1953, due to illness.

TWINING, Nathan Farragut. General (Retired). Only Air Force general to be Chairman of the Joint Chiefs of Staff; the third Chief of Staff of the USAF: born Monroe, Wis., October 11, 1897. Nathan Twining grew up in a predominantly Navy family. His younger brother, Merrill Barber Twining, rose to lieutenant general and was Commandant of the Marine Corps School at Quantico, Va., until his retirement in 1959. Nathan Twining attended public schools in Monroe and Portland, Ore., and joined the Oregon National Guard in June 1916. He served as a corporal on border duty with the 3d Infantry until that September. He went on active duty for a second time in March 1917 as a sergeant with the same organization. In June he entered the US Military Academy, graduating in November 1918 as a second lieutenant of Infantry. He stayed at the Academy until June 1919, when he went to Europe to observe the battlefield in Germany, Belgium, France, and Italy. He was promoted to first lieutenant in



**General Hoyt
Sanford Vandenberg,
second USAF
Chief of Staff.**

January 1920. Twining next attended the Infantry School at Ft. Benning, Ga., graduating in June 1920 and remaining at Benning with the 29th Infantry. In February 1921 he became aide to Brig. Gen. B. A. Poore and served with him at Camp Travis, Tex.; Ft. Logan, Colo.; and Ft. Sam Houston, Tex. In 1923 he turned to flying, taking instruction at Brooks and Kelly Fields, Tex., and getting his wings in September 1924. He stayed at Brooks as a flying instructor, then went to March Field, Calif., in the same capacity. In February 1930 he went to Hawaii for duty with the 18th Pursuit Group at Schofield Barracks. Two years later he returned home to the 3d Attack Group at Ft. Crockett, Tex. In February 1934 he became engineering officer for the Central Zone at Chicago, went back to Ft. Crockett as Adjutant of the 3d Group, and in March 1935 became Assistant Operations Officer of the 3d Wing at Barksdale Field, La., and was soon promoted to captain.

In succession Twining attended the Air Corps Tactical School at Maxwell Field, Ala., and the Command and General Staff School at Ft. Leavenworth, Kan. In June 1937 he was Air Corps technical supervisor at the San Antonio Air Depot at Duncan Field, Tex. While there he was promoted to major in October 1938. He was called to Washington in August 1940 in technical inspection assignments to the Chief of Air Corps, with promotion to lieutenant colonel in July 1941. That December Twining went into the Operations Division at Headquarters and in February 1942 was promoted to colonel and named Assistant Executive to the Chief of Staff of the AAF. In May he became the Director of War Organizations and Movements.

He was promoted to brigadier general in June and went to the South Pacific in July as Chief of Staff of the Allied Forces in that area. The following January he was named Commanding General of the Thirteenth Air Force and in February was promoted to major general, shortly after his B-17 was shot down, with fifteen aboard, in the sea off the New Hebrides Islands in the South Pacific. With the others, Twining spent six days on a life raft before a Navy patrol bomber rescued them. In mid-1943 Admiral Halsey signed an order that made Twining air commander of the Solomon Islands and in tactical control of all Army, Navy, Marine, and Allied Air Forces in the South Pacific. In this capacity Twining directed the air movement prior to and during the occupation of the Treasury Islands and Bougainville Islands. In November 1943 he became Commanding General of the Fifteenth Air Force in Italy and engineered the heavy bomb raids on the Axis Balkans and the Romanian oil refineries at Ploesti. The following January he became Commander of the Mediterranean Allied Strategic Air Forces, in addition to his other duties, and had a leading role in the eventual air victory in Europe during World War II. He came home as a lieutenant gen-

(Continued on following page)

General Nathan Farragut Twining (Retired), third USAF Chief of Staff.



General Thomas Dresser White, fourth USAF Chief of Staff.

eral to be Commanding General of Air Materiel Command at Wright-Patterson AFB, Ohio. On October 1, 1947, he was appointed Commanding General of the Alaskan Department and Commander in Chief of Alaskan Command, with headquarters at Ft. Richardson.

In July 1950 he returned to Washington as head of personnel for three months at Hq. USAF until October 10 when he was promoted to full general and appointed Vice Chief of Staff of the Air Force. He directed the move from propeller planes to jets in that capacity and as Chief of Staff for four years, beginning on June 30, 1953. On March 26, 1957, President Eisenhower chose General Twining to succeed Admiral Radford as Chairman of the Joint Chiefs of Staff. This became effective August 15, 1957. Prior to taking over the top military position in the nation, Twining and a group of Air Force officers visited the USSR for a look at aviation facilities and planes. General Twining completed slightly more than three years as Chairman of the Joint Chiefs and retired from the service September 30, 1960.

WHITE, Thomas Dresser. General. Fourth Chief of Staff of US Air Force: born Walker, Minn., August 6, 1901; died Walter Reed Army Hospital, Washington, D. C., December 22, 1965. Thomas White, son of an Episcopal minister who later became a bishop, grew up in Springfield, Ill., and attended St. John's Military Academy at Delafield, Wis. He was one of the youngest persons ever admitted and graduated from the US Military Academy, getting his commission as second lieutenant of Infantry at the age of eighteen, with promotion the same day, July 2, 1920, to first lieutenant. He completed the Infantry School course at Ft. Benning, Ga., in July 1921 and was assigned to the 14th Infantry at Ft. Davis in the Panama Canal Zone. He took flying training at Brooks and Kelly Fields, Tex., after switching to the Air Service, getting his wings and assignment to the 99th Observation Squadron at Bolling Field in September 1925. In mid-1927 White went to Peking, China, as a student of the Chinese language, where he compiled a Chinese-English dictionary of military terms. In 1931 he returned to the

US for duty in Hq. Air Corps in Washington. In February 1934, still a first lieutenant, he went to Russia as Assistant Military Attaché for Air.

He was commended for the excellent air intelligence reports he wrote about the USSR. To his superiors White was a close observer of the USSR's growing airpower. He noted the country had several hundred four-engine bombers in service at that time, and he flew in one during this tour. He also served as pilot of an observation plane for Ambassador William C. Bullitt.

In early 1935 White was named Assistant Military Attaché for Air to Italy and Greece, and in August was promoted to captain. He came home to attend the Air Corps Tactical School at Maxwell Field, Ala., graduating in May 1938, and a year later completed the Command and General Staff School at Ft. Leavenworth, Kan. He was promoted to major in May 1939. He returned to Washington for assignment to the Office of the Chief of Air Corps. Assigned in April 1940 to Brazil as Military Attaché, he elected to fly there in a BC-2 (AT-6) airplane. He took off from Bolling Field, Washington, on the 9,300-mile flight. Going via Santiago, Chile, he arrived in Rio de Janeiro twenty-one days later. He was promoted to lieutenant colonel in July 1941 while in Brazil.

He continued the study of languages in off-duty time, becoming proficient in Italian, Spanish, Greek, Portuguese, Russian, and Chinese. White returned to the US in March 1942 as Assistant Chief of Staff for Operations of the Third Air Force at Tampa, Fla., and promotion to colonel. He became Chief of Staff of the Third and in November 1942 was promoted to brigadier general. He returned to Hq. AAF in January 1944 as Assistant Chief of Staff for Intelligence. His request for combat duty belatedly was honored in September 1944. He went to the Pacific as Deputy Commanding General of the Thirteenth Air Force, taking part in the New Guinea, Southern Philippines, and Borneo campaigns. In June 1945 he moved up as Commanding General of the Seventh Air Force in the Marianas, and directed its move along the islands to Okinawa. He stayed with the Seventh at war's end in the Pacific and took it to Hickam Field, Hawaii, in January 1946 as the Seventh remained a component of what became the Far East Air Forces in Tokyo under Lt. Gen. Ennis Whitehead.

White was promoted to major general on July 6, 1946, at a time when many generals were being dropped back to lower ranks because of the ceiling imposed by the Congress. In October 1946 White was called to Tokyo by General Whitehead as his Chief of Staff, and a year later was sent to Nagoya as Commanding General of the Fifth Air Force in Japan. He returned to Hq. USAF in October 1948 as Director of Legislation and Liaison.

In May 1950 he was appointed Air Force Member of the Joint Strategic Survey Committee in the Office of the Joint Chiefs of Staff. In February 1951 White became Director of Plans in Hq. USAF. In July 1951 he was promoted to lieutenant general and named Deputy Chief of Staff for Plans. On June 30, 1953, he was promoted to full general and named Vice Chief of Staff under Gen. Nathan Twining.

Thomas White served four years as Vice Chief and four years as Chief of Staff until his retirement from the Air Force on June 30, 1961. During this long period at Headquarters, beginning in 1948, including the eight years in the number-one and number-two positions in USAF, he was the chief architect and supporter at Headquarters level for the successful ballistic missile and aerospace programs undertaken and developed during the 1950s.

(Continued on page 193)

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General Curtis
Emerson LeMay
(Retired), fifth
USAF Chief of
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LeMay, Curtis Emerson. General (Retired). Fifth Chief of Staff of the USAF: born Columbus, Ohio, November 15, 1906. Curtis LeMay, world symbol of the nation's strategic airpower through his combat experience with the B-29s in World War II and buildup of SAC, was graduated from high school in his hometown and from Ohio State University, with a Bachelor of Civil Engineering degree in 1927. He became an aviation cadet in 1928, completed pilot training at Kelly Field, Tex., and got his commission and wings in October 1929.

He served first with the 27th Pursuit Squadron at Selfridge Field, Mich., and in other fighter operations for several years, with promotion to first lieutenant in March 1935. He was assigned to bomber operations in 1937, with the 2d Bomb Group at Langley Field, Va. In 1937-38 LeMay was the lead navigator on two mass flights of B-17 Flying Fortresses to South America, with the group receiving the Mackay Trophy in 1938 for this outstanding aerial achievement, first such mass flight in history.

Just prior to World War II he also pioneered air routes over the South Atlantic to Africa and over the North Atlantic to England for the countless ferrying missions to come. LeMay was promoted to captain in January 1940, to major in March 1941, to lieutenant colonel in January 1942, and to colonel that June. By then he had organized and trained the 305th Bomb Group at Pendleton, Calif., taking it to England, where he led many combat missions.

To improve bombing accuracy LeMay initiated straight-in bomb runs and formation patterns, new techniques and procedures which were eventually used by all B-17 bomber units throughout the theater, and later by the B-29s against Japan. In England he also commanded the 3d Bomb Division. He was promoted to brigadier general in October 1943, and led his division on the famed Regensburg raid, a B-17 shuttle mission that originated in England, struck deep in Germany, and terminated in Africa. In March 1944 LeMay got his second star and in July was transferred to the Pacific to direct the B-29 bombardment by the 20th Bomber Command in the CBI Theater. He moved to Guam to be Commanding General of the 20th's attacks on the Japanese mainland and later became Chief of Staff of the Strategic Air Forces in the Pacific.

In the B-29 operations from the Marianas, LeMay made the decision, which today ranks as one of the greatest ever made in warfare, to strip the B-29, which was built for high-altitude missions, down to lighter weight for low-level night attacks on Japan, armed with fire bombs.

Using this technique on March 9, 1945, a force of 335 B-29s destroyed a large portion of Tokyo and the industrial area, creating the greatest single disaster in military



General John Paul
McConnell, present
USAF Chief of
Staff.

history. The fire-bomb raids contributed to the rapid defeat of Japan, first nation ever forced to surrender in a major war without the necessity of a land and sea invasion.

At the end of the war LeMay flew a B-29 from Japan to Chicago nonstop in a record flight. He was assigned to Hq. Air Materiel Command and then transferred to Washington as the first Deputy Chief of Air Staff for R&D.

In October 1947 he was promoted to lieutenant general as Commander of USAFE at Wiesbaden, Germany, where he organized air operations for the Berlin Airlift of 1948. After a year he returned to the US as Commanding General of the then recently formed Strategic Air Command. He was promoted to general on October 29, 1951.

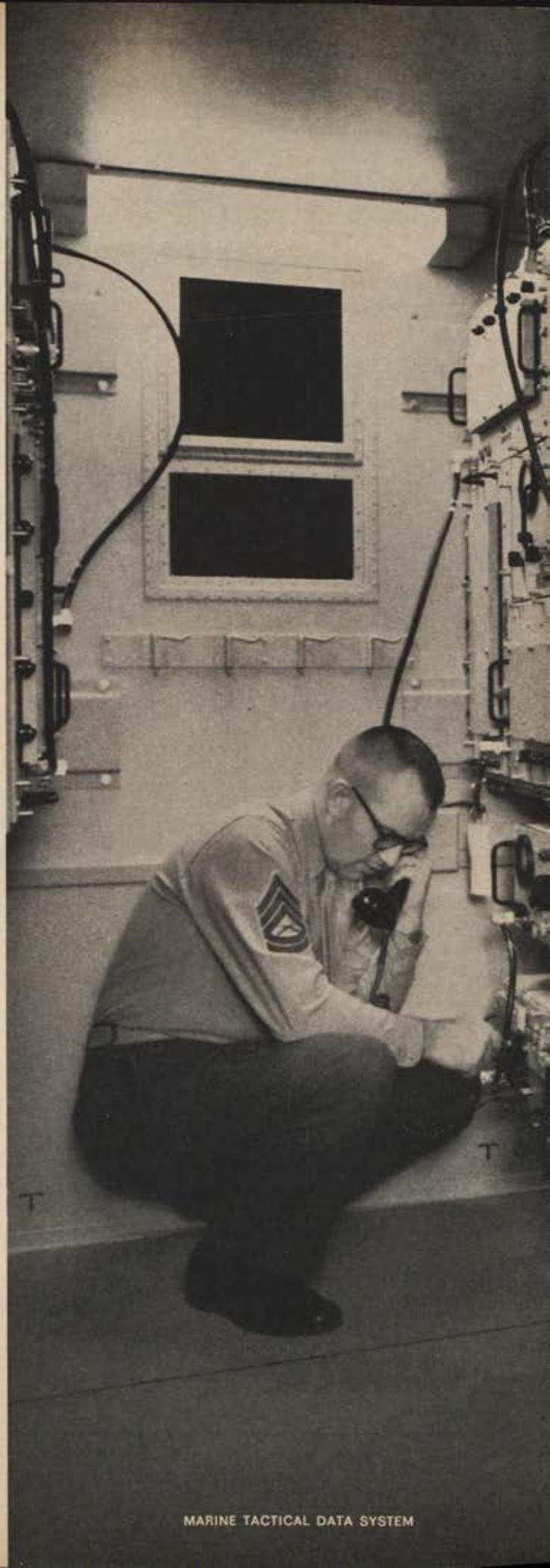
For almost ten years he commanded and built SAC to its enviable position as the world's most powerful deterrent force, composed initially of jet bombers and in recent years strengthened with intercontinental ballistic missiles. LeMay early saw the possibility of ICBMs to complement bombers and helped lay plans for their development. When he moved to Hq. USAF in July 1957 as Vice Chief of Staff, under Gen. Thomas D. White, he helped direct the missile and military space program to its present stature.

LeMay served four years as Vice Chief and moved up to Chief on July 1, 1961, when General White retired. LeMay completed his two-year term on June 30, 1963, and was extended for one year. On April 8, 1964, President Johnson asked him to remain on duty for an additional seven months. LeMay retired from the Air Force February 1, 1965. He is now Chairman of the Board for Networks Electronic Corp., Chatsworth, Calif.

McCONNELL, John Paul. General. Present Chief of Staff of the Air Force: born Booneville, Ark., February 7, 1908. John P. McConnell was graduated from Henderson Brown College in Arkansas with a B.S. degree in 1927, and from West Point Military Academy in 1932. The following year he received his wings after flying training at Randolph and Kelly Fields, Tex. Serving in Asia during World War II, he held the positions of Senior Air Staff Officer, Air Command Southeast Asia; Senior Air Adviser to the Chinese Government; and Commander of the Air Division, Nanking Headquarters Command. After returning to Washington, he became Chief of the Reserve and National Guard Division and then Chief of the Air Force's Civilian Components Group. He was Commander of both the 7th Air Division, SAC, and the Third Air Force while stationed in England in the early 1950s. General McConnell was named Director of Plans of Strategic Air Command, then Commander of SAC's Second Air Force, and then Vice Commander in Chief, SAC. In 1962, he was assigned as Deputy Commander in Chief, US European Command, and in 1964 was appointed USAF Vice Chief of Staff. General McConnell assumed the position of Air Force Chief of Staff on February 1, 1965.—END



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COMMUNICATION
SATELLITE
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Air Force Magazine

Guide to Air Force Bases

WHERE THEY ARE LOCATED • THEIR PHONE NUMBERS
WHAT THEIR JOBS ARE • HOW THEY WERE NAMED
MAP OF MAJOR AIR FORCE BASES • LOCATIONS OF
AIR FORCE RESERVE AND AIR NATIONAL GUARD
FLYING UNITS • UNITED STATES AIR FORCE
BASES, INSTALLATIONS, AND FACILITIES LOCATED OVERSEAS

ALTUS AFB, Okla. 73523, 3 mi. NE of Altus. Phone: (405) HUDson 2-8100. Heavy bomber and tanker base, 2d AF, SAC. Shifts to MAC in summer 1968. Named for city.
AMARILLO AFB, Tex. 79111, 14 mi. SE of Amarillo. Phone: (806) DIamond 9-1511. Technical Training Center; supply and administrative training; jet mechanics and airframe repair schools, ATC; heavy bomber base, 2d AF, SAC. Named for nearby city. Base closes by June 1968.
ANDREWS AFB, Md. 20331, 11 mi. SE of Washington, D. C. Phone: (301) 981-9111. Headquarters Command; Hq. AFSC; Hq. National Range Div., AFSC; Hq. 1st Reserve Region, CAC; Naval Air Reserve Training Base. Formerly Camp Springs AAB, renamed for Lt. Gen. Frank M. Andrews, airpower pioneer, WW II CG, European Theater of Operations, killed in aircraft accident, Iceland, May 3, 1943.

ARNOLD ENGINEERING DEVELOPMENT CENTER, Tenn., at Arnold AFS 37389, 10 mi. E of Tullahoma. Phone: (615) GLendale 5-2611. Hq. AEDC; AFSC. Named for Gen. H. H. "Hap" Arnold, WW II AF CG.

BAKALAR AFB, Ind. 47201, 3 mi. N of Columbus. Phone: (812) 372-2501. Reserve training, CAC. Formerly Atterbury AFB, renamed for Lt. John E. Bakalar, WW II fighter pilot, killed in France, September 1944. Base closes by October 1968.

BARKSDALE AFB, La. 71110, 1 mi. S of Bossier City, 2 mi. E of Shreveport. Phone: (318) 425-1211. Hq. 2d AF, SAC; heavy bomber and tanker base. Named for Lt. Eugene H. Barksdale, WW I pilot, killed near Wright Field, Ohio, August 1926, while testing observation-type plane.

BEALE AFB, Calif. 95903, 11 mi. SE of Marysville. Phone: (916) 634-3000. Heavy bomber and tanker base, 15th AF, SAC. Formerly Camp Beale, named for Brig. Gen. Edward F. Beale, California Indian agent before the Civil War.

BERGSTROM AFB, Tex. 78743, 7 mi. SE of Austin. Phone: (512) EVERgreen 5-4100. Tactical recon base, Hq. 12th AF, TAC. Formerly Del Valle AAB, renamed for Capt. John A. E. Bergstrom of Austin, killed at Clark Field, P. I., December 1941.

BLYTHEVILLE AFB, Ark. 72317, 3 mi. SE of Blytheville. Phone: (501) LEhigh 2-5667. Heavy bomber and tanker base, 2d AF, SAC. Named for city.

BOLLING AFB, D. C. 20332, 3 mi. S of the US Capitol. Phone: (202) JOhnson 2-9000. Headquarters Command, USAF. Hq. Research and Technology Div., AFSC; rotary-wing flying only. Named for Col. Raynal C. Bolling Assistant Chief of Air Service, died saving life of a 19-year-old private near Amiens, France, on March 26, 1918.

BROOKLEY AFB, Ala. 36615, 3 mi. SW of Mobile. Phone: (205) HEmlock 8-6011. Hq. Air Materiel Area, AFLC. Formerly Bates Field, renamed for Capt. Wendell H. Brookley, test pilot, killed in BT-2B crash near Bolling Field, February 1934. Base closes by June 1969.

BROOKS AFB, Tex. 78235, 7 mi. SE of San Antonio. Phone: (512) LEhigh 2-8811. Home of USAF Aerospace Medical Division, AFSC. Formerly Gosport Field, renamed for Lt. Sidney J. Brooks, Jr., native of San Antonio, who lost his life in a flight on the eve of his graduation from pilot training in 1917.

BUNKER HILL AFB, Ind. 46971, 9 mi. S of Peru. Phone:

(219) MURdock 9-2211. Medium bomber and tanker base, 2d AF, SAC. Formerly the location of a naval air station. Named geographically.

CANNON AFB, N. M. 88101, 7 mi. W of Clovis. Phone: (505) SUNset 4-3311. Tactical fighter base, 12th AF, TAC. Formerly Clovis AFB, renamed for Gen. John K. Cannon, TAC Commander from 1950-54, who was Commander of Allied Air Forces in the Mediterranean in WW II.

CARSWELL AFB, Tex. 76127, 7 mi. WNW of Fort Worth. Phone: (817) PERshing 8-3511. Heavy bomber and tanker base, 2d AF, SAC. Formerly Tarrant Field, renamed for Maj. Horace C. Carswell, Jr., of Fort Worth, WW II B-24 pilot and recipient of CMH, who was killed in China, October 1944.

CASTLE AFB, Calif. 95342, 7 mi. NW of Merced. Phone: (209) RANDolph 3-1611. Heavy bomber and tanker operational and training base, 15th AF, SAC; fighter-interceptor base, ADC. Formerly Merced Field, renamed for Brig. Gen. Frederick W. Castle, WW II B-17 pilot and recipient of CMH, killed over Germany, 1944.

CHANUTE AFB, Ill. 61868, 1 mi. SE of Rantoul. Phone: (217) 893-3111. Aircraft maintenance and weather schools, Technical Training Center, ATC. Named for Octave Chanute, aviation pioneer and civil engineer, died in US, 1910.

CHARLESTON AFB, S. C. 29404, 10 mi. N of Charleston. Phone: (803) SHERwood 7-4111. Air transport base, 21st AF, MAC; fighter-interceptor base, ADC. Named for city.

CLINTON CO. AFB, Ohio 45177, 2 mi. SE of Wilmington. Phone: (513) 382-3711. Reserve training, CAC. Named geographically.

CLINTON-SHERMAN AFB, Okla. 73634, 1 mi. W of Burns Flat. Phone: (405) Burns Flat, LOGan 2-3121. Heavy bomber and tanker base, 8th AF, SAC. Formerly Clinton NAS. Base closes June 1970.

COLUMBUS AFB, Miss. 39705, 9 mi. N of Columbus. Phone: (601) GENEva 4-7322. Heavy bomber and tanker base, 2d AF, SAC.

CONNALLY AFB. (See *James Connally AFB.*)

CRAIG AFB, Ala. 36703, 5 mi. SE of Selma. Phone: (205) TRinity 4-7431. Undergraduate pilot training, ATC. Named for Bruce K. Craig, flight engineer for B-24 manufacturer, killed during B-24 test flight in US, 1941.

DAVIS-MONTHAN AFB, Ariz. 85707, 4 mi. SE of Tucson. Phone: (602) EAST 7-5411. Reconnaissance base, 15th AF, SAC; Titan ICBM support base; tactical fighter crew-training base, TAC. Military Aircraft Storage and Disposal Center, AFLC. Formerly Tucson Municipal Airport, renamed for Lt. Samuel H. Davis, killed in US, 1921, and Lt. Oscar Monthan, bomber pilot, who was killed in Hawaii in 1924.

DOBBINS AFB, Ga. 30063, 2 mi. SE of Marietta. Phone: (404) 428-4461. Reserve training, troop carrier, Hq. 3d Reserve Region, CAC. Formerly Marietta AFB, renamed for Capt. Charles M. Dobbins, killed while transporting paratroops over Sicily in June 1943.

DOVER AFB, Del. 19901, 3 mi. SE of Dover. Phone: (302) 734-8211. Air transport base, 21st AF, MAC; fighter-interceptor base, ADC. Named for city.

DOW AFB, Me. 04401, 2 mi. W of Bangor. Phone: (207) 989-2300. Heavy bomber and tanker base, 8th AF, SAC; fighter-interceptor base, ADC. Formerly Bangor AB, renamed for 2d Lt. James F. Dow of Oakfield, Me., killed in crash near Mitchel Field, N. Y., June 1940. USAF units evacuate base by June 1968.

DULUTH INTERNATIONAL AP, Minn. 55814, 7 mi. NNW of Duluth. Phone: (218) RANDolph 7-8211. Fighter-interceptor and air defense missile base, ADC; SAGE Direction Center. Formerly Williamson-Johnson AP, renamed for city.

DYESS AFB, Tex. 79607, 6 mi. SW of Abilene. Phone: (915) OWen 6-0212. Heavy bomber and tanker base, 2d AF, SAC; troop carrier base, 12th AF, TAC. Formerly Tye Field, Abilene Municipal Airport, and Abilene AFB, renamed for Lt. Col. William E. Dyess of Albany, Tex., WW II fighter pilot in South Pacific, killed in a P-38 crash in December 1943 in California.

EDWARDS AFB, Calif. 93523, 18 mi. E of Rosamond. Phone: (805) CLifford 8-2111. Hq. AF Flight Test Center, AFSC. Formerly Muroc AFB, renamed for Capt. Glen W. Edwards, test pilot, killed at Muroc Field, June 5, 1948, in crash of a YB-49 "Flying Wing."

EGLIN AF AUXILIARY FIELD #9. (See *Hurlburt Field.*)

EGLIN AFB, Fla. 32544, 2 mi. SW of Valparaiso. Phone: (904) 881-6668. Hq. Air Proving Ground Center, AFSC; Tactical Air Warfare Center; tactical fighter base. Named for Lt. Col. Frederick I. Eglin, killed in an aircraft accident in 1937.

ELLINGTON AFB, Tex. 77030, 16 mi. SE of Houston. Phone: (713) HUDson 7-1400. Air Reserve, CAC. Named for 2d Lt. Eric L. Ellington, killed during training flight near San Diego, Calif., in 1913. Base transfers to ANG July 1968.

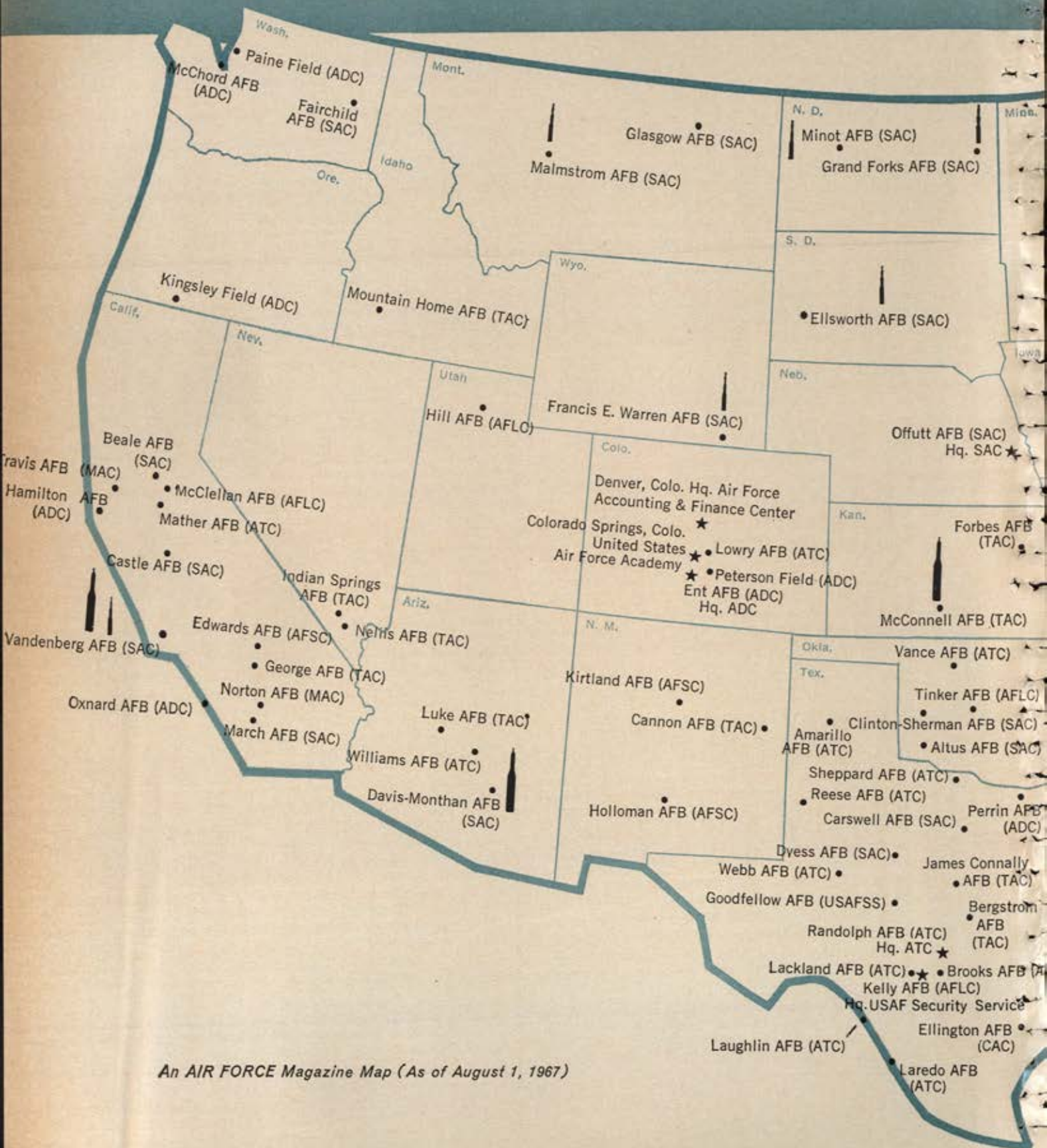
ELLSWORTH AFB, S. D. 57706, 8 mi. NE of Rapid City. Phone: (605) FILLmore 2-2400. Heavy bomber, tanker, and Minuteman ICBM support base, 15th AF, SAC.

(Continued on page 200)

Glossary of Terms Used in Guide to AFBs

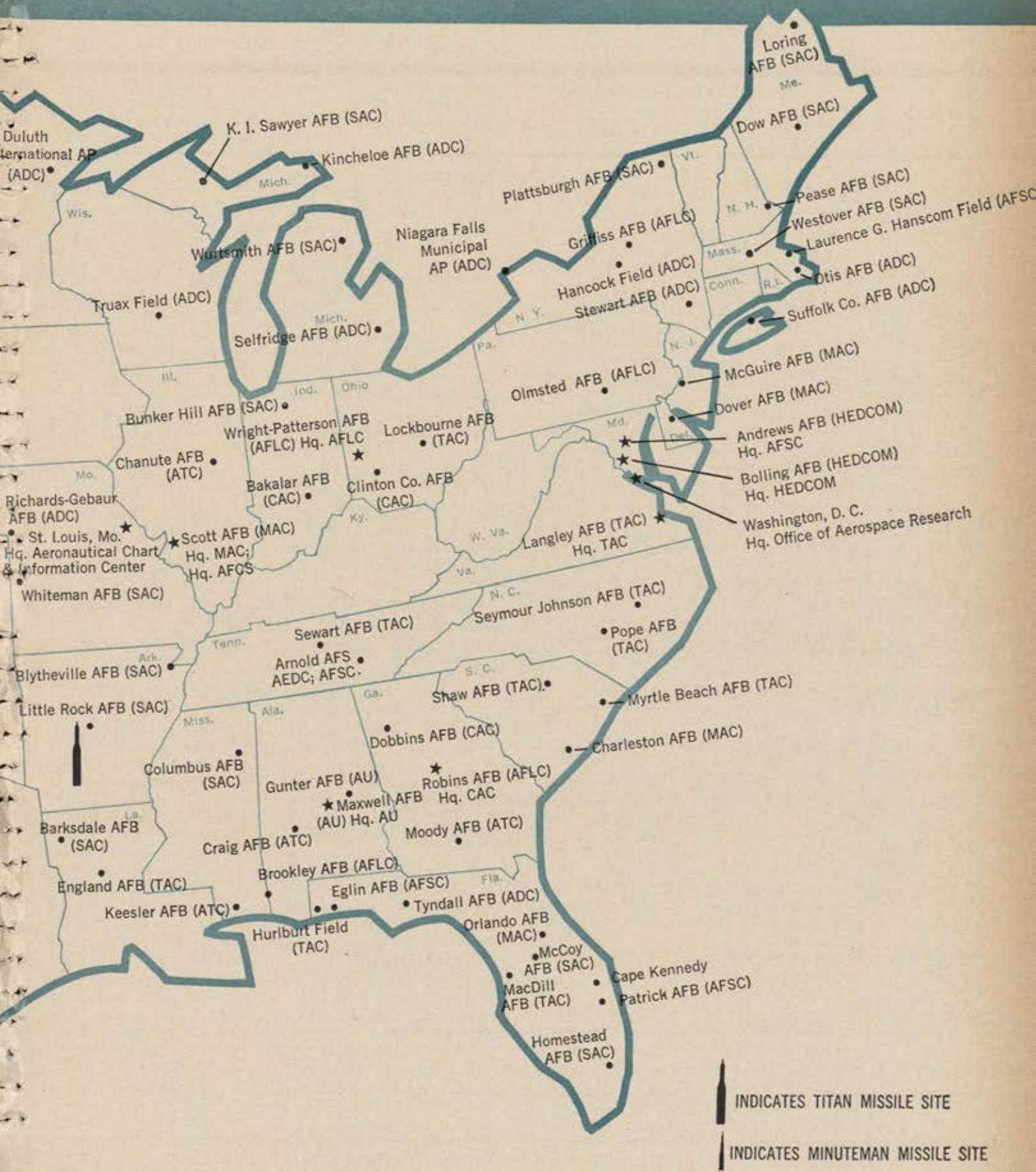
AAB	Army Air Base
AAVS	Aerospace Audio-Visual Service
AB	Air Base
ADC	Air Defense Command
AEDC	Arnold Engineering Development Center
AF	Air Force
AFB	Air Force Base
AFCS	Air Force Communications Service
AFLC	Air Force Logistics Command
AFROTC	Air Force Reserve Officers Training Corps
AFSC	Air Force Systems Command
AMA	Air Materiel Area
ANG	Air National Guard
AP	Airport
ASD	Aeronautical Systems Division
ATC	Air Training Command
AU	Air University
AWS	Air Weather Service
CAC	Continental Air Command
CAP	Civil Air Patrol
CBI	China-Burma-India Theater
CG	Commanding General
CMH	Congressional Medal of Honor
CO	Commanding Officer
DFC	Distinguished Flying Cross
DSC	Distinguished Service Cross
ETO	European Theater of Operations
GEEIA	Ground Electronics Engineering Installation Agency
HEDCOM	Headquarters Command
ICBM	Intercontinental Ballistic Missile
MAC	Military Airlift Command
NAS	Naval Air Station
NORAD	North American Air Defense Command
SAC	Strategic Air Command
SAGE	Semi-Automatic Ground Environment
TAC	Tactical Air Command
USAF	United States Air Force
USAFSS	USAF Security Service
WW I	World War I
WW II	World War II

Major Active Air Force Bases in



An AIR FORCE Magazine Map (As of August 1, 1967)

the Continental United States



Formerly Rapid City AFB, renamed for Brig. Gen. Richard E. Ellsworth, killed in B-36 crash in Newfoundland, March 18, 1953.

ENGLAND AFB, La. 71304, 6 mi. NNW of Alexandria. Phone: (318) HI. 3-4561. Tactical fighter base, 12th AF, TAC; 1st Air Commando Wing. Formerly Alexandria AFB, renamed for Lt. Col. John B. England, WW II ace killed in an air crash in France, November 17, 1954.

ENT AFB, Colo. 80912, Colorado Springs. Phone: (303) 635-8911. Hq. ADC; Hq. North American Air Defense Command (NORAD); Hq. 9th Aerospace Defense Div., ADC. Named for Maj. Gen. Uzal G. Ent, CG, 2d AF, recipient of DSC, died in 1948.

FAIRCHILD AFB, Wash. 99011, 11 mi. WSW of Spokane. Phone: (509) CHestnut 7-1212. Heavy bomber and tanker base, 15th AF, SAC; survival and special training, ATC. Formerly Spokane AFB, renamed for Gen. Muir S. Fairchild, WW I bomber pilot, Vice Chief of Staff, USAF, who died in Washington, D. C., March 1950.

FORBES AFB, Kan. 66620, 7 mi. S of Topeka. Phone: (913) UNion 2-1234. Troop carrier base, TAC; photomapping and charting wing, MAC. Formerly Topeka AAB, renamed for Maj. Daniel H. Forbes, Jr., WW II bomber pilot killed at Muroc Field, Calif., in the crash of a YB-49 "Flying Wing," June 1948.

FRANCIS E. WARREN AFB, Wyo. 82003, adjacent to Cheyenne. Phone: (307) 775-2510. Minuteman ICBM support base, 15th AF, SAC. Named for Wyoming's first US Senator and first elected governor, Civil War recipient of CMH, died in US, 1929.

GEORGE AFB, Calif. 92393, 6 mi. NW of Victorville. Phone: (714) CHapel 6-8611. Tactical fighter base, 12th AF, TAC. Formerly Victorville AAB, renamed for Brig. Gen. Harold H. George, WW I ace, Commander of US Air Forces in Australia in WW II, killed in Australia, April 1942.

GLASGOW AFB, Mont. 99011, 18 mi. NNE of Glasgow. Phone: (406) 228-4311. Heavy bomber and tanker base, 15th AF, SAC; fighter-interceptor base, ADC. Named for city. Base closes June 1968.

GOODFELLOW AFB, Tex. 76904, 2 mi. SE of San Angelo. Phone: (915) 653-3231. USAF Security Service technical training base. Named for Lt. John J. Goodfellow, Jr., of San Angelo, killed in fighter combat in France, 1918.

GRAND FORKS AFB, N. D. 58203, 14 mi. W of Grand Forks. Phone: (701) Grand Forks 772-3431. Heavy bomber and tanker base, 2d AF, SAC; fighter-interceptor base, ADC; Minuteman ICBM support base. Named for city.

GRIFFISS AFB, N. Y. 13442, 2 mi. NE of Rome. Phone: (315) 330-1110. Hq. GEEIA, AFLC; fighter-interceptor base, ADC; heavy bomber and tanker base, SAC. Formerly Rome AFB, renamed for Lt. Col. Townsend E. Griffiss of Buffalo, recipient of DSC, killed in flight from Russia to England, February 1942.

GUNTER AFB, Ala. 36114, 5 mi. NE of Montgomery. Phone: (205) 272-1210. Extension Course Institute, USAF, AU; Hq. 14th AF, ADC; SAGE Direction Center, ADC. Named for William A. Gunter, mayor of Montgomery for 27 years, ardent exponent of airpower, who died in 1940.

HAMILTON AFB, Calif. 94935, 6 mi. NNE of San Rafael. Phone: (415) TUCKER 3-7711. Fighter-interceptor base, ADC; Hq. 6th Reserve Region, CAC; Hq. 4th AF, ADC. Formerly Marin Meadows, renamed for 1st Lt. Lloyd A. Hamilton, recipient of DSC, killed in fighter combat, France, August 1918.

HANCOCK FIELD, N. Y. 13225, 5 mi. NNE of Syracuse. Phone: (315) GLenview 8-5500. SAGE Direction Center, ADC. Formerly Syracuse AF Station.

HANSCOM FIELD. (See *Laurence G. Hanscom Field*.)

HILL AFB, Utah 84401, 6 mi. S of Ogden. Phone: (801) 777-1131. Hq. Air Materiel Area, AFLC; air transport base, MAC. Named for Maj. Ployer P. Hill, killed near Wright Field while testing one of the first B-17s, October 1935.

HOLLOMAN AFB, N. M. 88330, 8 mi. SW of Alamogordo. Phone: (505) GRanite 3-6511. Hq. AF Missile Development Center, AFSC; tactical fighter base, TAC. Formerly Alamogordo AAB, renamed for Col. George V. Holloman, guided-missile pioneer who was killed in an air crash in Formosa, March 1946.

HOMESTEAD AFB, Fla. 33033, 5 mi. NNE of Homestead. Phone: (305) EDison 6-8011. Heavy bomber and tanker base, 8th AF, SAC; tactical fighter base, TAC; fighter-interceptor base, ADC. Named for city.

HURLBURT FIELD (*Eglin AF Auxiliary Field #9*), Fla. 32544, 6 mi. W of Fort Walton Beach. Phone: (305) 946-9680. TAC base. Home of USAF Special Air Warfare Center; combat crew training, USAF Air Ground Operations School. On Eglin AFB reservation.

INDIAN SPRINGS AFB, Nev. 89018, 1 mi. NW of Indian Springs. Phone: (702) Indian Springs 20. Bombing and gunnery range support base, TAC. Named geographically.

JAMES CONNALLY AFB, Tex. 76703, 7 mi. NNE of Waco. Phone: (817) SWift 9-3611. Support base, TAC. Formerly Waco AFB, renamed for Col. James T. Connally of Waco, who was killed on a B-29 mission over Yokohama, Japan, May 1945. Base in expanded caretaker basis until closure by June 1968.

KEESLER AFB, Miss. 39534, adjoining Biloxi. Phone: (601) IDlewood 2-1561. Technical Training Center, ATC. Named for Lt. Samuel R. Keesler, Jr., of Greenwood, Miss., aerial observer, killed on special bombing mission near Verdun, France, October 1918.

KELLY AFB, Tex. 78241, 6 mi. WSW of San Antonio. Phone: (512) WALnut 3-5411. Hq. Air Materiel Area, AFLC; Hq. USAF Security Service; air transport base, MAC. Named for Lt. George E. M. Kelly, pioneer Army pilot, killed in an airplane crash in San Antonio, 1911.

KINCHELOE AFB, Mich. 49786, 3 mi. SE of Kinross. Phone: (906) GYpsy 5-5611. Fighter-interceptor and air defense missile base, ADC; heavy bomber and tanker base, 2d AF, SAC. Formerly Kinross AFB, renamed in honor of Capt. Iven C. Kincheloe, Jr., Korean War jet ace and once holder of world altitude record of 126,200 feet, set in 1956 in the Bell X-2 rocketplane, killed on July 26, 1958, in the crash of an F-104 Starfighter at Edwards AFB, Calif. Base closes 1970.

KINGSLEY FIELD, Ore. 97601, 5 mi. SE of Klamath Falls. Phone: (503) TUXedo 2-4411. Fighter-interceptor base, ADC. Formerly Klamath Falls Municipal Airport, renamed in honor of 2d Lt. David R. Kingsley, killed in Ploesti raid in June 1944.

KIRTLAND AFB, N. M. 87118, borders the southern edge of Albuquerque. Phone: (505) CHapel 7-1711. Research-and-development base, Hq. AF Special Weapons Center and Nuclear Effects Radiation Lab, AFSC. Formerly Albuquerque AAB, renamed for Col. Roy S. Kirtland, aviation pioneer and former CO of Langley Field, Va., died in 1941.

K. I. SAWYER AFB, Mich. 49842, 23 mi. S of Marquette. Phone: (906) DICKens 6-9211. Heavy bomber and tanker

base, 2d AF, SAC; SAGE; fighter-interceptor base, ADC. Named for Kenneth I. Sawyer, Marquette County Road Commissioner, who died in 1944.

LACKLAND AFB, Tex. 78236, 7 mi. WSW of San Antonio. Phone: (512) OR. 4-3211. Basic Military Training Center, WAF training, USAF Recruiting School, USAF Marksmanship Center, Officer Training School, ATC. Formerly San Antonio Aviation Cadet Center, renamed for Brig. Gen. Frank D. Lackland, former commandant of Kelly Field flying school, who died in 1943.

LANGLEY AFB, Va. 23365, 3 mi. N of Hampton. Phone: (703) 764-9990. Hq. TAC; troop carrier base, TAC; fighter-interceptor and air defense missile base, ADC; Hq. Tactical Communications Area, AFCS. Named for Samuel P. Langley, pioneer aeronautical scientist, who died in 1906.

LAREDO AFB, Tex. 78041, 3 mi. NE of Laredo. Phone: (512) RANDolph 3-9121. Undergraduate pilot training, ATC. Named for city.

LAUGHLIN AFB, Tex. 78840, 7 mi. E of Del Rio. Phone: (512) 298-3511. Undergraduate pilot training, ATC. Named for Lt. Jack T. Laughlin, pilot who was killed in action in the Far East in 1942.

LAURENCE G. HANSCOM FIELD, Mass. 01731, 1 mi. SSW of Bedford. Phone: (617) 274-6100. Hq. USAF Electronic Systems Div. and the Air Force Cambridge Research Laboratories, AFSC. Formerly Bedford Airport, renamed for Laurence G. Hanscom, Boston and Worcester newspaperman, Army Reserve pilot, killed near base, 1941.

LITTLE ROCK AFB, Ark. 72077, 15 mi. NE of Little Rock. Phone: (501) YUKon 5-1431. Medium bomber and tanker base, 2d AF, SAC; Titan ICBM support base. Named for city.

LOCKBOURNE AFB, Ohio 43217, 11 mi. SSE of Columbus. Phone: (614) 491-8211. Troop carrier base, TAC; fighter-interceptor base, ADC; tanker base, 8th AF, SAC. Named for nearby city.

LORING AFB, Me. 07450, 2 mi. NW of Limestone. Phone: (207) FAirview 8-7311. Heavy bomber and tanker base, 8th AF, SAC; fighter-interceptor base, ADC. Formerly Limestone AFB, renamed for Maj. Charles J. Loring, Jr., CMH recipient, killed in Korea in November 1952 when he crashed his damaged F-80 into enemy artillery emplacements, destroying them.

LOWRY AFB, Colo. 80230, 5 mi. ESE of Denver. Phone: (303) DUDley 8-5411. Technical Training Center, ATC. Named for Lt. Francis B. Lowry of Denver, recipient of DSC, killed on photo mission over France, September 1918, only Colorado airman to be killed in WW I.

LUKE AFB, Ariz. 85301, 20 mi. WNW of Phoenix. Phone: (602) WESTport 5-9311. Tactical fighter crew training, 12th AF, TAC; SAGE Direction Center, ADC. Named for Lt. Frank Luke, Jr., "balloon-busting" WW I ace, recipient of CMH and DSC, killed in France, September 1918.

MacDILL AFB, Fla. 33608, 8 mi. SSW of Tampa. Phone: (813) Tampa 836-1411. Tactical fighter base, 9th AF, TAC; Hq. US Strike Command. Named for Col. Leslie MacDill, fighter pilot, killed in an air crash at Anacostia, D. C., 1938.

MALMSTROM AFB, Mont. 59402, 4 mi. E of Great Falls. Phone: (406) GLendale 2-9561. Minuteman ICBM support base, 15th AF, SAC; fighter-interceptor base, ADC; SAGE Direction Center, ADC. Home of nation's first Minuteman missile. Formerly Great Falls AFB, renamed for Col. Einar A. Malmstrom, killed in airplane accident near Great Falls, August 21, 1954.

MARCH AFB, Calif. 92508, 9 mi. SE of Riverside. Phone: (714) MOREno LD 20. Hq. 15th AF, SAC; heavy bomber

and tanker base, SAC. Named for Lt. Peyton C. March, Jr., son of WW I Army Chief of Staff, killed in an air crash in US, 1918.

MATHER AFB, Calif. 95655, 12 mi. SE of Sacramento. Phone: (916) EMpire 3-3161. Navigator training, ATC; heavy bomber and tanker base, 15th AF, SAC. Named for Lt. Carl S. Mather, killed near Ellington Field during training flight, 1918, five days after receiving commission.

MAXWELL AFB, Ala. 36112, 1 mi. WNW of Montgomery. Phone: (205) 265-5621. Hq. Air University; Air War College; Air Command and Staff College; Hq. AFROTC; Hq. CAP; Aerospace Studies Institute; Squadron Officer School; USAF Chaplain School; Warfare Systems School; Academic Instructor and Allied Officer School. Named for 2d Lt. William C. Maxwell of Natchez, Miss., killed in Luzon, Philippines, August 1920.

McCHORD AFB, Wash. 98438, 8 mi. S of Tacoma. Phone: (206) JUNiper 8-2121. Fighter-interceptor base, ADC; SAGE Direction Center, ADC; air transport base, 22d AF, MAC. Named for Col. William C. McChord, killed in US, 1937.

McCLELLAN AFB, Calif. 95652, 10 mi. NE of Sacramento. Phone: (916) WABash 2-1511. Hq. Air Materiel Area, AFLC; airborne early warning and control, ADC. Named for Maj. Hezekiah McClellan, pioneer in Arctic aeronautical experiments, killed testing plane in US, 1936.

McCONNELL AFB, Kan. 67221, 5 mi. SE of Wichita. Phone: (316) MURray 5-1151. Tactical fighter combat crew training base, 12th AF, TAC; Titan ICBM support base, 8th AF, SAC. Formerly Wichita AFB, renamed for the two McConnell brothers of Wichita: Thomas L., killed July 10, 1943, in the South Pacific, and Fred M., Jr., killed in 1945 in a private plane crash in Kansas.

McCOY AFB, Fla. 32812, 7 mi. S of Orlando. Phone: (305) 855-3210. Heavy bomber and tanker base, 8th AF, SAC; aircraft early warning and control, ADC. Formerly Pinecastle AFB, renamed for Col. Michael N. W. McCoy, B-47 wing commander, killed in an aircraft accident, October 1957, near Orlando.

McGUIRE AFB, N. J. 08641, 18 mi. SE of Trenton. Phone: (609) RAYmond 4-2100. Hq. 21st AF, MAC; air transport base, MAC; air defense missile base, ADC; SAGE Direction Center, ADC. Formerly Fort Dix AAB, renamed for Maj. Thomas B. McGuire, Jr., of Ridgewood, N. J., second ranking WW II ace with 38 victories, P-38 pilot, recipient of CMH and DSC, killed over Leyte, Philippines, January 7, 1945.

MINOT AFB, N. D. 58703, 13 mi. N of Minot. Phone: (701) TEMple 7-1161. Heavy bomber and tanker base, Minuteman ICBM support base, 2d AF, SAC; fighter-interceptor base, ADC. Named for city.

MOODY AFB, Ga. 31601, 10 mi. NNE of Valdosta. (Continued on page 203)

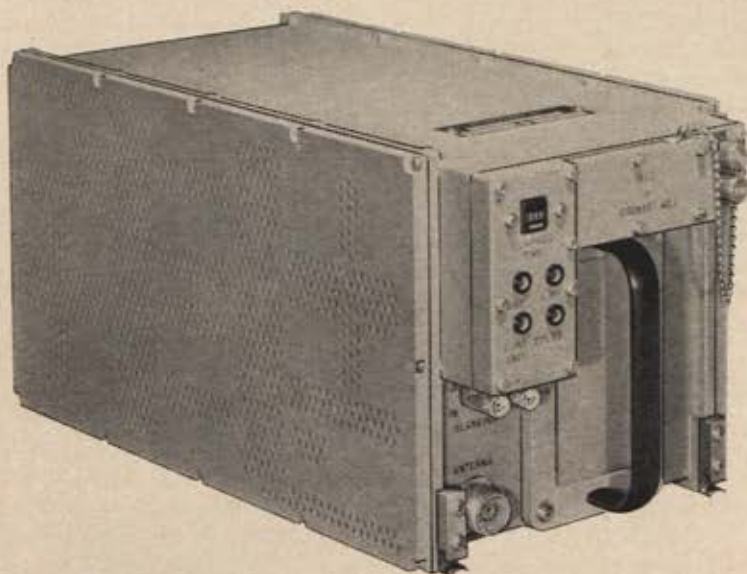
BASE CLOSINGS DURING THE PAST YEAR

The following bases have been closed since the last "Guide to Air Force Bases" appeared in the September 1966 Almanac issue:

- Hunter AFB, Ga. Troop carrier base, MAC. Base now utilized by US Army.
- Turner AFB, Ga. Heavy bomber and tanker base, SAC. Base now utilized by US Navy.
- Walker AFB, N. M. Heavy bomber and tanker base, SAC.



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Phone: (912) EDgewood 3-4211. Undergraduate pilot training, ATC. Named for Maj. George P. Moody, killed while testing AT-10 transitional trainer in Kansas, 1941.

MOUNTAIN HOME AFB, Idaho 83648, 11 mi. WSW of Mountain Home. Phone: (208) 828-2111. Tactical recon base, 12th AF, TAC. Named for city.

MYRTLE BEACH AFB, S. C. 29577, 3 mi. SW of Myrtle Beach. Phone: (803) Myrtle Beach 448-8311. Tactical fighter base, 9th AF, TAC. Named for city.

NELLIS AFB, Nev. 89110, 8 mi. NE of Las Vegas. Phone: (702) 382-1800. Tactical fighter crew training, 12th AF, TAC; Tactical Fighter Weapons Center. Formerly Las Vegas AFB, renamed for Lt. William H. Nellis of Las Vegas, fighter pilot, killed in action over Luxembourg, December 1944.

NIAGARA FALLS MUNICIPAL AP, N. Y. 14306, 4 mi. E of Niagara Falls. Phone: (716) 297-4100. Air defense missile base, ADC. Named for city.

NORTON AFB, Calif. 92409, in San Bernardino. Phone: (714) 382-1001. Air transport base, MAC; Hq. Deputy Commander for Missiles, AFSC; Office, The Auditor General and Deputy, The Inspector General, USAF. Formerly San Bernardino Air Depot, renamed for Capt. Leland F. Norton, bomber pilot, killed in an aircraft accident near Amiens, France, May 1944.

OFFUTT AFB, Neb. 68113, 9 mi. S of Omaha. Phone: (402) 291-2100. Hq. SAC; reconnaissance base, 2d AF, SAC. Formerly Fort Crook, renamed for 1st Lt. Jarvis Jennes Offutt, Omaha's first WW I air casualty, who was killed in fighter action, France, 1918.

OLMSTED AFB, Pa. 17057, 1 mi. NW of Middletown. Phone: (717) 944-5521. Hq. Air Materiel Area, AFLC. Formerly Middletown Air Depot, renamed for Lt. Robert S. Olmsted, balloon pilot, killed when struck by lightning over Belgium, September 1923. Base closes by July 1968.

ORLANDO AFB, Fla. 32813, 2 mi. E of Orlando. Phone: (305) 241-2401. Hq. AAVS; Hq. Aerospace Rescue and Recovery Service, MAC. Named for city. AF withdraws and base transfers to Navy by July 1968.

OTIS AFB, Mass. 02542, 5 mi. NNE of Falmouth. Phone: (617) LOcust 3-5511. Fighter-interceptor and air defense missile base, ADC; airborne early warning and control, ADC. Named for Lt. Frank J. Otis, killed in an air crash in the Illinois River on January 11, 1937.

OXNARD AFB, Calif. 93033, 5 mi. E of Oxnard. Phone: (805) 486-1631. Fighter-interceptor base, ADC. Named for city.

PAINE FIELD, Wash. 98205, 6 mi. S of Everett. Phone: (206) ELiot 3-1161. Fighter-interceptor base, ADC. Formerly Paine AFB. Named for 2d Lt. Topliff O. Paine, airmail pilot, killed while mapping airmail routes, 1922.

PATRICK AFB, Fla. 32925, 12 mi. SE of Cocoa. Phone: (305) ULysses 7-1110. Hq. AF Eastern Test Range, AFSC; adjacent to Cape Kennedy. Formerly Banana River NAS, renamed for Maj. Gen. Mason M. Patrick, Chief of Army Air Service after WW I, died in US in January 1942.

PEASE AFB, N. H. 03803, 3 mi. W of Portsmouth. Phone: (603) GENEva 6-0100. Heavy bomber and tanker base, 8th AF, SAC; home of 54th Aerospace Rescue and Recovery Squadron. Formerly Portsmouth AFB, renamed for Capt. Harl Pease, Jr., CMH recipient, WW II pilot lost over Rabaul, New Britain, on August 6, 1942.

PERRIN AFB, Tex. 75090, 6 mi. NNW of Sherman. Phone: (214) STillwell 7-2971. Pilot interceptor training, ADC; pilot instructor training, ATC. Named for Lt. Col. Elmer D. Perrin of Boerne, Tex., killed testing a B-26 near Baltimore, Md., June 1941.

PETERSON FIELD, Colo. 80914, 6 mi. E of Colorado Springs. Phone: (303) 635-8911. Administrative flying, ADC. Named for 1st Lt. Edward J. Peterson, killed in US in an airplane crash, 1942.

PLATTSBURGH AFB, N. Y. 12903, 1 mi. SW of Plattsburgh. Phone: (518) JORDan 3-4500. Heavy bomber and tanker base, 8th AF, SAC. Named for city.

POPE AFB, N. C. 28308, 12 mi. NW of Fayetteville. Phone: (919) 396-4111. Tactical Airlift Center, troop carrier base, 9th AF, TAC. Named for 1st Lt. Harley H. Pope, who was killed while he was making a force land-

(Continued on following page)

LOCATIONS OF AIR FORCE RESERVE FLYING UNITS

ALABAMA

Brookley AFB, Mobile

ARIZONA

Luke AFB, Phoenix

CALIFORNIA

Hamilton AFB, San Rafael
McClellan AFB, Sacramento
March AFB, Riverside

DISTRICT OF COLUMBIA

Andrews AFB

FLORIDA

Homestead AFB, Homestead

GEORGIA

Dobbins AFB, Marietta

ILLINOIS

O'Hare International Airport, Chicago
Scott AFB, Belleville

INDIANA

Bakalar AFB, Columbus

LOUISIANA

Barksdale AFB, Bossier City
New Orleans NAS, New Orleans

MASSACHUSETTS

Laurence G. Hanscom Field, Bedford
Westover AFB, Chicopee Falls

MICHIGAN

Selfridge AFB, Mount Clemens

MINNESOTA

Minneapolis-St. Paul International Airport,
Minneapolis

MISSOURI

Richards-Gebaur AFB, Kansas City

NEW JERSEY

McGuire AFB, Trenton

NEW YORK

Niagara Falls Municipal AP, Niagara Falls
Stewart AFB, Newburgh

OHIO

Clinton County AFB, Wilmington
Youngstown Municipal Airport, Youngstown

OKLAHOMA

Tinker AFB, Oklahoma City

OREGON

Portland International Airport, Portland

PENNSYLVANIA

Greater Pittsburgh Airport, Pittsburgh
Willow Grove Air Reserve Facility,
Willow Grove

TEXAS

Corswell AFB, Fort Worth
Ellington AFB, Houston
Kelly AFB, San Antonio

UTAH

Hill AFB, Ogden

WASHINGTON

McChord AFB, Tacoma

WISCONSIN

General Mitchell Field, Milwaukee

ing in a Jenny in North Carolina, in January 1919.

RANDOLPH AFB, Tex. 78148, 15 mi. ENE of San Antonio. Phone: (512) OLIVE 8-5311. Hq. ATC; USAF Military Personnel Center; Hq. 4th Reserve Region, CAC; undergraduate pilot training, ATC. Named for Capt. William M. Randolph of Austin, fighter pilot, killed in a training-flight accident in Texas, 1928.

REESE AFB, Tex. 79401, 12 mi. W of Lubbock. Phone: (806) 885-4511. Undergraduate pilot training, ATC. Formerly Lubbock AFB, renamed for Lt. Augustus F. Reese, Jr., of Shallowater, Tex., killed on bomber mission over Cagliari, Italy, May 1943.

RICHARDS-GEBAUR AFB, Mo. 64031, 16 mi. S of Kansas City. Phone: (816) DICKENS 5-4400. Fighter-interceptor base, ADC; Hq. 10th AF, ADC. Formerly Grandview AFB, renamed for Lt. John F. Richards, II, of Kansas City, first area pilot to die in combat in WW I; and for Lt. Col. Arthur W. Gebaur, Jr., who was killed over North Korea in 1952.

ROBINS AFB, Ga. 31094, 14 mi. SSE of Macon. Phone: (912) 926-1110. Hq. Air Materiel Area, AFLC; Hq. CAC; heavy bomber and tanker base, 8th AF, SAC; air transport base, MAC. Named for Brig. Gen. Augustine Warner Robins, Chief of Materiel Division, Air Corps, who

(Continued on page 207)

LOCATIONS OF AIR NATIONAL GUARD FLYING UNITS

ALABAMA

Birmingham Municipal Airport, Birmingham
Dannelly Field, Montgomery

ALASKA

Anchorage International Airport, Anchorage

ARIZONA

Sky Harbor Municipal Airport, Phoenix
Tucson Municipal Airport, Tucson

ARKANSAS

Fort Smith Municipal Airport, Fort Smith
Little Rock AFB, Little Rock

CALIFORNIA

Fresno Air Terminal, Fresno
Hayward Municipal Airport, Hayward
Ontario International Airport, Ontario
Van Nuys Airport, Van Nuys

COLORADO

Buckley Air National Guard Base, Denver

CONNECTICUT

Bradley Field, Windsor Locks

DELAWARE

Greater Wilmington Airport, New Castle

DISTRICT OF COLUMBIA

Andrews AFB

FLORIDA

Imeson Airport, Jacksonville

GEORGIA

Dobbins AFB, Marietta
Travis Field, Savannah

HAWAII

Hickam AFB, Honolulu

IDAHO

Boise Air Terminal, Boise

ILLINOIS

Capital Municipal Airport, Springfield
O'Hare International Airport, Chicago
Greater Peoria Airport, Peoria

INDIANA

Baer Field, Fort Wayne
Hulman Field, Terre Haute

IOWA

Des Moines Municipal Airport, Des Moines
Sioux City Municipal Airport, Sioux City

KANSAS

Forbes AFB, Topeka
McConnell AFB, Wichita

KENTUCKY

Standiford Field, Louisville

LOUISIANA

New Orleans NAS, New Orleans

MAINE

Dow AFB, Bangor

MARYLAND

Martin Airport, Baltimore

MASSACHUSETTS

Barnes Municipal Airport, Westfield
Logan International Airport, Boston

MICHIGAN

Detroit Metropolitan Wayne County Airport, Detroit
Kellogg Airport, Battle Creek

MINNESOTA

Duluth International Airport, Duluth
Minneapolis-St. Paul International Airport, Minneapolis

MISSISSIPPI

Allen C. Thompson Field, Jackson
Key Field, Meridian

MISSOURI

Lambert-St. Louis Municipal Airport, St. Louis
Rosecrans Memorial Airport, St. Joseph

MONTANA

Great Falls International Airport, Great Falls

NEBRASKA

Lincoln AFB, Lincoln

NEVADA

Reno Municipal Airport, Reno

NEW HAMPSHIRE

Pease AFB, Newington

NEW JERSEY

Atlantic City Airport, Atlantic City
McGuire AFB, Trenton

NEW MEXICO

Kirtland AFB, Albuquerque

NEW YORK

Clarence E. Hancock Airport, Syracuse
New York NAS, Brooklyn
Niagara Falls Municipal Airport, Niagara Falls
Schenectady City Airport, Schenectady
Westchester County Airport, White Plains

NORTH CAROLINA

Douglas Municipal Airport, Charlotte

NORTH DAKOTA

Hector Field, Fargo

OHIO

Clinton County AFB, Wilmington
Lockbourne AFB, Columbus
Mansfield Municipal Airport, Mansfield
Springfield Municipal Airport, Springfield
Toledo Express Airport, Toledo

OKLAHOMA

Tulsa Municipal Airport, Tulsa
Will Rogers Field, Oklahoma City

OREGON

Portland International Airport, Portland

PENNSYLVANIA

Greater Pittsburgh Airport, Pittsburgh
Olmsted AFB, Middletown
Willow Grove NAS, Willow Grove

PUERTO RICO

Puerto Rico International Airport, San Juan

RHODE ISLAND

Theodore F. Green Airport, Providence

SOUTH CAROLINA

McEntire Air National Guard Base, Columbia

SOUTH DAKOTA

Joe Foss Field, Sioux Falls

TENNESSEE

Nashville Metropolitan Airport, Nashville
McGhee-Tyson Airport, Knoxville
Memphis Municipal Airport, Memphis

TEXAS

Dallas NAS, Dallas
Ellington AFB, Houston
Kelly AFB, San Antonio

UTAH

Salt Lake City Municipal Airport, Salt Lake City

VERMONT

Burlington Municipal Airport, Burlington

VIRGINIA

Byrd Field, Richmond

WASHINGTON

Spokane International Airport, Spokane

WEST VIRGINIA

Kanawha County Airport, Charleston
Martinsburg Municipal Airport, Martinsburg

WISCONSIN

General Mitchell Field, Milwaukee
Truax Field, Madison

WYOMING

Cheyenne Municipal Airport, Cheyenne

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United States Air Force on its
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pioneering work in terrain following; the specific, experimental study of high-speed flutter and the broad-scale, analytical investigation of penetration aids for tactical aircraft. □ We are glad for these two decades of opportunity to help build national security. With you, we look forward to doing what is needed to preserve it.



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ground station where it is rapid-processed for viewing in near real-time. Relay aircraft can extend operational ranges to several hundred miles. Add processing and viewing equipment and the relay aircraft also serves as an airborne command post. Two years of operational testing of the Data Link in a 1964-65 USAF program gives Cubic the experience to solve complex systems integration problems and the second generation hardware needed to implement a highly reliable, maintainable system. For additional information, write to Systems Manager, Systems Division, Department F-255, Cubic Corporation, San Diego, California 92123.

CUBIC CORPORATION  **SYSTEMS DIVISION**

devised system of cataloging in the 1920s still used, died in 1940.

SAWYER AFB. (See *K. I. Sawyer AFB.*)

SCOTT AFB, Ill. 62226, 6 mi. ENE of Belleville. Phone: (618) ADams 4-4000. Hq. MAC; Hq. AWS; Hq. AFCS. Named for Cpl. Frank S. Scott, first enlisted man to die in an air accident, killed at College Park, Md., 1912.

SELFRIDGE AFB, Mich. 48046, 3 mi. E of Mount Clemens. Phone: (313) 465-1241. Fighter-interceptor base, ADC; Hq. 5th Reserve Region, CAC. Formerly Joy Aviation Field, renamed for Lt. Thomas E. Selfridge, killed in 1908 while on flight with Orville Wright to demonstrate Wright plane. Base transfers to ANG in October 1967.

SEWART AFB, Tenn. 37168, 3 mi. N of Smyrna. Phone: (615) GLendale 9-2561. Troop carrier base, 12th AF, TAC. Formerly Smyrna AFB, renamed for Maj. Allan J. Sewart, Jr., bomber pilot, recipient of DSC, killed in action over

the Solomons in November 1942. Base closes June 1970.

SEYMOUR JOHNSON AFB, N. C. 27530, 2 mi. SSE of Goldsboro. Phone: (919) REpublic 5-1121. Hq. 19th AF, TAC; tactical fighter base, 9th AF, TAC; heavy bomber and tanker base, 8th AF, SAC. Named for Lt. Seymour A. Johnson, Navy pilot from Goldsboro, who was killed in 1942.

SHAW AFB, S. C. 29152, 7 mi. WNW of Sumter. Phone: (803) 775-1111. Hq. 9th AF, TAC; tactical reconnaissance and combat crew training base; USAF Tactical Air Reconnaissance Center. Named for 1st Lt. Erwin D. Shaw of Sumter, killed during recon flight over German lines, July 1918, while serving with Royal Flying Corps.

SHEPPARD AFB, Tex. 76311, 5 mi. N of Wichita Falls. Phone: (817) 851-2511. Technical Training Center, ATC; USAF helicopter pilot school, medical service school, ATC. Named for Morris E. Sheppard, US Senator from Texas,

(Continued on following page)

UNITED STATES AIR FORCE BASES, INSTALLATIONS, AND FACILITIES LOCATED OVERSEAS

Following is a list of bases, installations, and facilities where men and women of the United States Air Force are stationed outside the continental limits of the United States. This is not a complete list but does include the major stations used by the global USAF.—THE EDITORS

ALASKA

Eielson AFB
Elmendorf AFB
Galena Airport
King Salmon Airport
Murphy Dome AFS
Shemya AF Station

AZORES

Lajes Field

BERMUDA

Kindley AFB

CANADA

Goose AB, Labrador

CANAL ZONE

Albrook AFB
Howard AFB

CRETE

Iraklion Air Station

GERMANY

Bitburg AB
Hahn AB
Lindsey Air Station
Ramstein AB
Rhein-Main AB
Sembach AB
Spangdahlem AB
Tempelhof Central Airport, Berlin
Wiesbaden AB

GREECE

Athens Airport

GREENLAND

Sondrestrom AB
Thule AB

GUAM

Andersen AFB

HAWAII

Bellows AFB
Hickam AFB
Wheeler AFB

ICELAND

Keflavik Airport

ITALY

Aviano AB
Naples Admin.

IWO JIMA

Iwo Jima AB

JAPAN

Fuchu Air Station
Itazuke AB
Misawa AB
Tachikawa AB
Yamato Air Station
Yokota AB

JOHNSTON ISLAND

Johnston Island AB

KOREA

Kimpo AB
Kunsan AB
Osan AB
Taegu Airfield

LIBYA

Wheelus AB

NETHERLANDS, THE

Camp New Amsterdam AB

NORWAY

Oslo

OKINAWA

Kadena AB
Naha AB

PAKISTAN

Peshawar Air Station

PHILIPPINE ISLANDS

Clark AB
Mactan Airfield

PUERTO RICO

Romey AFB

REPUBLIC OF VIETNAM

Bien Hoa AB
Binh Thuy AB
Cam Ranh Bay AB
Da Nang Airport
Nha Trang Airport
Phan Rang AB
Phu Cat AB
Pleiku Airport
Tan Son Nhut Airfield
Tuy Hoa AB

SPAIN

Moran AB
San Pablo Admin.
Torrejon AB
Zaragoza AB

TAIWAN (FORMOSA)

Chiayi AB
Ching Chuan Kang AB
Shu Lin Kou Air Station
Tainan Air Station
Taipei Air Station

THAILAND

U Tapao AB
Don Muang Airport
Korat AB
Nakhon Phanom Airport
Nam Phong AB
Takhli AB
Ubon Airfield
Udon Airfield

TURKEY

Ankara Air Station
Cigli AB
Incirlik AB
Izmir Admin.

UNITED KINGDOM

Alconbury RAF Station
Bentwaters RAF Station
High Wycombe Air Station
Lakenheath RAF Station
Mildenhall RAF Station
Prestwick Airfield, Scotland
Sculthorpe RAF Station
South Ruislip Air Station
Upper Heyford RAF Station
Wethersfield RAF Station
Woodbridge RAF Station

chairman of Senate Military Affairs Committee, who died in 1941.

SHERMAN AFB. (See *Clinton-Sherman AFB.*)

STEWART AFB, N. Y. 12554, 4 mi. W of Newburgh. Phone: (914) JOhn 2-1300. Hq. 1st AF, ADC. Named for Lachlan Stewart, sea captain whose son provided land for the base.

SUFFOLK CO. AFB, N. Y. 11978, 3 mi. N of Westhampton Beach, L. I. Phone: (516) WEsthampton 4-1900. Fighter-interceptor base, ADC. Named geographically.

TINKER AFB, Okla. 73145, 8 mi. ESE of Oklahoma City. Phone: (405) PErshing 2-7321. Hq. Air Materiel Area, AFLC; transport training, MAC. Named for Maj. Gen. Clarence L. Tinker, an Osage Indian, bomber and fighter pilot, CG, 7th AF, killed in raid on Wake Island, June 1942.

TRAVIS AFB, Calif. 94535, 6 mi. ENE of Fairfield and Suisun. Phone: (707) IDlewood 7-2211. Hq. 22d AF, MAC; heavy bomber and tanker base, 15th AF, SAC; air transport base, MAC. Formerly Fairfield-Suisun AFB, renamed for Brig. Gen. Robert F. Travis, bomber pilot, recipient of DSC, killed in B-29 crash in US, August 1950.

TRUAX FIELD, Wis. 53707, 1 mi. E of Madison. Phone: (608) 249-5311. SAGE direction center, ADC. Named for 1st Lt. Thomas L. Truax of Madison, a pilot who was killed in a training flight in US, November 1941. Base closes June 1968.

TYNDALL AFB, Fla. 32403, 8 mi. E of Panama City. Phone: (914) ATlantic 6-2111. Combat crew training schools for F-101 and F-106 pilots, ADC; pilot instructor training, ATC. Named for Lt. Frank B. Tyndall of Port Seward, Fla., WW I fighter pilot, killed in an air crash in 1930, first Florida military flyer to be killed.

VANCE AFB, Okla. 73703, 4 mi. SSW of Enid. Phone: (405) ADams 7-2121. Undergraduate pilot training, ATC. Formerly Enid AFB, renamed for Lt. Col. Leon R. Vance, Jr., WW II recipient of CMH, lost in hospital aircraft forced down at sea off Iceland, 1944.

VANDENBERG AFB, Calif. 93437, 10 mi. NW of Lompoc. Phone: (805) 866-1611. Hq. 1st Strategic Aerospace Division, SAC; Air Force ICBM launch and missile com-

bat crew training center; Hq. AF Western Test Range, AFSC. Formerly Cooke AFB, renamed for Gen. Hoyt S. Vandenberg, 9th AF Commander in ETO in WW II, AF Chief of Staff from 1948 to 1953, who died April 2, 1954.

WARREN AFB. (See *Francis E. Warren AFB.*)

WEBB AFB, Tex. 79721, 1.8 mi. SW of Big Spring. Phone: (915) AMherst 4-2511. Undergraduate pilot training, ATC. Formerly Big Spring AFB, renamed for 1st Lt. James L. Webb, Jr., F-51 pilot, killed off Japanese coast, 1949.

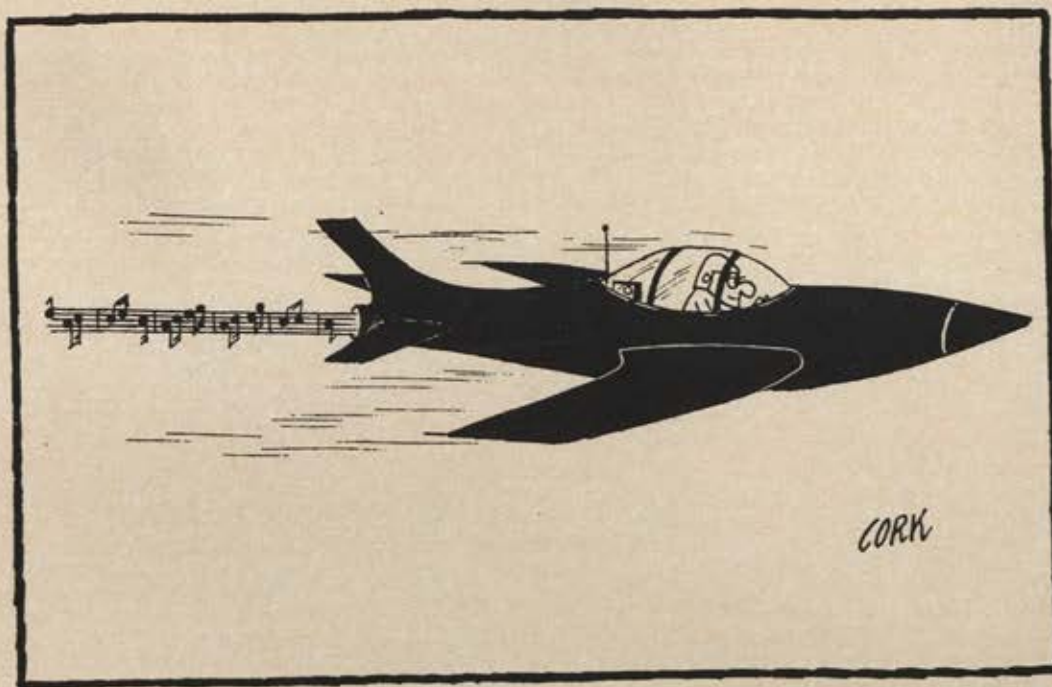
WESTOVER AFB, Mass. 01022, 3 mi. NNE of Chicopee Falls. Phone: (413) LYceum 3-6411. Hq. 8th AF, SAC; heavy bomber and tanker base, SAC. Named for Maj. Gen. Oscar Westover, Chief of the Air Corps, who was killed in an air crash near Burbank, Calif., September 1938.

WHITEMAN AFB, Mo. 65304, 3 mi. S of Knob Noster. Phone: (816) LOgan 3-5511. Minuteman ICBM support base, 8th AF, SAC. Formerly Sedalia AFB, renamed for 2d Lt. George A. Whiteman of Sedalia, killed in action at Pearl Harbor on December 7, 1941.

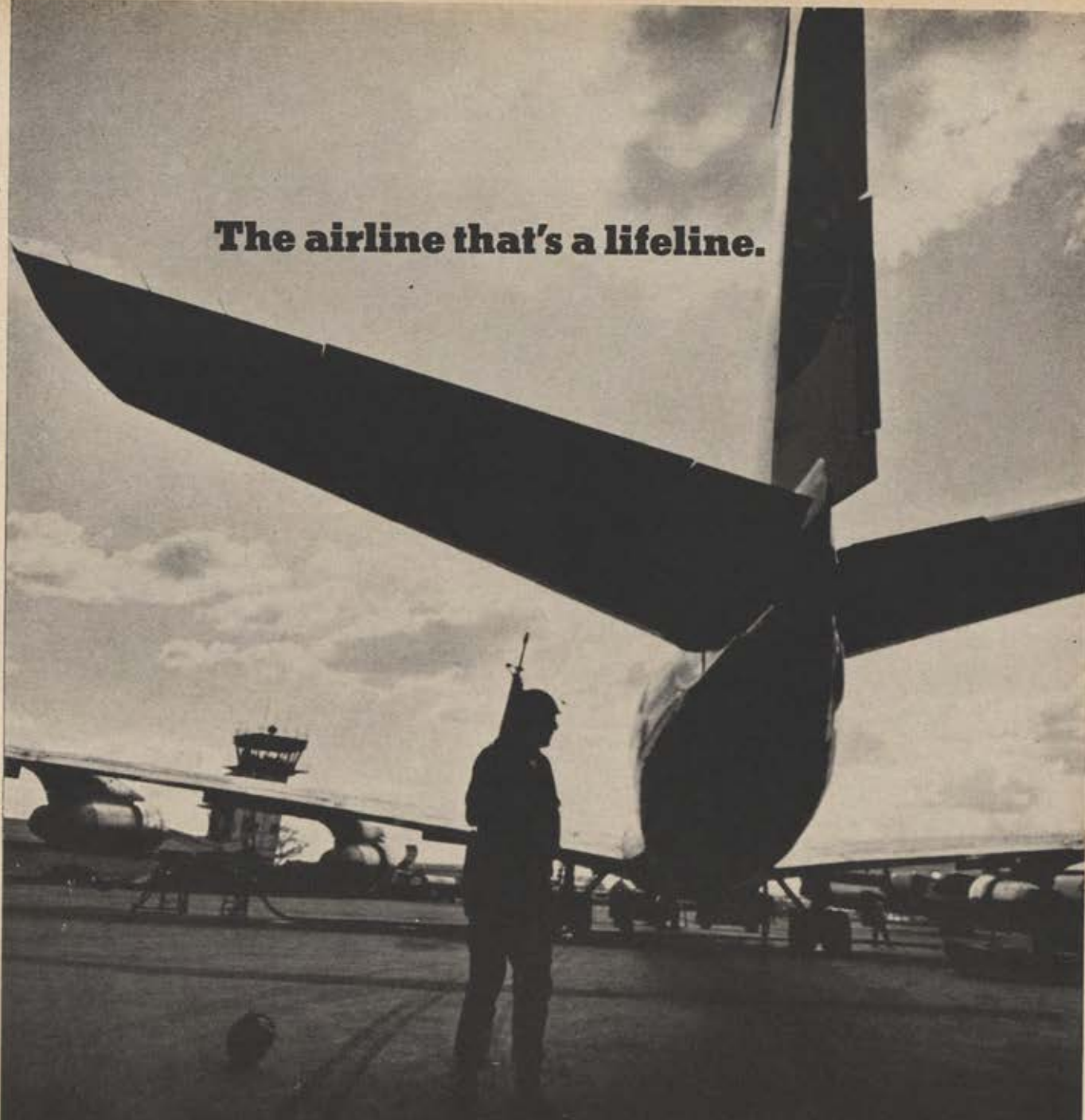
WILLIAMS AFB, Ariz. 85225, 10 mi. E of Chandler. Phone: (602) YUKon 8-2611. Undergraduate pilot training, ATC. Formerly Higley Field, renamed for Lt. Charles L. Williams, native of Arizona, bomber pilot, killed in Hawaii, July 1927.

WRIGHT-PATTERSON AFB, Ohio 45433, 5 mi. ENE of Dayton. Phone: (513) 257-1110. Hq. AFLC, logistics headquarters of Air Force; major research-and-development center; engineering school; heavy bomber and tanker base, SAC; home of Air Force Museum; Hq. Aeronautical Systems Division and Foreign Technology Division, AFSC. Formerly separate areas including Fairfield Air Depot, Wilbur Wright Field, and Patterson Field; renamed for Orville and Wilbur Wright, and for Lt. Frank S. Patterson, killed in air crash near base testing a synchronized machine gun, June 1918.

WURTSMITH AFB, Mich. 48751, 3 mi. NW of Oscoda. Phone: (517) 739-3611. Heavy bomber and tanker base, 2d AF, SAC; fighter-interceptor base, ADC. Formerly Camp Skeel, later Oscoda AFB, renamed for Maj. Gen. Paul B. Wurtsmith, CG, 13th AF, who was killed in a B-25 crash in North Carolina, 1946.—END



W-20



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FIRST IN LATIN AMERICA

FIRST ROUND THE WORLD





An orbital demonstration of the start, stop, restart capabilities of a new louvered fuel cell power system

A new louvered fuel cell designed for unmanned satellites was aboard a Titan 3-C that carried a number of Air Force experiments into space late last year. Orbiting altitude attained was 184 statute miles. The objective for the fuel cell was to verify its performance under conditions of zero-gravity and space vacuum by operating it a minimum of 50 hours with starting, stopping and restarting by ground commands. The system was developed by Allis-Chalmers for the Air Force Aero Propulsion Laboratory at Wright-Patterson Air Force Base, Ohio.

During the scheduled five days of operation in space, the hydrogen oxygen fuel cell system supplied up to 95 watts of power which was dissipated in a resistive heating load. The unit was stopped and restarted on several occasions by means of signal telemetered from earth.

An unusual feature of this fuel cell is its thermal control system. Low-emittance louvers cover the high emittance surfaces of the fuel cell itself. The louvers are automatically opened and closed like venetian blinds to vary the emittance of the module to control its temperature. As a result, no radi-

ator or liquid cooling system is necessary. This greatly reduces the parasitic power required.

Also basic to the cell's design simplicity is its unique Static Moisture Removal System that allows water produced by the electro-chemical combination of hydrogen and oxygen to be vented directly from the module as vapor. There is no need for a complex auxiliary water-removal system.

The louvered fuel cell is designed to meet unmanned satellite power requirements of 100 watts to 1 KW for up to 720 hours of operation. For missions in this range, the energy-to-weight ratios of the complete system, including cryogenic reactant supply, run as high as 650 watt-hours per pound; more than six times that of battery systems.

Modules weighing 31.5 pounds each can be combined in building block fashion to give a desired configuration for any specific application. Each module is completely self-sufficient, requiring no auxiliary subsystem other than the reactant supply.

Interfaces are minimal. They are: hydrogen and oxygen cryogenic tankage piping to each module, the electric

cable connections, and water vapor vent.

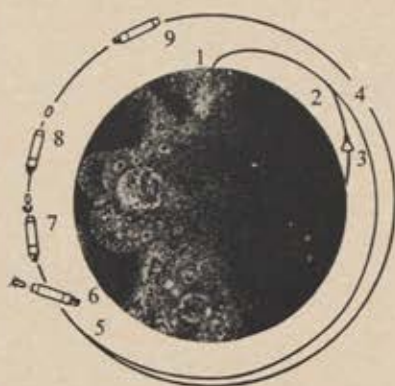
Thermal integration with instrumented satellites is simplified because the louvers are readily interchangeable with thermal insulating panels to provide any special temperature control or to shield any adjacent equipment which cannot tolerate heat radiation from the module.

Only three watts of parasitic power are required and that is for instrumentation. However, under conditions of low-power output or during fuel cell startup, some parasitic power may be necessary to maintain operating temperatures. The thermal control system requires no power.

Predicted reliability levels for the louvered fuel-cell are of a high order, and may be controlled according to the particular configuration selected.

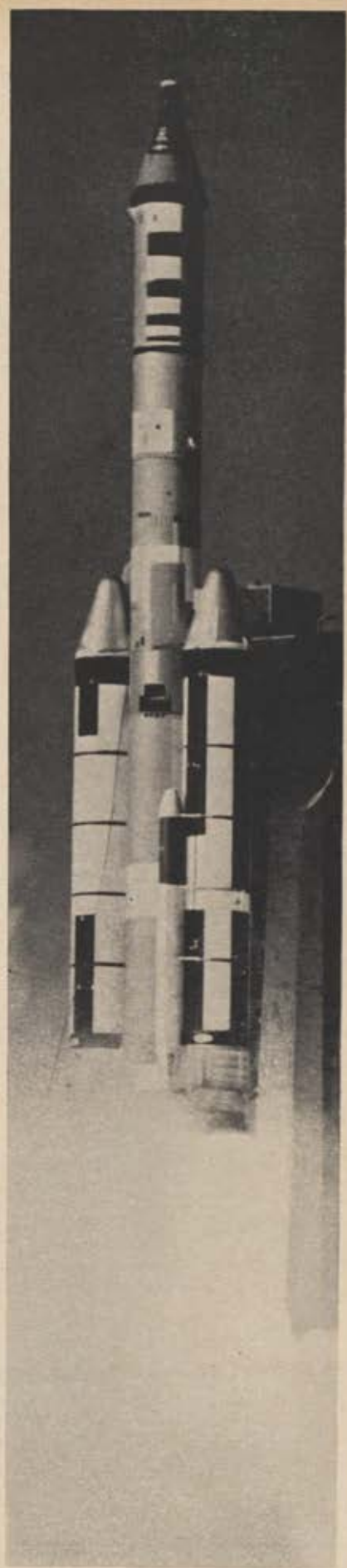
For detailed information on louvered fuel cell systems or other Allis-Chalmers fuel cells for space and terrestrial applications, write to Director of Business Development, Allis-Chalmers Research Division, Milwaukee, Wisconsin 53201. A-2230





MISSION PROFILE

- 1- Launch point
- 2 First transtage burnout and separation of Gemini test capsule
- 3 Re-entry and recovery of Gemini test capsule
- 4 Second transtage burn to transfer OV4-3 spacecraft to 160 N Mi apogee
- 5 Third transtage burn to circularize orbit at 160 N Mi
- 6 Pitch up to 30 deg. to eject OV1-6
- 7 Reorient to velocity vector and eject OV4-1(T)
- 8 Eject OV4-(R)
- 9 OV4-3 spacecraft continues to support scientific experiments . . . fuel cell experiments begin



No time for engine failure

Continental's new T67-T-1 twin turboshaft powerplant assures greater safety, better economy and offers the simplest operation of any twin engine helicopter powerplant available today.

The most unique feature is the completely automatic power sharing system that maintains power balance between the engines and increases power from the remaining engine in the event of single engine failure. The automatic power sharing system also relieves the pilot from constantly monitoring and trimming power. This promotes greater safety by permitting the pilot to pay full attention to control of the helicopter, air and ground observations and other flight requirements.

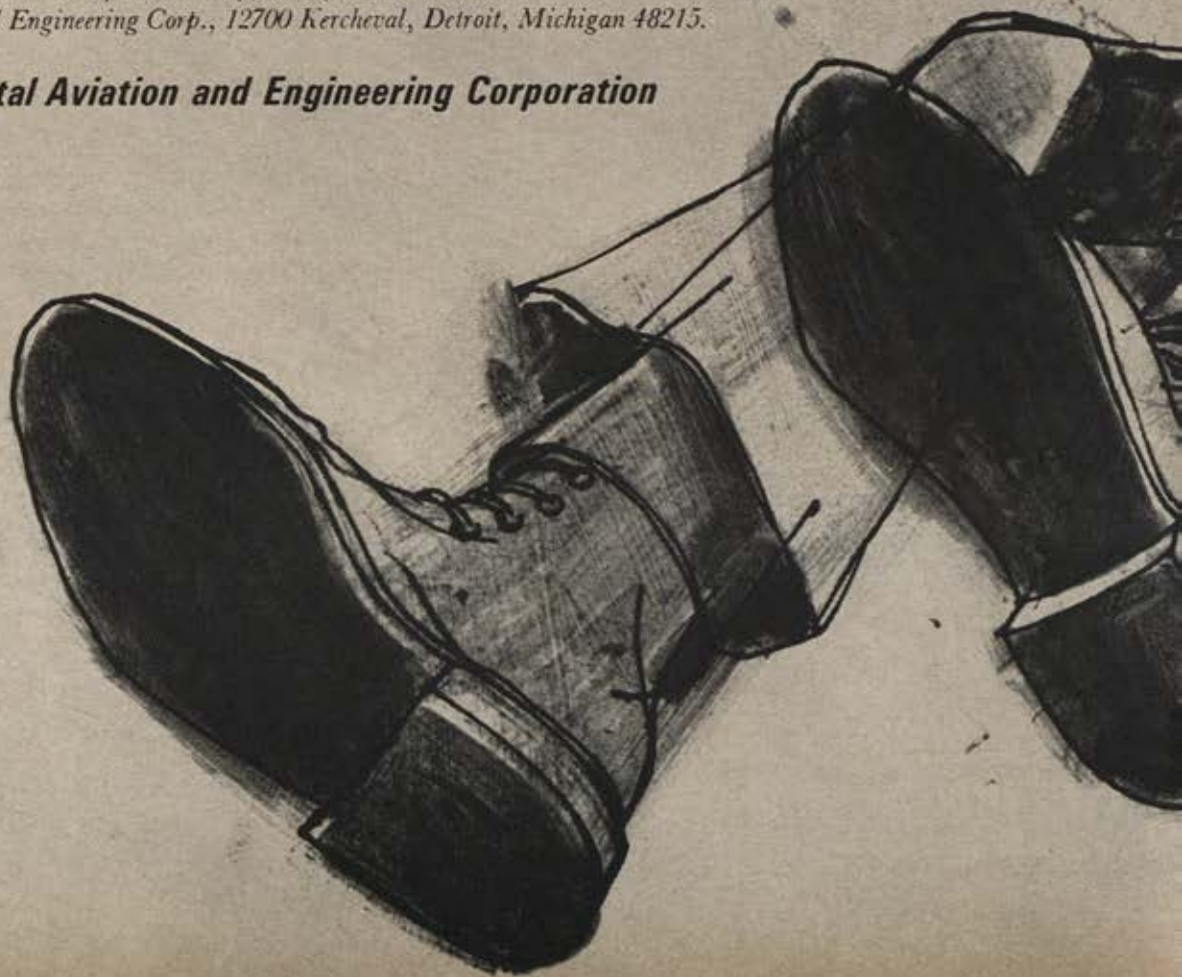
The Bell UH-1D helicopter powered by the T67-T-1 takes off and operates on one engine (at reduced payload) permitting self-evacuation from combat areas to a repair base. Complete interchangeability of both engines further simplifies maintenance and logistics.

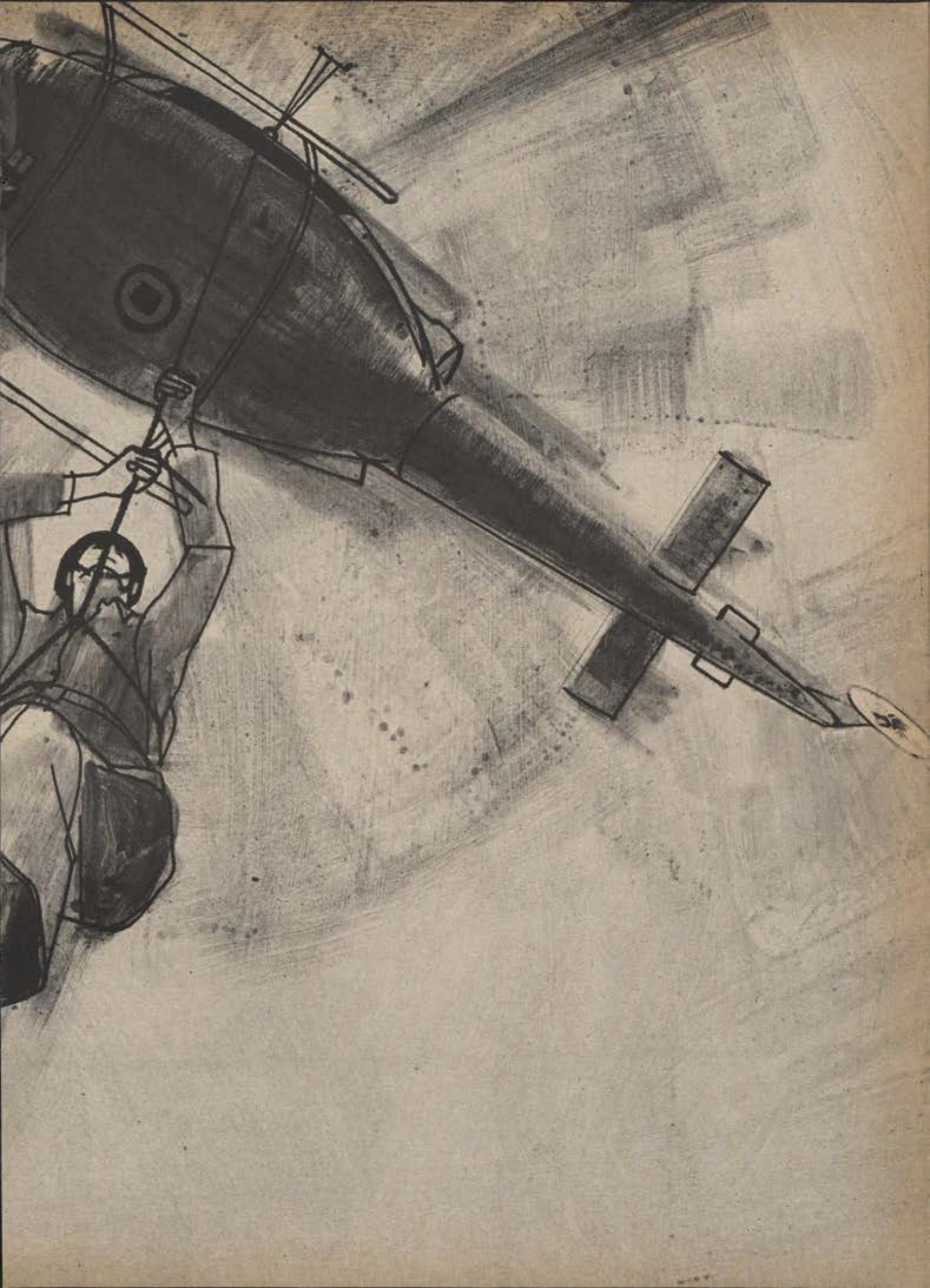
The new T67-T-1 has completed a 50 hour Pre-Flight Rating Test and has logged over 90 hours in a Bell UH-1D helicopter. Official flight evaluations were conducted by the Army, Navy and Air Force.

Continental Aviation and Engineering Corp., 12700 Kercheval, Detroit, Michigan 48215.



Continental Aviation and Engineering Corporation





Boosters and Missiles

The Boosters

Titan III

Standardized space-launch system for variety of manned and unmanned booster missions, including USAF's Manned Orbiting Laboratory. Among principal configurations are Titan IIIA, consisting of Titan II core with new upper stage and control module and comprising core vehicle for other Titans; Titan IIIB, core vehicle minus upper stage and control module, which can be replaced by other high-energy vehicles; Titan IIIC, complete Titan IIIA plus 2 5-segmented strap-on motors of more than a million pounds thrust; Titan IIIM, with 7 segments in each strap-on motor, which will be used to launch MOL. Titan IIIA made first flight in Sept. 1964, IIIC in June 1965. Titan is being used to launch Initial Defense Communications Satellites, VELA, tactical communications satellite, and multiple engineering payloads.

Systems integrator and airframe: Martin Marietta Corp.; technical assistance, Aerospace Corp. **Dimensions:** length—IIIA, 124 ft.; IIIB, 145 ft.; IIIC, 127 ft.; IIIM, 170 ft.; diameter—IIIA and B, 10 ft.; IIIC and M, 30 ft. **Powerplant:** same as Titan II except first stage uprated to 470,000 lb., plus strap-on boosters bringing total thrust to nearly 3 million lb. in IIIC; IIIM, 3,300,000 lb. **Launch weight:** IIIA, 345,000 lb.; IIIC, 700 tons; IIIM, 850 tons. **Guidance:** IIIA and IIIC, all-inertial; IIIB, radio. **Other contractors:** Propulsion, Titan III core, Aerojet-General; strap-on booster segments, United Technology Center; guidance, AC Electronics Div., GMC, Western Electric Co.; ITL facilities assembly, Ralph M. Parsons Co. **Primary using command:** AFSC.

Atlas SLV-3

Withdrawn from USAF's ICBM force, man-rated Atlas was booster for US manned Mercury flights. However, Atlas vehicles have been refurbished for use in support of Nike-X and



Titan IIIB



Atlas-Agena



Thor

ABRES (Advanced Ballistic Reentry System) programs. Refurbished Atlas D, E, and F boosters have also been used in low-cost DoD programs. Since early 1963, all NASA research projects have used the Atlas SLV-3 booster; DoD programs have used the SLV-3 for high-cost payloads requiring a high-reliability booster. The SLV-3 has had a total of 102 flights since March 1962. In combination with Agena D, the SLV-3 launched the Mariner V spacecraft in June of this year on a 4-month voyage to within 2,000 miles of Venus, and the Lunar Orbiter V in August. The first Atlas SLV-3A, with extended tank, will be launched in January 1968 on the OGO (Orbiting Geophysical Observatory) program for NASA. Larger tank

increases thrust of 3 main engines from 388,000 lb. to 395,000 lb., while sustainer thrust is raised from 57,000 lb. to 68,000 lb. Two-stage Centaur booster, with Atlas-D first stage, is NASA's prime vehicle launching Surveyor spacecraft to soft landings on the moon. New improved Atlas/Centaur booster (SLV-3C) will launch remaining Surveyor missions using the Centaur upper stage. The first SLV-3C will be launched later this year. SLV-3C will also be used for NASA's OAO (Orbiting Astronomical Observatory) and ATS (Applications Technology Satellite) programs.

Prime contractor: General Dynamics/Convair. **Launch weight:** SLV-3, 260,000 lb.; SLV-3A, 310,000 lb.; SLV-3C, 284,000 lb. **Dimensions:**

length, SLV-3, 60 ft.; SLV-3A, 80 ft.; SLV-3C, 70 ft.; diameter, 10 ft. **Guidance:** radio command. **Other contractors:** propulsion, Rocketdyne; guidance, General Electric. **Primary using commands:** AFSC, NASA.

Agena

Upper-stage booster and spacecraft used in combination with Atlas, Thor, and Titan; served as rendezvous vehicle in Gemini program; Atlas-Agena combination has launched numerous space vehicles, including Ranger, Samos, OGO, Mariner, Lunar Orbiter, and VELA. Thor-Agena provided boost for Echo, Nimbus, Discoverer, and others. Employs restartable liquid-fueled engine with 16,000 lb. thrust. AFSC awarded contract in April for improved Agena D to accommodate heavier satellite payloads; program involves modifying engine to operate on storable propellant, developing secondary propulsion module operating off main tanks, and increasing overall thrust. **Prime contractor:** Lockheed Missile & Space Co. **Other contractors:** propulsion, Bell Aerosystems; guidance, Honeywell. **Primary using commands:** AFSC, NASA.

Thor

Long since retired as intermediate-range ballistic missile, Thor continues in service as space booster in combination with various upper-stage vehicles, as Thor-Able, Thor-Delta, Thor-Agena, and Thor-Burner II. It is the most reliable of all US boosters, with more than 200 launches since first flight in January 1957, 96 percent of which were successful. Thor is currently employed primarily in Thrust-Augmented-Thor (TAT) and Long-Tank-Thor configurations. TAT is equipped with 3 solid-propellant strap-on motors with 55,000 lb. thrust each, increasing total first-stage thrust to 330,000 lb. Long-Tank-Thor, now operational, combines all TAT features with new propellant tankage, providing substantial increase in payload capacity. USAF also procures Thors for NASA for use as first stage of Delta and Thrust-Augmented-Delta (TAD) boosters. Thor has launched scores of unmanned space vehicles, including Discoverer and classified military satellites, Telstar, Syncom, Transit, Tiro, and Nimbus. **Prime contractor:** McDonnell Douglas Corp. **Launch weight:** 120,000 lb. or more. **Dimensions:** length 76 to 90 ft., diameter 8 ft. **Thrust:** basic Thor, 160,000 lb.; TAT, 330,000 lb.; Long-Tank-Thor, 357,000 lb. **Payload:** 800 lb. for Thor-Delta to 2,600 lb. for Long-Tank-Thor in earth orbit; 250 lb. or more to escape velocity. **Other contractors:** propulsion, Rocketdyne (basic

Thor), Thiokol (strap-on motors); guidance, Bell Telephone Labs, Honeywell. **Primary using commands:** AFSC, NASA.

NASA/DoD Scout

Four-stage solid-propellant launch vehicle used by NASA, agencies of the Department of Defense, and a number of foreign nations for orbital, high-altitude probes and high-speed reentry space projects. Recent solid-motor improvements, including fourth-stage motor by United Technology Center and second-stage motor by Thiokol, have upgraded performance considerably. Vehicle now can place 320-pound payload in nominal 300-nautical-mile orbit compared to 131-pound payload originally. Scout has launched dozens of unmanned spacecraft, including Explorers and classified military satellites, space probes, and reentry vehicles. **Prime contractor and systems manager:** Missiles and Space Div., LTV Aerospace Corp. **Dimensions:** length 72 ft., maximum diameter 3 ft. 4 in. **Weight:** 40,000 lb. **Guidance:** inertial. **Booster/thrust:** first stage, Algol IIB, 105,000 lb.; second, Castor II, 60,000 lb.; third, Antares II, 22,000 lb.; fourth, FW-4S, 6,000 lb.; all solid propellant; alternate stages may be substituted. **Other contractors:** propulsion, Aerojet-General, Thiokol, Allegany Ballistic Laboratory, Hercules, United Technology Center; guidance, Honeywell. **Primary using commands:** AFSC, NASA.

Burner II

Upper-stage booster, adaptable to any standard USAF launch vehicle, bridging payload gap between Scout booster and more expensive Agena and Ablestar upper stages. Burner II may become fourth stage of Minuteman I if that former ICBM enters on new career as spacecraft booster. It has been operational since March of this year. **Prime contractor:** Boeing Co. **Other contractors:** propulsion, Thiokol; guidance, Honeywell. **Primary using command:** AFSC.

The Missiles

CGM-13B Mace

Tactical, air-breathing, surface-to-surface missile launched from fixed, hardened sites. One Mace B squadron remaining in Germany is being phased out in favor of Army's Pershing missile; remaining Mace Bs deployed in Okinawa are tentatively scheduled to remain through 1972. **Prime contractor:** Martin Marietta Corp. **Speed:** 600 mph plus. **Range:** 1,200 mi. **Dimensions:** length 44 ft., span 22 ft. 9 in., diameter 4.5 ft. **Launch weight:** 18,000 lb. **Power system:** J33 turbojet



Minuteman

with 5,200 lb. thrust, plus rocket booster of 100,000 lb. thrust for zero launch. **Guidance:** inertial. **Warhead:** conventional or nuclear. **Other contractors:** engine, Allison; booster, Thiokol; guidance system, AC Spark Plug Div., GMC, General Mills. **Primary using commands:** USAF, PACAF.

LGM-25C, Titan II

Two-stage, liquid-propellant ICBM. Man-rated Titan II was launch vehicle for NASA-DoD Gemini program and with modifications serves as core for Titan III; employs storable propellants and is silo-launched in less than a minute; has thrust, range, and payload greater than any other US ICBM. Pairs of Titan II squadrons, 9 missiles per squadron, are based at McConnell AFB, Kan.; Davis-Monthan AFB, Ariz.; and Little Rock AFB, Ark. Fifty-four-missile force to be retained at least through FY 1971. Procurement ended, but production capability is on standby basis. **Prime contractor:** Martin Marietta Corp. **Speed:** over 15,000 mph. **Range:** over 9,000 mi. **Dimensions:** length 103 ft., diameter 10 ft. **Launch weight:** 330,000 lb. **Power system:** liquid propelled, first-stage thrust 430,000 lb., second stage 100,000 lb. **Guidance:** all-inertial. **Warhead:** nuclear. **Other contractors:** technical direction, TRW Systems, Inc.; propulsion system, Aerojet-General; guidance, AC Electronics Div., GMC; reentry vehicle, General Electric. **Primary using commands:** SAC; Titan II in booster role, NASA, AFSC.

LGM-30A, B, F, G, Minuteman

Solid-propellant ICBM; principal USAF deterrent missile weapon. *(Continued on following page)*



AIM-4D, AIM-47A



Sparrows

gram includes 6 Minuteman wings with total of 1,000 missiles. Force modernization program, with replacement of early LGM-30As by -30Fs, began even before emplacement of final 50 missiles at Malmstrom AFB, Mont., last April. Studies now in progress to develop engineering and support requirements to convert replaced Minuteman Is into spacecraft boosters. LGM-30G, Minuteman III, is as far advanced over Minuteman I as B-52 is over B-17, according to Defense Secretary Robert McNamara. Missile alone isn't as important as payload it carries, in which advances of strategic significance are being made to give it "very good chance" of penetrating an ABM defense system. Wing I, Malmstrom AFB, Mont., has 150 Minuteman-30As, as well as 50 Minuteman IIs. Wings II, III, at Ellsworth AFB, S. D., and Minot AFB, N. D., are equipped with 150 -30Bs each; Wing IV, Whiteman AFB, Mo., has 100 -30Bs, 50 -30Fs. Wing V, Warren AFB, Wyo., has 150 -30Bs, 50 -30Fs. Wing VI, Grand Forks, N. D., has 150 -30Fs. As additional -30Fs and Gs become available they will replace -30As and Bs; -30Gs are to be equipped with improved third stage which will further increase payload.

Systems integration contractor: Boeing Co. **Maximum speed:** over 15,000 mph. **Range:** 6,300 mi. in LGM-30B to 8,000 mi. or more in LGM-30F, G. **Dimensions:** length, -30B, 56 ft.; -30F, 58 ft. 9 in.; diameter 6 ft. 2 in. **Launch weight:** 70,000 lb. **Power system:** 3-stage solid-propellant rockets—first stage, 170,000 lb. thrust; second stage, 65,000 lb. (A & B models); third stage, 35,000 lb. (A & B mod-

els). **Guidance:** all-inertial. **Warhead:** nuclear. **Other contractors:** systems engineering and technical direction, TRW Systems, Inc.; propulsion, first stage, all models, Thiokol; second stage, all models, Aerojet-General; third stage, -30B, F, Hercules; -30G, Aerojet-General; guidance, North American Autonetics; reentry vehicle, Avco, General Electric; post-boost control system for reentry vehicle, Bell Aerosystems; F model ground electronics system, Sylvania. **Primary using command:** SAC.

Advanced ICBM

Funds were requested in FY 1968 DoD appropriation to permit initiation of contract definition for a new strategic missile system, if, in words of Secretary McNamara, "that proves to be desirable." Special study group has been assembled to examine technological feasibility of various proposed systems.

CIM-10B Bomarc B

Surface-to-air, winged area-defense missile. Total of 188 missiles based at 6 US sites (Duluth, Minn.; Kincheloe AFB, Mich.; Langley AFB, Va.; McGuire AFB, N. J.; Niagara Falls Municipal AP, N. Y.; and Otis AFB, Mass.) and 2 RCAF sites. Production is completed. **Prime contractor:** Boeing Co. **Cruise speed:** 2,000 mph. **Range:** 440 mi. **Ceiling:** 100,000 ft. **Dimensions:** length 45 ft., diameter 35 in., span 18 ft. 2 in. **Launch weight:** 16,000 lb. **Power systems:** solid-propellant booster, 50,000 lb. thrust; 2 ramjet cruise engines, 16,000 lb. thrust. **Guidance:** homing radar. **Warhead:** nuclear. **Other contractors:** booster, Thiokol; ramjet engines, Mar-



Bomarc

quardt; guidance, General Precision, Westinghouse, IBM; fuze, Bendix; erector-launcher, FMC Corp. **Primary using commands:** ADC, RCAF.

AIR-2A Genie

Air-to-air rocket operational on F-89J, F-101B, and F-106. May be employed on F-4C. **Prime contractor:** McDonnell Douglas Corp. **Speed:** Mach 3. **Range:** 6 mi. **Dimensions:** length 9 ft. 7 in., diameter 17 in., span 2 ft. **Launch weight:** 800 lb. **Power system:** solid-propellant rocket.

(Continued on page 221)

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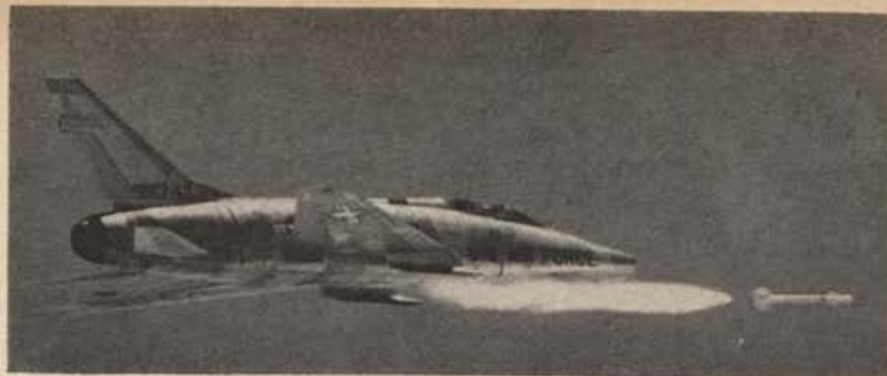
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AEROSPACE CONTROLS **ITT**



Sidewinder and F-100

36,000 lb. thrust. **Guidance:** none. **Warhead:** nuclear. **Other contractor:** propulsion, Aerojet-General. **Primary using commands:** ADC, ANG.

AIM-4A through G; AIM-26A, B; AIM-47A Falcon

Air-to-air guided missiles, of which 9 configurations are in use, production, or development. AIM-4Bs have all been converted to -4Ds. AIM-47A designated as primary weapon for F-12A or F-111 interceptors. All but AIM-47A are operational; -4C and -26B are produced for Swedish AF by SAAB. Falcons are carried on F-89J, F-101, F-102, F-106, F-4C, have been operational with ADC for a decade as antibomber defense; AIM-4D recently ordered by TAC for use in air-to-air combat. Launched from aircraft at 70,000 to 80,000 ft. and traveling at Mach 6, AIM-47A can strike targets from ground to about 95,000 ft. at range of 100 mi. or more; no size or weight details available. **Prime contractor:** Hughes Aircraft Co. **Speed:** AIM-4F, G, Mach 3; others, Mach 2. **Range:** -4F, G, 7 mi.; others 5 mi. **Dimensions:** length, -4F, 7 ft. 2 in.; -4C, 6 ft. 9 in.; -26A, 7 ft.; others 6 ft. 6 in.; diameter, -26A, 11 in.; others 6.5 in. **Launch weight:** -26A, 203 lb.; others from 120 to 150 lb. **Power system:** -4F, G, 2-stage solid-propellant; others single-stage solid. **Guidance:** -4C, D, G, infrared homing; others semiactive radar homing; -4D guidance system modified to make possible tighter turns for "dog-fighting" Falcon. **Warhead:** -26A, -47A, nuclear; others conventional. **Other contractors:** propulsion, -47A, Lockheed; all others, Thiokol; engine casings, Norris Thermador; fuze and arming, General Sintering, Philco; guidance, Hughes. **Primary using commands:** ADC, TAC.

AIM-7E Sparrow III

Air-to-air guided missile, providing 360-degree attack capability, employed on USAF F-4C as well as

F-4s in Navy and Marine Corps. Sparrows will be used on British F-4K and M; development work on advanced Sparrow, AIM-7F, to be completed this FY. **Prime contractor:** Raytheon Co. **Speed:** Mach 3. **Range:** over 8 mi. **Effective ceiling:** well above 50,000 ft. **Dimensions:** length 12 ft., diameter 8 in.; span 3 ft. 3 in. **Weight:** 450 lb. **Power system:** solid-propellant rocket. **Guidance:** semiactive homing radar. **Warhead:** conventional. **Other contractors:** propulsion, Rocketdyne, Aerojet-General; guidance, Raytheon. **Primary using commands:** TAC, PACAF.

AIM-9B, C, D Sidewinder

Air-to-air guided missile originally developed by US Naval Ordnance Test Station, used on USAF F-100, F-101, F-104, F-105, and F-4. Large-scale production for Navy and USAF continuing; -9B produced in Europe for NATO allies under license; surface-to-air version, Chaparral, being produced for US Army. **Prime contractor:** -9B, Philco, General Electric; -9C, Motorola; -9D, Philco, Raytheon; technical direction, Naval Ordnance Test Station. **Speed:** -9B, Mach 2.5; C, D, Mach 2.5 plus. **Range:** -9B, 2 mi.; C, D, 8 mi.; range increases with altitude. **Dimensions:** length 9 ft.,

diameter 5 in., span about 2 ft. **Weight:** -9B, 160 lb.; C, D, 185 lb. **Power system:** solid-propellant rocket. **Guidance:** -9B, D, infrared homing; C, semiactive radar. **Warhead:** 10 lb. high explosive. **Other contractors:** propulsion, -9B, Naval Propellant Plant; C, D, Rocketdyne; guidance, Philco, Raytheon, General Electric, Motorola; warhead, ACF Industries; motor parts, Norris Thermador; fuze, Eastman Kodak, Honeywell, Baldwin Piano. **Primary using commands:** TAC, ADC, overseas commands, US allies.

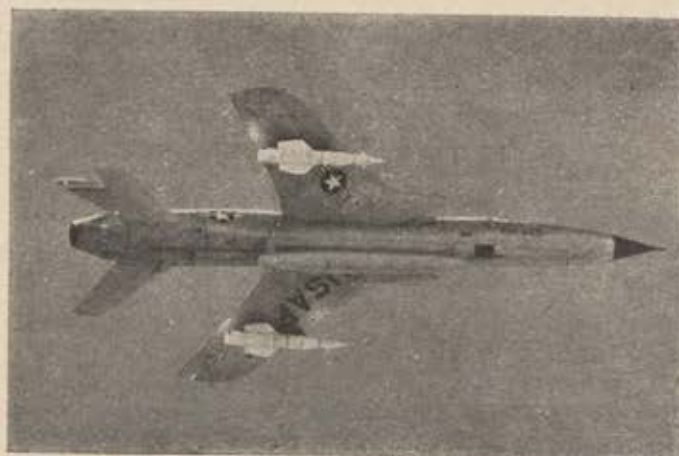
AGM-12B, C, D Bullpup

Air-to-surface guided missile developed by US Navy, carried on USAF F-100, F-4C, and F-105 tactical fighters. Very effective against hardened targets, although pilot is vulnerable to ground fire as he must fly along missile's path to guide it onto target. AGM-12B being produced in Europe for NATO air arms. **Prime contractors:** AGM-12B, C, Maxson Co.; -12D, Martin Marietta Corp., Orlando Div. **Speed:** -12B, 1,200 mph; C, D, 1,400 mph. **Range:** -12B, over 2 mi.; C, D, over 3 mi. **Dimensions:** length, -12B, 10 ft. 6 in.; C, 13 ft. 7 in.; diameter 1 ft. **Weight:** -12B 571 lb.; C, 1,785 lb. **Power system:** storable, liquid-propellant rocket. **Guidance:** command (radio signals from launch plane). **Warhead:** -12B, C, conventional; D, nuclear or conventional. **Other contractors:** powerplant, Thiokol; AGM-12B, C initially produced by Martin Marietta, Orlando Div., which is developing high-fragmentation air-burst version of -12B. **Primary using commands:** TAC, PACAF, USAF.

ADM-20C Quail

Air-launched, air-breathing missile carried aboard B-52 bombers and released over enemy territory. Because it produces the same radar image as B-52, it multiplies enemy defense problems. Each B-52 bomber can car-

(Continued on following page)



Bullpups on F-105

ry several Quail missiles; advanced version with longer range in development. **Prime contractor:** McDonnell Douglas Corp. **Speed:** comparable to B-52 bomber, high subsonic. **Range:** 250 mi. **Dimensions:** length 12 ft. 10 in., diameter 2 ft. 6 in., span 5 ft. 4 in. **Launch weight:** 1,200 lb. **Power system:** J85 turbojet engine with 2,450 lb. thrust. **Guidance:** gyro autopilot. **Warhead:** none; carries ECM to confuse enemy radar. **Other contractors:** powerplant, General Electric; guidance, McDonnell Douglas; countermeasures gear, TRW Systems, Inc.; aircraft modification, Boeing. **Primary using command:** SAC.

AGM-28B Hound Dog

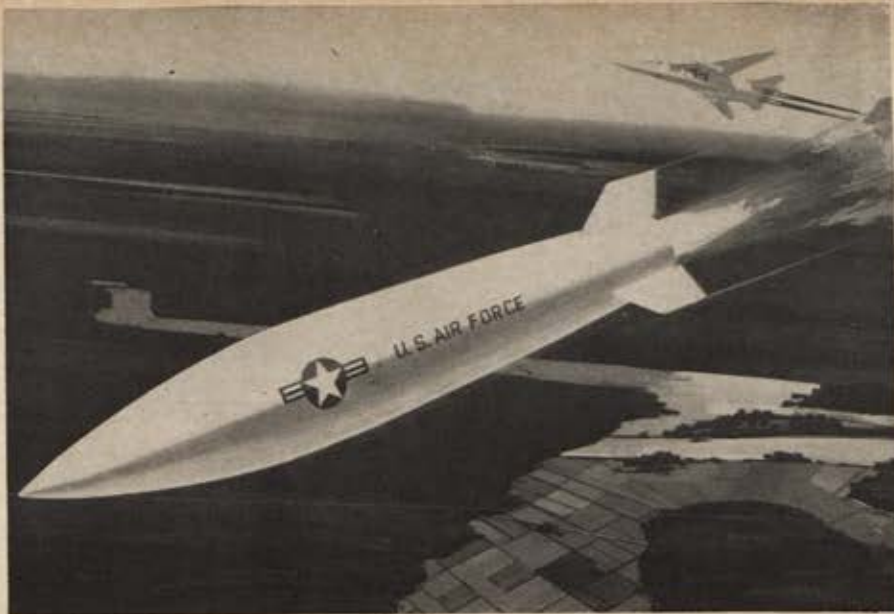
Air-to-surface, air-breathing SAC standoff missile with canard airplane configuration. Can be launched and flown at low altitudes. Will continue in operational status at least until 1970; in 1971, with phase out of B-52C to F, Hound Dog force will be phased down accordingly. New terminal guidance terrain-following navigation system being added to improve reliability. **Prime contractor:** North American Aviation. **Speed:** Mach 2 plus. **Ceiling:** above 50,000 ft. **Range:** 700 mi. **Dimensions:** length 42 ft. 6 in., diameter 28 in., span 12 ft. **Launch weight:** 9,600 lb. **Power system:** J52-P-3 turbojet, 7,500 lb. thrust. **Guidance:** inertial. **Warhead:** nuclear. **Other contractors:** propulsion, Pratt & Whitney; guidance, North American Autonetics; astrotracker, Kollsman Instrument. **Primary using command:** SAC.

AGM-45A Shrike

Air-to-surface, antiradiation Navy-developed missile designed to home on electromagnetic signals from enemy radar installations. Operational on USAF and Navy planes attacking targets in North Vietnam. Guidance mechanism can be thrown off if ground transmitter shuts off or operates intermittently. Improvements are being sought to broaden memory span, widen frequency sweep. **Systems manager:** Naval Ordnance Test Station; Texas Instruments is prime contractor for guidance-and-control system. **Dimensions:** length 10 ft., diameter 8 in. **Launch weight:** 390 lb. **Range:** 10 mi. **Power system:** solid-propellant (Rocketdyne). **Guidance:** electromagnetic. **Warhead:** high explosive. **Primary using command:** TAC.

Standard ARM

Advanced radiation missile for use with A-6A, F-4D, and F-105F aircraft. Standard ARM Mod 0 has gone into production. Advanced ARM tech-



SRAM (artist's conception)

nology has been initiated looking beyond ARM 1.

AGM-62A Walleye

Air-to-surface, television-guided weapon with movable fins, in production for USAF and Navy. **Prime contractor:** Martin Marietta Corp., Orlando Div.; technical direction, Naval Ordnance Test Station. **Range:** 6 mi. **Weight:** 1,100 lb. **Power system:** none (gravity glide bomb). **Guidance:** after pilot visually acquires target, he locks TV guidance system on target, releases weapon, and takes whatever evasive action is necessary. Weapon guides itself to target without further signals or commands from pilot or aircraft. **Warhead:** high explosive. **Other contractors:** vidicon tube, RCA; ram air turbine, Hamilton-Standard Div., United Aircraft; servo controls, Weston Hydraulics Ltd., Borg-Warner Corp.; gyros, R. C. Allen Business Machine Co., Courter Products Div. of Memcor, Inc., National Waterlift; castings, ALCOA, Skagit, and Willard Bronze; guidance lens and window, Argus, Bell & Howell; inner shell assembly, Intercontinental Manufacturing Co.; gyro motors and signal generators, American Electronics, Inc. **Primary using commands:** TAC, PACAF.

XAGM-64A Hornet

Air-to-ground radar-guided missile. Although it is not programmed for operational use, the Hornet, in feasibility demonstration program, is being tested at Eglin AFB, Fla., fired from F-100 at fixed and moving targets. It may lead to use of similar guidance systems in short- and medium-range,

air-to-ground weapons. **Prime contractor:** North American Aviation, Columbus Div. **Guidance:** monitoring cockpit display relayed from missile's seeker head, pilot locates target and locks missile on it. **Warhead:** conventional. **Other contractor:** guidance, Texas Instruments.

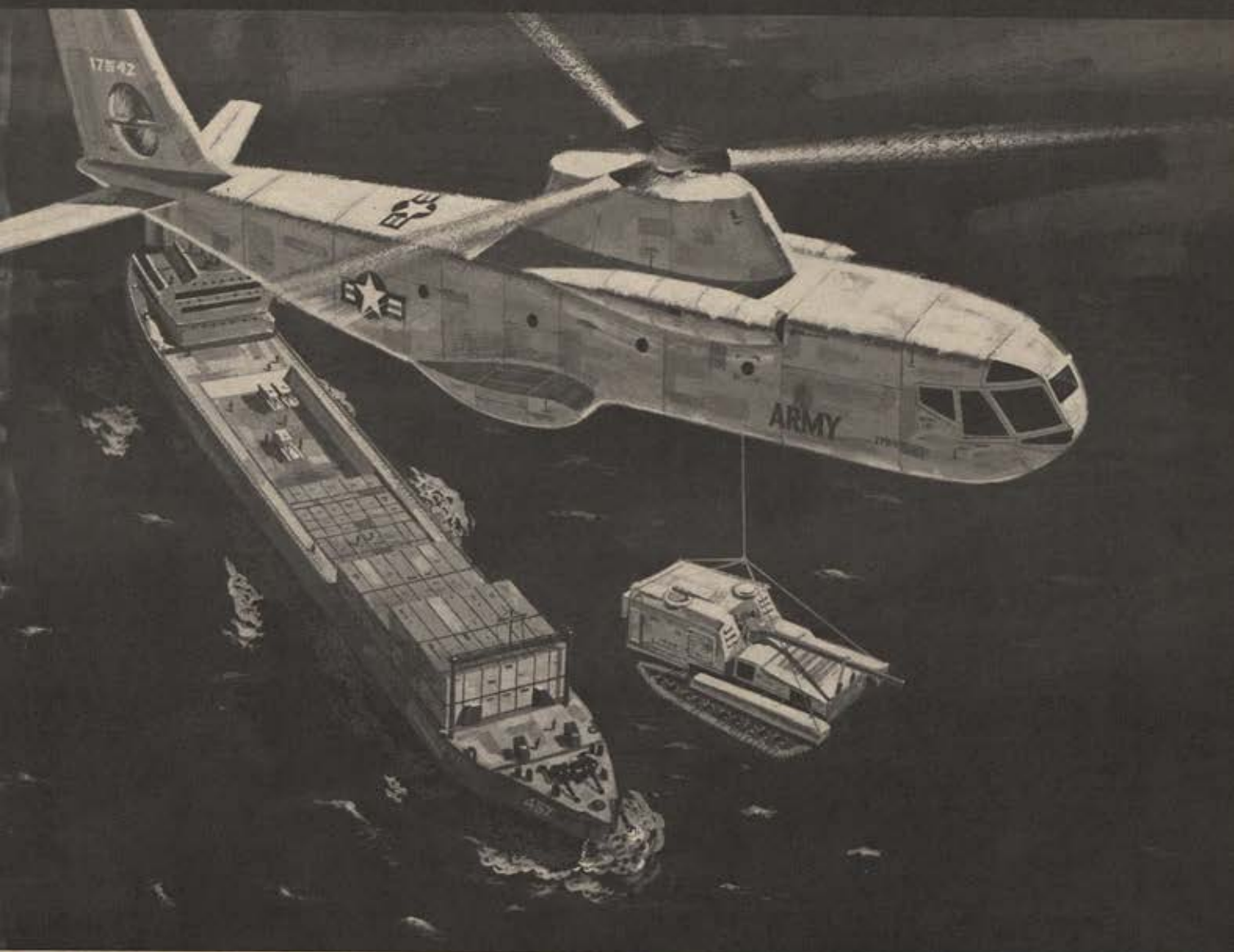
XAGM-65A Maverick

Tactical air-to-ground powered missile, TV-guided, intended for use on A-7D, F-4D, and F-111A, in contract definition phase at North American Aviation, Columbus Div. **Warhead:** conventional. No other details available.

AGM-69A SRAM

Short-range, supersonic, air-to-ground attack missile with nuclear capability, designed to be carried by the new FB-111 and adaptable for use on G and H models of B-52. Tests on SRAM are beginning this fall at Holloman AFB, N. M. Test phase is expected to be completed in 1969. **Prime contractor:** Boeing Co. DoD contract totals \$142.3 million; Air Force has firm option with Boeing, to be exercised within 2 years from contract award, for an initial production quantity of SRAM missiles for \$93.5 million. Boeing is responsible for total SRAM system performance, including mating system to carrier aircraft. **Other contractors:** propulsion, Lockheed; guidance, General Precision; B-52 inertial measurement unit, Litton; FB-111 and B-52 computers, North American Autonetics; B-52 radiating-site target acquisition system, Sylvania Electronics; missile safe-arm fuze, Unidynamics Phoenix.

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The Bombers and Reconnaissance Planes

EB-, RB-, WB-47 Stratojet

Electronic, photo, and weather reconnaissance aircraft; all B-47 bombers have been retired. **Contractor:** Boeing Co. **Powerplant:** 6 General Electric J47 turbojets, 6,000 lb. thrust each (7,200 lb. wet). **Dimensions:** span 116 ft., length 107 ft., height 28 ft. **Speed:** over 630 mph. **Ceiling:** above 40,000 ft. **Range:** beyond 3,000 mi. **Crew:** 6 in EB-, RB-47; 4 in WB-47. **Maximum gross takeoff weight:** 230,000 lb. **Primary using commands:** PACAF, SAC, MAC.

B-52 Stratofortress

Strategic heavy bomber, mainstay of USAF manned-bomber deterrent strength; employed extensively in Southeast Asia to hit Viet Cong troop concentrations and logistic centers, operating from bases on Guam and in Thailand. First prototype flew April 1952; total of 744 built when production ended in October 1962. B-52As and Bs have been scrapped; C through F series are scheduled for retirement by 1970; G and H models will remain operational into mid-1970s, supplemented by FB-111s. **Contractor:** Boeing Co. **Powerplant:** C through E models, 8 Pratt & Whitney J57-19W

turbojets; F, G models, 8 P&W J57-43s, both with 13,750 lb. thrust; H model, 8 P&W TF33-3s, 17,000 lb. thrust. G and H models equipped to carry two Hound Dog missiles each, whose engines of 7,500 lb. thrust can be employed for additional takeoff power. **Dimensions:** span 185 ft., length 156 ft., height, C-F models, 48 ft., G-H, 40 ft. 8 in. **Speed:** over 650 mph. **Ceiling:** above 50,000 ft. **Range:** C-F, beyond 6,000 mi.; G, beyond 7,500 mi.; H, beyond 9,000 mi. **Bomb load/armament:** up to 60,000 lb.; 4 .50-caliber machine guns in tail; 2 AGM-28 Hound Dog missiles under wings in G and H models. **Crew:** 6. **Maximum gross takeoff weight:** ranges from 450,000 lb. in C model to 488,000 lb. in H. **Primary using command:** SAC.

B-57B, RB-57D, F Canberra

Light bomber, once retired from operational inventory, but now on new combat career in Southeast Asia. Redesignation to A-57 under consideration, but bomber, or attack, version is scheduled to be phased out of USAF inventory by June 30, 1968. RB-57B reconnaissance models will remain in Air National Guard. Two

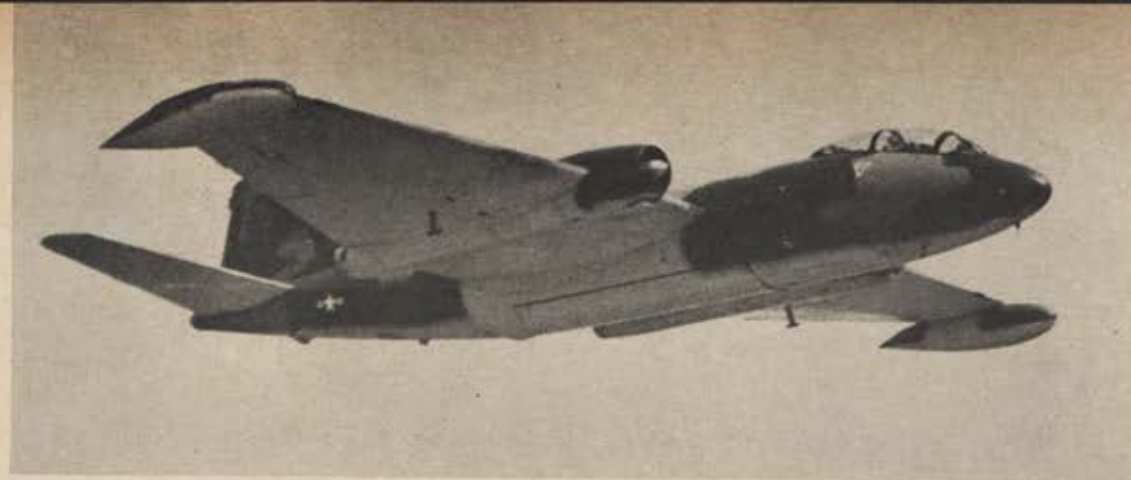
reconnaissance versions remaining with USAF are RB-57F, extensively reworked from earlier types, featuring much greater wingspan and high-thrust turbofan engines for high-altitude, long-range missions; and RB-57D, initially built for long-range electronic recce, extensively modified by Martin. **Contractor:** Martin Marietta Corp., US licensee for British Electric Canberra; RB-57F modifications by General Dynamics/Ft. Worth. **Powerplant:** B-57B, 2 Wright J65 engines, 7,200 lb. thrust; RB-57D, 2 Pratt & Whitney J57s, 10,000 lb. thrust; RB-57F, 2 Pratt & Whitney TF33-11 turbofans, 18,000 lb. thrust, supplemented by 2 Pratt & Whitney J60-9 turbojets, 3,300 lb. thrust each. **Dimensions:** B, span 64 ft., length 65 ft. 6 in., height 16 ft.; D, span 106 ft., length 67 ft. 10 in., height 17 ft. 6 in.; F, span 122 ft., length 69 ft., height 19 ft. **Speed:** 600 mph. **Ceiling:** B, over 45,000 ft.; D, F, 100,000 ft. **Range:** B, 2,000 mi.; D, F, 4,000 mi. **Payload:** B, 8 wing-mounted .50-caliber machine guns or 4 HVAR rockets; up to 8,000-lb. weapons payload in bomb bay and on wing pylons; D, F carry cameras, electronic sensing gear, weather sampling equipment. **Crew:** 2. **Maximum**



WB-47 Stratojet



B-52 Stratofortress



B-57B
Canberra

gross takeoff weight: more than 60,000 lb. Primary using commands: PACAF, SAC, ANG.

B-58A Hustler

World's fastest nuclear bomber, exceeding Mach 2 at 35,000 ft. One-third the size of a B-52, it carries nuclear weapons and part of fuel supply in pod under fuselage, flies home from mission "clean." Because it is not readily adaptable to carry conventional weapons, it has seen no service in Vietnam War. Two SAC wings fly B-58s—43d of Little Rock AFB, Ark., and 305th, Bunker Hill AFB, Ind.—each with 40 planes, plus spares. Force is slated for phaseout by 1970,

but decision is subject to later review. B-58 of 305th Wing set international supersonic distance record for 8,000-mi. nonstop flight Oct. 16, 1963, from Tokyo to London in 8 hr. 35 min., averaging 938 mph, with five refuelings en route. **Contractor:** General Dynamics/Ft. Worth. **Powerplant:** 4 General Electric J79-5 turbojets, 15,600 lb. thrust with afterburner. **Dimensions:** span 56 ft. 10 in., length 96 ft. 9 in., height 29 ft. 11 in. **Speed:** 1,380 mph at 35,000 ft. **Ceiling:** over 60,000 ft. **Range:** intercontinental, with midair refueling. **Bomb load/armament:** nuclear weapon in disposable pod; 1 General Electric T-171E3 20-mm Vulcan cannon in tail. **Crew:**

3—pilot, bombardier-navigator, defensive-systems operator. **Maximum gross takeoff weight:** over 160,000 lb. **Primary using command:** SAC.

EB-66 Destroyer

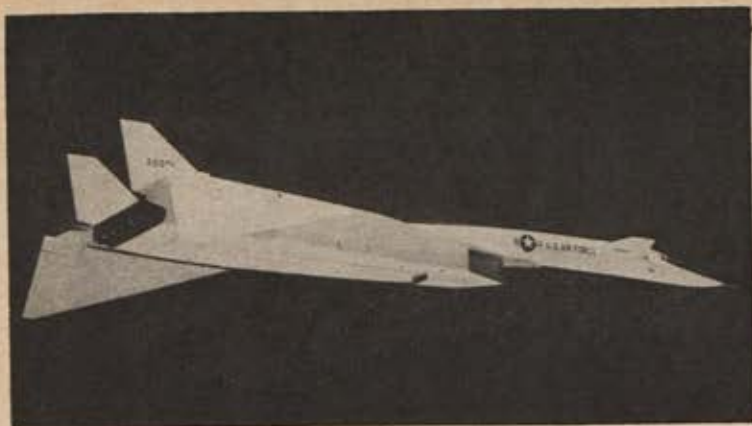
USAF version of Navy A-3D. Bomber version long since retired, but Destroyer has been employed more recently in RB-66 reconnaissance configuration. Most of these are now being converted to electronic scouting and countermeasures aircraft. Last B-66 was produced by Douglas in 1958, but USAF now plans to keep EB-66s in Tactical Electronic Warfare Support (TEWS) force until mid-1970s, and is spending \$48.3 million this fiscal year in modifying more Destroyers to EB-66 configuration which are being withdrawn from reconnaissance units and storage. RB-66 photo craft are being replaced by RF-4C Phantom IIs. **Contractor:** McDonnell Douglas Corp. **Powerplant:** 2 Allison J71-13 turbojets, 10,200 lb. thrust. **Dimensions:** span, 72 ft. 6 in., length 75 ft. 2 in., height 23 ft. 7 in. **Speed:** 700 mph. **Ceiling:** over 45,000 ft. **Range:** over 1,500 mi. **Armament:** 2 20-mm cannon in tail; wide range of electronic gear to detect and track enemy missiles and radar-guided guns, to jam enemy radar, and to guide and control friendly fighter-bombers, particularly in bad weather. **Crew:** 6. **Maximum gross takeoff weight:** 70,000 lb. or more. **Primary using commands:** PACAF, TAC.

XB-70 Valkyrie

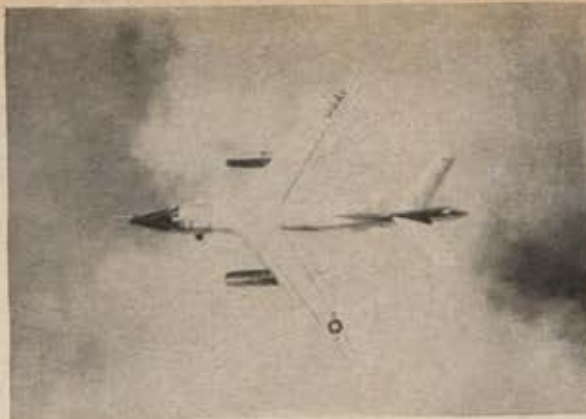
Mach 3 intercontinental bomber, conceived in 1954 as follow-on to B-52. Only two prototypes were built, second of which was destroyed in midair collision with F-104 chase plane on June 8, 1966, costing lives of NASA Chief Test Pilot Joe Walker in F-104 and Maj. Carl Cross in XB-70. USAF has assigned remaining XB-70 to NASA, but is assisting in research (Continued on following page)



B-58 Hustler



XB-70 Valkyrie



EB-66 Destroyer

flights to gather data for the national supersonic transport program. **Contractor:** North American Aviation. **Powerplant:** 6 General Electric YJ93-3 turbojets, 30,000 lb. thrust each with afterburner. **Dimensions:** span 105 ft., length 185 ft. **Speed:** more than 2,000 mph. **Ceiling:** 70,000 ft. **Range:** 6,000 mi. **Payload:** originally designed to carry more than 20,000-lb. bomb load. **Crew:** 2 in flight test; cockpit can accommodate 4. **Maximum gross takeoff weight:** 550,000 lb. **Primary using commands:** AFSC, NASA.

SR-71

Mach 3, long-range, advanced strategic reconnaissance aircraft, capable of both preattack and postattack recon missions. Flying at 2,000 mph at 80,000 feet, it can survey 60,000 square miles of land or ocean per hour. Development was initiated in February 1963. Less than two years later, in December 1964, SR-71 made first flight at Palmdale, Calif. Total production run estimated at 16 to 18 aircraft, of which three have been destroyed in accidents. Like the YF-12A interceptor, SR-71 grew out of Lockheed's secret A-11 development program; it is heavier than YF-12A, primarily to accommodate increased fuel, which gives it longer range than its interceptor twin. **Contractor:** Lockheed Aircraft Corp. **Powerplant:** 2 Pratt & Whitney J58 engines with afterburners, estimated thrust 35,000 lb. each. **Dimensions:** span 55 ft., length 107 ft., height 18 ft. 6 in. **Speed:** above 2,000 mph. **Ceiling:** 80,000 ft. **Range:** more than 2,000 mi. **Payload:** can be equipped with various reconnaissance systems, ranging from simple battlefield surveillance to multiple-sensor, high-performance systems for interdiction reconnaissance, and to strategic systems for specialized surveillance over wide areas of the world. **Crew:** 2, pilot and reconnaissance systems officer. **Maximum gross takeoff weight:** estimated at 140,000 lb. or more. **Primary using command:** SAC.

FB-111A
Strategic bomber version of variable-sweep-wing F-111 fighter-bomber, matching fuselage of Air Force F-111A with wing of Navy F-111B; intended to replace B-52s C through F in Strategic Air Command. Developmental model FB-111A attained Mach 2.0 on first flight, July 30, 1967. SAC is programmed to receive 210 FB-111s beginning in 1968. **Contractor:** General Dynamics/Ft. Worth. **Powerplant:** 2 Pratt & Whitney TF30 afterburning fanjet engines, each with thrust in 20,000-lb. class. **Dimensions:**

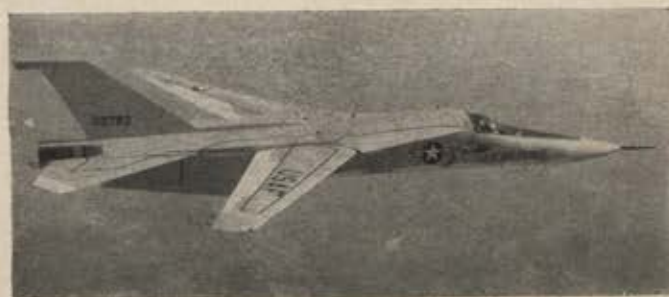
length 73.5 ft.; wingspan, extended 70 ft., fully swept 33 ft. 11 in.; height 17 ft. **Speed:** Mach 2.2. **Ceiling:** above 60,000 ft. **Range:** combat, 2,500 mi.; ferry, 4,100 mi. **Payload:** will carry nuclear or wing-mounted conventional weapons, latter totaling 30,000 lb. or more. Wings cannot be swept when aircraft is carrying maximum payload. **Crew:** 2, seated side by side. **Maximum gross takeoff weight:** 110,000 lb. **Primary using command:** SAC.

AMSA

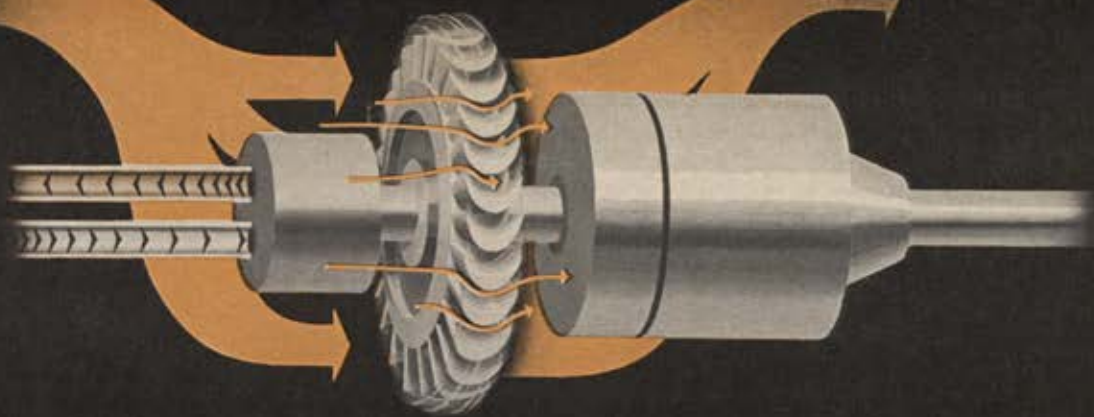
Advanced Manned Strategic Aircraft, being sought by USAF as replacement for B-52 in mid-1970s. Not yet approved for contract-definition studies, although work is proceeding on development of engines and avionics. Employing variable-sweep wings, AMSA is expected to have top speed of Mach 2.5, with unrefueled range of from 7,000 to 10,000 miles, approximately that of the subsonic B-52. Weight estimates range from 350,000 to more than 500,000 pounds. It would carry conventional or nuclear weapons. Defense Secretary McNamara estimates it would cost \$2 billion to bring AMSA to production stage. A force of 200 AMSA bombers, he says, would cost \$6 to \$8 billion more from production through their operational life.



SR-71



FB-111



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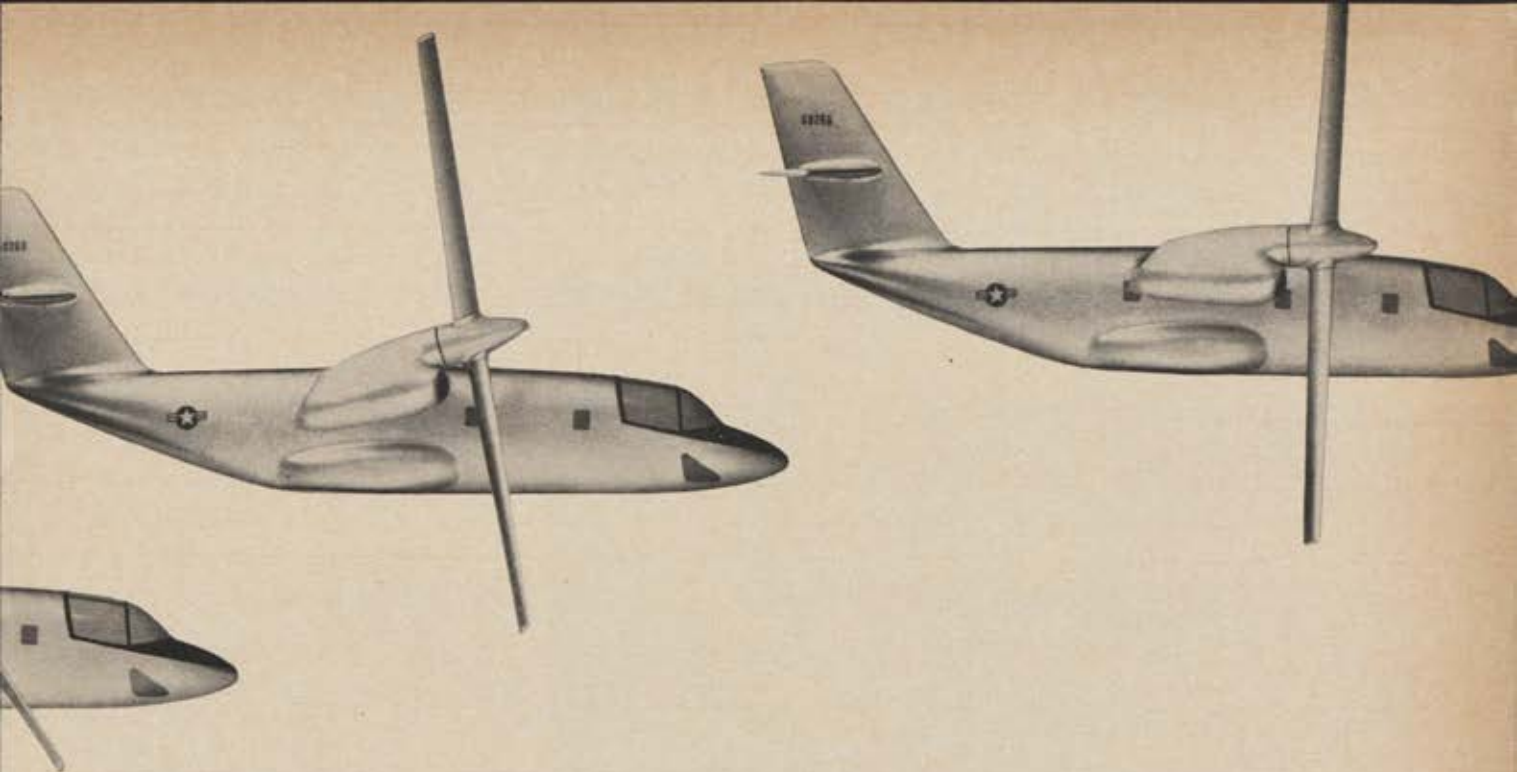
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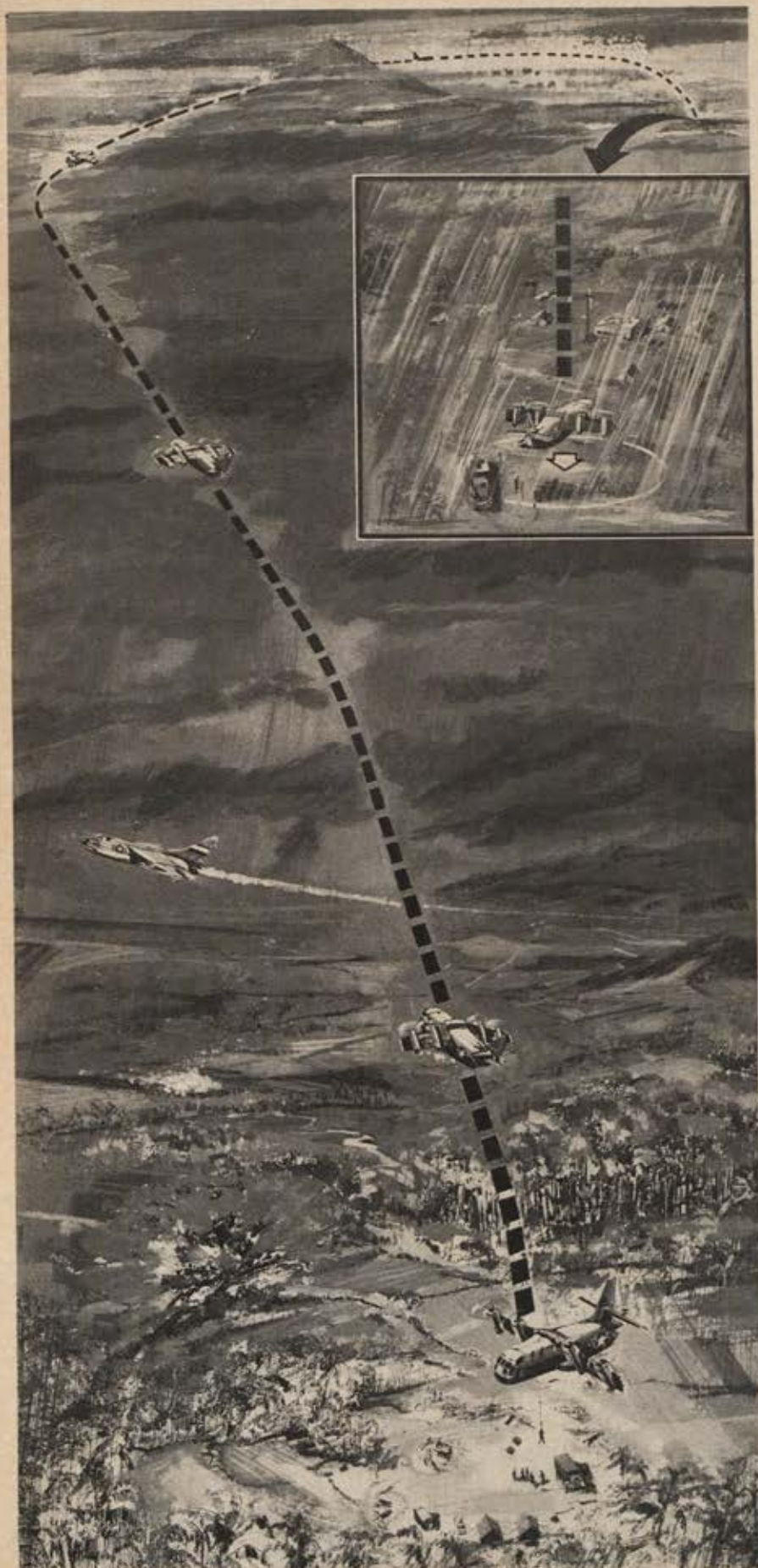
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The Attack Planes

A-1E Skyraider

Close-support aircraft, acquired by USAF for Vietnam combat primarily to replace T-28 and B-26 planes withdrawn because of structural deficiencies. Employed also by Air Commando Wing. USAF inventory is fast declining; those remaining in Southeast Asia now serve mainly to escort rescue helicopters on missions in Laos and North Vietnam. Can be flown by one- or two-man crew, latter seated side by side. A-1H single-seat version is employed by South Vietnamese AF. **Contractor:** McDonnell Douglas Corp. **Powerplant:** Wright R3350-26WA engine, 2,700 hp. **Dimensions:** span 50 ft. 9 in., length 39 ft., height 15 ft. 8 in. **Speed:** 365 mph maximum. **Ceiling:** about 25,000 ft. **Range:** beyond 2,700 mi. **Bomb load:** 8,000 lb. on wing bomb racks. **Armament:** 4 20-mm cannon; capable of handling nuclear weapons. **Crew:** 2. **Maximum gross takeoff weight:** 25,000 lb. **Primary using commands:** PACAF, TAC.

A-7D Corsair II

Air Force version of US Navy's new subsonic long-range attack plane, programmed to equip seven TAC wings, with initial deliveries in 1969. Capable of carrying its own weight in payload, A-7D promises excellent close-support capabilities in permissive air environment. It will be equipped with avionics enabling it to fly "nap of the earth" to avoid radar detection. Designed for rough combat environment, it will carry armor plate to protect pilot, engine, and fuel lines from ground fire. As in Navy version, wings will fold to permit parking in tight revetments. **Contractor:** Ling-Temco-Vought, Inc. **Powerplant:** Rolls-Royce Spey TF41, with 14,250 lb. thrust, produced in US by Allison Div., GMC. (Navy A-7A employs Pratt & Whitney TF30-6, 11,000 lb. thrust). **Dimensions:** span 39 ft. 9 in., length 46 ft. 2 in., height 16 ft. 2 in. **Speed:** more

than 650 mph. **Range:** combat radius 400 mi., plus 1 hour loiter time in target area, with 4-ton bomb load; ferry range 2,780 miles; in-flight refueling capability. **Payload:** 15,000 lb., carried on 6 wing stations, with 2 fuselage pylons for rockets or missiles; equipped also with M61 Vulcan 20-mm cannon with 6,000 rpm rate of fire. **Crew:** 1. **Maximum gross takeoff weight:** more than 40,000 lb. **Primary using command:** TAC.

A-26A Invader

Latest version of Douglas veteran light bomber of World War II and Korea, extensively modified by On Mark Engineering Co., Van Nuys, Calif. Original "attack" designation has been restored after plane was known for past twenty years as B-26. A-26As are being flown by USAF Air Commando crews in Thailand against Communist forces in Laos. Virtually all earlier versions of B-26 have been retired. **Contractor:** McDonnell Douglas Corp.; modifications by On Mark Engineering Co. **Powerplant:** 2 Pratt & Whitney R2800-52W engines, 2,500 hp each. **Dimensions:** span 71 ft. 6 in., length 50 ft., height 18 ft. 6 in. **Speed:** 305 mph cruise. **Ceiling:** 30,000 ft. **Range:** up to 800 mi. combat radius; ferry range with 675-gallon tank in bomb bay, 3,450 mi. **Bomb load/armament:** can carry up to 6 tons in bomb bay and on 8 wing pylons; 8 .50-caliber guns in nose. **Crew:** 3. **Maximum gross takeoff weight:** 43,000 lb. **Primary using command:** TAC.

A-37A, B

Close-support attack aircraft developed from T-37B Mentor jet trainer, undergoing 4-month combat test in Vietnam by 604th Air Commando Sq. USAF ordered 39 A-37As, modified from T-37B, plus 57 A-37Bs from new production. Main differences between A-37A and B are that the latter is equipped for in-flight refueling and

is stressed for 6 Gs, compared to 5 Gs for A-37A. Engines employed in A-37A/B produce more than twice as much thrust as in T-37, enabling gross takeoff weight to be doubled, thus accommodating pylons for bombs or fuel tanks, wingtip tanks, and nose gun. **Contractor:** Cessna Aircraft Co. **Powerplant:** 2 GE J85s of 2,400 lb. thrust each in A-37A/B, compared to 2 Continental J69-25 turbojets of 1,025 lb. thrust in T-37B. **Dimensions:** span 33 ft. 10 in., length 29 ft. 4 in., height 9 ft. 5 in. **Speed:** 350 mph. **Ceiling:** 35,000 ft. **Range:** over 650 mi. **Crew:** 1 or 2. **Maximum gross takeoff weight:** 12,000 lb. **Primary using command:** TAC.

A-X

Low-cost attack fighter envisioned as comparable to A-1E Skyraider in payload and loiter capability but with twice the A-1E's speed. Plane will "meet qualitative requirements for specialized close air support," according to USAF Chief of Staff Gen. John P. McConnell.

USAF's requirements include high degree of survivability against relatively unsophisticated ground fire, high subsonic top speed to respond quickly to requests for close air support, and long loiter time capability over the battlefield. Plane should also carry about a four-ton weapons payload and cost not more than \$1 million. Single-seater is preferred, although two-man crew hasn't been ruled out. Powerplant may be turbo-prop or fanjet. Takeoff weight is expected to be from 25,000 to 35,000 lb.

Some months ago, AF Secretary Harold Brown indicated that USAF is now seeking to develop a family of aircraft, each fitted for a particular role but with some overlap capability. A-X would fall somewhere between North American's OV-10A Bronco light armed reconnaissance aircraft and Ling-Temco-Vought's A-7D.

The Fighters

F-84F Thunderstreak

No longer in inventory of active Air Force, the F-84F and its reconnaissance counterpart, the RF-84F Thunderflash, are flown by many Air National Guard units in the east, south, and midwest, and by air forces of several NATO powers. **Contractor:** Republic Aviation Div., Fairchild Hiller. **Powerplant:** Wright Sapphire J65-7 single jet, 7,200 lb. thrust. **Dimensions:** span 33 ft. 6 in., length 43 ft. 4 in. (RF-84F, 47 ft. 6 in.), height 14 ft. 4 in. **Speed:** over 600 mph. **Ceiling:** above 45,000 ft. **Range:** beyond 2,000 mi. **Bomb load:** 6,000 lb. conventional or nuclear bombs, incendiary, or rockets. **Armament:** 6 .50-caliber machine guns. **Crew:** 1. **Maximum gross takeoff weight:** 26,000 lb. **Primary using command:** ANG.

F-86 Sabrejet

Famed conqueror of the MIG-15 in Korea, the Sabrejet is no longer flown by the active Air Force but is still used in the Air Guard, and various models built in US and elsewhere under license are being flown in several free world countries. Types range from F-86A, first flown in May 1948, to F-86L interceptor employing SAGE data-link equipment. **Contractor:** North American Aviation. Foreign licensees include Canadair, Fiat, Commonwealth (Australia), and Mitsubishi.

Powerplant: F-86A, General Electric J47-1, -2, -9, -13; D, L, GE J47-17, -33; E, GE J47-13; F, GE J47-27; H, GE J73-3E; K, GE J47-33. Canadian-built F-86s use Orenda turbojet, Australian models the Rolls-Royce Avon. Thrust varies from 5,200 lb. in earlier models to 9,300 lb. in H model. **Dimensions:** H model, span 37 ft. 1 in., length 38 ft. 9 in., height 14 ft. **Speed:** over 650 mph. **Ceiling:** above 45,000 ft. **Range:** beyond 1,000 mi. with external tanks. **Bomb load:** 2 1,000-lb. bombs or 16 5-in. rockets or combinations, plus 2 additional 1,000-lb. bombs in lieu of fuel tanks. **Armament:** 6 .50-caliber machine guns or 4 20-mm cannon in nose. F-86D carries 24 2.75-in. rockets. **Crew:** 1. **Maximum gross takeoff weight:** 18,000 lb. **Primary using commands:** ANG, NATO, and SEATO nations.

F-89J Scorpion

This air-to-air interceptor, first flown in August 1948, has all but disappeared from US inventory, making its last stand in Air National Guard units in Maine and Iowa. **Contractor:** Northrop Corp. **Powerplant:** 2 Allison J35-35 turbojets, 15,000 lb. thrust with afterburner. **Dimensions:** span 56 ft. 2 in., length 53 ft. 4 in., height 17 ft. 7 in. **Speed:** over 600 mph. **Ceiling:** above 45,000 ft. **Range:** beyond 1,000 mi. **Armament:** 104 2.75-

in. rockets, AIR-2 Genie rockets, or AIM-4 Falcon missiles. **Crew:** 2—pilot and radar observer. **Maximum gross takeoff weight:** more than 40,000 lb. **Primary using command:** ANG.

F-100 Supersabre

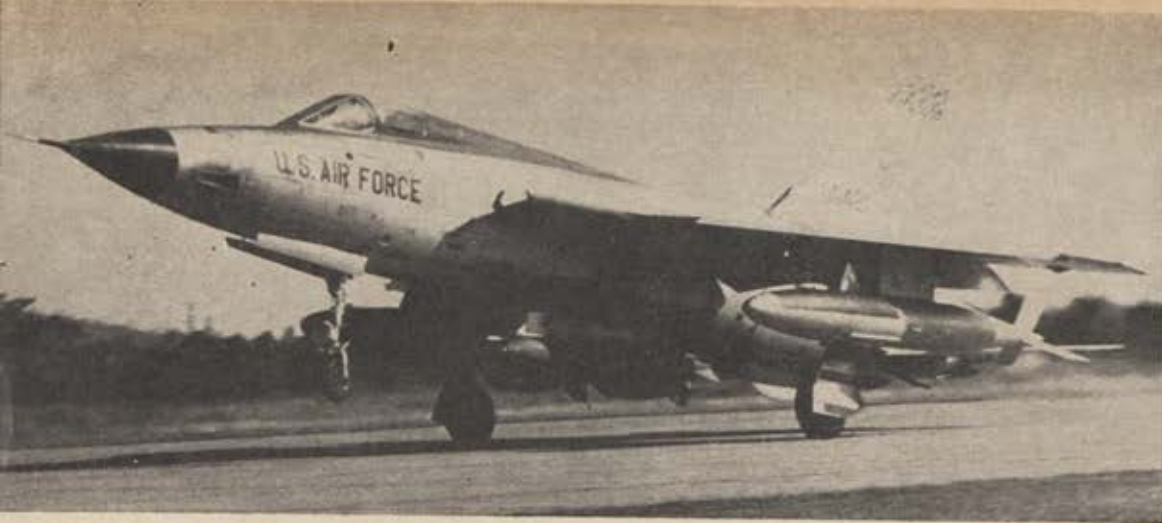
Principal USAF fighter in close-support operations in Vietnam. Nine F-100-equipped Air Guard fighter groups have been brought to full strength and combat readiness, available for immediate recall if needed. First USAF fighter to exceed the speed of sound in level flight. F-100F is 2-seat version for use mainly as a trainer. F-100 has been supplied to several NATO countries and to Nationalist China. Production completed in October 1959. **Contractor:** North American Aviation. **Powerplant:** F-100A, C, Pratt & Whitney J57-7; D, F, Pratt & Whitney J57-21, rated at 16,000 lb. thrust with afterburner. **Dimensions:** C model, span 38 ft., length 47 ft., height 16 ft. **Speed:** over 800 mph. **Ceiling:** over 50,000 ft. **Range:** beyond 1,600 mi. without refueling. **Bomb load:** can carry varied mixture of conventional or nuclear bombs, plus incendiary, rockets. **Armament:** 4 20-mm cannon, Sidewinder or Bullpup missiles. **Crew:** 1; 2 in F-100F. **Maximum gross takeoff weight:** 38,000 lb. **Primary using commands:** TAC, USAFE, PACAF, ANG, NATO,



A-37A



F-100 Supersabre



F-105
Thunderchief

and Chinese Nationalist Air Force.

F-101, RF-101 Voodoo

Employed in fighter, interceptor, and reconnaissance roles with top speed approaching Mach 2. F-101A and C are tactical fighters, 2-place F-101B is an interceptor. Reconnaissance models are RF-101A, C, extensively flown in Vietnam. At low level its 6 cameras take close-up photos at 1,000 mph; at high level it can photograph a 20,000-square-mile area in a single mission. RF-101s, being replaced by RF-4Cs in USAF, are reverting to ANG. **Contractor:** McDonnell Douglas Corp. **Powerplant:** A, C models, 2 Pratt & Whitney J57-13 turbojets; B, 2 Pratt & Whitney J57-55s; total thrust more than 30,000 lb. with afterburner. **Dimensions:** span 39 ft. 7 in., length A and C, 69 ft.; B, 71 ft. 11 in., height 18 ft. **Speed:** 1,200 mph. **Ceiling:** above 50,000 ft. **Range:** beyond 1,000 mi. without refueling. **Bomb load:** conventional or nuclear bombs carried on rotary bomb door. **Armament:** A, C, 4 20-mm cannon, plus 12 rockets and 3 Falcon missiles; B carries combination of Genie and Falcon missiles, plus cannon. **Crew:** A and C, 1; B, 2. **Maximum gross takeoff weight:** A, C, 49,000 lb.; B, over 50,000 lb. **Primary using commands:** TAC, ADC, USAF, PACAF, ANG, RCAF.

F-102 Delta Dagger

World's first supersonic all-weather jet interceptor, and first to incorporate area-rule (Coke-bottle) fuselage design. Electronic equipment and armament carried internally. Radar locks onto target and at right instant electronic fire-control system automatically prepares and fires its weapons. External fuel tanks now being added to all F-102s and TF-102s. Two-place TF-102A used mainly for transition training. Last F-102A completed April

1958 after about 1,000 of 2 production versions, F and TF, had been built. B model was redesignated and developed as F-106. Modification test in progress to evaluate converting some F-102s to reconnaissance role in Air National Guard, replacing RF-84Fs and RB-57s. **Contractor:** General Dynamics/Convair. **Powerplant:** Pratt & Whitney J57-23 turbojet, 17,000 lb. thrust with afterburner. **Dimensions:** span 38 ft., length 68 ft. 3 in., height 21 ft. 3 in. **Speed:** 850 mph. **Ceiling:** above 50,000 ft. **Range:** beyond 1,000 mi., augmented by external tanks and in-flight refueling. **Armament:** 6 AIM-4 Falcons, plus 24 2.75-in. folding-fin rockets. **Crew:** F-102A, 1; TF-102A, 2 side by side. **Maximum gross takeoff weight:** over 25,000 lb. **Primary using commands:** ADC, AAC, PACAF, ANG.

F-104 Starfighter

Employed by many free world air forces as air-to-air interceptor, close-support fighter, and nuclear fighter-bomber. USAF F-104 strength has been reduced to one squadron at Homestead AFB, Fla., plus another Starfighter squadron in Puerto Rico ANG, but well over a thousand F-104s are operational around the world. Models built include the A, an interceptor; a 2-place B; the C, for Tactical Air Command; D, 2-seater for TAC; F, US-built for West Germany; G, of which more than 900 are being built in Europe; TF-104G, 2-seater for Germany; J, being built in Japan; CF-104, produced by Canadair for Canada, Greece, and Turkey; CF-104D, 2-seater built for RCAF; and NF-104A, with auxiliary rocket engine, for training research pilots. F-104S Super Starfighter is now in production in Italy for Italian AF, and under consideration for West German Luftwaffe. **Contractor:** Lockheed Aircraft Corp. Licensees include Canadair, Mitsubishi,

and numerous consortiums in Europe, plus Fiat for F-104S. **Powerplant:** General Electric J79-3, -7 or -11, 15,800 lb. thrust with afterburner; F-104S employs J79/J1Q, 17,900 lb. thrust; NF-104A also employs North American LR-121 rocket engine, 6,000 lb. thrust. **Dimensions:** span 21 ft. 11 in., length 54 ft. 9 in., height 13 ft. 6 in. **Speed:** over 1,400 mph. **Ceiling:** above 55,000 ft., NF-104 has topped 100,000 ft. **Range:** beyond 1,000 mi. **Bomb load:** conventional and nuclear weapons. **Armament:** Sidewinders, Vulcan 20-mm cannon. **Crew:** F-104A and C, 1; F-104B and D, 2. **Maximum gross takeoff weight:** 27,000 lb. **Primary using commands:** ADC, ANG, NATO, RCAF, JASDF.

F-105D Thunderchief

All-weather Mach 2 tactical fighter capable of delivering 6 tons of firepower in support of ground forces. Mainstay of fighter-bomber operations against targets in North Vietnam. Of 833 F-105s built, less than 400 remain. More than 200 were lost in past year, many to enemy anti-aircraft fire. F-105B day fighter-bombers were withdrawn from USAF and assigned to ANG. In one test, F-105D delivered 7 tons of weapons—26 565-lb. bombs—heaviest load ever carried by a single-engine plane. Reconnaissance package can be fitted in bomb bay enabling F-105D to perform strike and reconnaissance duties on same mission. F-105F is 2-seat version. **Contractor:** Republic Aviation Div., Fairchild Hiller. **Powerplant:** 1 Pratt & Whitney J75-19W turbojet, 26,500 lb. thrust with afterburner. **Dimensions:** span 34 ft. 11 in., length 67 ft., height 19 ft. 8 in. **Speed:** Mach 2.25 at 38,000 ft., 1.1 on deck. **Ceiling:** 52,000 ft. **Range:** over 2,000 mi. without refueling. **Bomb load:** 8,000 lb. of nuclear or conventional weapons in

(Continued on following page)

bomb bay, plus 4,000 lb. of bombs, incendiaries, rockets, or Bullpup or Sidewinder missiles on wing pylons and under bomb bay. Armament: 1 General Electric 20-mm Vulcan cannon. Crew: 1; F-105F, 2. Maximum gross takeoff weight: 48,000 lb. Primary using commands: TAC, USAFE, PACAF, ANG.

F-106A Delta Dart

Follow-on to F-102 Delta Dagger, incorporates more powerful engine, redesigned tail, fuselage fuel tank, and improved electronics and armament. Under combat-intercept conditions the plane flies and fires automatically, employing highly sophisticated electronic-guidance and fire-control system developed by Hughes Aircraft Co. System, designated MA-1, operates plane soon after takeoff, flies it through climb and cruise to attack position, detects target, fires at optimum range, and immediately breaks off to seek other targets. Two-place combat-trainer version is designated F-106B. Like F-102, Delta Dart is now being fitted with in-flight refueling gear and external fuel tanks usable at supersonic speeds. Contractor: General Dynamics/Convair. Powerplant: A, Pratt & Whitney J75-9 turbojet; B, J75-17, 24,500 lb. thrust. Dimensions: span 38 ft. 3 in., length 70 ft. 8 in., height 20 ft. 3 in. Speed: over 1,400 mph. Ceiling: over 50,000 ft. Range: 1,500 mi. augmented by external tanks and in-flight refueling. Armament: 1 Genie nuclear rocket, plus several Super Falcon missiles in internal weapons bay. Crew: 1; F-106B, 2. Maximum gross takeoff weight: over 35,000 lb. Primary using command: ADC.

F-4C, D, E, RF-4C Phantom II

Extensively flown in Southeast Asia both in close-support missions and against targets in North Vietnam, USAF's Phantom IIs are champion MIG-killers of Vietnam War, employing Sidewinder and Sparrow missiles and 20-mm Gatling gun to destroy



F-4 Phantom being refueled

enemy MIG-17s and -21s. F-4Cs have performed effectively in combat, but will be turned over to combat training units in US as soon as they are replaced by F-4Ds and F-4Es. F-4D incorporates improvements to increase air-to-ground weapon delivery accuracy and new optical sight for air-to-air gunnery. F-4Ds have replaced F-105Ds in USAFE. F-4E features higher-thrust J79-17 engines, internally mounted 20-mm gun, and CORDS radar to detect and track low-flying targets. RF-4C reconnaissance aircraft, replacing RB-66s and RF-101s, retains performance and handling characteristics of F-4C fighter. TAC is programmed for 14 wings of Phantom IIs. F-4s are also flown in US Navy, for which design was originally developed, and Marine Corps. Britain is acquiring F-4K for Royal Navy and F-4M for RAF. Contractor: McDonnell Douglas Corp. Powerplant: F-4C, D, and RF-4C employ 2 General Electric J79-15s, generating 17,000 lb. thrust each with afterburner. J79-17s in F-4E produce 17,900 lb. thrust each. Dimensions: span 38 ft. 5 in., length 58 ft. 3 in., height 16 ft. 3 in.

Speed: Mach 2.5. Ceiling: above 66,000 ft.; has reached 98,000 ft. in 6 min. 11 sec. Range: more than 2,000 mi. without refueling; probe and drogue refueling system permits buddy refueling. Bomb load: more than 12,000 lb. Armament: Bullpup, Sidewinder, Sparrow III missiles, rockets, napalm; F-4C, D can be fitted with one or more 20-mm Gatling guns externally; F-4E carries one internally. Crew: 2, aircraft commander and pilot in fighters, pilot and navigator in RF-4C. Maximum gross takeoff weight: over 40,000 lb. Primary using commands: TAC, PACAF, USAFE.

F-5A Freedom Fighter

Following successful "Skoshi Tiger" combat test of F-5A in Vietnam by USAF's 10th Fighter Commando Sq., its planes were turned over on June 1, 1967, to Vietnamese AF. None are now operational in USAF, except in training foreign pilots at Williams AFB, Ariz., but F-5 is being produced for air forces of 15 allied nations, including Canada, and is under consideration by several others. F-5A is single-seater; F-5B accommodates 2-man crew for training or combat missions. It carries up to 6,200 lb. external stores—armament or fuel—and can take off or land from sod field. Freedom Fighter evolved from USAF T-38 Talon jet trainer. Contractor: Northrop Corp., Norair Div. Powerplant: 2 General Electric J85-13 turbojets, 4,080 lb. thrust with afterburner. Later version, including Canada's CF-5, will employ J85-15 engine with 4,300 lb. thrust. Dimensions: span 26 ft. 5 in., length 43 ft. 11 in., height 13 ft. Speed: 1,000 mph. Ceiling: over 55,000 ft. Range: combat, 400 mi.; ferry, 2,100 mi. with external tanks. Armament: 2 M39 20-mm cannon in nose. Can carry Side-



F-111A

winder missiles or 2,000-lb. bomb, or rockets in combination. Crew: F-5A, 1; F-5B, 2. Maximum gross takeoff weight: 19,000 lb. Primary using commands: US allies.

F-111A

Versatile fighter-bomber whose combination of variable-sweep wings and turbofan afterburning engines (both production aircraft firsts) make possible speeds of from under 100 knots to Mach 2.5 at altitude and supersonic low-level dash. In May 1967, Defense Department signed contract for 493 F-111s, including 331 F-111As for TAC, 64 FB-111s for SAC, 24 F-111Bs for Navy, 50 F-111Ks for RAF, and 24 F-111Cs for Royal Australian AF. Deliveries begin in September and extend through early 1970. Fixed price contract, including target 9 percent profit, was \$1,821,938,651. Recent major program milestones include unofficial range record for tactical fighter set during transatlantic flight to Paris Air Show using internal fuel only; conversion of TAC's 4520th Combat Crew Training Wing to F-111s and activation of the 4480th Tactical Fighter Wing this summer at Nellis AFB, Nev.; first flight of developmental model FB-111A in July; and first flight of RF-111A and delivery of first production F-111A scheduled for September. Combat test of F-111A against targets in North Vietnam is being planned for early 1968. Contractor: General Dynamics/Ft. Worth; Grumman principal subcontractor for F-111B. Powerplant: 2 Pratt & Whitney TF30 engines, each in 20,000 lb. thrust class. Dimensions: F-111A, wingspan 31 ft. 11 in. swept, 63 ft. fully extended, length 73 ft. 6 in., height 17 ft. Speed: Mach 2.5 at altitude, supersonic at low level. Ceiling: above 60,000 ft. Range: transoceanic unrefueled. Armament: virtually all conventional and nuclear weapons, including internally mounted M61 Gatling gun. Crew: 2, side by side. Maximum takeoff weight: over 70,000 lb. Primary using commands: TAC, SAC.

YF-12A

Advanced interceptor in development test stage; three planes built so far. Development began as secret Lockheed Aircraft Corp. project in 1959, designated A-11. Another outgrowth of A-11 design is SR-71 bomber. YF-12A claims 9 world records—absolute speed record of 2,062 mph; speed over closed-circuit courses with varying payloads; and horizontal flight at 80,000 ft. Employs ASC-18 pulse doppler fire-control system and AIM-47A long-range guided missile. Current interceptors require accurate



US/FRG
Tactical
Fighter

control from ground radars which direct them to proper altitude, speed, and heading for intercept. YF-12A's ASC-18/AIM-47 systems enable it to operate relatively independent of ground control. With its improved speed, range, and weaponry, it can complete several strikes with greater accuracy in less time than present interceptors. Contractor: Lockheed Aircraft Corp. Powerplant: 2 Pratt & Whitney J58 turbojet engines with afterburners, estimated at 30,000 lb. thrust. Dimensions: length 100 ft., span 50 ft., height 18 ft. Speed: more than 2,000 mph. Ceiling: above 70,000 ft. Range: 1,500 mi. or more. Armament: Hughes ASC-18 fire control, AIM-47 missile; carries 4 or more missiles. Crew: 2. Maximum gross takeoff weight: estimated at 140,000 lb. Primary using commands: AFSC, ADC.

US/FRG V/STOL Advanced Tactical Fighter

Now in systems definition phase as a joint development project of the US and the Federal Republic of Germany, the proposed fighter is a medium-weight aircraft capable of operating conventionally, from short airstrips, or vertically. The design incorporates variable-sweep wings plus a new concept of retractable, swing-out lift engines located just forward of the leading edge of the wings. Mounted on arms which swing out from the fuselage, the engines can be tilted to varying degrees from the horizontal to provide vertical lift or extremely short rolling takeoff capability with full loads. The two lift/cruise engines are mounted at the rear of the fuselage and will have deflected thrust for STOL or vertical operations. The combination of lift and deflected thrust propulsion gives a classic tripod stability throughout takeoff and landing. Detailed specifications and performance are classified, but the aircraft is reported to be comparable to the F-105. Systems defini-

tion will be completed in November, and a decision on building of prototypes is expected by spring 1968. Contractor: EWR Fairchild International, a joint venture company comprised of members of the US firm of Republic Aviation Div. of Fairchild Hiller and the German firm of EWR Sud. Powerplant: Lift/cruise engine competition between Pratt & Whitney Aircraft and General Electric; lift engines, joint development between Rolls-Royce Ltd. and Allison Div. of General Motors. Crew: 2.

F-X

Exploratory program to develop fighter as F-4 replacement in mid- to late-1970s. Defense Department is urging USAF to work with Navy in seeking common design for plane Navy has designated VFAX. There are some differences of opinion on characteristics desired. Air Force prefers "hot" air-to-air fighter with only minimum ground attack capability, since its A-X project is expected to meet latter requirement. Navy, however, perhaps visualizing VFAX as substitute for F-111B, says it wants plane capable of air-to-air and air-to-ground missions, with perhaps a "little stronger emphasis" on the interceptor role. Other differences are that Navy wants a swing-wing design, on which USAF is undecided. The Air Force prefers a single-seater; Navy wants a two-man crew. Weight is expected to be about that of the F-4—40,000 lb., or slightly below. Both agree the plane should have two engines, each in the 20,000-lb.-thrust class. Prospective manufacturers are now engaged in a second round of studies for the Air Force, intended to produce sufficient detailed data on which DoD can decide whether to enter the contract-definition phase. In view of existing climate in DoD, USAF and Navy may have to arrive at a substantial meeting of minds before next step in development is approved.

The Cargo Planes

C-5A Galaxy

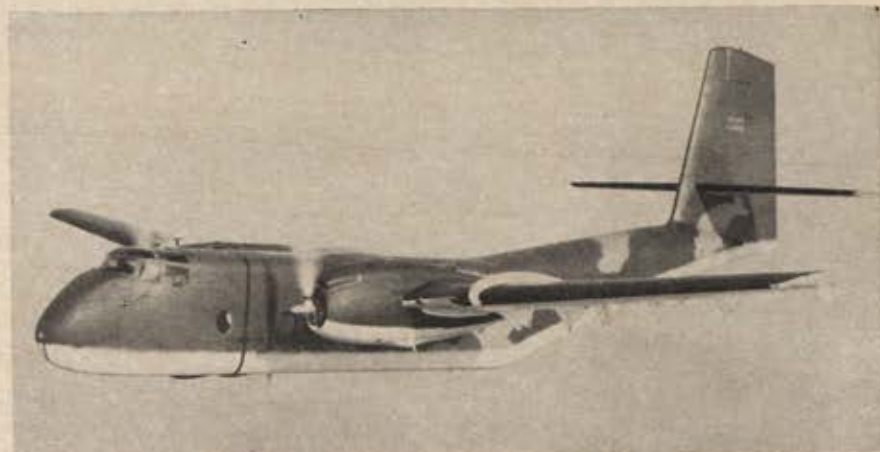
Heavy logistics transport scheduled to begin operational service with MAC in 1969. Rollout scheduled February 1968, first flight June '68. Will carry three times the payload of the C-141, and accommodate 98 percent of heavy bulky equipment required by ground forces for maximum combat effectiveness, compared to two-thirds of such equipment which can be carried in C-141. Upper-level compartment above cargo bay provides room for relief crew and 75 troops. High flotation landing gear allows it to operate from primitive airfields. Current contract calls for 58 planes, with firm option for 57 more. Eventual production run may exceed 300, including sales to other free world nations. Other missions discussed for C-5A include Project Medusa, which would make it launch platform for Poseidon missile; sub hunter; and airborne warning, control, and missile-firing interceptor. **Contractor:** Lockheed-Georgia Co. **Powerplant:** 4 GE 1/6 turboprops with 40,000 lb. thrust each. **Dimensions:** length 243 ft., span 222 ft. 8 in., height 63 ft. **Cruising speed:** 440 knots. **Range:** 6,325 mi. with 112,600-lb. payload. **Maximum payload:** 265,000 lb. over 3,100 mi. **Maximum gross takeoff weight:** 728,000 lb. **Primary using command:** MAC.

VC-6A

Light executive transport, military version of Beechcraft 90 King Air, of which 2 have been acquired for White House fleet. **Contractor:** Beech Aircraft Corp. **Powerplant:** 2 United Aircraft of Canada PT6A-6 turboprops of 500 shp each. **Dimensions:** length 35 ft. 6 in., span 45 ft. 11 in., height 14 ft. 8 in. **Speed:** 270 mph. **Range/payload:** carries up to 10 passengers with maximum range of 1,400 mi. **Crew:** 2. **Maximum gross takeoff weight:** 9,300 lb. **Primary using command:** MAC.

C-7A Caribou

Canadian-built STOL tactical transport, formerly designated CV-2B. Transferred from US Army to USAF January 1967. Employed principally



C-7A Caribou

in Vietnam, where it supplements C-123 and C-130, landing on dirt runways barely 1,000 feet long. Also flown in Vietnam by Australian AF, and in service of several air forces in Southeast Asia, Africa, and Middle East. **Contractor:** de Havilland Aircraft of Canada Ltd. **Powerplant:** 2 Pratt & Whitney R2000 engines, 1,450 hp each. **Dimensions:** length 72 ft. 7 in., span 95 ft. 7 in., height 31 ft. 9 in. **Speed:** 180 mph. **Ceiling:** 24,000 ft. **Range:** 240 mi. full payload, 1,300 mi. ferry. **Payload:** 32 troops or 5,000 lb. cargo. **Crew:** 2. **Maximum gross takeoff weight:** 28,500 lb. **Primary using commands:** TAC, PACAF.

C-8A Buffalo

Turboprop STOL transport, formerly called CV-7A. Four had been purchased by Army for prototype testing after US shared development funding with Canadian government. Assigned to USAF in January; since transferred to NASA for experimental tests. **Contractor:** de Havilland Aircraft of Canada Ltd. **Powerplant:** 2 General Electric T64 turbines, each rated at 3,060 shp. **Dimensions:** span 96 ft., length 77 ft. 3 in., height 28 ft. 8 in. **Cruising speed:** 208 mph. **Range:** 500 mi. with maximum payload; 2,170 mi. with 4,000-lb. payload. **Maximum**

payload: 13,800 lb. or 41 troops. **Gross takeoff weight:** 41,000 lb. **Primary using commands:** TAC, NASA.

C-46 Commando

This World War II light transport, famed for flying the Hump between India, Burma, and China, has again been retired from the USAF inventory after brief service with TAC's Air Commando Wing.

C-47 Skytrain

The "Gooney Bird," first flown in 1935, is still a valued workhorse in USAF, other services, other lands. AC-47, nicknamed "Puff, the Magic Dragon." Dragon-ship, or Spookie, carries 3 7.62-mm Miniguns for close-support missions in Vietnam. Others equipped for classified missions in Southeast Asia. Current inventory of US military aircraft lists 24 variations of basic aircraft from C-47A to TC-47K, plus 9 types of C-117, military version of DC-3. In all, Douglas built more than 10,000. **Contractor:** McDonnell Douglas Corp. **Powerplant:** 2 Pratt & Whitney R1830-90D, 1,200 hp. each. **Dimensions:** span 95 ft., length 64 ft. 4 in., height 16 ft. 10 in. **Speed:** 230 mph. **Ceiling:** 23,000 ft. **Range:** 2,125 mi. **Payload:** 7,500 lb. or 28 troops. **Crew:** 3; 7 in AC-47.



C-123K Provider

Maximum gross takeoff weight: 33,000 lb. Primary using commands: All major commands.

C-54 Skymaster

Cargo-troop carrier; made first flight Feb. 1942; later served as a heavy cargo transport for Air Force and Navy. Used extensively as an administrative command aircraft. Several versions employed in air-evac role. HC-54 used by Aerospace Rescue and Recovery Service. Contractor: McDonnell Douglas Corp. Powerplant: 4 Pratt & Whitney R2000-9 piston engines, 1,450 hp each. Dimensions: span 117 ft. 6 in., length 93 ft. 9 in., height 27 ft. 6 in. Speed: 300 mph. Ceiling: 30,000 ft. Range: beyond 2,000 mi. Payload: 32,000 lb., 50 troops. Crew: 5 or more. Maximum gross takeoff weight: 82,500 lb. Primary using commands: MAC, other USAF commands.

C-97 Stratofreighter

Now being flown primarily by Air National Guard, C-97 is used as personnel and cargo transport and in KC-97 version as tanker. ANG C-97s fly MAC cargo on training missions to Europe and Far East as well as within ZI. HC-97 operated by Aerospace Rescue and Recovery Service. Contractor: Boeing Co. Powerplant: 4 Pratt & Whitney R4360-59 Wasp Majors, 2,650 hp each (3,500 hp on takeoff); KC-97Ls modified with 2 wing-mounted General Electric J47 turbojets of 5,620 lb. thrust for additional power on takeoff and during refueling operations. Dimensions: span 141 ft. 3 in., length 110 ft. 4 in., height 38 ft. 3 in. Speed: over 350 mph. Ceiling: above 35,000 ft. Range: beyond 4,000 mi. Payload: 96 troops or 69 litter patients without refueling equipment, or more than 65,000 lb. Crew: 5. Maximum gross takeoff weight: 175,000 lb. Primary using commands: ANG, MAC.

C-118 Liftmaster

Cargo-troop carrier; military version of civil airlines' DC-6A; made first flight Sept. 1949; initially de-

signed as cargo carrier to meet requirements for swift and economical transportation of air freight; phased out of MAC except for aeromed-evac role. Contractor: McDonnell Douglas Corp. Powerplant: 4 Pratt & Whitney R2800-52W piston engines, 2,500 takeoff hp each with water injection, 1,800 hp cruise. Dimensions: span 117 ft. 6 in., length 106 ft., height 28 ft. 8 in. Speed: 370 mph. Ceiling: above 20,000 ft. Range: 5,000 mi. Payload: 25,500 lb. or 76 equipped troops. Crew: 5. Maximum gross takeoff weight: 107,000 lb. Primary using command: MAC.

C-119 Flying Boxcar

Cargo-troop carrier, in use since 1947. Long a Tactical Air Command standby, particularly for troop drops and aerial resupply, now used mainly by Air Reserve troop carrier wings and 2 Air Guard Air Commando units. Contractor: Fairchild Hiller Corp. Powerplant: 2 Wright R3350-85 turbocompound engines, 3,500 hp takeoff. Dimensions: span 109 ft. 4 in., length 86 ft. 6 in., height 26 ft. 2 in. Speed: 250 mph. Ceiling: above 30,000 ft. Range: 2,000 mi. with 10,000 lb. Payload: 30,000 lb. or 62 equipped troops. Crew: 3 to 5. Maximum gross takeoff weight: 73,000 lb. Primary using commands: AFRes, ANG.

C-121 Super Constellation

Cargo, troop carrier, air evac aircraft, famous for unique design in which fuselage serves as airfoil as do horizontal planes. C-121 has had a long career in both military and civilian configurations. Among military versions are C-121 cargo and troop carrier; EC-121 radar early-warning picket aircraft fitted with wingtip tanks for added range and 6 tons of electronic gear, operated by ADC, and in Southeast Asia as radar-warning escort for fighter-bombers and interceptors; C-121C, G flown by the ANG as air transport or as aeromedical-evac plane. Contractor: Lockheed Aircraft Corp. Powerplant: 4 Wright R3350-34 turbocompound engines, 3,250 hp each. Dimensions: span 123 ft., length 116

ft., height 23 ft. Speed: 370 mph. Ceiling: above 25,000 ft. Range: beyond 3,500 mi., more for EC-121. Payload: 30,000 lb. or 72 passengers. Crew: 3 to 5, plus radar operators in EC-121. Maximum gross takeoff weight: 145,000 lb. Primary using commands: ADC, PACAF, ANG.

C-123K Provider

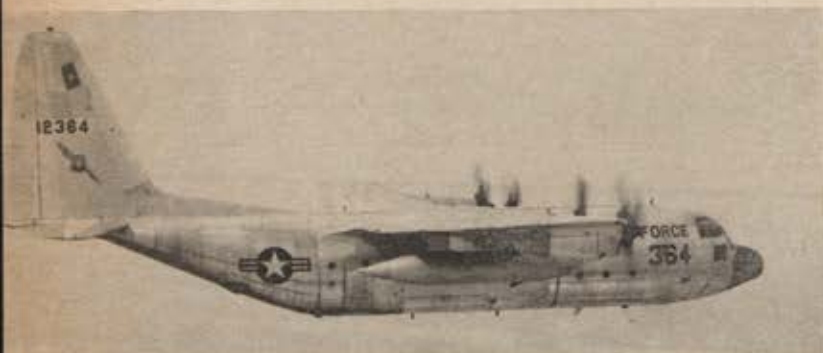
Jet-assisted twin-engined transport widely employed in Vietnam in cargo and troop-carrier roles. Added thrust provided by pair of General Electric J85 turbojet engines suspended from wings outboard of standard piston engines reduces takeoff roll with faster climbout to avoid enemy small-arms fire, and enables it to carry one-third heavier payload. Total of 122 C-123s have been modified to K configuration, with 76 assigned to Vietnam and 46 to TAC Stateside bases. Earlier versions without auxiliary jet engines also serve in Vietnam and elsewhere in TAC. High tail assembly and squat landing gear permits tail-ramp loading of combat equipment. H and K models have wider landing gear to improve crosswind landing stability. Contractor: Fairchild Hiller Corp. Powerplant: 2 Pratt & Whitney R2800-99W piston engines, 2,500 hp each; 2 GE J85 auxiliary engines on C-123K, 2,850 lb. thrust each. Dimensions: span 110 ft., length 76 ft. 3 in., height 34 ft. 1 in. Speed: 245 mph. Ceiling: above 25,000 ft. Range: beyond 1,000 mi. Payload: 24,000 lb. or 60 equipped troops. Crew: 2 to 4. Maximum gross takeoff weight: about 60,000 lb. Primary using commands: TAC, USAFE, PACAF.

C-124 Globemaster

In service since 1950, has operated in all areas of globe, including North, South Poles. Special features include clamshell nose door which opens to allow use of built-in ramp; 94 percent of all military vehicles can be driven up ramp, transported fully assembled; elevator located in middle of fuselage also can quickly load or unload to or from plane's cargo sections, which can be converted to double-deck cabin for troops. Last C-124 delivered to USAF in May 1955. Contractor: McDonnell Douglas Corp. Powerplant: 4 Pratt & Whitney R4360-63A piston engines, 3,800 hp. Dimensions: span 174 ft. 2 in., length 130 ft., height 48 ft. 3 in. Speed: over 300 mph. Ceiling: above 20,000 ft. Range: 2,300 mi. with 50,000-lb. payload. Payload: 200 fully equipped troops or 127 litters or 74,000 lb. of cargo. Crew: 5, plus doctors and nurses with litter patients. Maximum gross takeoff weight: 194,500 lb. Primary using commands: MAC, USAFE, AFLC, SAC, AFRes, ANG.

(Continued on following page)

KC-135
Stratotanker



C-130E
Hercules

C-130 Hercules

Versatile four-engined transport, performing wide variety of missions in Vietnam and around the world. Operates from 73 airstrips in Vietnam, hauling troops, passengers, and cargo. USAF is testing C-130 equipped with 7 Gatling guns, more than double the firepower of AC-47 Dragon-ships. C-130E is kingpin of US Strike Command paratroop and paradrop operations, indispensable element of TAC Composite Air Strike Force deployments. Some have been modified as launch vehicles for Ryan Firebee drones, which fly reconnaissance missions over North Vietnam and Red China. HC-130P is an air rescue plane, capable of picking up personnel from land or water with Fulton recovery gear. Twenty HC-130Ps also serve as tankers for HH-3E helicopters, greatly extending their range and loiter capability. JC-130Bs operating from Hawaii regularly make air recoveries of capsules released from secret Discoverer satellites. RC-130As have performed photomapping missions in South America, Ethiopia, and elsewhere. HC-130B and E serve in search and rescue roles; others track storms for Air Weather Service. DC-130As launch and control drone targets for air defense weapon systems. C-130Ds, equipped with skis and JATO bottles, support operations in Antarctic and other cold regions. More than 500 C-130s have been produced for Air Force, Navy, and Coast Guard. Navy is considering modifying some for amphibious roles. In inventory also of 13 foreign air forces. Produc-

tion line to be shut down this year to make room for C-5. **Contractor:** Lockheed-Georgia Co. **Powerplant:** 4 Allison T56-7 propjet engines, 4,050 shp each. **Dimensions:** span 132 ft. 7 in., length 97 ft. 9 in., height 38 ft. 4 in. **Maximum cruise speed:** 360 mph. **Ceiling:** above 30,000 ft. **Range:** with 25,000-lb. payload, 3,668 mi. without pylon tanks, 4,370 mi. with pylon tanks. **Payload:** 45,000 lb., 92 troops, 64 paratroopers, or 74 litters plus 2 attendants. **Crew:** 5. **Maximum gross takeoff weight:** 155,000 lb. **Primary using commands:** TAC, MAC, PACAF.

C-131 Samaritan

Cargo-troop carrier, trainer; C-131 and T-29 are military versions of the Convair 240, 340, and 440; used as troop carrier, for transportation of litter patients, as trainer for bombardiers, navigators, and radar operators. VC-131 is executive transport. **Contractor:** General Dynamics/Convair. **Powerplant:** 2 Pratt & Whitney R-2800-99W piston engines, 2,500 hp each. **Dimensions:** span 91 ft. 9 in., length 74 ft. 8 in., height 27 ft. 3 in. B and D models slightly larger. **Speed:** more than 300 mph. **Ceiling:** above 25,000 ft. **Range:** beyond 1,000 mi. **Payload:** 40 passengers, 27 litters, about 12,000 lb. **Crew:** 2. **Maximum gross takeoff weight:** 55,000 lb. **Primary using commands:** MAC, ATC, SAC, TAC, PACAF, USAFE.

C-133 Cargomaster

Giant turboprop transport, largest in USAF operational inventory until

C-5A becomes available; 90-ft.-long cargo hold can accommodate any of USAF's intercontinental ballistic missiles, haul 100,000 lb. of cargo, a pair of 40,000-lb. prime movers, 16 loaded jeeps, or 200 passengers. Both C-133A and B have side-loading doors in forward fuselage; integral ramp in rear; B model has clamshell doors aft. USAF received 34 C-133As and 15 Bs before production was completed in April 1961. **Contractor:** McDonnell Douglas Corp. **Powerplant:** 4 Pratt & Whitney T34-9W turboprops, 7,500 shp each. **Dimensions:** span 179 ft. 8 in., length 158 ft., height 48 ft. **Speed:** 300 mph. **Ceiling:** above 30,000 ft. **Range:** 2,250 mi. with 90,000-lb. cargo, 4,300 mi. with 44,000 lb. **Payload:** over 100,000 lb. maximum. **Crew:** 5. **Maximum gross takeoff weight:** 286,000 lb. **Primary using command:** MAC.

KC-135 Stratotanker

Grew out of Boeing's prototype 707 commercial transport after Boeing demonstrated feasibility and economy of refueling B-47, B-52, and B-58 at high speed and altitude. More than 600 KC-135s have been delivered to USAF, starting in June 1957. Originally equipped only with flying boom for refueling bombers, KC-135s now employ drones as well to accommodate probe-equipped TAC fighters. Several EC-135Cs are equipped as SAC aerial command posts, each capable of directing SAC's bomber force if its underground command post were put out of action. At least one is airborne at all times. In 1961, USAF ordered C-135 transports for MAC, developed from KC-135. Fifteen C-135As and 30 C-135Bs were delivered. With entry of C-141 transport, however, C-135s have been shifted to other missions, including radar and weather reconnaissance (RC-135, WC-135). A dozen KC-135s with Pratt & Whitney TF33-5 engines were purchased by France to refuel its Mirage IV Mach 2 bombers. **Contractor:** Boeing Co. **Powerplant:** KC-135A, C-135A, 4 Pratt & Whitney J57-59W turbojets, 13,750 lb. thrust; KC-135B, C-135B, 4 Pratt & Whitney TF39-9 turbofans, 18,000 lb. thrust. **Dimensions:** span 130 ft. 10 in., length, KC-135, 136 ft. 3 in.; C-135, 134 ft. 6 in., height 38 ft. 4 in. **Speed:** 600 mph. **Ceiling:** above 50,000 ft. **Range:** 5,000 mi., ferry range 8,000 mi. or more. **Payload:** 85,000 lb. **Crew:** 4. **Maximum gross takeoff weight:** KC-135, 297,000 lb.; C-135, 277,000 lb. **Primary using commands:** SAC, MAC.

VC-137 Presidential Transport

Known as Air Force One, VC-137C is flown by USAF as transport for the

President, cabinet members, foreign heads of state. It is basically the intercontinental Boeing 707-320B, but with staterooms, berths, conference table, and elaborate communications and electronics equipment. Three VC-137Bs — originally Boeing 707-120s, but converted to more powerful turbofan engines yielding longer range — also serve as high-level VIP transports. **Contractor:** Boeing Co. **Powerplant:** 4 Pratt & Whitney JT3D-3 turbofan engines, 18,000 lb. thrust each. **Dimensions:** VC-137C, span 142 ft. 5 in., length 152 ft. 11 in., height 42 ft. 5 in.; VC-137B, span 130 ft. 10 in., length 144 ft. 6 in., height 41 ft. 8 in. **Cruising speed:** 600 mph. **Range:** 7,000 mi. **Payload:** 53,000 lb. **Crew:** 6. **Maximum gross takeoff weight:** 328,000 lb. **Primary using command:** MAC.

C-140 JetStar

Small jet transport. USAF has 16 C-140s—5 C-140As used by Air Force Communications Service in checking navigation aids and communications; 5 C-140Bs in mission-support roles; and 6 VC-140Bs for MAC's Special Air Missions Wing. AFCS employs JetStar because it is capable of duplicating high-altitude flight path, approach, etc., of strategic bombers. **Contractor:** Lockheed Aircraft Corp. **Powerplant:** 4 Pratt & Whitney J60 jets mounted in pairs in nacelles on aft fuselage, 3,000 lb. thrust each. **Dimensions:** span 54 ft. 5 in., length 60 ft. 6 in., height 20 ft. 6 in. **Speed:** 550 mph. **Ceiling:** 45,000 ft. **Range:** 2,500 mi. **Payload:** 10 passengers in VC-140B, 13 in C-140B, or equivalent cargo. **Crew:** 5 for AFCS; 3 for special air missions. **Maximum gross takeoff weight:** 41,000 lb. **Primary using commands:** AFCS, MAC.

C-141 StarLifter

First pure-jet aircraft developed from start as cargo plane. Entered MAC operations in 1965. Production will terminate in December with delivery of 224th plane to USAF. Fourteen MAC squadrons to be equipped. Now operating from seven MAC bases — Travis and Norton AFBs, Calif.; Charleston AFB, S. C.; Dover AFB, Del.; McChord AFB, Wash.; McGuire AFB, N. J.; and Robins AFB, Ga. Cargo capacity exceeded only by C-133. Cubic capacity restrictions, however, limit C-141 to about 55 percent of weight capacity, except when carrying high-density cargo, such as ammunition. C-5A Galaxy will complement C-141, permitting former to carry heavy and bulky cargo while latter accommodates troops. Linked with USAF's 463L cargo-handling

(Continued on following page)



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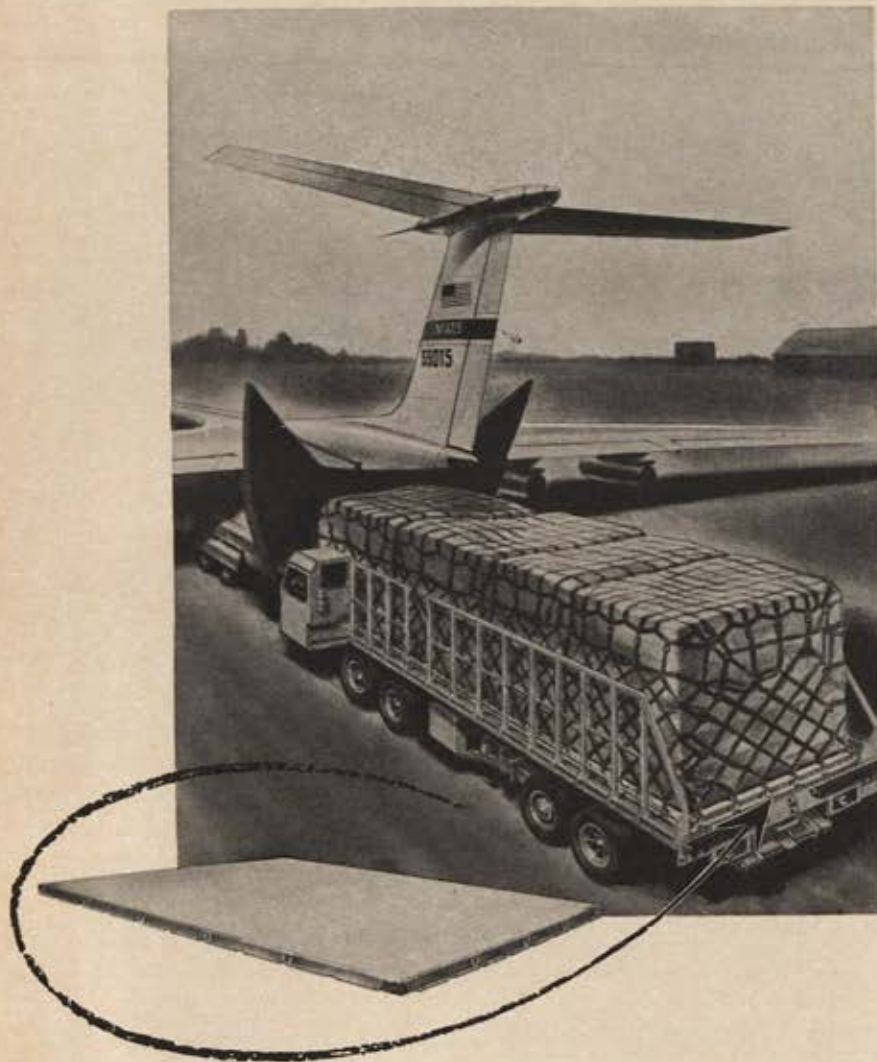
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system, C-141A can be unloaded and reloaded for takeoff within 30 minutes, or cargo can be airdropped at 230 mph. **Contractor:** Lockheed-Georgia Co. **Powerplant:** 4 Pratt & Whitney TF33-7 turbofans, 21,000 lb. thrust each. **Dimensions:** span 160 ft., length 145 ft., height 39 ft. **Speed:** 550 mph. **Ceiling:** above 45,000 ft. **Range/Payload:** 4,600 mi. with 60,000 lb.; 5,800 mi. with 30,000 lb.; ferry range, 6,800 mi. **Crew:** 8—2 alternate 4-man crews. **Maximum gross takeoff weight:** 318,000 lb. **Primary using command:** MAC.

XC/142A V/STOL Transport

Triservice operational research vehicle designed for both vertical takeoff and short takeoff. Contract let by USAF in January 1962. First XC-142A rolled out in June '64; first flight in Sept. '64; first conversion flight Jan. '65. Triservice operational evaluation testing initiated at Edwards AFB in July 1965. Two of five planes built have been lost in accidents. **Contractor:** LTV/Hiller/Ryan. **Powerplant:** 4 General Electric T64 turboprop engines, linked by an interconnecting shaft, 3,080 shp each. Normally cruises on two engines. **Dimensions:** span 67 ft. 6 in., length 58 ft., height 26 ft. **Speed:** cruises at 285 mph, maximum speed 430 mph. **Ceiling:** 25,000 ft. **Range:** 3,000-mi. ferry range; 460 mi. with maximum payload. **Payload:** STOL 12,000 lb., VTOL 8,000 lb., or 32 fully equipped troops. **Crew:** 3. **Maximum gross takeoff weight:** STOL, 41,500 lb.; VTOL, 37,500 lb. **Primary using command:** AFSC.

C-X

Twin-engined turboprop for executive and utility transport assignments, for which nine manufacturers have submitted bids. Plane is to be capable of hauling a minimum of 12 passengers or equivalent cargo over a 1,000-nautical-mi. range. Design selected is expected to be basically an off-the-shelf commercial transport, with modifications for military use. Firms seeking contract award are Aero Commander, Beech, Cessna, Fairchild Hiller, Handley Page Ltd. of Britain, Helio, Mooney, Piper, and Swearingen. Winner is expected to be named by end of year, with deliveries beginning in FY '69.

CX-2

Proposed aeromedical jet transport aircraft, intended to replace C-118 and C-131 in aeromed functions. Off-shelf procurement anticipated, possibly in Fiscal Year 1969, from such types as Douglas DC-9, Boeing 737, and BAC-111 built by British Aircraft Corp.

The Trainers



T-28 Nomad

T-28D Nomad; YAT-28E

Counterinsurgency fighter, developed from former USAF trainer, employed by Air Commandos as trainer and light tactical aircraft and by Laos and Thailand in war against Viet Cong and North Vietnam. Various models of T-28 are in air forces of 16 nations on all continents. Souped-up, heavier version, YAT-28E, features 2,450-shp Lycoming T55 turboprop engine for increased speed and range, stronger wing to handle more weapons, and provisions for a Sidewinder missile on each wingtip. Following describes T-28D. **Contractor:** North American Aviation, Inc. **Powerplant:** Wright R1820-56S radial engine, 1,425 hp, with 3-bladed prop. **Dimensions:** span 40 ft. 7 in., length 33 ft., height 12 ft. 8 in. **Speed:** 230 mph. **Ceiling:** above 16,500 ft. **Range:** beyond 1,400 mi. **Armament:** 2 .50-caliber machine guns, 1,800 lb. of ordnance, rockets, bombs, incendiary. **Crew:** 2. **Maximum gross takeoff weight:** 9,000 lb. **Primary using command:** TAC.

T-29 Flying Classroom

Trainer version of C-131, for airborne instruction of bombardiers, navigators, radar operators. Some T-29s have been modified for use as administrative aircraft. B and subsequent

models are pressurized. T-29Ds are equipped for training in K bombing system. **Contractor:** General Dynamics/Convair. **Powerplant:** 2 Pratt & Whitney R2800-99W piston engines, 2,500 hp each. **Dimensions:** span 91 ft. 9 in., length 74 ft. 8 in., height 27 ft. 3 in. **Speed:** more than 300 mph. **Ceiling:** above 25,000 ft. **Range:** more than 1,000 mi. **Capacity:** 14 students and 2 instructors; 6 students in D model. **Crew:** 3. **Maximum gross takeoff weight:** 44,500 lb. **Primary using command:** ATC.

T-33 T-Bird

Jet pilot trainer; has dual controls, ejection seats; made first flight in March 1948; replaced in advanced pilot training by T-38 but widely used throughout Air Force for proficiency flying. TAC experimenting with AT-33 attack version, restoring .50-caliber guns and adding wing pylons to carry bomb loads. More than

5,600 T-Birds were built. **Contractor:** Lockheed Aircraft Corp. **Powerplant:** Allison J33-35 turbojet, 5,200 lb. thrust. **Dimensions:** span 37 ft. 6 in., length 37 ft. 8 in., height 11 ft. 7 in. **Speed:** 600 mph. **Ceiling:** above 45,000 ft. **Range:** beyond 1,000 mi. **Armament:** optional, 2 .50-caliber machine guns. **Crew:** 2. **Maximum gross takeoff weight:** 16,000 lb. **Primary using commands:** most major air commands.

T-37B

Primary jet trainer, featuring side-by-side seating for student and instructor; more than 900 in use for pilot training in USAF and 10 other allied nations. **Contractor:** Cessna Aircraft Co. **Powerplant:** 2 Continental J69-T-25 turbojets, 1,025 lb. thrust each. **Dimensions:** span 33 ft. 10 in., length 29 ft. 4 in., height 9 ft. 5 in. **Speed:** 350 mph. **Ceiling:** 35,000 ft. **Range:** over 650 mi. **Crew:** 2—student and instructor. (Continued on following page)



T-29
Flying
Classroom



T-38 Talon

T-37

T-41



T-33 T-Bird



T-39A Sabreliner

dent and instructor. Maximum gross takeoff weight: 6,600 lb. Primary using command: ATC.

T-38 Talon

High-speed trainer, replacing T-33 as advanced jet pilot trainer. First T-38 flight April 1959; entered USAF inventory March 1961. Forerunner of F-5A. Jacqueline Cochran set 8 world-class records in speed, distance, and altitude in T-38 from August to October 1961, achieving top speed of 844 mph and peak altitude of 56,072 ft., for which she was awarded the Harmon International Aviatix Trophy. **Contractor:** Northrop Corp. **Powerplant:** 2 General Electric J85-5s, 3,850 lb. thrust each with afterburner. **Dimensions:** span 25 ft. 3 in., length 46 ft. 4 in., height 12 ft. 11 in. **Speed:** approximately 850 mph, or more than Mach 1.2. **Ceiling:** above 55,000 ft. **Range:** more than 1,000 mi. **Crew:** 2—student and instructor in tandem.

Maximum gross takeoff weight: 11,600 lb. Primary using command: ATC.

T-39A, B Sabreliner

Utility plane-trainer; first flight September 16, 1958; twin-jet featuring sweptback wings, 2 engines mounted externally on the fuselage aft of the wing. Suitable for single-pilot operation, has dual controls and instrumentation. T-39 is basic utility trainer and light, fast transport; T-39B is fitted with all-weather search-and-range radar (NASARR) and doppler navigation system for training F-105 pilots. Recently modified version of T-39A has been delivered to USAF, seating 7 passengers instead of 4, raising the gross takeoff weight 890 pounds. **Contractor:** North American Aviation. **Powerplant:** Pratt & Whitney J60-3As, 3,000 lb. thrust each. **Dimensions:** span 44 ft. 5 in., length 43 ft. 9 in., height 16 ft. **Speed:** over 575 mph.

Ceiling: over 40,000 ft. **Range:** beyond 1,000 mi. **Capacity:** 4-7 passengers. **Crew:** 2. **Maximum gross takeoff weight:** 17,760 lb.; 18,650 lb. in modified 7-passenger version. **Primary using commands:** ATC, TAC, SAC, MAC, USAFE.

T-41A

Newest 2-seat light primary trainer. Pilot trainees receive 30 hours in T-41A, off-shelf military version of Cessna 172-F, before going on to T-37 jet. Instruction in T-41A is given in civilian contractor schools on or near USAF pilot training bases. Army also acquiring T-41 as trainer. **Contractor:** Cessna Aircraft Co. **Powerplant:** Continental O300-C, 145 hp. Fixed-pitch propeller. **Dimensions:** span 36 ft. 2 in., length 26 ft. 6 in., height 8 ft. 11 in. **Speed:** 138 mph. **Ceiling:** 13,100 ft. **Range:** 540 mi. **Crew:** 2. **Maximum gross takeoff weight:** 2,300 lb. **Primary using command:** ATC.



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The Helicopters



HH-19 Chickasaw

UH-1F Iroquois

Employed by SAC for ICBM site support, and in an armed version by TAC Special Air Warfare forces, including units in Thailand. Latter application prompted amendment to Army-Air Force agreement effective January 1967 in which Army gave up its fixed-wing transports while USAF acknowledged Army's right to armed helicopters. In revision, USAF may employ armed helicopters to train foreign air forces, and to support USAF forces, other government agencies, and indigenous forces "only when operating without US Army advisers or not under US Army control." Thus USAF may now acquire other armed helicopters for Special Air Warfare units. **Contractor:** Bell Helicopter Co. **Powerplant:** 1 General Electric T58-3, 1,325 shp. **Dimensions:** rotor diameter 48 ft., length 48 ft. 11 in., height 14 ft. 10 in. **Speed:** 138 mph. **Ceiling:** over 20,000 ft. **Range:** with 2,000-lb. load or 10 passengers, 345 mi. **Maximum useful load:** 4,574 lb. **Maximum gross takeoff weight:** 9,000 lb. **Crew:**

1. Primary using commands: SAC, TAC, PACAF, ATC.

CH-, HH-3E

High-speed twin-turbine cargo and rescue helicopter, replacing HH-19 and HH-21. Nicknamed the Jolly Green Giant, the HH-3E penetrates deep into North Vietnam to rescue USAF and Navy pilots downed by enemy guns. HH-3Es are refueled by Lockheed HC-130P transports, modified to serve as tankers. CH-3E features hydraulically operated rear ramp for straight-in loading of vehicles, 2,000-lb. winch for internal cargo handling. Both models can operate from land or water. Similar versions flown by Navy, Marine Corps. **Contractor:** Sikorsky Aircraft Div., United Aircraft Corp. **Powerplant:** 2 General Electric T58-5 gas turbines, 1,500 shp each. **Dimensions:** rotor span 62 ft., length 60 ft. 9 in., height 16 ft. 1 in. **Speed:** 165 mph, cruising speed 154 mph. **Ceiling:** 11,700 ft. **Range:** 748 mi. with 2 tip tanks. **Payload:** 5,000 lb. or 25 passengers. **Crew:** 3. Maxi-

UH-1F Iroquois



HH-53B

mum gross takeoff weight: 22,050 lb. Primary using commands: SAC, MAC, TAC, PACAF.

UH-13H, J Sioux

Numerous models of this light 3- or 4-place utility helicopter are in use by US armed forces and those of other nations as well as in civilian flying. About 3,000 have been built in US and under license elsewhere. UH-13H carries 3 people, including pilot; -13J carries 4. **Contractor:** Bell Helicopter Co. **Powerplant:** Lycoming VO-435 6-cylinder fan-cooled engine, 260 hp derated to 200 hp. **Dimensions:** length 32 ft. 4 in., height 9 ft. 4 in., rotor diameter 35 ft. 1 in. (-13H), 37 ft. 2 in. (-13J). **Speed:** 105 mph. **Ceiling:** 17,000 ft. **Range:** 230 mi. **Maximum gross takeoff weight:** 2,640 lb. Primary using commands: Most USAF commands.

HH-19B Chickasaw

Liaison-rescue helicopter, gradually being retired after extensive use by USAF, Army, Navy, Marines, Coast Guard, civilian firms, foreign nations. **Contractor:** Sikorsky Aircraft Div., United Aircraft Corp. **Powerplant:** Wright R1300-3, 700 hp. **Dimensions:** rotor span 53 ft., length 41 ft. 2 in., height 15 ft. 6 in. **Speed:** over 100 mph. **Ceiling:** 12,000 ft. **Range:** beyond 500 mi. **Payload:** 2,500 lb. or 10 passengers. **Crew:** 2 or 3. Maxi-

imum gross takeoff weight: 7,500 lb. Primary using commands: Most major USAF commands.

HH-21B, CH-21B, C Workhorse

Like the HH-19B, this veteran, which first flew in 1952 and is best known for its banana-shaped fuselage, is being phased out. **Contractor:** Vertol Div., Boeing Co. **Powerplant:** Wright R1820, 1,425 hp. **Dimensions:** rotor span 44 ft., length 52 ft. 6 in., height 16 ft. **Speed:** 140 mph. **Ceiling:** above 20,000 ft. **Range:** 300 mi. **Payload:** 20 troops or 12 litters plus attendant. **Crew:** 2 or 3. **Maximum gross takeoff weight:** 15,000 lb. **Primary using commands:** TAC, MAC, AAC, HEDCOM.

HH-43B Huskie

Crash-rescue, fire-fighting helicopter. HH-43A employs Pratt & Whitney R1340 piston engine, HH-43B a Lycoming T53-1 shaft turbine. First delivery of B made in June 1959. HH-43F, advanced version powered by 1,150 shp Lycoming T53-11, going to US allies under MAP. **Contractor:** Kaman Aircraft Corp. **Powerplant:** Pratt & Whitney R1340-48 piston engine, HH-43A; Lycoming T53L-1A turbine, HH-43B; model A, 600 hp; model B, 825 shp. **Dimensions:** rotor span 47 ft., length 25 ft., height 12 ft. 7 in. **Speed:** over 100 mph. **Ceiling:** above 25,000 ft. **Range:** A model, 220 mi.; B, 250 mi. **Payload:** 2,000 lb. or 7 passengers plus pilot. **Crew:** 2. **Maximum gross takeoff weight:** model A, 6,800 lb.; B, 7,100 lb. **Primary using commands:** All USAF commands.

HH-53B

Long-range rescue helicopter, largest and fastest in the Air Force inventory, operated by Aerospace Rescue and Recovery Service to augment the Sikorsky HH-3E Jolly Green Giant in Vietnam. First flight was March 15, 1967. Flight endurance of HH-53B will be limited only by crew endurance since it can be refueled in flight from standard tanker airplanes. Earlier version, the CH-53A, is in service with US Marines in Vietnam as a heavy lift troop and cargo transport. HH-53B differs from Marine version primarily in the addition of a refueling probe, rescue hoist, and droppable auxiliary fuel tanks. **Contractor:** Sikorsky Aircraft Div., United Aircraft Corp. **Powerplant:** 2 General Electric T64-3 turboshaft engines, 3,080 shp each. **Dimensions:** 6-blade rotor span 72 ft. 2.7 in., 4-blade tail rotor span 16 ft., length 67 ft. 2.4 in., height 24 ft. 11 in. **Speed:** 195 mph, cruising speed 172 mph. **Ceiling:** 18,550 ft. **Range:** 258 mi. without the use of in-

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flight refueling. **Payload:** 38 troops or 24 litter patients with 4 medical attendants. **Crew:** 4. **Maximum gross takeoff weight:** 42,000 lb. **Primary using commands:** MAC, PACAF.

CARA—Combat Aircrew Recovery Aircraft

USAF is evaluating proposals from several contractors for an aircraft to eventually replace the helicopters now performing rescue and recovery functions in Vietnam. It will be able to fly at higher speeds, hover, land, and get away faster than present helicopters. The project has been given highest

priority by both the Navy and Air Force. Under the CARA concept, planes would be employed on cargo missions when not required for rescue, but would be able to respond instantly to a call for help. V/STOL capability is essential, and both USAF and Navy are reviewing all existing vertical takeoff designs, among them LTV XC-142, Canadair CL-84, Bell X-22, and Lockheed XV-5B, as well as compound helicopters, including modified versions of the Bell UH-1, Kaman UH-2, Lockheed AH-56A, and Piasecki 16H. Air Force estimates it may need as many as 100 CARA.



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The Utility and Experimental Planes

O-2B



O-1 Bird Dog

Forward Air Controller (FAC) aircraft to perform "eyeball" reconnaissance of ground targets and guide fighter and attack planes on close-support missions. Being replaced by O-2A. **Contractor:** Cessna Aircraft Co. **Powerplant:** Continental O470 6-cylinder engine with 213 hp. **Dimensions:** length 25 ft. 10 in., span 36 ft., height 7 ft. 4 in. **Speed:** 105 mph. **Ceiling:** 18,500 ft. **Range:** 530 mi. **Armament:** target-marking rockets; some carry .50-caliber machine gun. **Crew:** 1. **Maximum gross takeoff weight:** 2,400 lb. **Primary using commands:** TAC, PACAF.

O-2A, B

Twin-engined, twin-tailed push-pull aircraft, off-the-shelf version of the Cessna 337 Super Skymaster. The O-2A augments and will eventually replace the O-1 Bird Dog on FAC missions in Vietnam, while the O-2B is employed to drop leaflets and broadcast messages to friendly and enemy personnel. More than 200 O-2s are on order. **Contractor:** Cessna Aircraft Co. **Powerplant:** 2 horizontally opposed Continental IO360 6-cylinder air-cooled piston engines, 210 hp each. **Dimensions:** span 38 ft., length 29 ft. 9 in., height 9 ft. 4 in. **Speed:** 200 mph. **Ceiling:** 20,500 ft. **Range:** 1,000 mi. **Payload:** provision for carrying up to 4 passengers or equivalent cargo in cabin, plus wing pylons for carrying rockets, flares, 7.62-mm Minigun, and other light conventional ordnance.



OV-10A Bronco

Crew: 2, side by side. **Maximum gross takeoff weight:** 4,200 lb. **Primary using commands:** TAC, PACAF.

U-2A, D

Very high-altitude weather and photo reconnaissance aircraft. Used in high-altitude sampling program (HASP) for Defense Atomic Support Agency, and research into clear-air turbulence, operating in various parts of the world. Employed also on reconnaissance missions over North Vietnam and, flown by Chinese Nationalist AF pilots, over Red China. Earlier models were powered by Pratt & Whitney J57 turbojet, later ones employ Pratt & Whitney J75-13 adapted to run on low-volatility fuel. Its long range can be further extended by shutting off engine and gliding. **Contractor:** Lockheed Aircraft Corp. **Powerplant:** Pratt

(Continued on following page)



HU-16 Albatross

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& Whitney J57C, 11,000 lb. thrust, or J75-13, about 20,000 lb. thrust. Dimensions: span 80 ft., length 49 ft. 7 in., height 13 ft. Speed: 500 mph. Ceiling: above 70,000 ft. Range: 3,000 mi. or more. Armament: none. Crew: 1; 2 in U-2D. Maximum gross takeoff weight: 17,270 lb. (with J57C). Primary using command: SAC.

U-3A, B

Low-wing, twin-engine liaison-administration aircraft, "off-shelf" counterpart of Cessna 310 civil model. Initially designated L-27A. USAF bought 160 U-3As and 35 U-3Bs, latter with better all-weather capability and slightly increased powerplant. Contractor: Cessna Aircraft Co. Powerplant: A, 2 Continental 0470-M, 240 hp; B, 2 10470-D, 260 hp. Dimensions: span 36 ft. 11 in., length 29 ft. 7 in., height 10 ft. Speed: 240 mph. Ceiling: 21,500 ft. Range: 1,400 mi. Crew: 2, plus 3 passengers. Maximum gross takeoff weight: 4,830 lb. Primary using commands: All major USAF commands.

U-4B

Liaison-administration, high-wing, twin-engine; earlier model U-4A also purchased; both models off-the-shelf versions of the Aero Commander (680). Contractor: Aero Commander. Powerplant: 2 Lycoming GSO-480-A1A 6-cylinder air-cooled engines, 340 hp at 3,400 rpm. Dimensions: span 49 ft. 6 1/2 in., length 35 ft. 2 in., height 14 ft. 6 in. Speed: 250 mph. Ceiling: 24,200 ft. Range: 1,400 mi. Crew: 2. Maximum gross takeoff weight: 7,000 lb. Primary using command: HED-COM.

U-6A Beaver

Liaison-administration, high-wing lightplane, produced for Air Force and Army since 1947. Contractor: de Havilland Aircraft of Canada Ltd. Powerplant: Pratt & Whitney R985-AN-3 piston engine, 450 hp. Dimensions: span 48 ft., length 30 ft. 4 in., height 10 ft. 5 in. Speed: 180 mph. Ceiling: 20,000 ft. Range: 600 mi. Payload: 7 passengers or 1,000 lb. Crew: 1. Maximum gross takeoff weight: 4,820 lb. Primary using commands: SAC, ANG.

U-10A, B, C Courier

Four- to 6-place utility transport employed primarily in counterinsurgency missions. Principal advantage is its ability to fly at speeds as low as 30 mph, providing excellent visual reconnaissance capability in jungle terrain, and facilitating short-field landing and takeoff. It can take off over treetops within 500 ft. from unimproved surfaces, land in 400 ft. or less. Contractor:



X-24A Lifting Body

tor: Helio Aircraft Corp. Powerplant: A, B, Lycoming GO480, 295 hp; C, IGSO-540, 360 hp. Dimensions: span 39 ft., length 30 ft., height 8 ft. 10 in. Speed: 150 mph. Ceiling: 16,500 ft. Range: 1,100 mi. Payload: 4 passengers or 1,000 lb.; B and C models have paratroop door. Armament: Courier can be fitted with a variety of light armament, cameras, etc. Crew: 2. Maximum gross takeoff weight: 3,900 lb. Primary using commands: TAC, PACAF.

HU-16A, B Albatross

Search-and-rescue amphibian, operational since 1947, has been extremely active around the world. Formerly designated SA-16. B model slightly larger. Used mainly by the Aerospace Rescue and Recovery Service, in limited numbers by major air commands with own crash-rescue units. Used by Air National Guard as medium transport for Army Special Forces. Extremely versatile, durable aircraft. Holds several world class records for speed/payload and distance for amphibian planes. Contractor: Grumman Aircraft Engineering Corp. Powerplant: 2 Wright R1820-76A or B piston engines, 1,425 hp each. Dimensions: A, span 80 ft., length 60 ft. 8 in., height 24 ft. 4 in.; B, span 96 ft. 8 in., length 62 ft. 10 in., height 25 ft. 10 in. Speed: 230 mph. Ceiling: 24,000 ft. Range: 2,500 mi. maximum. Payload: 10 passengers plus rescue and aid equipment. Crew: 6. Maximum gross takeoff weight: 30,000 lb. Primary using commands: MAC, PACAF, ANG.

XV-6A Kestrel

V/STOL tactical fighter, built in Britain as P.1127. After sharing in operational tests in England, US acquired 6 aircraft for triservice evaluation of V/STOL concept in field conditions. These tests have been com-

pleted, and 6 planes are now undergoing additional flight tests under USAF and NASA direction at Edwards AFB, Calif. **Contractor:** Hawker Siddeley Aviation Ltd. **Powerplant:** Bristol Siddeley BS.53 Pegasus Mk. 5 turbofan, 15,200 lb. thrust. (RAF production version employs Mk. 6 engine with 18,000 lb. thrust.) **Dimensions:** span 23 ft., length 42 ft. 6 in., height 10 ft. 9 in. **Speed:** Mach 0.85. **Armament:** carried on pylons under wings. **Crew:** 1. **Maximum gross take-off weight:** 12,400 lb. VTOL, 15,500 lb. STOL.

OV-10A Bronco

Light armed reconnaissance aircraft, adaptable also for light cargo and troop carrier missions. Originally announced as successor to O-1, now being replaced by O-2. Setbacks have been encountered in development program, delaying deliveries of operational aircraft and prompting DoD to announce that no further orders will be placed after delivery on current contract of 157 to USAF and 124 to Marine Corps. **Contractor:** North American Aviation (Columbus). **Powerplant:** 2 Garrett AiResearch T76 turboprops, 715 shp each. **Dimensions:** span 40 ft. 3 in., length 41 ft. 7 in., height 15 ft. **Speed:** 280 mph. **Range:** 850 mi. **Armament/payload:** 2,400 lb. external stores, or 6 paratroops, or 3,200 lb. cargo. **Crew:** 1 or 2. **Maximum gross weight:** attack version 14,466 lb. **Primary using commands:** TAC, PACAF.

X-15A

High-speed, high-altitude research vehicle employed in experiments conducted jointly for USAF and NASA. Three X-15As have been built. X-15 No. 2 resumed flight operations after extensive rework, including addition of 2 jettisonable fuel tanks which increases burning time of engines by 40 percent, thus making possible theoretical speed of Mach 8 and altitude above 400,000 feet. **Garrett Corp.** is designing hypersonic ramjet engine to be tested on X-15 No. 2. **Maj. William J. Knight** flew X-15 No. 2 at a record speed of 4,233 mph late last year. Previous mark of 4,104 mph had been set by NASA's late test pilot, **Joe Walker**, who also set unofficial altitude record in X-15 of 354,200 feet. **Aircraft Nos. 1 and 2** now primarily engaged in scientific tests for NASA. **Contractor:** North American Aviation. **Powerplant:** Reaction Motors Div., Thiokol Corp. LR99, 57,000 lb. thrust at sea level, 70,000 lb. at peak altitude. **Dimensions:** span 22 ft. 5 in., height 13 ft. 6 in., length (No. 2) 52 ft. 5 in., (No. 1, 3) 50 ft. **Speed:** Mach 8. **Ceiling:** 400,000 ft. or more. **Crew:**

Another first from AAF ENVIRONICS New turbine-powered portable heater

AAF's new Model H-70 turbine-powered heater represents a major breakthrough in portable heating equipment. Weighing only about 100 pounds, it features compact ruggedness, quiet operation, and self-sufficiency to meet the most demanding military requirements. The first and only portable duct-type heater to utilize a turbine as a prime mover, the H-70 operates with greater reliability and efficiency, requires less maintenance than conventional equipment. Multifuel capability enables operation on any of the normal military fuels at temperatures as low as -65°F. Unit delivers up to 100,000 Btu/hr... 650 cfm at 150°F air at one inch static pressure. Initial and operating costs are surprisingly low!

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Environics is AAF's total system approach to R&D, production, and engineering management of packaged environments involving air filtration and purification, heating and cooling, ventilation, and humidity control.



1. **Maximum gross takeoff weight:** No. 2, 50,000 lb.; others, 34,000 lb. **Primary using commands:** AFSC, NASA.

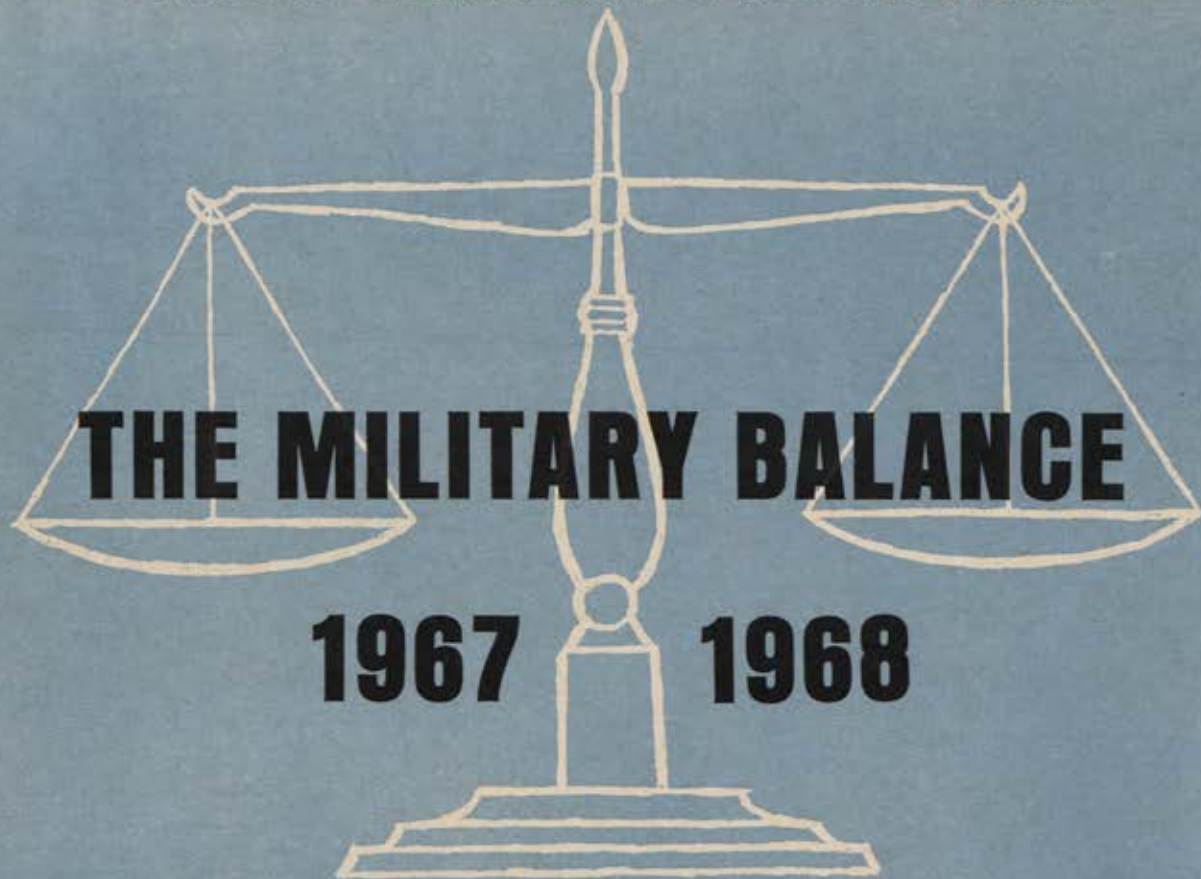
X-24A

Piloted, flatiron-shaped, wingless lifting body powered by a rocket engine and employed in flight research for USAF and NASA. Formerly designated the SV-5P, the X-24 will investigate the flight characteristics and maneuverability of piloted lifting bodies from supersonic reentry speeds at 100,000 feet down to conventional landing speeds. It is expected to pave the way for a manned, lifting-body reentry vehicle capable of returning

from space and landing at a designated site of pilot's choice. Earlier model, SV-5D, has been redesignated X-23. **Contractor:** Martin Marietta Corp. **Powerplant:** Thiokol XLR-11 rocket engine with 8,000 lb. thrust which ignites after being launched from B-52 mother ship; two Bell LLRV 500-lb.-thrust optional landing rockets. **Dimensions:** length 24 ft. 6 in., height 10 ft. 4 in., span 13 ft. 8 in. **Speed:** Mach 2. **Ceiling:** 100,000 ft. **Crew:** 1. **Maximum gross weight:** 11,000 lb. empty. **Primary using commands:** AFSC and NASA.

—JUDITH E. DAWSON AND
ALLAN R. SCHOLIN

In the November-December issue
AEROSPACE INTERNATIONAL is proud to present



AEROSPACE INTERNATIONAL, in cooperation with the Institute of Strategic Studies, London, will again publish the **complete** text of the Institute's annual report-in-depth on the military position of the world's major powers.

The Military Balance provides extensive Army, Navy, and Air Force data from over 50 countries . . . including size of armed forces, nature and number of weapons systems, defense budget estimates, military service requirements, and other pertinent information. The report covers the Warsaw Pact Nations, China, NATO Nations, SEATO Nations, US Mutual Defense Treaty Powers such as Japan, and major nonaligned countries such as India.

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CHAPTER OF THE MONTH

Ak-Sar-Ben, Neb., Chapter, cited for consistent and effective support of AFA's membership efforts.

The Ak-Sar-Ben Chapter of Omaha, Neb., perennial leader in AFA's membership effort, reached a new high in total membership (3,901) as a result of its recent highly successful membership drive, which obtained some 1,125 new AFA members. The Chapter's goal is 4,500 members by December 31, 1967.

But there's more to this story than just a Chapter reaching a new high in total membership, important as that may be. There's the story of how and why this Chapter is so successful in membership solicitation, and who sparks the drive.

Chartered in January 1953, the Chapter, under the very capable leadership of its founder, Arthur C. Storz, Sr., now a permanent AFA National Director, conducted an annual membership drive that proved to be so outstanding that by 1955 the Chapter had become the largest chapter in AFA—a position it has maintained through the past twelve years.

Because of his wide participation in Omaha civic affairs, Mr. Storz has received excellent cooperation for the annual membership drive from the military community at Offutt AFB, and the civilian and business communities of Omaha, to the mutual benefit of all concerned.

The Chapter's successful membership drives have resulted in many gifts to Offutt AFB Welfare Funds.

The most recent gifts from the Chapter were in appreciation of the cooperation and support received from base personnel during the Chapter's 1967 Membership Drive, and were presented by Mr. Storz to Col. William L. Reynolds, Commander, Offutt AFB, during ceremonies at the Offutt AFB Officers' Open Mess at which Chapter President Paul W. Gaillard also was present. Mr. Storz presented checks in the amounts of \$2,500 and \$1,000 from the Ak-Sar-Ben Chapter and the Nebraska State Organization respectively. The money from these gifts to the Offutt AFB Airman's Welfare Fund will be used to purchase special equipment to enhance the food-serving operation in the dining hall.

Mr. Storz then presented a check for \$1,000 from the Ak-Sar-Ben Chapter to Colonel Reynolds for forwarding to Gen. Emmett "Rosy" O'Donnell, USAF (Ret.), President of the United Service Organizations (USO).

One of the many positions held in the community by Mr. Storz is that of a Trustee for the Eppley Foundation. Due to his participation in AFA activities, which interested him in the USO, Mr. Storz convinced the Foundation to donate \$5,000 to the USO. Mr. Storz also presented this donation to Colonel Reynolds. It was specified that the money from both checks must be used for USO activities in Vietnam.

The final presentation was a \$1,000 check from the Chapter to AFA's education affiliate, the Aerospace Education Foundation.

This, then, is the story of the who, how, and why the Ak-Sar-Ben Chapter is the leader in AFA's membership effort, and tells a little of what can be accomplished when a chapter has the full cooperation and support of the local military, civilian, and business communities—plus an Art Storz.

"A Salute to the Eighth Air Force" was the theme of the New York State AFA Organization's recent 20th Annual Convention.

Hosted by the Plattsburgh Chapter, the Convention opened with a reception. The next day's program started with an AFA Workshop conducted by AFA Organization Director Don Steele.

Two business sessions and a luncheon completed the morning and afternoon program.

The banquet honoring the Eighth Air Force was held in the Plattsburgh AFB Officers' Club and featured Lt. Gen. William B. Kieffer, Commander, Eighth Air Force, as the principal speaker.

Plattsburgh Chapter President Clyde Lewis served as Master of Ceremonies, and Col. Warren D. Johnson, Commander, 380th Strategic Aerospace Wing at Plattsburgh AFB, was the Military Host.

During the evening, the Colin P. Kelly Chapter of Rome, N. Y., was honored as the "New York Chapter of the Year." The Harry Copeland Aerospace Education Award went to James T. Pyle, and a special citation was presented to the Queens Chapter for its many years of supervising and editing the New York State AFA Convention journal.

Special Crew Awards were presented to crews from units at Plattsburgh AFB and Griffiss AFB.

The Convention was timed to coincide with the Fourth of July weekend so that delegates could take advantage of the holiday and the Convention site's proximity to Montreal to attend Expo '67. Most delegates did just that!

—DON STEELE

In ceremonies recently held at the Offutt AFB Officers' Club, AFA National Director Arthur C. Storz, Sr., left, presents to Col. William L. Reynolds, Base Commander, several checks for the Airman's Welfare Fund (see text).



This Is AFA

The Air Force Association is an independent, nonprofit airpower organization with no personal, political, or commercial axes to grind; established January 26, 1946; incorporated February 4, 1946.

Membership

Active Members: US citizens who support the aims and objectives of the Air Force Association, and who are not on active duty with any branch of the United States armed forces—\$7 per year.

Service Members (nonvoting, nonofficeholding): US citizens on extended active duty with any branch of the United States armed forces—\$7 per year.

Cadet Members (nonvoting, nonofficeholding): US citizens enrolled as Air Force ROTC Cadets, Civil Air Patrol Cadets, or Cadets of the United States Air Force Academy—\$3.50 per year.

Associate Members (nonvoting, nonofficeholding): Non-US citizens who

support the aims and objectives of the Air Force Association whose application for membership meets AFA constitutional requirements—\$7 per year.

Objectives

• The Association provides an organization through which free men may unite to fulfill the responsibilities imposed by the impact of aerospace technology on modern society; to support armed strength adequate to maintain the security and peace of the United States and the free world; to educate themselves and the public at large in the development of adequate aerospace power for the betterment of all mankind; and to help develop friendly relations among free nations; based on respect for the principle of freedom and equal rights to all mankind.



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A mild climate affords Atlanta visitors a great many sporting activities including boating on two major lakes. For AFA golfers, the Augusta Masters Tournament is played just 160 miles away, in April.

Stone Mountain, one of the South's major tourist attractions, is sixteen miles from downtown Atlanta. Its 683-foot bulk—estimated to weigh a half-billion tons—represents the world's largest exposed chunk of granite.

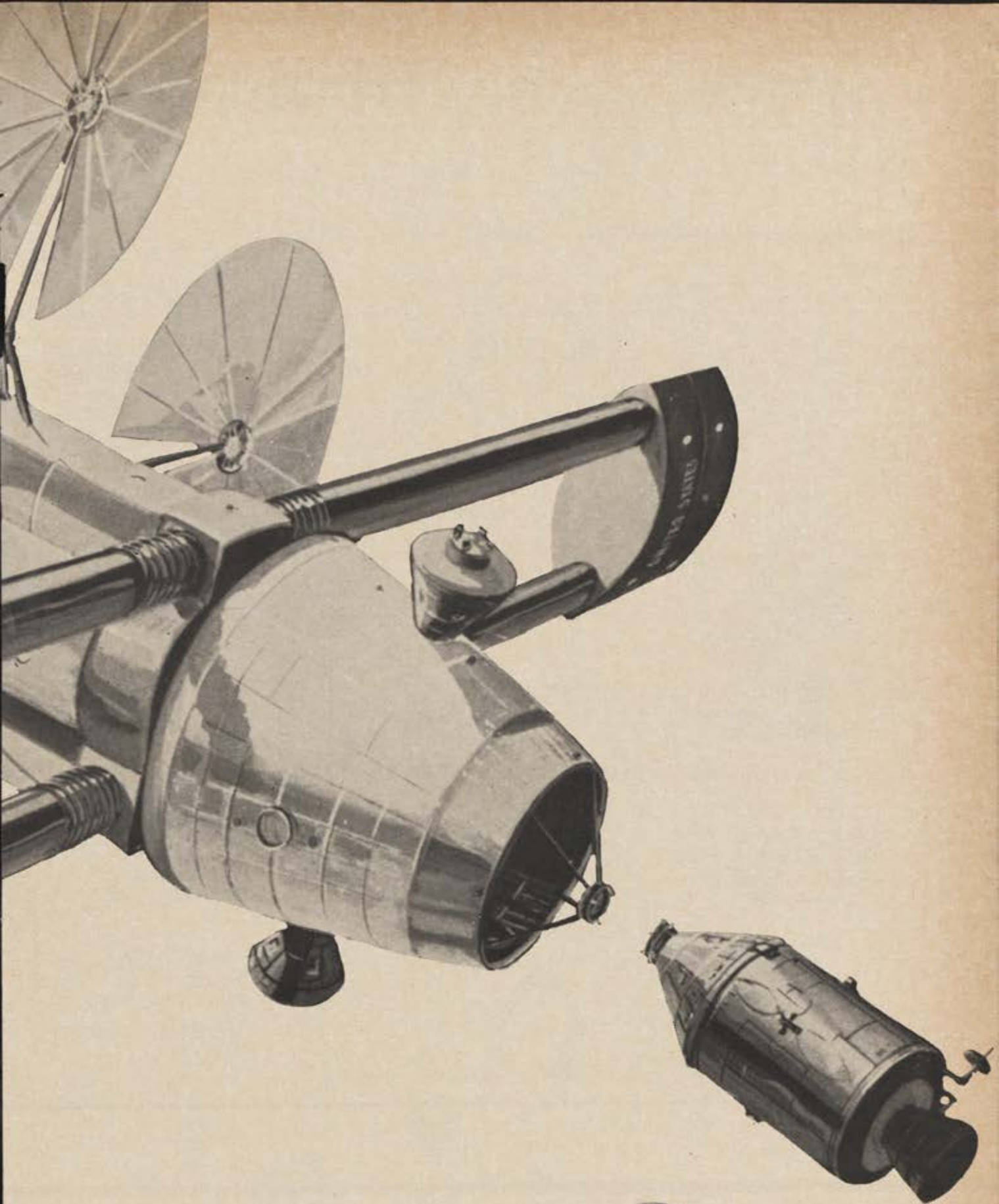


GRUMMAN'S MOBILE HOME

Way-out work, like this space station, is in Grumman's orbit. Right up our alley, in fact. Our Lunar Module (LM), scheduled to land on the moon in this decade, will be test-orbited soon. Now we're working on the Apollo Telescope Mount (ATM), based on the LM, and have our eye on an Orbiting Space Station for 1975.

Space systems are second nature to us. There's a family resemblance in the problems involved. And our scientists have been there before. They may reside on Long Island, but they live in space. Have for years.





GRUMMAN

Aircraft Engineering Corporation,
Bethpage, Long Island, New York



Bob Stevens'

"There I was..."

Everyone is convinced there's all the time in the world—then for some strange reason they suddenly begin to take you seriously . . .

REMEMBER THE OLD SAYING, "THERE'S SAFETY IN NUMBERS"?

SCENE: A B-17 FORMATION OVER "FESTUNG EUROPA"—

THIS IS RED LEADER --
AWRIGHT, FOR THE 10TH
TIME, CLOSE UP THE FORMATION! CLOSE IT UP! CL--



THEN, FROM THE REAR RANK--

FOCKE-
WULFS
AT
6 O'CLOCK
HIGH!



THANKS TO LT. COL. DON CURRIE
COURSE 123100 C-67-12
4017 CCR TRG SQ.
CASTLE AFB, CALIF

CONTROL TOWERS SEEMED SO FAR REMOVED FROM THE PROBLEM--

TOWER, THIS IS AIR
FORCE 1234, I HAVE
A FUEL LEAK...



AIRCRAFT CALLING TOWER,
WHAT IS YOUR TYPE,
YOUR LOCATION, NAME
OF PILOT, FUEL REMAINING,
DESTINATION, POINT OF
DEPARTURE, NO. OF PERSONNEL
ON BOARD, HIGHEST
RANK, ETC., ETC., ETC.....?



Bob Stevens

HOLD IT BUSTER!!
HOLD IT! YOU'RE
NOW TALKING TO
A B-24 GLIDER
PILOT!!



GOT A "THERE I WAS"?
SEND IT IN c/o THIS
FEATURE... \$\$\$ REWARD!

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When your computer computes in New York, will they get the message in Seattle . . . or in Syracuse, or London, or Sydney, or Frankfurt?

They can if you have a Honeywell data communication system. And they can talk back, too.

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Because Honeywell had data communication in mind when they designed the Series 200 third-generation computers.

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In three years it will be 80%.

Better talk to Honeywell. Better talk to Honeywell.

Designers with a "make room for invention" philosophy laid the lines for the Phantom. Latest evidence of that foresight is the United States Air Force's new...

F-4E

Youngest Fighter In The Sky

With the first flight of the F-4E, dramatic advancements in engine, armament and fire-control technology have been added to the Phantom.

The F-4E has an internal General Electric multi-barrel rapid-fire cannon, adding an air-to-air and air-to-ground gun capability to the missile, bombing, and rocket capabilities of earlier Phantom models.

The USAF F-4E also introduces an advanced Westinghouse radar, slotted stabilators and other aerodynamic refinements.

Our development teams are continuing to improve the Phantom, keeping the best of what they have, adding the best of what is new, and continuing to demonstrate that mission flexibility is an inherent quality of the growth-oriented Phantom design.

Even as new versions of the Phantom fly, McDonnell Douglas "Anticipation Engineers" are designing advanced "X" fighters for the decades of the Seventies and Eighties. In these, as in the Phantom, structural commonality, multi-mission/multi-nation adaptability, and a "stay young" design will be fundamental characteristics.

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