

15th ANNUAL
AIR FORCE ALMANAC

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AIR FORCE

and **SPACE DIGEST**

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

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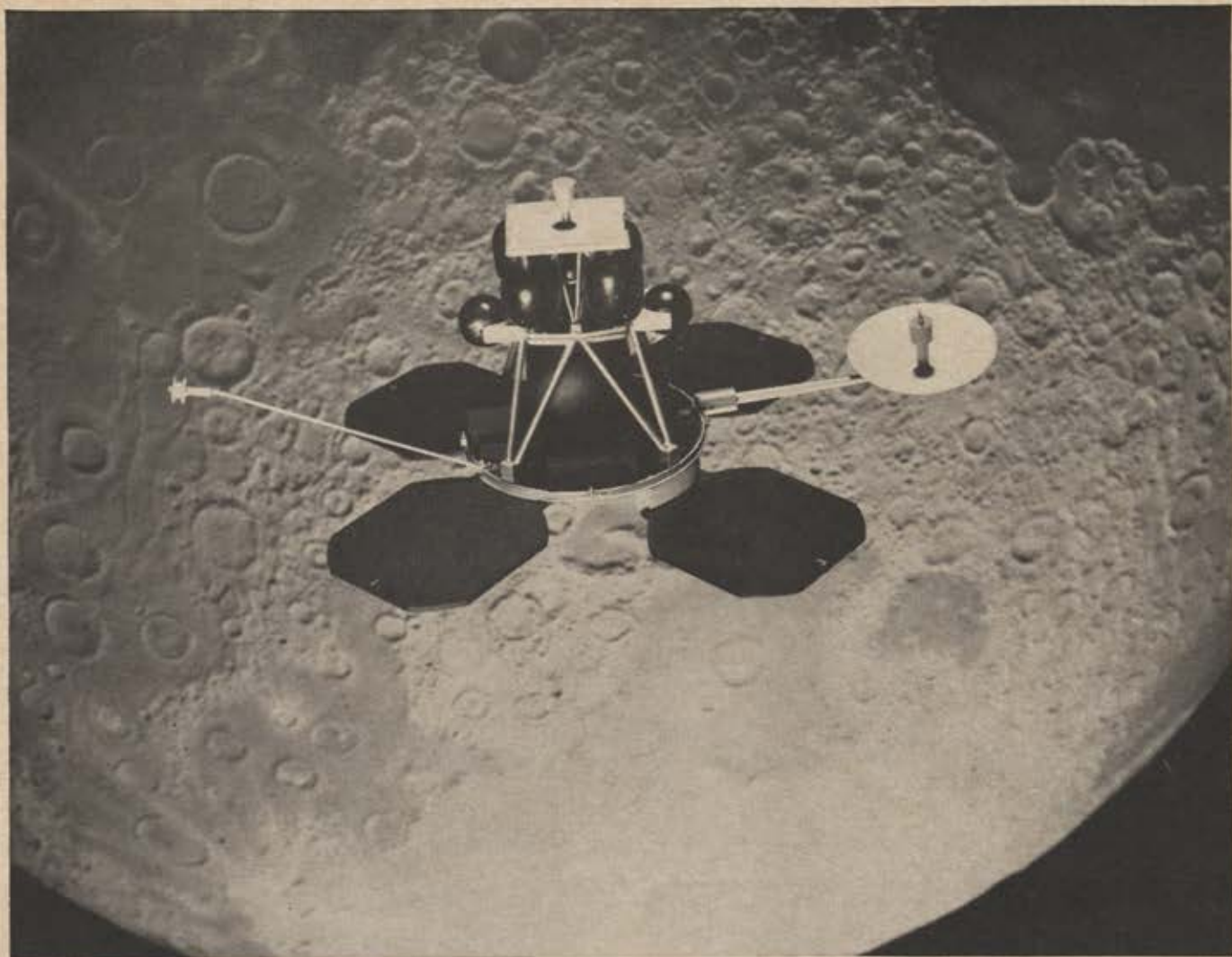
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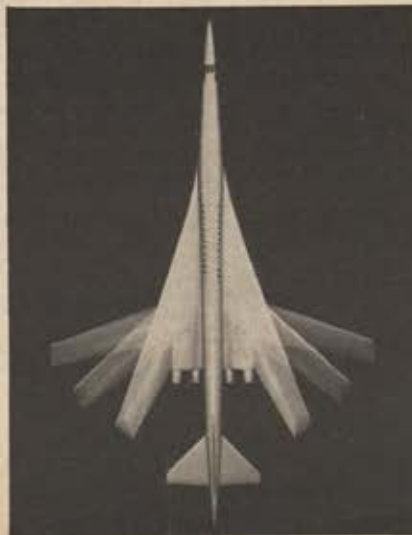
density of micrometeoroids and radiation near moon. Scientists will also track Orbiter to learn more about moon's gravity. Boeing is building 8 Orbiters for NASA, 3 for ground test, 5 for flight. First launch is scheduled next year at Cape Kennedy.

Capability has many faces at Boeing



BIG BLOW. Wind tunnel tests are used in air-to-ground missile studies. Boeing's vast missile, space booster and electronics experience in radar, guidance and penetration aids is helping to develop advanced attack missile system concept.

SUPERSONIC jetliner, under development by Boeing, could carry over 200 passengers across U.S. in two hours. Variable wing gives ideal sweep-back choices for supersonic and subsonic flight, plus straight wing for slow landings.



U.S. NAVY's versatile new transport helicopter, UH-46A, built by Boeing's Vertol Division. UH-46A's replenish combat ships while underway (permitting maintenance of task force integrity), also perform search and rescue, personnel transfer, and other missions.

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The Canadian government has chosen the supersonic Northrop F-5 as the new tactical fighter for the Canadian Forces.

The Canadian version of this versatile aircraft will be designated the CF-5. Canada expects to acquire approximately 125 of the new tactical fighters over a 4-year period. Canada thus becomes the ninth nation to select a version of the F-5.

Among the qualities which have made the F-5 the logical choice for these nations are its maneuverability, high acceleration and rate of climb, stability as a weapons platform, ability to operate from sod fields, simple logistics and ease of maintenance, fast turnaround time, and low attrition.

The F-5 was designed to do many jobs throughout the world — and do them well.

NORTHROP F-5

NOW... MORE CAPABILITIES FROM LTV ELECTROSYSTEMS



LTV Military Electronics Division general manager is Dr. Harold Goldberg, one of the electronics industry's most versatile and experienced executives.



LTV Continental Electronics companies president is James O. Weldon (right), America's first super-power electronics communications engineer.

Through growth, expansion and diversification, LTV ElectroSystems has become an unexcelled leader in defense electronics, specializing in the design, development and production of electronic systems having ground, airborne and space applications. Beginning as LTV Temco Aerosystems Division, the company developed its reputation through quick reaction to military needs, on time and within costs, and set a growth record by doubling annual sales twice in less than 10 years.

Established as one of the three major subsidiary companies of Ling-Temco-Vought, Inc. at the beginning of 1965, LTV ElectroSystems has been quick to react in its new status. Knowing a company improves its capability best by broadening its base, LTV ElectroSystems acquired at mid-year the assets of two important divisions of the parent company: LTV Continental Electronics and LTV Military Electronics Division.

With Continental, LTV ElectroSystems acquired the Free World's most experienced organization specializing in super-power electronics and a major participant in all of the

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LTV ElectroSystems top management team includes (front to rear) D. L. Hearn and Carl Bentley, vice presidents, and Fred Buehring, president, shown here inside ABC¹, the Airborne Battlefield Command and Control Center built from scratch in 98 days.

large VLF (very low frequency) radio installations of the past decade, including Voice of America, Voice of Polaris, and NATO VLF installation at Anthorn, England.

With the acquisition of Military Electronics Division, LTV ElectroSystems gains a substantial growth building block with established and proven capability in guidance and controls, data display and information systems, communications and instrumentation, automatic test equipment, test laboratories and advanced encapsulation.

Today at LTV ElectroSystems you have one primary source for total capability in the field of electronics. It has the experience, knowledge, facilities and resources to conceive, design, engineer, manage, manufacture, test and deliver high quality defense, space and electronic systems and associated equipment from prototype to long-production-run quantities.

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AIR FORCE

—and SPACE DIGEST—



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The answer to terrain following is a control that meets the same response conditions: automatic correction and switching to another system within the limited time factor of 10/1000 second.

The answer to precision low level or dive bombing is virtually instantaneous failure detection and instantaneous switching to a redundant control to prevent a possible crash.

These are three of many critical flight regimes which pilots constantly face. Control failure in critical flight paths is a serious problem, more so today with all-weather operation and landing, increased speed and close precision flying. *A flight control must sustain any possible failure without performance degradation and must operate subsequent to any probable second failure.* HydroLogic Redundant Control System have been developed to meet these needs.

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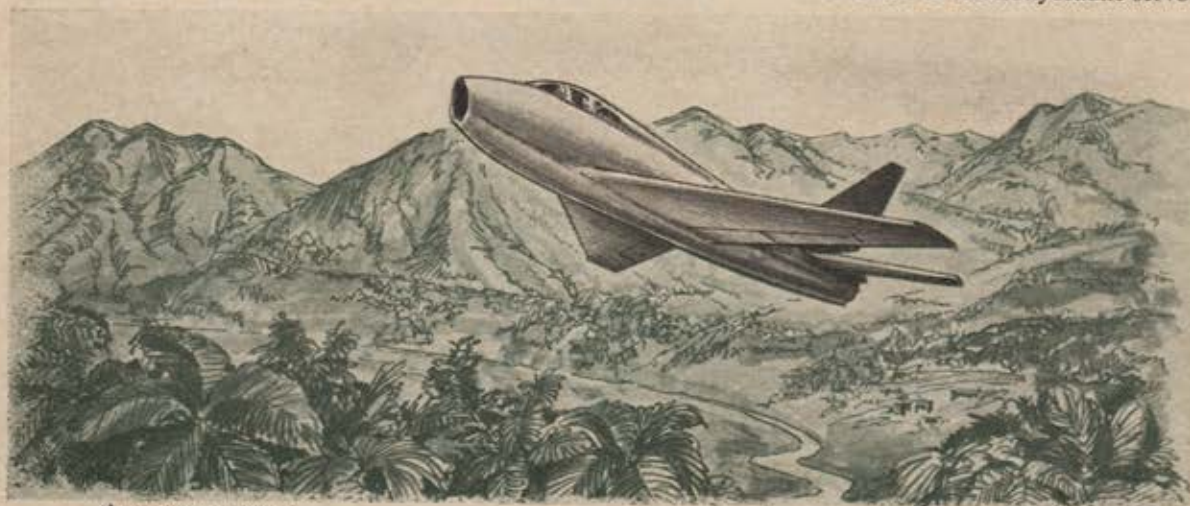
with all-hydraulic monitors and comparators, and offers virtually instantaneous control failure detection and failure removal. If one of the redundant systems fails, *the switching is done to the other system even before the pilot can detect failure.* And, at all times, the pilot can override the control.

HydroLogic monitoring performs the identical function of an electrical logic scheme, with inherent advantages of maximum reliability and simplicity by the use of all-hydraulic logic. The entire HydroLogic system can be installed at actuator location, eliminating up to 75% of interconnections characteristic of electrical logic and monitoring.

All-Hydraulics Increase Reliability

This system uses the working fluid, hydraulics, to perform monitoring and switching functions, in addition to operating the servoactuator. This feature of having all failure detection and correction done entirely by hydraulic is most important. By comparison, typical electrical logic systems must go through a combination of electrical, hydraulic and mechanical devices which degrade performance and reliability. All-hydraulic logic systems do not. The all-hydraulic system also performs efficiently at sustained temperatures associated with high speed flight. Another major reliability feature of HydroLogic monitoring is its capability of detecting hydraulic, electrical or mechanical failure.

From a maintenance viewpoint, the system simplicity of the all-hydraulic features make it one of the easiest control systems to maintain, both in time and cost. Systems are readily accessible and replaceable. The reliability of hydraulic systems, of course, is proven by the use of thousands of electrohydraulic servoactuators through-



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Technical material on system redundancy and the application of HydroLogic Redundant Controls is available on request.

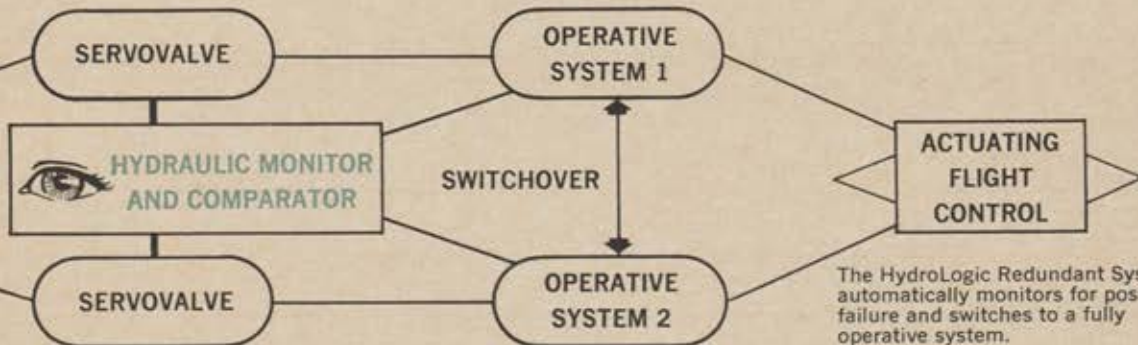
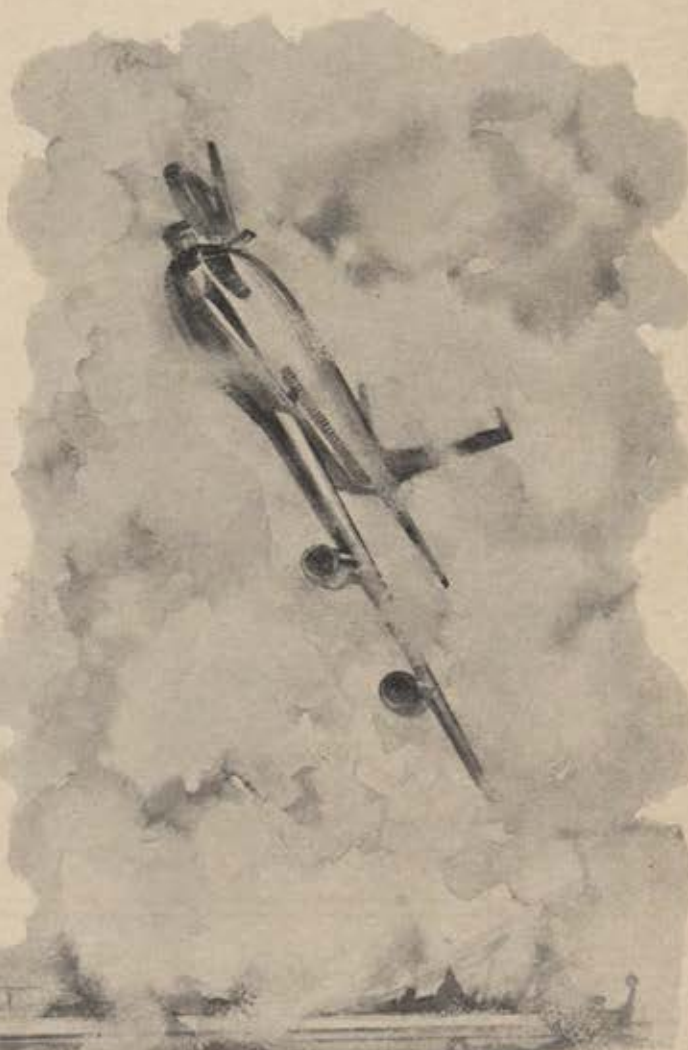


HYDRAULIC RESEARCH

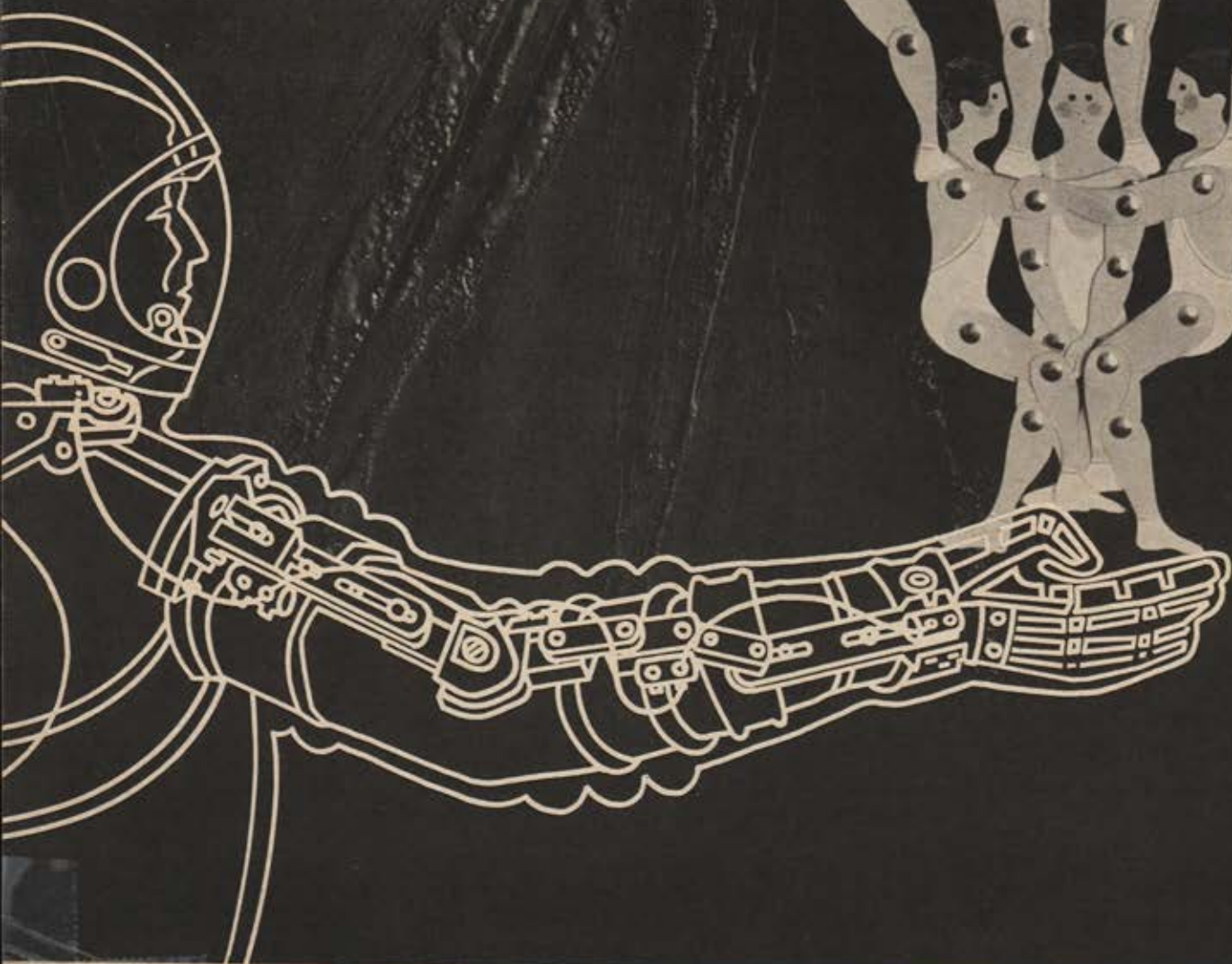
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The HydroLogic Redundant System automatically monitors for possible failure and switches to a fully operative system.



LIFT A TON WITH EITHER HAND?

It's simple if you're outfitted with a Man Amplifier, a framelike powered exoskeleton that fits the human form. Now under development, a Man Amplifier might well be powered by Kearfott actuators. One use foreseen for the system is to make it easy for astronauts to work in the vacuum of space.

Our rotary and linear actuators have already solved some of the most far-out problems in control system design.

ELECTROHYDRAULIC ACTUATORS. Kearfott Hydropacks were the first fully self-contained, modularized, plug-in hydraulic actuator systems to become standard hardware on an operational missile. These compact units are installed right where the muscle is needed and energized from the nearest electrical outlet. We supply six Hydropacks for each of the Army's Pershing missiles, and more than 360 of these units have flown without a reported failure. The same principle (a closed loop system with pump, sump and actuator) is being applied in the Navy's ASMS missile.

Kearfott makes other novel hydraulic actuators which are not self-contained. One is being used for radar platform stabilization in the RF4C. Another acts as the steering muscle in an LVH hydrofoil boat. Still another helps out in a helicopter flight control system. These actuators have a unique ball-socket design which eliminates misalignment and allows rigid mounting of the actuator.

ELECTROMECHANICAL ACTUATORS. These, too, are seeing service in a wide range of applications. A non-reversing actuator is used in the XC 142 to control pitch and trim of the horizontal tail surface. Another positions the tail prop. Both actuators operate during the transition from horizontal to vertical flight. Electromechanical actuators are functioning in the stability augmentation system of the CH46A Sea Knight helicopter, holding it steady even during a hasty unloading under combat conditions.

As for esoteric space applications — four Kearfott actuators were used on the Mariner 4 to control steering during its mid-course maneuver. Two others in the Apollo spacecraft transmit considerable torque through a hermetic seal, opening and closing the astro-sextant hatch and the crew hatch.

AN IMPARTIAL VIEWPOINT. Having both types of actuators leaves us very open minded about the choice of one or the other. When it comes to preferences, we choose the one that solves the problem at least cost. It's easy enough to debate the merits of electromechanical versus hydraulic actuators, but there's no debating the merit of having satisfied customers — and we're most fortunate in this respect. We'd be glad to help you make a selection if the need ever arises. We'd be more than happy meanwhile to send you literature that will provide some enlightenment on the subject.

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Little Falls, New Jersey

Airpower's Past Is Prologue

By James H. Straubel

PUBLISHER, AIR FORCE/SPACE DIGEST

TWENTY years after the atomic *coup de grâce* to World War II, an Air Force pilot is orbiting in space and a nuclear physicist is taking over as Secretary of the Air Force. Both events seem well suited to the image of a modern, dynamic Air Force.

Yet at the same time B-52 strategic jets of nuclear deterrent fame are iron-bombing tactical targets in the jungles of Southeast Asia. This may seem out of focus, but it dramatically points up the fact that Vietnam is fast bringing the Air Force back into historical patterns.

The original Air War Plan of World War II, as pointed out elsewhere in this issue, provided for the defeat of Germany without full-scale land invasion—but with B-29 type bombers rather than the B-17s and B-24s that were actually used. What the results might have been in Europe with the more potent B-29s, one can only speculate on now. Defeat from the air *was* achieved, with B-29s, over the Japanese islands.

Today, in Southeast Asia, we again ready a force for an air-supported land campaign in the tradition of World War II and Korea. Again airpower is being brought into play on a restrained basis. This time the big official worry—and understandably so—is escalation to atomic proportions.

For the moment, without belittling the political restrictions involved, it is worth observing that over the years—the limited Korean War is a prime example—restraint of airpower has been the rule rather than the exception. You plan and build to power up, then operate with power down. But airpower, essentially, is flexible power and *can* be brought into full accord, as it has in the past, with the realities of politically limited low-level conflict. This is the reality that permits us to operate our military forces in Southeast Asia today with any hope of success.

At the same time it must be remembered that during the demobilizing era after World War II, when the Air Force was reduced to the equivalent of two-group fighting strength, national security, if not survival, called for a power-up capability—for “massive retaliation,” despite the attempts to downgrade that concept.

In the process of building deterrent strength, we are charged with having become “a muscle-bound giant,” to quote the critical comment of author Theodore H. White. But such hindsight fails to take account of the political tempo of the 1950s. Actually, Russian intransigence made it clear that only the threat of a massive punch could deter an aggressive, nuclear-armed USSR. And, in those days, our military budget left no room for both the big deterrent and low-level war. If a change in airpower emphasis is needed now, it can be achieved all the more easily because we now *have* the

big punch capability that will continue to be required.

Ted White in his book, *The Making of the President—1964*, takes pride in “the cherished options and range of escalations” in striking power achieved in recent years. But, when the heat was on, as it was during the Cuban crisis of October 1962, SAC’s deterrent power was relied on. It was there and ready. SAC’s motto, “Peace Is Our Profession,” proved to be more than just words—the point being that power all across the spectrum is essential in our era.

Earlier, in the 1950s, as the Air Force went underground, literally, in its missile silos, good men argued that the Air Force should have avoided these “cannons” as unrelated to the airpower mission. But was there a choice? The strategic mission had become more basic to the Air Force than flying itself. Beyond that, the Air Force missile program became the basic ingredient of the national space program. The investment paid off twice.

Political considerations have intervened to delay the logical and imperative Air Force manned spaceflight missions. But whether you measure it in terms of launchings—facilities, vehicles, and personnel—or the ever-growing Air Force emphasis on the management side of NASA, the Air Force is a fundamental part of the nation’s man-in-space program. And the Air Force’s Manned Orbiting Laboratory has at long last been given a green light.

Yet, the pendulum of national thinking has swung so far in the direction of missiles and space that the fact of the Air Force as a flying outfit has been obscured at a time when the flying Air Force and aviation are more important than ever to the nation.

Today, twenty years after the airplane war of World War II, the airplane is on the threshold of a renaissance which promises to eclipse in performance gains anything experienced in aviation history. Out of it will come a new Air Force—with new power and flexibility.

Out of this technology will also come, quite probably, a broad new highway into space. In its pursuit of hypersonic operating speeds, the Air Force can be expected to attain not only recoverable space boosters—with their revolutionary impact on spaceflight—but a whole new family of aerospace ships, capable of maneuvering freely in space and with the takeoff and landing characteristics of conventional aircraft. All this will make possible a breakthrough from current space exploration to full-fledged space utilization and to a full-scale space force.

History is useful only as it helps us to look ahead. This is the truth which underlies all Air Force tradition.—END



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Left: Picture No. 3 of series transmitted to earth in digital form (typical readout appears above) by Mariner IV spacecraft.

Mariner maps Mars . . . by the numbers!

Subsystems built by Texas Instruments played vital roles in recording, processing and receiving the remarkable pictures of Mars, as well as the flood of other data sent by Mariner IV throughout its eight-month 325-million-mile voyage.

A TI tape recorder electronics package operated the miniature tape recorder that stored and played back pictures of the planet.

A TI data encoder processed more than ten million engineering messages throughout the flight, as well as sequencing all the spectacular Mars photos from the tape memory to the transmitter. TI data demodulators located at the deep space information facilities (DSIF)

were employed to process the extremely weak signals as they were received.

A TI gyro-control electronics package helped control the position of Mariner IV in space. Its biggest task was to direct the midcourse maneuver.

A TI helium magnetometer measured interplanetary magnetic fields for 228 days, and then at encounter discovered the absence of a magnetic field around Mars.

Texas Instruments capabilities include design, development and production of space-borne electronic systems and subsystems. Write for further information on TI capabilities that may help you.

The Mariner/Mars program is another important space achievement of the Jet Propulsion Laboratory, California Institute of Technology, for the National Aeronautics and Space Administration.

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Trends and Implications

Gentlemen: Mr. Ulsamer's article, "The Coming Revolution in Aeronautics," was so excellent that I write to compliment your valued publication on its inclusion in your [July] issue.

It's about the best summary of trends and their likely result and implications that I have run across. The [section on the] "Cascading Effect" was particularly effective. . . .

GROVER LOENING
New York, N. Y.

Communist Containment

Gentlemen: I have enjoyed your publication for several years and coveted its contents as conveying a degree of sense which is completely lacking in other journals or magazines.

However, I must vehemently disagree with William E. Griffith's contention that Communist China *can* be contained ["Containing Communist China," July '65 issue]. I am further disappointed in your printing such nonsense. My mind boggles at the boundless naïveté of so-called experts in this country concerning the objectives of the international conspiracy called communism (China or otherwise). The *status quo* of 1959 to which Mr. Griffith wishes Southeast Asia to return (under our direction) is, of course, the very reason for the present trouble. Or rather, communism feeds on agreements which recognize their legitimate claim [to what] they acquired through naked aggression. This pattern has repeated itself so many times that all but the most myopic can see what happens. They have steadily advanced their acquisition of territory by the doctrine of "what's mine is mine, and what's yours is negotiable."

"Containment" as an expression of foreign policy has been around Foggy Bottom for a dismally long time. The march of communism over the land masses of the earth has been inexorable during that time. I do not, I am sure, have to set down here the country-by-country recitation of their advance since you are more well informed than most in this regard. By what lunacy does AIR FORCE/SPACE DIGEST see fit to publish an article

fostering the notion that containment can, will, or has worked? The plain facts refute this solecism, and your magazine should not waste its time in this delusion.

COLLIN E. COOPER, M.D.
La Canada, Calif.

• Dr. Griffith's views are, of course, his own. His major point seems to us well argued, that Chinese Communist expansionism is a menace to Asia and the US and, therefore, must be contained, with the hope that the resoluteness of this country will convince Red China that its aims are unattainable. His reference to the 1959 status quo as an American policy aim is, we assume, meant to suggest that it may be possible to convince the Red Chinese of the futility of their aims without the necessity of a massive conventional—and possibly nuclear—US-Chinese confrontation, which might rapidly escalate into World War III. How effectively containment as a policy has worked vis-à-vis the Soviet Union is certainly arguable, but it seems that it has worked to some extent. The Russians are certainly still troublesome, but they have been deterred from attacking Western Europe. Although we may not necessarily agree with every item in Dr. Griffith's policy proposals, "nonsense" seems a harsh judgment of his thoughtful article.—THE EDITORS

Job Well Done

Gentlemen: Congratulations on an exceptional résumé [by William Leavitt] of [the] outstanding "White Committee Report on the Air Force Academy" [June '65].

I am in agreement with the White report. Gen. Thomas D. White, in [Mr. Leavitt's] words "has done an excellent job in a tough assignment."

CHARLES H. BOEHM
Specialist in School Finance and
Administration of Schools
Bogota, Colombia

New Medal

Gentlemen: I was glad to see, on page 25, July AIR FORCE/SPACE DIGEST, the picture of Lt. Col. Robinson Risner receiving the Air Force Cross.

Is he the first to receive the new design of this Air Force decoration? . . .

THOMAS LEE CASKEY
Lafayette, La.

• All awards of the new Air Force Cross previous to Colonel Risner's were made posthumously. Thus, he is the first member of the Air Force to wear it. The Cross, which ranks just below the Medal of Honor, is awarded for extraordinary heroism while serving in any capacity of the Air Force while engaging in action against an



Air Force Cross

enemy of the US, engaging in a military operation involving conflict with an opposing foreign force, serving with friendly foreign forces engaged in an armed conflict against an opposing armed force in which the US is not a belligerent party, or for conspicuous gallantry and intrepidity at risk of life above and beyond the call of duty.—THE EDITORS

A Pat on Our Back

Gentlemen: . . . Never, in my life, has such a small investment [Flight Pay Protection] proved to be so rewarding and comforting at a crucial time. Permit me to hasten an explanation of that statement.

As to rewarding—by comparison to the sum received, the mere pittance paid in membership fees would repre-

(Continued on following page)

sent the optimum dream of any Wall Street broker or investor. Aside from the monetary consideration, the up-to-the-minute factual information presented in AIR FORCE/SPACE DIGEST is a reward in itself for the nominal membership fee. As a matter of fact, my wife teaches college prep English in the Hampton High School, and as we finish with each monthly issue she takes it to school for the students to use as current reference material. This publication is a valuable source of information for every forward-thinking member of the aerospace team.

As to comforting—in the face of the rising cost of living we all have a tendency to plan our budget as though the flight pay would always be forthcoming. This has, all too frequently, been proved a false assumption. The only assurance that anyone has, pertaining to that income, is a membership in AFA. As to my own case, with a daughter who is a sophomore in college, the loss of flight pay would not have caused me to take her out of school, but it would have necessitated a considerable readjustment in the family budget. It was reassuring and comforting to know that an AFA check would arrive promptly each month to replace the lost income.

I can say without reservation that in our jet age, with aircraft not as forgiving as the faithful old "Gooney Bird," with our accident-prone gadgetry in all aspects of life, that a membership in AFA should be on the "must" list of every member of the flying aerospace team. That is the only way available to assure our full income will not be disrupted through unforeseen incidents.

My membership in AFA has proved to be a most gratifying experience through both the insurance and the monthly magazine. I have received nothing but the most prompt and courteous attention, and I commend your services to all rated personnel.

MAJ. GEORGE C. ELVEY
Hampton, Va.

Fuzzy Past

Gentlemen: With reference to your comments on my letter printed on page 12 of the July 1965 issue of AIR FORCE/SPACE DIGEST, I stand ashamed, abashed, and corrected. Apparently for the last twenty odd years I have been living in abysmal ignorance. Before dashing off my slit trench/ditching criticism I should have checked authoritative sources. Some of my more experienced former infantry friends, who read your magazine, have expressed complete agreement with you and deep disgust with my mis-

informed comment. I can only blame it on several mistakes:

1. Lack of attention at one or more lectures a couple of decades ago.

2. Serving in the Air Corps at locations where there were no slit or straddle trenches.

3. A forgetful mind.

I'm still confused, though. Your use of the "straddle trench" connotation is completely new to me—in my experience—I was aware of slit trenches, ditching, and foxholes, but not of straddle trenches.

Please accept my apologies for my error-ridden criticism and blame it on my "fuzzy image" of that long-ago war. It's fortunate I never had to make a hurry-up choice as to which to use on a dark night.

E. W. GREGORY, II
Washington, D. C.

● *It was simply a case of following one's nose.*—THE EDITORS

389th Bomb Group

Gentlemen: . . . I am at present engaged in research for material for a magazine article I am doing on a bomb group of the 2d Air Division, Eighth Air Force, which was based in England during World War II.

This unit was the 389th, in those days stationed at Hethel in Norfolk. The group flew many successful missions against the German war machine and also took part in the strike on the oil refineries at Ploesti, August 1, 1943. To assist in putting the article together I need photographs of the aircraft that flew with the 389th to help determine codes and markings, etc. I wonder if members who served with this group would contact me if they possess any pictures of B-24s that were taken at Hethel or any aerial shots showing Liberators of the 389th.

I am also trying to trace a former captain from the unit whose name is John A. Colt, Jr. He was an aircrew member, and in those days his State-side address was 462 Cherry St., New York, N. Y.

GERALD P. COLLINS
24a Watford Way, Hendon, N.W. 4
London, England

UNIT REUNION

Class 41-G

The Annual Reunion of Flying School Class 41-G will be an East-West doubleheader this year. The East Coast affair will be held at Andrews AFB, Md., and the West Coast classmates will meet at Norton AFB, Calif. Both events will be held the weekend of September 24-26. Contact

Lt. Col. John Vanderpoel
Andrews AFB, Md.

or
Lt. Col. William Trigg
Norton AFB, Calif.

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XOM CA TRANG BRIDGE shown with center span collapsed after direct hits with a U.S. Navy Bullpup missile. Bullpup was developed by Martin.

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AIRPOWER in the news



By Claude Witze

SENIOR EDITOR, AIR FORCE/SPACE DIGEST

History Lesson

WASHINGTON, D. C., AUGUST 15

Much of this year's issue of the Air Force Almanac is devoted to what we learned, if anything, from World War II. It is a subject that stirs the memories of a seasoned reporter.

One paramount fact is that there are so many parallels, however obscure, between the situation of today and that of twenty-five or thirty years ago. Certainly, the nature of the threat has changed. There now is the New Weapon, the one that made *proliferation* and *escalation* words that are heard over the kitchen sink and the Geneva conference table alike. What about the difference, if any, between fascism and communism as a threat? The older you get, the more difficult it is to tell them apart.

In Saigon, there is a cafe on Tu Do Street where the American press corps, or an important part of it, has a table reserved at lunchtime for about ten men. The mix of reporters changes from day to day, according to who is in town, who is busy chasing an angle at the Embassy, and who is spending a few days in the Mekong Delta to write some copy out of the rice paddies.

The lunchtime conversation is entirely about the war. There is no point in reviewing here what is said, because you have read most of it in the newspapers at one time or another. The scene at that Saigon cafe, each day between noon and siesta time, is almost a duplicate of what took place at the Adlon Hotel bar in Berlin in the early days of the Hitler regime.

Of course there are differences. The Saigon press corps has a war to cover, however it is done. At the Adlon bar in 1934, I concluded that the American reporters were interviewing each other. They wrote profound, but inaccurate, pieces about the direction being taken by the Nazi machine.

It must be declared, not admitted, at the outset that in 1934 I was a young and inexperienced reporter. Indeed, I was a reporter without a job, in the usual sense. The city editor of the New York *Herald Tribune*, the late Stanley Walker, told me "the woods are full of good newspapermen for \$18 a week." And he was right. In the worst of those depression years, and that includes 1934, there were newspapermen selling apples on the streets of several major American cities, and the outlook for a neophyte was not good. The New York *World*, where I had cut some teeth as a copy boy, had folded in 1931 while I was in college. With a modest bank account and no desire to go into servitude under the likes of Stanley Walker, I looked for another opportunity.

Felix Morley, who was something of a scholar as well as a newspaperman, was then editor of the Washington *Post*, and I had an introduction to him. We had some conversation about a spot on the staff, but I was not excited about the possibility, largely because his staff was known to be as unstable as the nation's economy at the moment. Then I told Mr. Morley that unless I could find a promising job opportunity, I intended to take off for

Europe and stay as long as my bank account and a few free-lance checks would support me. I wanted to write, and if I could not do it at a comfortable desk, I would do so from some *pension* and take my chances with the market.

Actually, my formula was acceptable to a few newspapers whose budgets did not permit the luxury of a full-time foreign correspondent. Felix Morley was trying to build up and improve his "page opposite editorial" with exclusive features and background observation by writers he selected as competent. I joined the stable. Our agreement was simple. He would pay \$15 for each article that got into print. I set out with the ambitious goal of appearing in the Washington *Post* once a week. I never made it, but the fault was mine for not producing fast enough. Mr. Morley bought every article I sent him.

I had been to Europe previously, in 1928, and had come home with a hearty appreciation of German food and drink. I had some knowledge of the language, and certainly the advent of Adolf Hitler as head of the government in 1933 made Berlin one of the news capitals of the world. It was there I found the Adlon bar.

In 1934 I was as welcome at the American press *Stammtisch* as I was at the Saigon cafe in 1964. And I was a more eager listener. If there was any difference between these two situations, it was in the age and experience level of my colleagues. At the Adlon, in 1934, they were, for the most part, seasoned reporters. I thought at the time that they were lazy. The men who were doing the real work were seldom seen at the Adlon. Among these latter I would include Louis Lochner of the Associated Press, radio's Bill Shirer, and the already ancient Karl von Wiegand, who never shed his Hearstian background and his relish for a headline. Der Alte Karl, at that time, was nearly blind but was still an International News Service mainstay. He had a couple of young bloods and a loyal woman employee to hunt for his sensations.

Too much time has passed for a review of the errors these fully reasonable men put into print. Looking back, my recollection is that they did not want to believe that fascism in Europe was a threat to the democratic nations, including our own. They had yet to cover such milestones as Munich, the Spanish Civil War, or even a rigged Nazi election. There was the blood purge in June of 1934, but it seemed to rock the observers outside of Germany more than it did the only representatives of a free press who were there to face the rowdy Paul Joseph Goebbels.

In Berlin I watched nervously the parades of the Hitler *Jugend*. And, on visits to the beer halls where Americans were less common, there were the brown-shirted SA storm troops. It was our understanding that they were nearly impossible when sober and even worse when drunk. When the hour drew late, respectable middle-class Germans drifted away from the cafes and left the streets to the SA, if they wanted them.

I took off for Munich, which is where the whole Nazi show had started. Using the contacts of a friend who had studied at the university in the Bavarian capital, I found

(Continued on following page)

Münchener Zeitung Einzelpreis 15 Pfg.
in Schwaben 10 Pfg.

Einzelpreis 15 Pfg.

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Eigene Redaktions-Vorsetzungen: Berlin W. 25, Väterickstraße 4, Stuttgart, Dresden, Posen, Wien, Prag, Hamburg, London, Paris, Basel, Bern, Bernburg.

[illegible]

Tr. 226/227

Refined

Dienstag/Mittwoch, 14./15. August 1934

Waterside: 43. Zebra

Der Führer Garant des Weltfriedens.

Wirtschaft und Wohl

Die Arbeit des Eisenbahnbeamten erfordert Fleiß und Leberei. Die Arbeit anderer heißt faß (es ist möglich, wenn das bedeutet) heißt in immer Ruhe, Ordnung und Disziplin seiner Bildung folgt und der Arbeit. Wenn es seiner Bildung entspricht; denn nur das Fortkommen und der Glaube an den neuen Staat haben es ermöglicht, die großen Aufgaben in Angriff zu nehmen und zu lösen, die auch die früheren

Ministerpräsident Göring wirbt in München.

Hunderttausend auf dem Königsplatz

Winterpräsident Hermann Götsche spricht zu den Studenten, zu den Bauern, zu Trübsalenden, zu der ganzen Welt!

... lieber, dem es ehrlieh um Deutschland und
... zu tun ist. lieber: es liegt

der Nation. Die Zukunft der Nation ist die Zukunft
Teutschlands. Wie liegt es Schicksal und weites
geschick, in das Wissen des Mannes, dem die
große Weltmacht der Weltmacht und Erde
die Hand reicht hat, Adolf Hitler, Adolf Hitler

Der Winterpräsident freut, wir alle empfinden das gleiche, aber verzagt nicht, noch regiert die Natur und nicht die Mächte der Welt. Noch beherrscht das ganze Welt, bei hier ein deutliches Hoffen liegt, unser brüdt durch Gegenmaßnahmen, oderwähnt durch

The *Münchener Zeitung* front page of mid-August 1934, is an early version of a newspaper edited under strict control of Paul Goebbels, Hitler's propaganda minister. In this copy there is a report on a campaign speech by Hermann Göring, urging merger of presidency and chancellorship in the person of Hitler. Headline says Hitler victory means peace.

a pleasant landlady at 76 Türkenstrasse, who offered me a front room, breakfast, and laundry service for 2½ marks a day. Herr and Frau Georg Frey had a flat on the fourth floor of this somber stone-fronted building with two rooms available for students. The other one was occupied by an attractive girl who had no use for Americans and made a studied attempt to be as rude as possible.

It was in the Frey establishment that I learned the most about what Germany had been through and where its citizens thought it was going. Herr Frey was a jolly fellow; he was what the Germans call a *Naturmensch*. This means he was lusty, witty, and happy underneath his mental and physical callouses. Herr Frey was a subforeman at the BMW (Bayerische Motorenwerke) and worked nights. This fit well with my own schedule, which kept me out late, and we breakfasted together each day soon after noon.

Herr Frey was eager to show me Hitler's Germany. He had been jobless for several years before the advent of nazism. He was not a member of the party but was satisfied to cheer it for the bread and beer it brought back to his table. He talked me into buying a secondhand bicycle to accompany him on long weekend rides into the Bavarian countryside and around the historic and beautiful gardens of the city.

But there were sensitive spots. There was the downtown memorial to the Nazi martyrs who had died in the abortive Hitler *Putsch*. I insisted on walking or riding past this abomination without showing respect. Herr Frey was just as insistent on raising his arm in the party salute.

Then came the death of President von Hindenburg. This was a genuine blow to the Germans, and the decent people of the country showed their grief. But not the Nazis. They used his funeral as an excuse to parade their grossness and shout their *Sieg Heils*. Then they used his demise as the excuse for another phony election to make Hitler president as well as chancellor of the Reich. The voter had a choice of *Ja* or *Nein*. I challenged this bluntly in my arguments with Herr Frey, but could not persuade

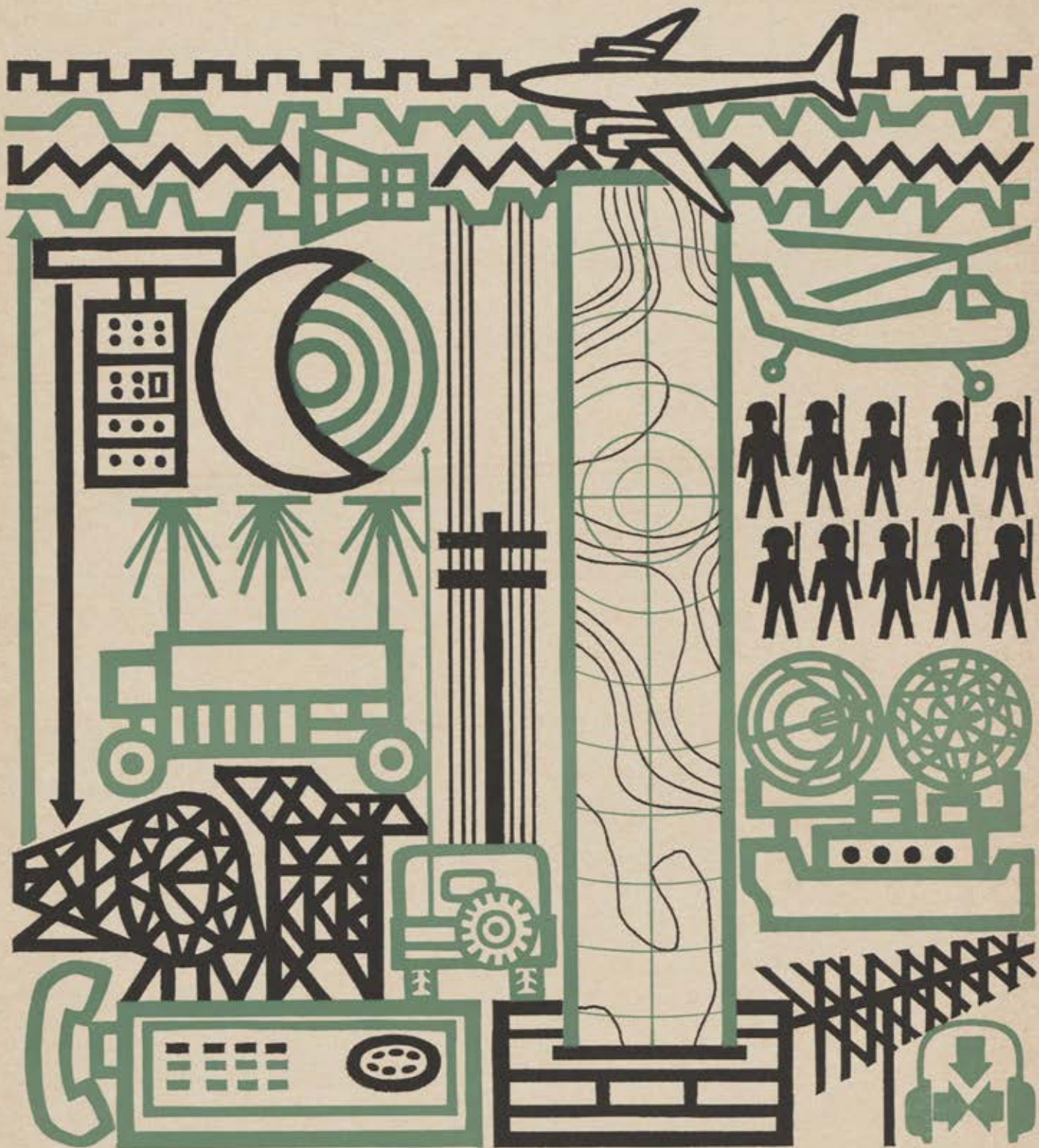
him that this kind of vote was a travesty. He dragged me with him to the polling place so that I could see that he marked a ballot of his own free will and there was no coercion on the scene. He never understood the point I was making.

At one end of Türkenstrasse the Hitler SS elite had an immense armory, not far from the party's Brown House headquarters. (Both were to become targets of Allied bombers a decade later.) In 1934, the armory was the major assembly point for the SS when these troopers were dispatched on exercises or sent to the Austrian border in early attempts to intimidate that nation. I would be awakened, shortly before dawn, by the black-uniformed phalanx. The lines were solid, from curb to curb across Türkenstrasse. They marched in close ranks, and it seemed that the buildings shook with the thrump, thrump, thrump of their heavy boots. They were all big men, armed and ferocious. It was the first time in my life that I had seen a military display that scared me. I think one reason I was scared was that I realized no American of my acquaintance had ever seen such a sight and few would believe my description. It was also while watching one of their marches from my bedroom window that I became certain in my conviction that Hitler meant war.

There was another good reason for knowing the conflict would come, one that the men in the Adlon bar would never report. The BMW had an elaborate showroom in downtown Munich. It was full of the most attractive motorcycles and probably the finest ones in the world. At breakfast one morning, after I had lived several weeks with the Freys, I asked my landlord a question about "the motorcycles you make at BMW." He corrected me in a matter-of-fact way. He said he did not make motorcycles. I displayed surprise and said I thought that was the big BMW product. He said motorcycles were important, but he was employed making component parts for Messerschmitt fighter planes.

(Continued on page 20)

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—Photo by Claude Witze

The date is August 7, 1934. The place: The Königsplatz, Munich. The memorial service for President von Hindenburg is turned into a Nazi rally. Citizens who want to pay tribute to the deceased national leader are forced to give Nazi salute and *Sieg Heil* as cheer for Fuehrer.

It was made clear that the aircraft were not being assembled in Munich at the time. Herr Frey obviously had no idea where the packing cases were headed when they left his work area. Years later, American bombers would seek out those factories. But, in case you have forgotten, this breakfast conversation took place in 1934. At that time Germany still was under the discipline of the Treaty of Versailles and manufacture of warplanes was *verboten*.

Somehow these events of three decades ago fail to cast a meaningful shadow across our dilemma of 1965. They are in my mind every time I hear Secretary of State Rusk, pressed by his critics, make a statement about the American commitment in Southeast Asia. And when President Johnson explains for the umpteenth time that our purpose, or one of our purposes, is to have the confrontation now. And, as the President said, "We have learned at a terrible and brutal cost that retreat does not bring safety and weakness does not bring peace." He says the purpose of our enemy in Vietnam, like that of the blackshirts I saw on Türkenstrasse, is to defeat us and to extend the domination of its power. And, the President recalls, "We learned from Hitler at Munich that success only feeds the appetite of aggression." The President's reference, of course, is to the Munich Pact of 1938. When Britain's Chamberlain signed it, had he ever seen the blackshirts march? And did he know that Herr Frey had been building fighters for about five years?

I came home from Germany in time for the holiday season in 1934 and spent the next five years, the pregnancy of Armageddon, working on newspaper copy desks. There wasn't an edition that went to press without some display in type of the voice of dissent in America. *We can do business with Hitler* became a shibboleth among those who lacked the foresight of Roosevelt and Churchill. And this thinking was stimulated, I am certain, by some of the copy filed from the Adlon bar in Berlin.

I think I can prove it.

It was customary in the thirties, and may still be, for newspaper publishers and editors to make a spring visit to the continent. They always came home with firm ideas about Europe's level of prosperity, the outlook for political and international stability, and, of course, the outlook for war or peace. It is no secret that when these majordomos of the press traveled abroad they did it under the wings of their staff men on duty in those nations. I suspect some of them were taken to the Adlon bar to meet at the *Stammtisch* and absorb the reflections of their representatives.

The results of this exercise in 1939 are documented. They are on page 18 of *Life* Magazine for July 24, 1939. The headline says: "U.S. Publishers, Who Flew the Atlantic, Return With Assurances of Peace." Sure enough, there are the pictures of eight prominent American newspaper bosses. The editors of *Life* said these men had spent three days in Europe after crossing on the first flight to go to the continent by way of Newfoundland and Ireland. It was a route they were unwittingly blazing for four-engine bombers and history's first great air logistics effort.

How did these publishers spend their three days? "As practicing journalists in search of a story," according to *Life*. The subject: "Will there be war?"

The virtually unanimous opinion: "There will be no war this year."

Here are some of the choice quotes from the lines beneath the eight pictures:

"There will be no war, but England is ready."

"I came back reassured."

"The situation has greatly eased."

One publisher said he sat next to Chamberlain at tea and: "I am less inclined to think there is going to be a war than when I went over."

Another, a man who headed a great newspaper chain and a news service, had no doubt about the enduring peace. He said both Anthony Eden and Lord Beaverbrook had assured him there would be no war.

A final publisher displayed the kind of skepticism of which great newspapers are made. He said he had discovered a newspaperman in Europe, a rare bird, who predicted there would be a war in seven weeks. However, the publisher continued, "my impression is there is very likely *not* to be a war this year."

Well, his reporter friend was not fully accurate. Seven weeks is forty-nine days. Hitler marched into Poland on September 1, 1939. That was only thirty-eight days after *Life* hit the newsstands.

It is not my intention to strain the parallel, if there is one, between the 1930s and the 1960s. My impression is that the men lunching these days in that cafe on Tu Do Street in Saigon work a hell of a lot harder than the *bon vivants* of the Adlon bar. After all, Berlin in 1934 was a place for comfortable and cheap living, a choice post for a man with a typewriter, an expense account, and a paycheck in American dollars. Saigon is unpleasant and dangerous. As a rule, the reporters are not the seasoned men who felt, for the most part, that Hitler was not a threat. They can't see all the war in Vietnam, even with their frequent excursions to Pleiku, Da Nang, and down into the Mekong Delta.

For all the improved press effort to cover the Vietnamese war, out of Saigon, the Pentagon, the White House, and the State Department, it is clear that the facts of life are not getting across. The America Firsters of the mid-1930s have been replaced by the unwashed gadflies who are picketing the White House. They share their inspiration with the uninformed intellectuals who call all-night meetings on college campuses and *demand*, no less, that McGeorge Bundy tilt with them on a platform.

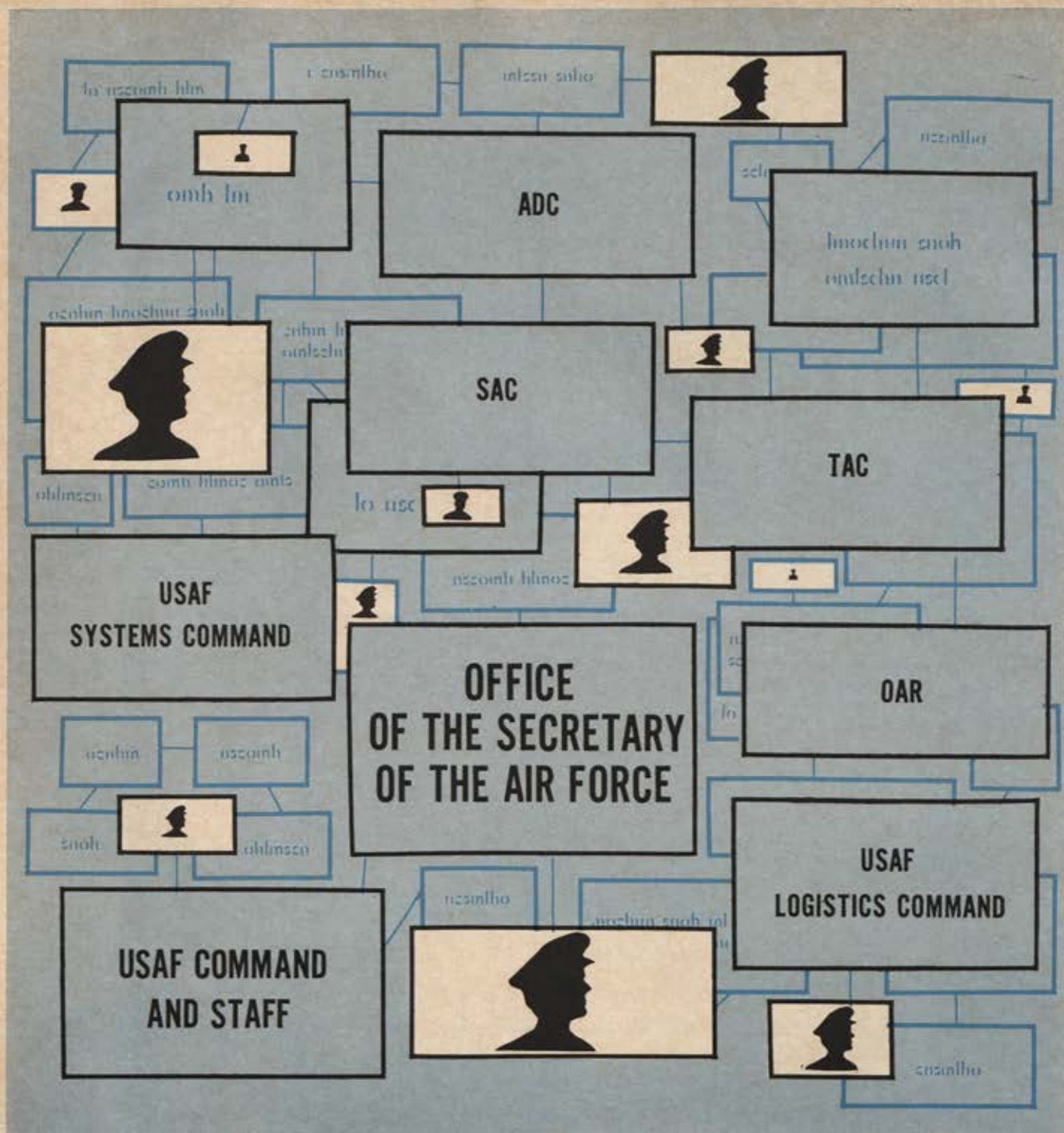
There is no doubt we learned many things from World War II. In the material sense, they are competently discussed in this issue of *Air Force Magazine*. In the area of men's minds, where every crisis we have with totalitarianism results in a new crop of unbelievers, the lesson is on the record and remains there. As President Johnson has realized by this time, the problem is one of communication. It must be solved by a government and a press with complete credibility. Nothing less than complete credibility will do.—END

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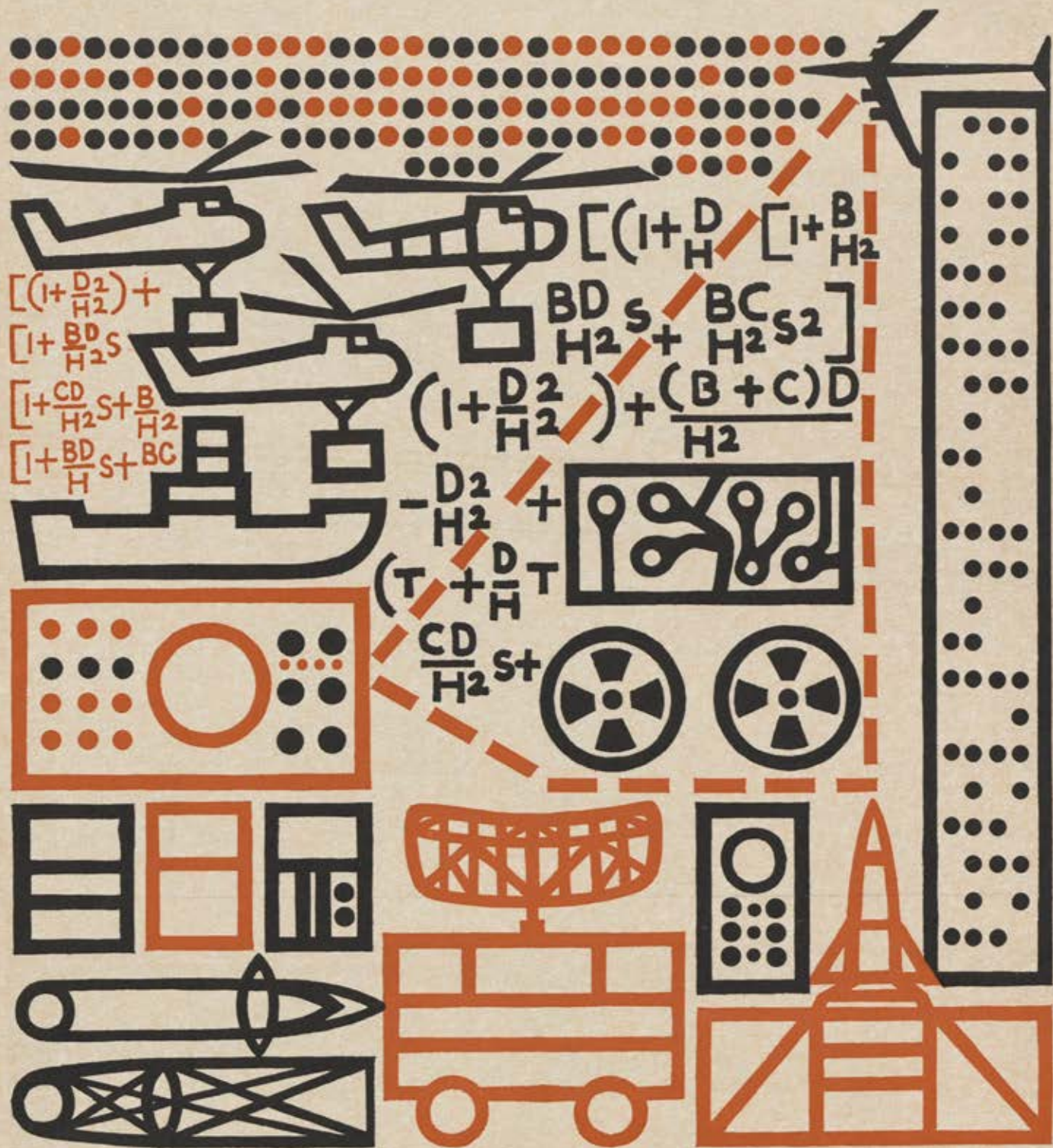
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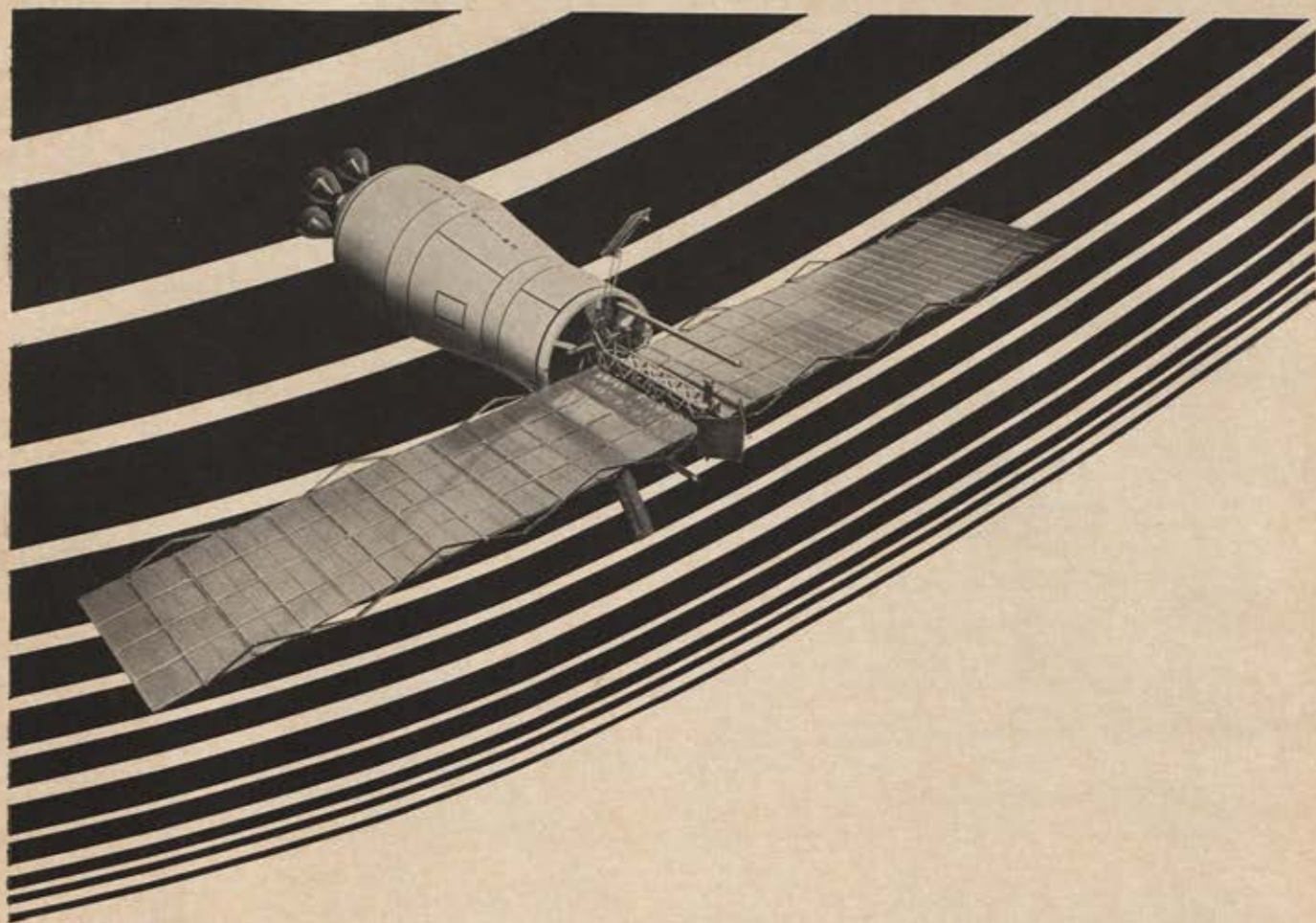
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THREE OUT OF THREE: Unfolding its giant "wings" in space recently was another of NASA's PEGASUS meteoroid detection satellites . . . a perfect record of three successes in three launches for PEGASUS' prime contractor, Fairchild Hiller. All three PEGASUS spacecraft—largest instrumented satellites ever orbited—are now transmitting data about space meteoroids through which men and instruments must fly to the moon and beyond. At 14 plants in 5 states, Fairchild Hiller builds spacecraft and data systems, V/STOL and conventional aircraft, electronic and mechanical devices . . . and a reputation for excellence.



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AEROSPACE WORLD

By Allan R. Scholin

ASSOCIATE EDITOR, AIR FORCE/SPACE DIGEST

WASHINGTON, D. C., AUG. 23

Air attacks against the Viet Cong in South Vietnam and their sources of support in North Vietnam will increase "manyfold" by the end of the year, Secretary of Defense Robert S. McNamara has announced.

He outlined to the Senate Appropriations Committee a number of steps to prepare the Air Force for its role in a major buildup of US forces to wrest the initiative from Communist guerrillas.

"The Government of South Vietnam's strategy, with which we concur, is to achieve the initiative, to expand gradually its area of control by breaking up major concentrations of enemy forces, using to the maximum our preponderance of airpower, both land- and sea-based," Secretary McNamara declared.

"The number of fixed-wing attack sorties by US aircraft in South Vietnam will increase manyfold by the end of the year. Armed helicopter sorties will also increase dramatically

during the same period, and extensive use will be made of heavy artillery, both land-based and sea-based. At the same time, our air and naval forces will continue to interdict the Viet Cong supply lines from North Vietnam, both land and sea."

Specific measures applying to the Air Force include the following:

- B-52 raids from Guam will be stepped up.

- To support greatly increased airlift requirements, utilization rate of MATS aircraft will be boosted to an average of eight hours a day, from five at present; the present rate of one and a half hours a day for TAC C-130Es will be raised to five hours.

- Nine Air National Guard F-100 groups, four ANG RF-84F reconnaissance units, and eleven C-124 groups in the Air Force Reserve will go to full authorized strength, "ready to deploy on twenty-four hours' notice by the end of this calendar year."

- To meet these goals, and to cover expansion in related training and sup-

port functions, strength of the active Air Force will be boosted by 40,000 to 864,000 men, plus 4,600 in the Air Reserve Forces.

Reserve Forces units, which are in effect alerted for possible call-up, are these:

In the Air Guard:

Three F-100 wings, each with three groups—113th Tactical Fighter Wing, Andrews AFB, Md., with 113th TF Gp., Andrews, 107th, Niagara Falls, N. Y., and 177th, Atlantic City, N. J.; 121st Wg., Lockbourne AFB, Ohio, with 121st Gp., Lockbourne, 131st, St. Louis, Mo., and 184th, McConnell AFB, Kan.; and 140th Wg., Denver, Colo., with 140th Gp., Denver, 150th, Kirtland AFB, N. M., and 185th, Sioux City, Iowa.

One RF-84F reconnaissance wing, the 127th, Detroit, Mich., with four groups—127th and 191st, Detroit; 155th, Lincoln, Neb.; and 188th, Ft. Smith, Ark.

Also to be brought to full strength
(Continued on following page)



The US Air Force can be lethal, as symbolized by these bombs streaming from two B-52 Stratofortresses of SAC's Guam-based 3d Air Division upon a Viet Cong stronghold in Vietnam. The thirty-bomber raids, each dropping 600 tons of bombs, are succeeding in breaking up enemy concentrations.



But the Air Force prefers its role as a guardian of world peace, exemplified in this starkly beautiful picture of a night launching at Cape Kennedy, Fla., recorded by USAF photographer Chuck Rogers on July 20, when an Atlas-Agena boosted a pair of nuclear detection satellites into orbit.



Rotating pylons mounted under the wings of this General Dynamics F-111A undergoing flight tests at Edwards AFB, Calif., swivel to keep the fighter's externally carried weapons parallel to the fuselage during changes in angle of the variable-sweep wing. Canister mounted on tail carries anti-spin chute for test use.

are the Guard's 157th Tactical Control Group, with headquarters at Jefferson Barracks, Mo., and the 127th Reconnaissance Technical Squadron, Battle Creek, Mich.

In the Air Force Reserve:

Six groups now flying C-124s—916th, Carswell AFB, Tex.; 917th, Barksdale AFB, La.; 918th, Dobbins AFB, Ga.; 935th and 936th, Richards-Gebaur AFB, Mo.; and 940th, McClellan AFB, Calif.

Two groups now converting to C-124s—941st, Paine Field, Wash., and 942d, March AFB, Calif.

Three groups now equipped with C-119s but scheduled to get C-124s as they are replaced in the active force by C-141s—905th, Bradley Field, Conn.; 915th, Homestead AFB, Fla.; and 937th, Tinker AFB, Okla.

The eleven Reserve groups are at present assigned to seven wing headquarters, all of which have been authorized some additional personnel to handle increased recruiting and administrative chores.

At full strength, these units will total 20,000 men.



USAF is expected to deploy a squadron of Northrop F-5s to South Vietnam by the end of October to evaluate the F-5's performance in support of ground forces in counterinsurgency operations.

Designated the 4503d Tactical Fighter Squadron (Provisional), the unit is now in training at Williams AFB, Ariz.

The Defense Department has not yet announced plans to buy the F-5 for the Tactical Air Command, although the US is furnishing it to several coun-

tries under the Military Assistance Program and Canada recently selected it for the RCAF. Planes for the provisional squadron have been drawn from MAP production.

But, barring the unlikely prospect that the F-5 falls on its face in South Vietnam, indications are that USAF will equip as many as four TAC wings with it, augmenting ten programmed wings of F-4s.

USAF has, of course, had considerable experience with the T-38 Talon advanced trainer version of the F-5, which recently passed the 500,000-flying-hour mark in Air Training Command. The Talon has proved economical to maintain, averaging 13.3 maintenance hours per hour of flight, and its accident rate in ATC was only 2.9 per 100,000 flying hours in 1964.

The Canadian version, designated the CF-5, will be assembled by Canadair Ltd., of Montreal, which will also build the airframes. General Electric J85-15 engines will be built by Orenda in Montreal, and many other components will be produced by sub-

contractors in Canada. The contract, as announced by Minister of Defence Paul Hellyer, calls for 125 planes to be produced over a five-year span at a cost of \$215 million. The portion of this money spent in the US will be offset by US military purchases in Canada, he said.

Performance of the F-5 in Vietnam will be of interest not only to the Viet Cong, who will absorb its striking power, but to the nine free-world nations like Canada already acquiring it for their air forces and to half a dozen others who are considering buying it.



The military pay raise, averaging 11.1 percent for enlisted men and 6.4 percent for officers—with biggest boosts for those in their first two years of service—takes effect September 1, after unanimous approval by both houses of Congress. It also increases combat pay from \$55 to \$65 a month.

The Air Force Association, which has strongly supported the pay bill since it was first introduced by Rep. L. Mendel Rivers (D.-S. C.), Chairman of the House Armed Services Committee, congratulates Congressman Rivers and his committee members, who so thoroughly convinced their colleagues in both chambers of the need for a more substantial increase than that proposed by the Administration. Congressman Rivers' original pay tables were modified somewhat in the Senate Armed Services Committee, led by Sen. Richard Russell of Georgia, but because the total sum remained at about a billion dollars a year, the Senate adjustments were readily accepted by Mr. Rivers and the House.



The Defense Department's plan to merge the Army Reserve with the Army National Guard has been rejected by the Hébert Subcommittee of (Continued on page 29)



At farewell dinner in Washington, Vice President Hubert H. Humphrey meets foreign air cadets who were guests of US Civil Air Patrol wing this summer. Twenty-one nations in Europe, Middle East, and western hemisphere joined in cadet exchange, with 138 American youths visiting overseas.

The OV-10A is the newest advance in the aviation state-of-the-art. It is a low-cost, lightweight airplane designed to:



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the House Armed Services Committee.

"On the basis of extensive testimony received since March 15 by the subcommittee in both open and closed sessions, the subcommittee believes that the present proposal of the Department of Defense to merge the Army Reserve components is not in our national interest," a statement signed by subcommittee chairman F. Edward Hébert (D.-La.), and seven of its eight members, asserted. "The merger, as proposed by the Department of Defense, would result in an immediate and serious loss in the combat readiness of the affected Reserve units."

Senate leaders, too, said this is no time to meddle with the existing Reserve structure.

Shortly before the subcommittee acted, Deputy Defense Secretary Cyrus Vance had sought to exclude discussions on merging the Air Reserve Forces on the grounds that, in his words, "Its prompt implementation is not required by the need for greater usable combat strength, as is the case with the Army Reserve components." The subcommittee immediately rejected that suggestion, declaring that its recommendations, whatever they were, would apply to both Army and Air.

The Hébert subcommittee left the door open for further discussions with DoD, emphasizing that it is "determined to resolve the question of future reorganization of the Reserve components by recommending the enactment of positive legislation on the subject."



Programmed reductions in Air Reserve Forces troop carrier units were opposed by AFA's Reserve and Guard Councils, which met in joint session in Washington in August.

"It is now public knowledge that DoD plans to phase out most of the Air Reserve Forces airlift units," the Councils said in a message to the agenda subcommittee of USAF's Air Reserves Forces Policy Committee. (See "Bulletin Board," p. 144, AIR FORCE/SPACE DIGEST, April '65, which reported Secretary McNamara's testimony to Congress that all C-119 aircraft are to be phased out, while C-123s are being returned to the active Air Force.) "In view of the worsening world situation," the Councils declared, "it is requested that this program be reevaluated."

The Councils also suggested that, because of Congress' decision not to proceed with merger plans in this session (Continued on following page)



There must be a better way.

Iced tea. Mint juleps. Skinny dipping at midnight. A small ivory fan. Beer. Sno cones. Skinny dipping at noon. Ice bags. Electric fans. A tall glass of cold water. Skinny dipping before dinner. Tom Collins. Popsicles.

All very well and good, but when we're talking about astronauts and space vehicles, none of them seem to make sense. Astronauts and the instruments they use tend to get pretty hot under the collar up there. And you know how grumpy you get when you're hot and sticky. So Hydro-Aire came up with the answer—liquid coolant pump assemblies. Apollo will use them. The Lunar Excursion Module will use them. The Saturn C-V uses them.

Hydro-Aire has had over 20 years experience in electro-mechanical, electric and fuel system engineering, but this problem demanded something else again. It's easy to do what you've been doing for 20 years, but when you're talking about completely new methods and components, that's another matter. We came up, for instance, with the Invermotor. (Ed. Note: These marketing/sales/advertising people can really obfuscate things. The Invermotor is a brushless DC motor. Can't you just see the conference? "Let's get a name for this thing." "How about Brushless DC Motor?" The guy that came up with that one probably hasn't been heard of since.) What Hydro-Aire does is hermetically seal the stator in a canned package. This way we can eliminate the unreliable shaft seals and allow fluid to be used for internal motor cooling and lubrication. Motor windings can be completely isolated from corrosive fluids.

Now back to all that experience. We build centrifugal pumps and all types of positive displacement pumps—vane, piston and gear. We build all the motors and drives to drive them. And we not only design them, we build them right in the house. What we're really leading up to in not too cool a fashion is: you *must* have some problems in critical fuel pumping for space technology programs. You know. Something really hot.

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sion, "an early message be sent to the field clarifying this situation." Pointing out that Reserve mobile communications units possess only ten percent of major equipment items, and that most of them are commercially available, it recommended that such items be acquired by direct procurement.

In other recommendations, it asked (1) that USAF seek restoration of Reserve unit vacancy promotions, possibly coupled with a career retirement plan to reduce field grade overages; (2) a revision of Sec. 8033, Title 10, US Code, pertaining to functions of

quired only one-tenth of its midcourse correction capability to hit its pre-selected target. It was the first completely successful Centaur launch in six attempts.

USAF will assign 128 officers to NASA's Manned Spacecraft Center in Houston, Tex., between now and next March on two-year tours to receive on-the-job training in operational control of manned spaceflights by augmenting NASA's flight operations staff.



SENIOR STAFF CHANGES . . . Maj. Gen. Gordon H. Austin, from DCS/Operations, Allied Air Forces Central Europe, Fontainebleau, France, to Cmdr., 26th NORAD (CONAD) Region and additional duty as Cmdr., 26th Air Div. (SAGE), Stewart AFB, N. Y., replacing Maj. Gen. Von R. Shores . . . **Maj. Gen. Glen R. Birchard**, Vice Cmdr., MATS, Scott AFB, Ill., is relieved from additional duty as C/S, MATS . . . **Alva L. Brothers, Jr.**, from Technical Director (Research Management), Aeronautical Systems Div., AFSC, to Dir., Advanced Reconnaissance Planning, Dep. for Reconnaissance, Aeronautical Systems Div., AFSC.

Maj. Gen. Cecil E. Combs, from Cmdt., AFIT, AU, Wright-Patterson AFB, Ohio, to Asst. to Cmdr., AFLC . . . **Robert L. Feik**, from Technical Director, The Electro-Mechanics Co., Austin, Tex., to Chief, Operations Research Analysis, Hq. AFCS, Scott AFB, Ill. . . . **Brig. Gen. Kenneth H. Gibson**, from Chief, USAF Gp., JUSMMAT, Turkey, to Dep. Project Manager, Project Cloud Gap, US Arms Control and Disarmament Agency, OSD.

Brig. Gen. Guy H. Goddard, from Civil Engineer, AFLC, Wright-Patterson AFB, Ohio, to Dep. Dir. for Construction, DCS/Programs and Resources, Hq. USAF . . . **Brig. Gen. Frederic C. Gray**, from Cmdr., TUSLOG, Ankara, Turkey, to Vice Cmdr., 26th Air Div. (SAGE), ADC, Stewart AFB, N. Y., replacing Brig. Gen. Thomas B. Whitehouse.

Maj. Gen. Lloyd P. Hopwood, from Cmdr., Amarillo Technical Center, ATC, Amarillo AFB, Tex., to C/S, Allied AF Southern Europe . . . **Eugene L. Kirschbaum**, from Planning and Programming Officer, DCS/Comptroller, AFSC, Andrews AFB, Md., to Technical Adviser to DCS/Comptroller, AFSC . . . **Brig. Gen. Joseph J. Kruzel**, from Cmdr., 832d Air Div., TAC, Cannon AFB, N. M., to Dir. of Operations, PACAF, Hickam AFB, Hawaii.

Maj. Gen. Glen W. Martin, from DCS for Plans and Operations, PACAF, Hickam AFB, Hawaii, to The Inspector General, Hq. USAF, replacing Lt. Gen. William K. Martin . . . **Lt. Gen. William K. Martin**, from The Inspector General, Hq. USAF, to Cmdr., 15th AF, SAC, March AFB, Calif., replacing Lt. Gen. Archie J. Old, Jr., who is retiring . . . **Maj. Gen. Augustus M. Minton**, from C/S, PACAF, Hickam AFB, Hawaii, to

Asst. to Cmdr., Hq. MATS, Scott AFB, Ill. **Brig. Gen. Robert C. Richardson**, from Asst. DCS/Plans, AFSC, Andrews AFB, Md., to DCS/Science and Technology, AFSC . . . **Maj. Gen. Robert R. Rowland**, from Asst. to C/S, PACAF, Hickam AFB, Hawaii, to C/S, PACAF, replacing Maj. Gen. Augustus M. Minton.

Maj. Gen. James C. Sherrill, from DCS/Plans, MATS, Scott AFB, Ill., to Dep. Dir. for Transportation, J-4, The Joint Staff, JCS . . . **Maj. Gen. Von R. Shores**, from Cmdr., 26th NORAD (CONAD) Region and additional duty as Cmdr., 26th Air Div. (SAGE), Stewart AFB, N. Y., to DCS/Operations, Allied Air Forces Central Europe, Fontainebleau, France, replacing Maj. Gen. Gordon H. Austin.

Brig. Gen. Lewis W. Stocking, from Dir., Combat Operations Center, J-3, NORAD and CONAD, Ent AFB, Colo., to Dep. Cmdr., 5th Allied Tactical AF, Vicenza, Italy . . . **Maj. Gen. John W. Vogt, Jr.**, from Asst. to DCS/Plans and Operations, PACAF, Hickam AFB, Hawaii, to DCS/Plans and Operations, replacing Maj. Gen. Glen W. Martin.

Brig. Gen. Thomas B. Whitehouse, from Vice Cmdr., 26th Air Div. (SAGE), ADC, Stewart AFB, N. Y., to C/S, US Military Assistance Command, Thailand . . . **Brig. Gen. Douglas E. Williams**, from C/S, AFCS, Scott AFB, Ill., to Vice Cmdr., AFCS.

NOMINATED FOR PROMOTIONS:

To Lieutenant General: Glen W. Martin.

To Major General: Richard S. Abbey, George S. Boyland, Jr., Joseph J. Cody, Jr., William E. Creer, Howard A. Davis, Joseph L. Dickman, Richard H. Ellis, Thomas R. Ford, William D. Greenfield, James W. Humphreys, Lawrence S. Lightner, Loren G. McCollom, Timothy F. O'Keefe, Thomas B. Whitehouse, William W. Wisman.

To Brigadier General: Russell A. Berg, Sterling P. Bettinger, Carroll H. Bolender, Archie M. Burke, Charles W. Carson, Jr., John S. Chandler, Jr., Frank J. Collins, John A. Des Portes, Frank K. Everest, Jr., Arthur E. Exon, John E. Frizen, Leo P. Geary, Thomas L. Hayes, Jr., Stephen W. Henry, Henry L. Hogan, III, Gerald W. Johnson, David C. Jones, James D. Kemp, Leo A. Kiley, James F. Kirkendall.

Also John W. Kline, Henry B. Kucheman, Jr., David I. Liebman, Lee M. Lightner, William V. McBride, Burl W. McLaughlin, Sherman F. Martin, Frederick E. Morris, Jr., John R. Murphy, Edward M. Nichols, Jr., Francis W. Nye, Roger E. Phelan, Russell K. Pierce, Jr., Daniel E. Riley, Herman Rumsey, Louis T. Seith, August F. Taute, James H. Thompson, Rocky Triantafellu, George V. Williams.

RETIREMENTS . . . Brig. Gen. William C. Bacon, Gen. Mark E. Bradley, Jr., Brig. Gen. Chester C. Cox, Lt. Gen. Harold W. Grant, Brig. Gen. Edward J. Hopkins, Maj. Gen. Joseph T. Kingsley, Jr., Gen. Walter C. Sweeney, Jr., Brig. Gen. Clair L. Wood.—END



USAF Lt. Col. James U. Cross, Military Aide to the President, met President Johnson as pilot of C-140 Jet-Star in which President often flies to his Texas ranch. Cross, forty-year-old Alabamian, succeeded Maj. Gen. Ted Clifton, USA, in the White House post.

the Policy Committee to make it more "meaningful"; and (3) an amendment to the Armed Forces Reserve Act of 1955 "to broaden the stated purposes of the Reserve Forces to include peacetime utilization," so that funds can be allocated to Reserve Forces projects in support of USAF missions.



News Notes—The F-12 Test Force, an organization of 500 men representing ADC, SAC, and AFSC, received the USAF outstanding unit award for their work on the Lockheed YF-12A and SR-71, highlighted by the YF-12's establishment of nine world and class records.

A perfect flight was logged by the Atlas-Centaur space booster from Cape Kennedy, Fla., August 11, in launching a Surveyor model payload on a simulated flight to the moon. Inserted into a 500,000- by 100-mile orbit, the spacecraft would have re-

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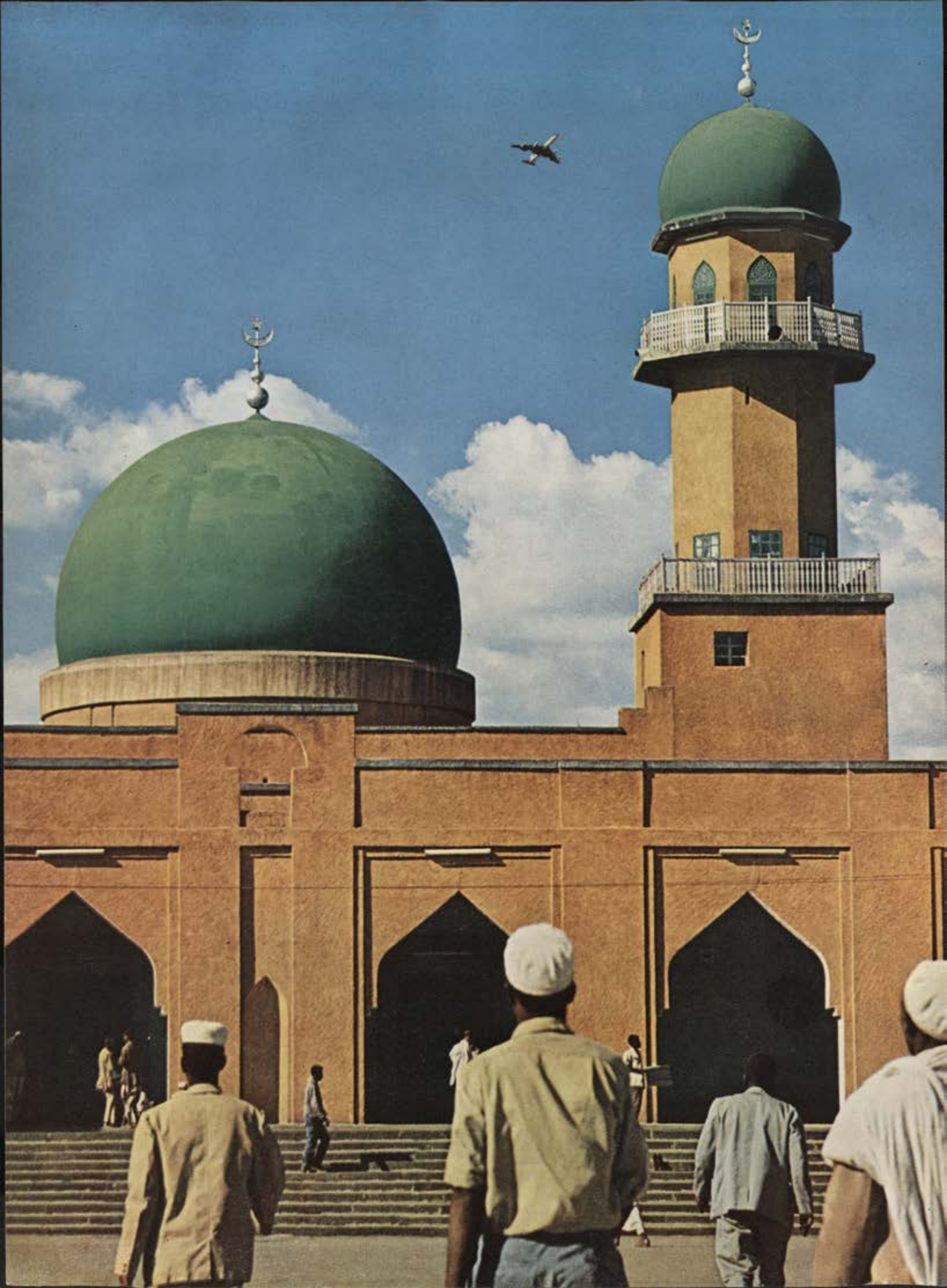
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Meeting the New Challenge

THIS Fifteenth Annual Air Force Almanac issue of AIR FORCE/SPACE DIGEST has as its primary theme the lessons of airpower as they have been painfully learned from the dim and unprepared era that preceded World War II until today. It is a story that is still unfolding. Now, twenty years after the end of the European and Japanese wars and a dozen years after Korea, our nation is again involved in conflict, this time against unseen enemies in steaming jungles. There, as elsewhere in the world, airpower is meeting new and difficult challenges. Out of these challenges new lessons are emerging.

Yet for what it can teach us, it is wise to look back on history. What role has airpower played and how was its strength built in the decades so many of us have lived through and during which so many of us have served?

In the evil hands of Hitler, airpower served a malignant deterrent role. First, it helped frighten the Western democracies into the inaction that brought on World War II. Then the Luftwaffe played a cruel role in the subjugation of Europe. In Allied hands, and thanks to the incredible performance of American industry, airpower helped smash the Nazi nightmare. Since 1945, in American and NATO hands, airpower has deterred the Soviet colossus from attempting to repeat Hitler's triumph in Europe. In Korea, a new kind of airpower helped turn back a militant China on the march.

Airpower's story in the past decades is technology's story, too. For without the mobilization of scientific and engineering brainpower that has been one of the miracles of our time, airpower could not have achieved these feats. In a few decades technological man has not only conquered the air, in war and peace, but now courses through space.

Each in his way, the contributors to this issue have told this story.

Secretary of the Air Force Eugene M. Zuckert writes feelingly about the Air Force he has known and which he did so very much to help build.

Air Force Chief of Staff Gen. John P. McConnell marks the anniversary of the establishment of the US Air Force as a separate arm and of the challenges it has and continues to face.

Historian Robert E. Futrell provides a sweeping historical background.

Karl G. Harr, Jr., President of the Aerospace Industries Association, recalls how US industry responded to President Roosevelt's World War II arsenal-of-democracy declaration and how the impossible was achieved. Out of that feat came a new and vital government-industry partnership, which has helped preserve the security of this country and the peace of the world.

Senior Editor Claude Witze writes, as a witness of the Nazi buildup before World War II, of the refusal of most people to see the holocaust being prepared by Hitler for the West. He draws some painful analogies to the present-day situation in Asia, where he has also been a witness.

Technical Editor J. S. Butz, Jr., tells the story of the World War II role of technology and raises some important questions as to the viability of today's military/technological policy, philosophy, and organization.

Associate Editor William Leavitt writes of the space revolution that was superimposed on the airpower advances of World War II and which has since transformed the world anew.

In addition, this issue carries the reports from the major air commands and the annual compilation of data on today's United States Air Force that have made the Almanac Issue a "must" reference book throughout the Air Force and the aerospace industry.

We hope this issue will be useful—and stimulating—to all our readers.

—THE EDITORS

In the eighteen years since its establishment as a separate service, the US Air Force has successfully met the challenges of a momentous era which has seen vast changes and advances in airpower, among them the deployment of a mixed force of combat-ready aircraft and ballistic missiles. Deterrence and defense have been the Air Force's aims. But new and stern challenges lie ahead...

Since 1947—The Endless Challenge to the Air Force

By Gen. John P. McConnell

CHIEF OF STAFF, UNITED STATES AIR FORCE



General McConnell, shown here with Secretary Zuckert and General LeMay at the time of his swearing-in as Chief of Staff last February, started his military aviation career in 1933 when he won his wings at Kelly Field, Tex., after graduating from West Point the previous year. He has a distinguished record of military service, having served in the Pacific during World War II, and later in important staff and command posts, including that of SAC Vice Commander in Chief and Deputy Commander in Chief, US European Command. He was Vice Chief of Staff, USAF, before succeeding Gen. Curtis E. LeMay as Chief of Staff.

AS WE commemorate the signing of the National Defense Act of September 18, 1947, which brought the Air Force into being as a separate service, it seems proper that we take full account of the threefold significance which that event has held for us and for the nation.

In a deeply gratifying sense, the passage of that law accorded recognition of the vital defense role which the Air Force had earned through its period of arduous development and its decisive contribution to victory in World War II. Implicit also in the Air Force's elevation to coequal status with the Army and Navy was a grateful acknowledgement of the service rendered by aviation pioneers who had the vision to recognize airpower's potential and the practical ability to develop and employ it for the protection of our freedom.

Another significant feature of this anniversary is the fact that it provides an occasion to note the Air Force's outstanding success over the past eighteen years in meeting its increased responsibilities. Not only has our service employed a mixed force of ballistic missiles and manned bombers effectively as the nation's primary instrument of strategic deterrence, it also has developed and demonstrated an improved capability for deterring aggression at the lower levels of conflict. Additionally, and within the past decade, we have made strides toward achieving the capability to defend our country in space.

Looking to the future, it is apparent that we are moving into a period of even greater opportunity and sterner challenge. On this Eighteenth Anniversary, I therefore consider it essential that we approach with renewed energy and dedication the many demanding tasks that lie ahead in management, scientific, and operational fields. This provides our best prospect for success in building on the proud tradition of the Air Force and in supporting our national objective to create conditions in which free countries can survive and prosper.—END



The dedicated public servant who has served as Air Force Secretary or as Assistant Secretary for half of the eighteen years the Air Force has been a separate service writes feelingly about his experiences and of his sense that the Air Force has truly attained its goal of professionalism all along the line. But he warns, too, of the significant problems facing the Air Force in a time of fast-moving change and technological advance . . .

A Parting Message

By Eugene M. Zuckert

SECRETARY OF THE AIR FORCE

Mr. Zuckert, who became Secretary of the Air Force in 1961, served earlier as Assistant Secretary under the service's first Secretary, Stuart Symington. A distinguished attorney, he is a former member of the Atomic Energy Commission and former Assistant Dean of the Harvard Graduate School of Business Administration. He is a naval veteran of World War II and a Yale graduate.

WHEN I was asked to write something for this issue of AIR FORCE/SPACE DIGEST it seemed to me that I could have chosen no better forum and no better time to say a few parting words of praise to our Air Force people. This is fitting because the annual Almanac Issue, devoted as it is to capturing the scope and sweep of the Air Force mission, is in essence a tribute to the men and women, military and civilian, who are the heart and soul of the Air Force.

On July 10 of this year the President announced my resignation from the job of Secretary of the Air Force. The decision to step down was, in my own mind, made last fall. It was not a hard one in the same sense as those I've had to make in almost five years of making some extremely hard decisions. It stems from my belief that four years is about the proper "tour" for a Secretary and that in a dynamic organization such as ours there is need for a periodic infusion of a fresh viewpoint at the top.

An organization thrives under different kinds of top executives at various points in the organization's evolution. Dr. Harold Brown will do an outstanding job as Secretary at this time in the growth of the Air Force. We are at a stage, I believe, where, despite the importance of current operations, the development of our future weapon systems is probably our biggest problem. Dr. Brown's vivid imagination and his unique experience as an outstanding scientist and administrator in research and development qualify him for taking

over the Air Force leadership and meeting the challenges of the future.

Actually leaving the Air Force is difficult. It is natural to want to see the outcome of the many plans initiated during my tenure in office, to see hardware emerge from blueprints, to see weapon systems take their places in operational units.

Most difficult, however, is severing the ties that connect an Air Force Secretary to every command, unit, and individual in the service. The Air Force has strong powers of attachment, and it is not easy to depart from it.

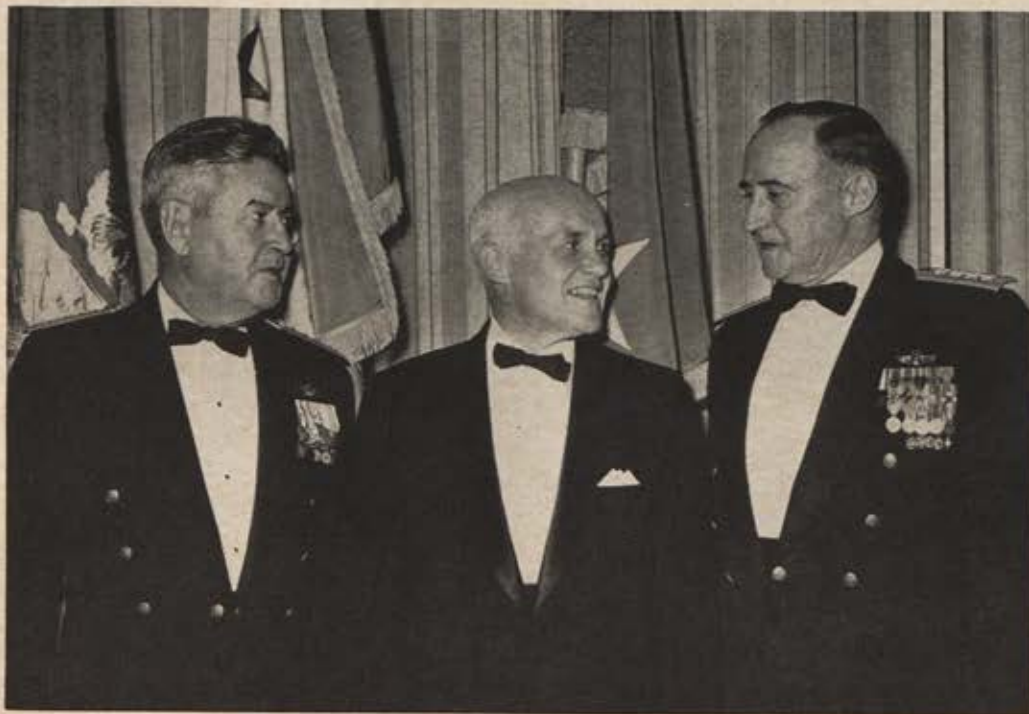
Though it is impossible to be completely objective at this point, I can look back over the four years and eight months of my Secretaryship and see sure signs of growth and maturity in our strength and capabilities. It is sincerely gratifying.

I can think back to dinings-in all around the Air Force, numerous luncheons and discussions with airmen, NCOs, and officers in many parts of the world. Everywhere I saw dedicated, hard-working, and talented people who were concerned that the Air Force was getting the best and doing its best.

My mind is filled with many thoughts about the importance of people in the Air Force. I remember welcoming each group of new staff officers to the Pentagon and trying to point out to them the tremendous responsibilities placed on them as individuals and as a group. I recall the meetings with new general officers, trying to convey to them the great need for their talents and wisdom. And I remember the many hours spent working with the Chief of Staff, trying to get the right people for the right jobs.

The Air Force has been a separate service for eighteen years, since September 1947. Statistically, I have been Secretary during twenty-five percent of that time and Secretary or Assistant Secretary for fifty percent of that time. With that kind of seniority, perhaps

(Continued on following page)



Two examples of the professionalism that outgoing Secretary of the Air Force Eugene Zuckert says has been achieved by the Air Force stand on either side of him. At left, the man who has become a symbol of Air Force excellence, General Curtis LeMay, and, right, his successor as Chief of Staff of the Air Force, General John P. McConnell.

I have the right to say that the professionalism of our Air Force people is no longer a goal: It is an achievement. The evidence is there in our counterinsurgency forces in Vietnam, in SAC's alert forces, in our tactical air forces, in MATS's airlift, and AFSC's and AFLC's management. It is evident everywhere in our Air Force. It can be seen, for example, in our Air Reserve and Air National Guard units, which are currently providing additional airlift support to MATS in the critical airlift to Vietnam.

Of course there is room for improvement. Technology doesn't stand still and neither does the world's political situation. The people of a professional force know that study and change are inherent to professionalism and that they have to gear themselves to that way of service. They not only know it, they're doing it.

Right in the Pentagon there is ample proof of this brand of professionalism. From my observation I can say that the Air Staff team is the best we've ever had. It's in the way the individual parts of the staff work together and their far greater sense of realism. And I think that we are managing with a greater degree of precision than I, personally, have ever seen before. All of this is the product of the cumulative work of General McConnell and the Chiefs of Staff who preceded him.

A former Service Secretary once described his office as a "rallying point for bad news." That's a fairly accurate description. It's the nature of the job, I suppose, that the blame stops there and the credit is passed either up or down. Most of the flaps or crises come in three categories—ordinary, secondary, and colossal—evolving, surprisingly enough, not from some momentous event, but from what I call "the windblown pop fly"—a piece of bad luck, a "goof" by somebody followed by the application of the principle that when things are bad they generally get worse.

The office is also the focal point of decisions of all

kinds—on weapon systems, for example. We've chalked up some tremendous achievements in gaining new systems, but I'll admit we've had some disappointments, too, like failing to get the AMSA and the F-12. The personal satisfaction of seeing the C-141, the F-111, and the Titan III come along so well has brightened our days and kept our optimism alive. The C-5 and the Manned Orbiting Laboratory (MOL) are other bright spots to look toward in our future.

In reflection, I regard the ICBM story an epic. Since 1961, Thors and Jupiters have gone out of the operational picture, along with Atlas and Titan I. Minuteman and Titan II have taken their places on the strategic line. It is an incredible achievement, especially so since it was done without loss of operational capability. If the Air Force had done none of the other great things or met all the demands it did, I still could not have been any prouder. And the Berlin and Cuban performances—they were true moments of distinction.

No one is without organizational problems. It seems to me that the only perfect organization is the one you don't have. Everything I've seen since 1961 convinces me that the land-sea-aerospace division of responsibilities is as sound a basis for organization as there is or could possibly be. I firmly believe that each service has specialized capabilities and skills in its respective spheres of operation. Their capacities for developing doctrine, determining requirements, and then developing the weapon systems to satisfy those requirements are justification for the continuation of those services as separate entities. I do not agree with the "Single Service" or "Purple Uniform" ideas. People often talk about the Canadian example. But our situation is so different from theirs. Size alone is a valid ground of distinction. So also is the extent of our commitments geographically and functionally.

People also talk about duplication of effort among

the services. It is really a minor problem, although there is bound to be some of it as a consequence of legitimate interservice competition. When the duplication gets too big and too costly in this area it is chopped off in due process either by the executive or the legislative branch of the government. If competition is good in industry and business, then why is it bad for the services? I say it's not, and that it should not be prohibited between the services any more than free enterprise is discouraged in our national economy.

At this point let me say that the Air Force and the Department of Defense have been aided immensely by the contributions of the Congress and the understanding of the President of defense problems. Without them the path to military strength and readiness would have been much rockier, if not impassable.

In the Pentagon, the theme is management. It's the key to effective yet prudent operation of the Defense establishment. As Secretary McNamara has interpreted and implemented the National Security Act, the Service Secretaries are managers of their respective services, much as the heads of Chevrolet, Pontiac, and Oldsmobile are managers with General Motors Corporation. And under this concept, the missions of the services are to support the specified and unified commands by equipping, manning, and training the specialized forces which are assigned to them. The services must establish requirements and determine what it takes in terms of resources—manpower, weapons, and money—to make those forces the best they can be. We must give them what they need to permit them to maintain military superiority over any possible opponent, and to enable them to respond quickly to and meet effectively any threat—from brushfire war to general nuclear war. I think the Air Force is doing that job, and doing it well.

There is a close correlation between management and leadership. It's difficult to know where one stops and the other begins. Both have special methods, tools, and techniques. Both offer wide latitudes for application of the personal touch. What is one man's cake may be another's poison. But there are certain inviolable rules and theorems which a good manager/leader must not buck. And there are certain proven devices which he cannot afford to leave idle. The better he understands them and knows how to use them, knows their limits and variable combinations, the better he'll be as a logistics manager, financial manager, or combat leader.

I have seen in these four and a half years a healthy concentration of effort aimed at the enrichment of management and leadership in the Air Force, not only in the higher echelons, but at every level of command in every field of skill. It will continue, and I am confident that the Air Force will keep on producing great managers and leaders who will surmount the problems of the future as Air Force men have in the past.

I come to the end of my tour with the same respect for Air Force people that I had when I began it. I pay tribute to you, the men and women of the Air Force, for what you are and for what you have done in strengthening the Air Force and national defense.—END



Secretary Zuckert claims professionalism is an Air Force achievement as well as a goal. Certainly SAC combat crews such as this one must have the skill and dedication of professionals to reliably perform their critical mission.



The Secretary calls the ICBM development story an incredible achievement. Since 1961, Thor, Atlas and Jupiter have gone out and the Minuteman, left, and Titan II have replaced them.



Another example of Air Force professional achievement cited by Secretary Zuckert are the USAF counterinsurgency forces in Vietnam, such as those who fly C-123s like that above, in and out of more than 100 rugged airstrips in Vietnam.



When President Roosevelt ordered an embargo of Japan's oil supplies before reinforcing American military forces in the Pacific, he overlooked the close relationship between foreign policy and military force. The buildup began in autumn of 1941, but it was too late, as photo showing B-17s burning on the ground at Hickam Field, Hawaii, December 7, 1941, testifies.

Airpower Lessons of

ON THE deck of the battleship *Missouri* in Tokyo Bay, on September 2, 1945, Japan's representatives signed an instrument of surrender, and World War II became history. For the first time in man's experience, airpower had added a new dimension to war. What were the lessons of six years of air combat?

The work of documenting the role of airpower in World War II was begun even while the war was raging. It was a massive compilation that stretched into the postwar years. In the summer of 1944, the Army Air Forces established an AAF Evaluation Board in each combat theater to study and report on how airpower was being used "so that we may, with economy, direct and employ airpower to the attainment of maximum results during the war and in the future."

A second major evaluation was initiated at the direction of President Franklin D. Roosevelt, in establishing the US Strategic Bombing Survey in November 1944. This task force of civilian and military evaluators prepared and published 208 reports on the strategic air war against Germany and 108 volumes surveying and evaluating the war against Japan.

In the ten years after 1948, the USAF Historical Program published seven fat volumes under the title *The Army Air Forces in World War II*, and completed more than a hundred smaller monographs. In addition, the Army's many-volume historical series and the Navy war histories considered and evaluated World War II airpower.

At the outset, the torrent of documentation actually made it difficult to point to specific lessons that would serve the future. But the effort went on. In the Air Force, two notable projects were undertaken in the 1950s.

Under Col. W. W. Momyer (now Lieutenant General and Commander, Air Training Command) in the early 1950s, the Air War College Evaluation Division drew deeply on the historical experiences of World War II in preparing the original Air Force basic doctrinal manuals series. But these manuals were heavy on evaluation and did not include operational examples which would have made them more meaningful

to a wide audience. At about the same time, an Air War College study group—called Project Control—headed by Col. Raymond S. Sleeper, restudied and "replayed" the course of historical events from the 1930s through 1945, and derived a new understanding of the impact of airpower on international conflict. However, this study was classified and given only limited circulation.

In the postwar years, Air Force history generally became rather compartmentalized and divorced from the mainstream of Air Force thought and action. Where books by Eisenhower, Bradley, Montgomery, and Patton, as well as many junior officers, covered the war in Europe, there were none by Spaatz, Doolittle, Vandenberg, Eaker, Twining, Norstad, Weyland, or Quesada. By remaining silent, the great Air Force leaders left a generation of younger military men without guidance that they alone could have provided. Indeed, until the establishment of the Air Force Academy, very few Air Force officers studied or were involved in research in air history in service schools.



The great air commanders like Gen. Carl A. Spaatz, second from right, left no legacy of writings as the World War II Army leaders have. Here the Commanding General of US Army Strategic Air Forces confers with Generals Twining, LeMay, and Giles, on reaching Guam to take command.

After a period of regrettable shortsightedness among US military planners before World War II, American airpower came into its own during the great conflict. But not completely, a fact which allowed only a partial demonstration of its war-winning potential and its usefulness in the attainment of military/political objectives without the necessity of drawn-out and costly ground invasions. Ironically, a major lesson of airpower's deployment in World War II was that its total value was not realized. This central fact is one of the most important of the many...

World War II

By Dr. Robert E. Futrell

AEROSPACE STUDIES INSTITUTE, AIR UNIVERSITY

We know that World War II history will never repeat itself exactly. The onrush of technology in electronics, jet propulsion, nuclear weapons, missiles, and space weapon systems has made that impossible. At best, history teaches by analogy—a sound evaluation of the future depends upon an appreciation of the past, an understanding of the present, and the selection from both time frames of trends that can reasonably be projected into the future.

With these ground rules, twenty years after World War II, it is possible today to identify the enduring air lessons of those momentous years, which promise to maintain their validity in the future.

Airpower as Deterrence

In the era of isolation, neutrality, and arms limitations that followed World War I, Air Corps officers found it difficult to defend developmental programs that envisioned force as a needed support to diplomacy. War Department plans were simply the maintenance of balanced air and ground forces and all-out mobilization in case the United States were attacked. In spite of the mad march of Germany and Japan toward war in the 1930s, the War Department General Staff reasoned that the Air Corps ought to be provided with ground-support aircraft rather than long-range bombers. Even though Adolf Hitler's threat of Luftwaffe attacks caused the British and French to capitulate to Nazi demands at Munich in September 1938, Gen. Malin C. Craig, Chief of Staff of the US Army, reasoned that funds required to buy sixty-seven B-17s could purchase nearly 300 attack bombers, and in July 1938 he accordingly directed the Air Corps to restrict its purchases to light, medium, and attack aircraft types in Fiscal Year 1940. "Nothing," ruled the War Department General Staff in October 1938, "has changed the conception that the Infantry Division continues to be the basic combat element by which battles are won, the enemy field forces destroyed, and captured territory held."

But President Roosevelt had his own views. He broke the air deadlock at a White House meeting on

November 14, 1938. In a historic first statement of the deterrent role of airpower, Roosevelt announced that *airplanes*—not ground forces—were the implements of war that would influence Hitler's decisions. In view of the great emphasis put on airpower by the Axis nations, Roosevelt declared that the United States would prepare itself to resist assault on the western hemisphere "from the North to the South Pole." Marking acceptance of the new military policy, a War Department Air Board, reporting in September 1939, stated that "the only reasonable hope of avoiding air attack is in the possession of such power of retaliation as to deter an enemy from initiating air warfare."

Begun at President Roosevelt's order after January 1939, the aerial armament buildup of the United States was too slow to deter Hitler from starting World War II on September 1, 1939. Confident in the power of his blitzkrieg ground tactics and of a Luftwaffe that had been designed and trained for close air support, Hitler assumed that he could accomplish his limited war objectives in Europe without allowing the conflict to escalate into total war. The American aerial rearmament was also too slow to affect the decision of the Japanese to go to war, a decision that became urgent to Japan's leaders after President Roosevelt ordered an economic embargo of Japan in July 1941.

When he ordered the Air Corps expansion in November 1938, President Roosevelt perceived that air armament and massive aircraft production could influence the political decisions of the Axis enemy nations. But his decision to embargo Japan's oil supplies in July 1941, without first having reinforced American military defenses in the Pacific, overlooked the close relationship between foreign policy and military force. Bent upon aggression, the Japanese had stockpiled strategic war materials, but those stockpiles were progressively reduced as the economic sanctions continued. On September 6, 1941, the Japanese accordingly made their fateful decision to preempt with military force, if diplomatic negotiations could not end the embargo.

Getting under way in the autumn of 1941, the US
(Continued on following page)



In retrospect, the US never accepted an air strategy in World War II. It saw airpower as an adjunct to the infantry and the Navy, rather than as an independent force. The strategic air war, of which this photo of waves of B-24s over the Ploesti oil fields in May 1944 is an example, did not begin intensively until late in the war.

air reinforcement of the Far East—to be built around four heavy bombardment groups—was to have been in place by February 1942. US war plans had earlier assumed that the Philippines were indefensible. Belated efforts now were made to rush modern P-40 fighters and B-17 bombers to these islands. But the Japanese did not wait for the completion of the build-up and began the war with the attack on Pearl Harbor on December 7, 1941, coinciding with a parallel assault on the Philippines.

From these unfortunate experiences at the war's beginnings, American leaders recognized the lesson that ready military forces—especially combat-ready airpower—can help deter aggression. "Many believe," wrote John Foster Dulles, "that if the Kaiser had known in advance that his attack on France by way of Belgium would have brought England, and then the United States, into the fray, he would never have made that attack. . . . Many also believe that if Hitler had known that his war would involve the United States, he would not have started it."

Gen. George C. Kenney spoke even more strongly: "If the value of airpower in the defense had been recognized a few years earlier, our national policy would not have accepted the inevitability of losing the Philippines at the outbreak of a war with Japan. Fairly strong bomber and fighter forces in the Philippines and in Hawaii, with the warning services available at that time, could have prevented the disaster at Pearl Harbor, Bataan, and Corregidor. It is extremely doubtful that Japan would even have challenged us at all."

Air Warfare and Political Goals

In the 1920s and 1930s American military schools taught the doctrine of Clausewitz: "War is nothing else than the continuation of state policy by different means." American military doctrine of war nevertheless included significant legalistic-moralistic concepts of total conflict to accomplish absolute purposes. "Decision to go to war having been made," stated War Department Training Regulations 10-5 of 1921, "operations will be carried into hostile territory, and every resource of the nation—mental, moral, and physical—will be utilized to bring about a definite, speedy, and successful conclusion." Thinking back upon his own experience as a leading Air Force commander and air

planner during World War II, Maj. Gen. Hayward S. Hansell, USAF (Ret.), has noted: "My military bosses and my associates and I were consumed with one overpowering purpose: how to win the war with assurance and fewest American casualties. We had little concern for what happened afterward."

Meeting in Washington early in 1941 to discuss strategic policies that would apply if the United States were forced into World War II, British and American staff planners completed, on March 27, a document called "American-British Conversations No. 1," or "ABC-1." The conferees agreed to concentrate the main war effort against Germany—the strongest adversary. This Allied offensive would include blockade, a "sustained air offensive" against German military power, early defeat of Italy, and the preparation of forces for an eventual land offensive against Germany. The discussions concluded that, as rapidly as possible, the Anglo-American nations would attain "superiority of air strength over that of the enemy, particularly in long-range striking forces."

Following the basic guidance of ABC-1, the AAF's Air War Plans Division completed AWPDP-1, "Munitions Requirements of the Army Air Forces," on August 12, 1941. This first major air war plan envisioned a strategic air campaign against Germany that would disrupt her electric power system, her transportation network, her oil and petroleum resources, and undermine the morale of the German people. The air planners reasoned that Germany's economic and social life was already strained by the campaigns in Russia, that an Allied land offensive against Germany could not be mounted for at least three years, and that if the air offensive were successful, a land offensive might not be necessary. They stated requirements for new B-29 Superfortress bombers and asked for the development of a 4,000-mile-radius-of-action bomber (the future B-36). AWPDP-1 also visualized an "ultimate force" of 239 air groups and 108 observation squadrons, an estimate remarkably similar to the 269 tactical groups that the AAF later possessed at its maximum strength during the war.

The US Army-Navy Joint Board accepted AWPDP-1 as a statement of AAF munitions requirements, but these men would not accept the idea that a strategic air offensive might eliminate the necessity for a land campaign. The Board warned: "Naval and airpower

may prevent wars from being lost, and, by weakening enemy strength, may greatly contribute to victory. By themselves, however, naval and air forces seldom, if ever, win important wars. It should be recognized as an almost invariable rule that only land armies can finally win wars."

Following Pearl Harbor, AWPD-4, "Air Estimate of the Situation and Recommendations for the Conduct of the War," recommended on December 15, 1941, that first production priorities be given to the AAF and that sea- and ground-force priorities be allocated "in the light of their contribution to the AAF mission." Meeting in Washington beginning on December 22, 1941, however, the Anglo-American Arcadia conference was unwilling to accept overriding strategic air priorities and instead adopted a "Victory Program" calling for increases of air, ground, and naval forces in a sequence of limited schedules geared to successively approved joint operations.

In March 1942, a reorganization of the War Department concentrated strategic planning in the General Staff's Operations Division and ended unilateral AAF planning. The last major AAF plan, entitled AWPD-42, "Requirements for Air Ascendancy," issued on September 9, 1942, moreover, followed approved strategy and defined the air mission in terms of cooperation with a surface campaign. Missions to be performed were: an air offensive against Europe to deplete the German Air Force, to destroy construction sources of German submarines, and generally undermine German war-making capacity; air support for a land offensive in Northwest Africa; air support of land operations to retain the Middle East; air support of surface operations in the Pacific and Far East to regain base areas needed for a final offensive against the Japanese homeland; and defense of the western hemisphere, including antisubmarine operations. As evidence of the shift to air support of a surface war strategy, AWPD-42 defined the priority targets in Germany as being airplane assembly plants; aircraft engine plants; submarine yards; and transportation, oil, aluminum, and rubber production facilities. There was one other significant change in the revised planning: AWPD-1 had expected that intensified bombing of Germany would begin in mid-1943, but AWPD-42 said this all-out air campaign could not be undertaken until late in 1944.

At the Casablanca Conference on January 21, 1943, Roosevelt and Churchill ordered a combined US-British bomber offensive against Germany designed to secure "the progressive destruction and dislocation of the German military, industrial, and economic systems, and the undermining of the morale of the German people to the point where their capacity for armed resistance is fatally weakened." The air offensive was to be preparatory to a surface invasion. The Casablanca directive, for example, required the strategic bombers to give first priority to attacks against German submarine bases and construction yards. Accepted as a result of President Roosevelt's political decision and without any military discussion, the Allied objective of "unconditional surrender" announced at Casablanca assumed absolute ground conquest of Germany.

In Quebec, at the Quadrant Conference in August



Buildup of B-17s and B-24s in Europe was slow and the strategic air campaign was not begun intensively until January 1944. Here a B-17 drops bombs on German light metal alloy works. Such targets were not, at first, given high priority.

1943, the Anglo-American war leaders turned their attention to Japan and approved advances both through the Central Pacific and along the New Guinea-Philippines axis. AAF planners favored the Central Pacific route as being likely to provide B-29 bases at the earliest date. Back in Washington after Quadrant, US joint staff planners sought to prepare an over-all plan for the defeat of Japan. The initial draft of this paper stated it had been clearly demonstrated in Europe that air forces were incapable of decisive action and that surface invasion of the Japanese home islands would be necessary to conclude the war. The best that the AAF member could do to get this statement changed was to secure a revision noting that a preliminary air offensive against Japan would be essential to the ultimate invasion of the home islands. At the Sextant Conference in Cairo, the United States, Great Britain, and China applied the "unconditional surrender" requirement to Japan. They also authorized the beginning of B-29 attacks against Japan from bases far in the interior of China by May 1944, and from bases in the Mariana Islands before the end of the year.

"Because the last war saw the weapons of all services employed in profusion," Gen. Carl A. Spaatz suggested in 1948, "one may argue the exact degree of contribution made by strategic bombing to the final decision." According to Spaatz, independent strategic airpower did not receive an adequate test in World War II because "the war against Germany was fundamentally an infantry war, supported by airpower,"

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much as the war against Japan was fundamentally a naval war supported by air." Designed to support surface operations and begun with small numbers of bombers, the air campaigns against Germany and Japan had much in common. In view of small capabilities, both air campaigns were initially directed against "long-chance" objectives (ball-bearing plants in Germany and coke ovens in Manchuria). These early attacks did not achieve decisive results.

In Europe, the buildup of B-17 and B-24 strategic bombers was relatively slow, and, in the end, the major weight of the strategic bombing attack followed, rather than preceded, the Normandy landings on June 6, 1944. Of the total of 2,770,540 tons of bombs dropped by AAF and Royal Air Force aircraft against Germany, only seventeen percent fell prior to January 1, 1944, and only twenty-eight percent prior to July 1, 1944.

Yet, although General Spaatz was not permitted to begin attacks against Germany's oil resources until May 12, 1944, by December 1944 German reserves of fuel were insufficient to sustain effective military operation. Begun intensively in September 1944, the strategic air campaign against Germany's transportation was described by the US Strategic Bombing Survey as "the decisive blow that completely disorganized the German economy." Electric power systems were never a principal target, contrary to the intentions of early AAF planners. "Had electric generating plants and substations been made primary targets . . .," the Survey adds, "the evidence indicates that their destruction would have had serious effects on Germany's war production."

Under the full force of strategic bomber attack, the economic life of Germany virtually collapsed by December 1944. "The German experience," concluded the Strategic Bombing Survey, "suggests that even a first-class military power—rugged and resilient as Germany was—cannot live long under full-scale and free exploitation of air weapons over the heart of its territory."

Operating against Japan from far-distant bases in the interior of China, with limited logistical support, the Twentieth Air Force's XX Bomber Command achieved only minor results when it began its mission on June 15, 1944. At the Octagon Conference in Quebec in September 1944, the Anglo-American war commanders accordingly committed themselves to the seizure of "objectives in the industrial heart of Japan." Under this agreement, the Pacific war was to culminate in 1945 with the invasion of Kyushu in October and of Honshu in December.

Even when the Twentieth Air Force's XXI Bomber Command began to operate from the Marianas on November 24, 1944, the B-29s met difficulty in mounting high-altitude precision-bombing attacks on Japan. Bad weather scattered formations, the high altitudes burned out engines, and many planes ditched at sea on the long flights to and from Japan. Meeting at Yalta in February 1945, the Allied leaders confirmed the surface strategy against Japan, and the Soviet Union obtained important territorial concessions in the Far East in return for a promise to join the war against Japan.

Impatient with results, which were actually better than they seemed, Gen. H. H. Arnold placed Maj. Gen. Curtis E. LeMay in command of the XXI Bomber Command on January 20, 1945. But neither the new Commander nor the commitment of a second B-29 wing to the Marianas appeared to improve the situation. With the arrival of a third B-29 wing in February, however, General Arnold authorized the beginning of incendiary attacks against Japanese industrial concentrations. Keeping his own counsel about the tactics he meant to use, General LeMay stripped guns and ammunition from the B-29s and sent his crews against Tokyo on the nights of March 9-10 with instructions to drop their heavy loads of incendiaries from altitudes lower than 9,200 feet. Over the target in a steady stream, the B-29s suffered only moderate losses as they kindled fires that destroyed about one-fourth of metropolitan Tokyo.

When General Arnold visited Guam early in June 1945, General LeMay told him that thirty to sixty of Japan's cities and every Japanese industrial target would be destroyed by October 1. Japanese fighters made their last effective opposition against the B-29s on June 5, and, thereafter, the Japanese elected to save their remaining planes for suicide attacks against the expected Allied invasion.

On June 20, Emperor Hirohito told his council that it would be necessary to have a plan to end the war at once, but Japan's militarists refused to accept unconditional surrender. These men clung to the hope that Japan's ground defenses would still be strong enough to inflict sufficient casualties on Allied invaders to win a conditional peace.

The revolutionary employment of nuclear weapons against Hiroshima and Nagasaki and the Soviet Union's last-minute declaration of war tended to obscure the contribution of the sustained US air offensive to the victory in August 1945.

"Without attempting to minimize the appalling and far-reaching results of the atomic bomb," General Arnold has written, "we have good reason to believe that its actual use provided a way out for the Japanese government. The fact is that the Japanese could not have held out long, because they lost control of their air. They could not offer effective opposition to our bombardment, and so could not prevent the destruction of their cities and industries."

Based upon detailed investigations within Japan, the US Strategic Bombing Survey reported that "Certainly prior to December 31, 1945, and in all probability prior to November 1, 1945, Japan would have surrendered even if the atomic bombs had not been dropped, even if Russia had not entered the war, and even if no invasion had been planned or contemplated."

In retrospect, the United States never accepted an air strategy in World War II. In any event, such a strategy would have been inconsistent with the objectives of total punishment of the aggressors and unconditional surrender. To President Roosevelt, unconditional surrender was an excellent objective since it promised to unify the divergent war aims of the nations that comprised the anti-Axis Grand Alliance. Acceptance

of this absolute objective, however, meant that the war had to be waged absolutely by massive surface forces and to culminate in surface invasions of the hostile nations. In the case of Germany, the United States refused to make peace before the nation was completely occupied by land forces. In Japan, however, the United States proved willing to accept a revolution within the government that brought the nation under the control of moderate men, who were permitted to negotiate a conditional surrender.

What might have been the result had the Anglo-American powers followed an air strategy designed not to capture the enemy nations but instead to bring their behavior into accord with an acceptable pattern of international relations? After a study of Germany and Japan in the period 1930-1945, the Air War College's Project Control concluded that under such circumstances the war with Japan could have ended six months sooner and the war with Germany probably twelve months earlier than actually was the case.

In looking back, General Spaatz declared the acceptance of strategic airpower capabilities by Anglo-American leaders would have had a wholesome effect, even if the war objectives had remained unchanged. "Had the revolutionary potentialities of the strategic air offensive been fully grasped by the men running the war," he wrote, "some of the fateful political concessions made to hold the Russians in the European war and to draw them into the Japanese war might never have been made."

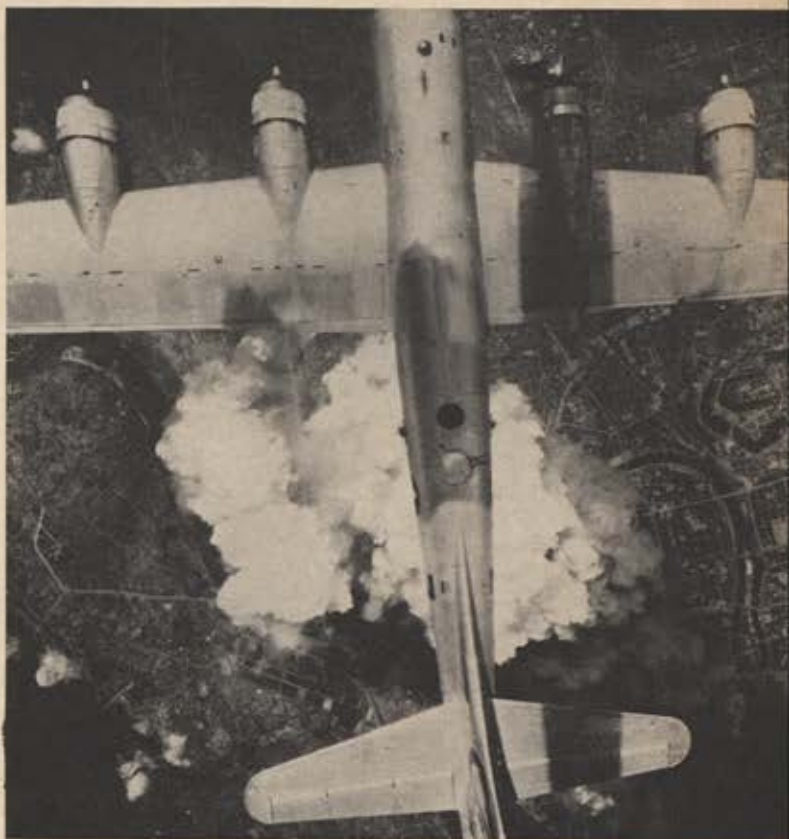
Assuming some of the responsibility for the lack of political vision in the midst of World War II, Maj. Gen. Hayward S. Hansell offered a final thought: "To be sure," he said, "in the game we were playing, we had to keep our eyes on the ball. But we should have had a better feeling for where the goalposts were located, and we should have remembered that this is a continuing tournament, a 'round robin,' and there will be other games."

War as an Art: Central Command and Force Flexibility

"The primary function of the armed forces is, when called upon to do so, to support and, within the sphere of military effort, to enforce the national policy of the nation," according to the basic policy-planning paper issued by the War Department Operations Division in October 1943, when studies of postwar US military organization was beginning. "There must be," the paper continued, "a complete correlation of national policy with military policy; of the political ends to be sought with the military means to achieve them. Such correlation must be flexible; adaptable to changing conditions and changing needs."

Having witnessed such sudden changes in US national policy as occurred in 1938, when there was an abrupt switch from isolationism to preparedness, War Department planners wanted to establish a military organization that could adapt quickly to rapidly changing national policy requirements.

Unfortunately, the impact of this idea became



After March 1945, when General LeMay introduced his revolutionary tactic of using stripped B-29s for low-altitude incendiary bombing raids over Tokyo, he told General Arnold he could destroy all Japanese industrial targets by October.

obscured when Gen. Omar Bradley put forth the concept that armed forces supported the national objectives of the United States. Unlike national *policy*, which changes to meet changing requirements, national *objectives* (although Bradley testified in 1949 that he could only assume what they were) were relatively unchanging. The organization of military forces in terms of stable national objectives would result in an inevitable hardening of force categories, loss of flexibility, and the concept that military force requirements could be precisely computed.

"The greatest lesson of this war," General Arnold said in his final report as AAF Commanding General on November 12, 1945, "has been the extent to which air, land, and sea operations can and must be coordinated by joint planning and unified command."

Such unified command and joint planning is necessary because the experience of World War II amply demonstrated that war is an art rather than a science and that victory depends upon expert judgment of responsible commanders. "No matter what scientific, technological, and organizational advances are made," Army Historian Kent Roberts Greenfield wrote, "the use of military power still has to be put in motion by fallible human beings."

Two illustrations suffice to demonstrate the effect of sound command judgment on air war. In early American heavy-bomber attacks in Europe, escorting fighters were required to maintain close cover for B-17s and

(Continued on following page)

AIRPOWER LESSONS OF WORLD WAR II

B-24s. The bomber crews liked this, but the fighters could not attain decisive results in destroying enemy aircraft when they were tied to the bomber. However, in December 1943, Field Marshal Hermann Goering (ignoring the basic fact of air fighting that when aircraft of roughly equal performance meet, the one that seeks to avoid combat is automatically at an almost certainly fatal disadvantage) issued orders to Luftwaffe fighters to avoid Allied fighters and concentrate their attacks on the bombers. Noting Goering's mistake, Maj. Gen. (later Lieutenant General) Jimmy Doolittle on January 4, 1944, ordered Eighth Air Force fighters to take the offensive—"to pursue the Hun until he was



At Crimean Conference, Russian Premier Josef Stalin talks to his Foreign Minister, Molotov. Many air leaders believe that concessions that were made to the Soviet Union would not have been necessary had the US depended more on airpower.

destroyed"—rather than to provide position defense to friendly bombers. Goering's basic mistake and the Eighth Air Force's quick recognition of it had much to do with the establishment of Allied air superiority over Europe in the next several months. In the Pacific in March 1945, General LeMay staked his career on his decision to strip B-29s of their guns, to load them with much heavier bombloads, and to send them on low-level night incendiary missions. This command decision shortened the war in the Pacific by many months.

In World War II, unified command and joint planning also proved necessary because—despite the fact that the US mobilized the world's greatest war production effort—there was never enough military capability to meet all the needs of all the various commands and services. In the end, the flexibility of US force capabilities, when directed by responsible commanders, got utmost results from limited resources. The experience of World War II left no doubt as to the impact of centrally controlled airpower on surface battles. In this effort, the employment of heavy bombers—with their large bomb-carrying capacity and extended range—proved invaluable.

"The Normandy invasion," Gen. Dwight D. Eisenhower explained in November 1945, "was based on a deep-seated faith in the power of the air forces, in overwhelming numbers, to intervene in the land battle. That is, a faith that the air forces, by their action, could have the effect on the ground of making it possible for a small force of land troops to invade a continent—a country strongly defended, in which there were sixty-one enemy divisions and where we could not possibly on the first day of the assault land more than seven divisions. . . . Without that air force, without the aid of its power, entirely aside from its anticipated ability to sweep the enemy air forces out of the sky, that invasion would have been fantastic. . . . Unless we had that faith in the airpower to intervene and to make safe that landing, it would have been more than fantastic, it would have been criminal."

In support of the Allied ground breakout from Normandy at St.-Lô on July 23, 1944, the entire Eighth and Ninth Air Forces were committed to a shattering carpet-bombing assault. And when American soldiers and marines were engaged in the bloody battle of Okinawa between April 17 and May 11, 1945, seventy-five percent of the XXI Bomber Command's B-29s were directed against airfields on Kyushu and Shikoku in order to stem the flow of Japanese suicide planes against the invading forces.

One of the major ironies of World War II was the lesson that, when operating against a first-class adversary on a continental land mass, air units assigned or attached to ground forces proved incapable of providing effective support to the ground forces. Prior to World War II, Air Corps observation squadrons had always been assigned to Army corps and divisions, and observation aircraft were selected in accordance with specifications laid down by the infantry, field artillery, and cavalry. In the 1930s substantial sums of scarce development funds were used in an unsuccessful attempt to secure an operational autogiro, but, in the end, the Army equipped its observation squadrons with slow O-47 aircraft. In 1939 and 1940, when the French encountered high-speed Luftwaffe fighters, they never got their autogiros into operation, and the British were unable to operate Lysander and Fairey battle observation planes, quite similar to the O-47s. After studying the Allied experience, the AAF made the decision to employ A-20 and P-39 aircraft for observation, and Piper Cubs and other light commercial planes for liaison and artillery-spotting functions.

Assigned to nine different Army Corps within the United States, the Air Corps observation squadrons were described in 1940 as being "more or less orphans." In July 1941, the War Department accordingly organized these squadrons into air support commands, which for training and mobilization purposes were placed under the AAF. From experience gained in the 1941 maneuvers, the War Department published Field Manual 31-35, *Aviation in Support of Ground Forces*, on April 9, 1942. This manual stated that an air support command was "habitually attached to or supports an army in the theater." The air support command was designed to provide centralized control for observation groups, troop carrier groups, or other combat air



Most of the early American victories over German fighters in Europe were scored with the P-47. From fumbblings in North Africa, US commanders learned basic lessons about ground support. The first of these was that air superiority must be obtained before ground troops can move.

groups assigned or attached to it. Ground force officers were not pleased with the centralization of control of air support at an Army level. They frankly favored attachment or assignment of air units to the ground units they supported.

When General Eisenhower led American forces into North Africa in November 1942, US Army and AAF organization got its first offensive battle test. As senior American air officer in the theater, General Spaatz, (then Major General) soon noted that the organization of such a force into separate air defense, bombardment, and air support commands permitted very little flexibility of operations. Centrally controlled Luftwaffe air units easily overwhelmed or else evaded divided American air squadrons.

Throughout November and December 1942, the Germans poured men, supplies, and planes across the Mediterranean into Tunisia. On January 6, 1943, the Twelfth Air Force attached the XII Air Support Command to the Sate Task Force (II Corps) for combat operations, and within a week, the command was in full support of the II Corps attack through central Tunisia. Axis counterattacks soon revealed the weakness of the command arrangement. Beginning on January 20, the Germans aimed strong blows against the French XIX Corps, which requested air support. The II Corps, however, refused to honor the request on the grounds that it had no responsibility for the French sector. In daily road-reconnaissance missions, P-39 observation planes invariably required escort of at least twelve fighters. The II Corps complained that enemy aircraft seemed to bomb and strafe at will. On one occasion a ground commander insisted that fighters patrol his sector for two days to prevent an expected Stuka attack.

From these fumbblings in Northwest Africa, General Eisenhower and General Spaatz put together a new air-ground organization. Its first lesson was that ground forces could not fight effectively when an enemy possessed air superiority. Speaking strongly on this subject later on, Lt. Gen. Manton S. Eddy (USA) said, "There is no question in a soldier's mind that airpower is as indispensable to the national security as bread and water are to life. Land forces cannot fight decisively unless the air is controlled by its sister services."



Ninth Air Force A-20s attack Nazi supply lines in the Cherbourg peninsula in close support of the D-Day landings. On June 6, 1944, more than 6,000 aircraft of the Eighth and Ninth Air Forces flew a total of 8,722 combat sorties, and the RAF, during the day, flew 5,676.

Airpower also had to interdict the movement of enemy personnel and supplies to the battle area. While the Americans were seeking new ideas in January 1943, Field Marshal Bernard L. Montgomery, Commander of the British Eighth Army, issued a small pamphlet entitled *Some Notes on High Command in War*. On the basis of his own experience, Montgomery emphasized that the greatest asset of airpower was its flexibility and that this flexibility could be realized only when airpower was centrally controlled by an air officer who maintained close association with the ground commander. "Nothing could be more fatal to successful results," Montgomery wrote, "than to dissipate the air resources into small packets placed under command of Army formation commanders, with each packet working on its own plan."

Writing to General Arnold from North Africa on March 7, 1943, General Spaatz emphasized that "the air battle must be won first. . . . Air units must be centralized and cannot be divided into small packets among several armies or corps. . . . When the battle situation requires it, all units, including medium and heavy bombardment, must support ground operations."

In Washington, Gen. George C. Marshall accepted the validity of the air lessons learned in combat. On July 21, 1943, the War Department published Field Manual 100-20, *Command and Employment of Air Power*. This field service regulation stated that landpower and airpower were coequal, that attainment of air superiority was the first requirement for the success of any major land operation, that the inherent flexibility of airpower was its greatest asset, and that the control of available airpower had to be centralized and command exercised through an air force commander if the inherent flexibility and ability to deliver a decisive blow was to be fully exploited. The manual described the mission and composition of a strategic air force, a tactical air force, an air defense command, and an air service command.

Perfecting in Italy, the organization outlined in Field Manual 100-20 was intensively developed in the major air-ground campaigns in Europe after June 1944. In the Pacific theaters of World War II, American forces accepted the same tasks of tactical airpower—air
(Continued on following page)



With Britain in the forefront due to its special requirement, all combatants came to use radar to control fighters and accurately direct antiaircraft artillery. Set above was used to control searchlight in foreground to flash instantly on enemy aircraft during North African campaign.

superiority, interdiction, and close support of ground troops—but in Gen. Douglas MacArthur's Southwest Pacific theater, where General Kenney was Air Commander, the entire Fifth Air Force supported the Sixth Army, and after June 1944 the Thirteenth Air Force usually supported the Eighth Army.

In the early days in the South Pacific, Marine and Thirteenth Air Force squadrons were organized in naval task groups to support ground fighting. In fact, Marine F4F Wildcats usually flew counterair patrols, while Air Force P-39 squadrons (which lacked the performance needed to intercept high-flying Japanese aircraft) provided close support to ground troops. In the island campaigns of the Central Pacific, carrier-based Navy and Marine air units and land-based Seventh Air Force squadrons provided air superiority, interdiction, and air support as necessary.

What proved to be true of combat aviation was also true for airlift aircraft: There were never enough transport planes to permit them to be parceled out among using organizations. The Anglo-American organization of theater airlift forces accordingly placed central control of most such units under some form of theater troop carrier headquarters, which could employ the transport planes interchangeably for integrated airlift or air-assault operations. Within the tactical air forces, tactical reconnaissance groups were also organized to provide photographic and visual reconnaissance to meet both Army and AAF requirements. This arrangement worked to the attested satisfaction of high-ranking US Army commanders in Europe.

By the latter stages of World War II, the AAF had perfected a doctrine and organization that wielded airpower as a unitary force. Many so-called tactical and strategic target systems blended together. Thus air superiority was a priority mission of both strategic and tactical air forces and both organizations were interested in transportation targets.

Army and AAF officers were so generally satisfied with the tactical air system employed in Europe that it was incorporated into War Department Field Man-

ual 31-35, *Air-Ground Operations*, in August 1946. Written to assimilate the best lessons from World War II, this manual stated: "The forces within a theater are composed of air, ground, and naval components. Unified command is vested in the theater commander, who is directly responsible for the administration and combat operations within the theater. It is his responsibility that operational plans provide for coordination of the forces at his disposal and that such plans are energetically and effectively executed."

Three years earlier, Field Manual 100-20 provided an even more important concept for commanders, stating: "The inherent flexibility of airpower is its greatest asset. This flexibility makes it possible to employ the whole weight of the available airpower against selected areas in turn; such concentrated use of the air striking force is a battle-winning factor of the first importance. Control of available airpower must be centralized and command must be exercised through the air force commander if this inherent flexibility and ability to deliver a decisive blow are to be fully exploited. Therefore, the command of air and ground forces in a theater of operations will be vested in the superior commander charged with the actual conduct of operations in the theater, who will exercise command of air forces through the air force commander and command of ground forces through the ground force commander."

There was one additional lesson, which General Arnold stated many times and repeated up until his death: "Actual battle experience," he said, "showed that airpower is indivisible."

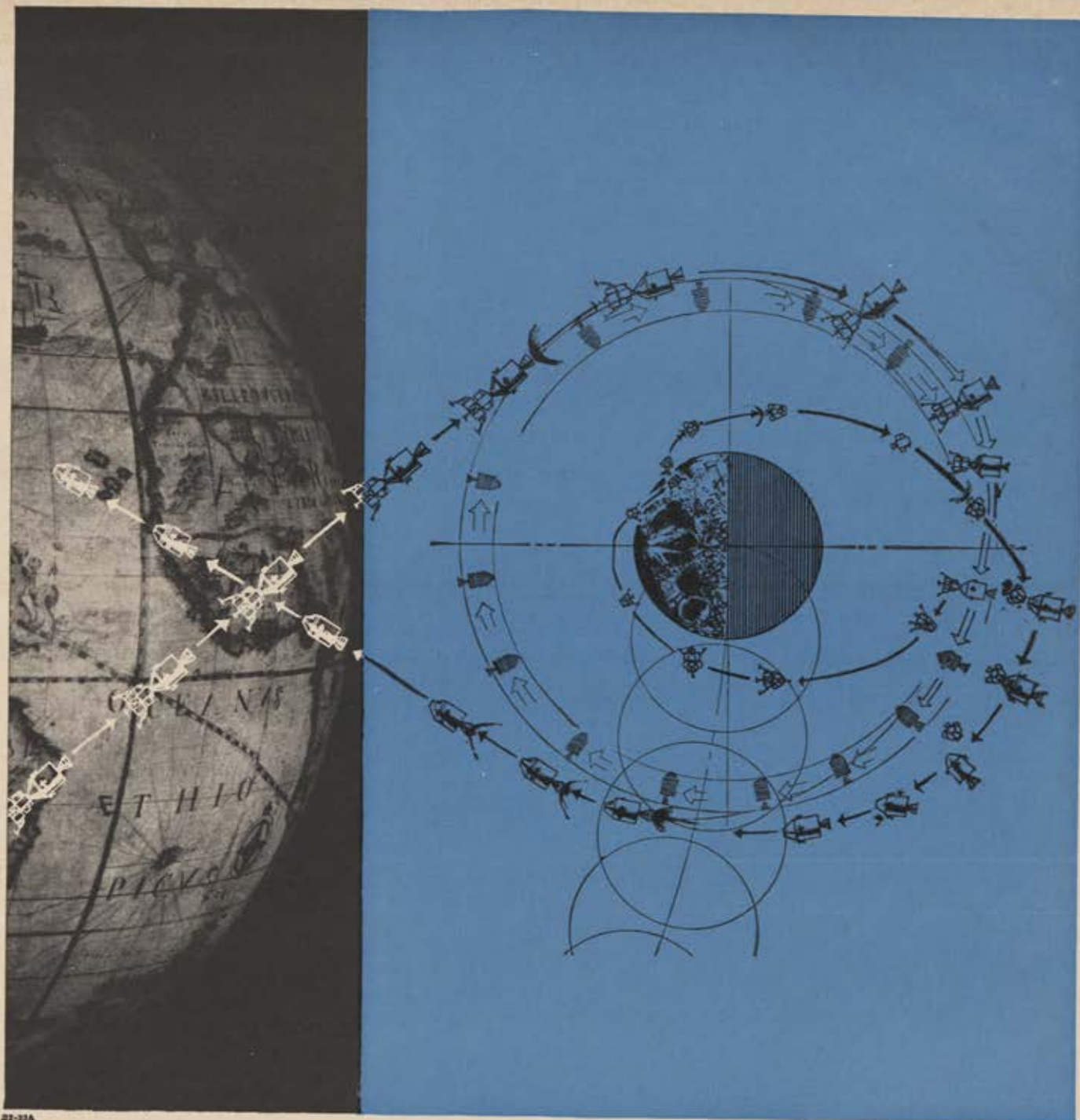
Technology and Airpower

"Wars are fought with weapons based on fundamentals discovered during the preceding years of peace," Dr. Theodore von Kármán concluded in December 1945 in the report of his scientific study committee, entitled *Toward New Horizons*. In the course of World War II, tremendous new scientific developments played a part in the conflict. The fundamentals of each of these developments were quite well known to each of the combatants prior to World War II, but their adaptation to military purposes depended upon the initiative and productive capabilities of the individual belligerent nations.

Looking back at World War II, the conclusion is inescapable that technological knowledge is of little value to military purpose unless the knowledge is translated into usable weapon systems. In this translation, moreover, there is an equal requirement for the scientist who determines possibilities and for the military thinker who, either from experience or intuition, recognizes the military worth of a technical possibility.

The application of electronics to warfare in the years between 1934 and 1945 revealed something of the requisite for a close relationship between scientific knowledge and military experience. The Air Force doctrine of strategic bombardment grew out of training maneuver experience in the late 1920s and was

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Because of early indecision on priorities and Hitler's insistence that it carry bombs, the ME-262 jet fighter was not put into serial production early enough to help Germany. Had it come earlier, the jet would have unquestionably exerted a decisive influence on the air war in Europe.

based upon Lt. (later Brigadier General) Kenneth Walker's reasoning that "a well-organized, well-planned, and well-flown air force attack will constitute an attack that cannot be stopped." As early as 1934 the basic principles of radio detection and ranging—or radar—were well understood in scientific circles in the United States, Great Britain, and Germany, but the closely held secret was not generally disseminated within the US military. In a way, this was fortunate since those members of the War Department General Staff opposed to the B-17 probably could have killed strategic bombardment if they had possessed a good understanding of the aircraft-warning systems that would be developed from radar.

Rising to their special requirement, the British expedited the construction of a chain of radar early-warning stations that helped an inferior force of RAF fighters meet and defeat superior numbers of Luftwaffe aircraft in the Battle of Britain. After this, the development and utilization of radar by all combatants permitted offensive fighter control and accurate anti-aircraft artillery direction, thus reducing the ability of bombardment to penetrate.

But at the same time other developments in radar enabled aircraft to perform precision bombing at night or in bad weather, thereby increasing the capabilities of offensive aviation. Electronic countermeasures also reduced the effectiveness of hostile-warning and gun-direction systems. No US bombing attack was ever stopped by hostile opposition short of its target, and, on the average, US strategic bomber combat losses were less than two percent.

Shortly after the war, the Air Force began to test new methods of analysis, and in one war game it played the B-17s and B-24s against the German fighter force and 88-mm. gun defenses of World War II. The war gamers concluded that the B-17s and B-24s could not live in such a hostile environment. "Experience, I think," said General LeMay as he recalled this incident, "is more important than some of the assumptions you make."

One of the strangest aspects of World War II was that Germany had an air weapon technology in her grasp early in the war that might have redressed her growing aerial inferiority, yet her Nazi master failed to push its development. Arrogant after Poland, and sure that he knew how much was enough, Adolf Hitler refused to order full mobilization of Germany's eco-

nomie potential for war until it was too late. In 1940, moreover, Hitler severely curtailed the development of new weapons which could not be quickly made available for combat. In Poland, against little opposition, the old JU-87 Stuka dive bomber was a tremendous weapon, but British fighters easily destroyed them in the Battle of Britain. The Stuka had been built for air exploitation rather than for fighting other aircraft.

Similarly, the admirable little Fieseler Storch plane, which served as an air observation post for German ground armies, was soon shot out of the air by the Allies.

As a result of low development priorities and Allied bombing raids, the Germans did not begin to employ their V-1 and V-2 missiles until June 1944, when the war was entering its final act. And because of early indecision as to priorities and Hitler's obdurate insistence that the ME-262 must carry bombs, that early jet fighter was not put into serial production until November 1944. The operational employment of a jet aircraft—superior by far to any Allied fighter—came too late to exert a decisive influence on the air war. For one thing, the fuel resources that would have been needed to field the ME-262 had already been destroyed by strategic air attack.

In summary, Germany's technological capability was of little consequence to her national defense because the technology was not translated into operational weapon systems.

In Retrospect and Prospect

Looking back at World War II from the vantage point of twenty years, it is easy to find fault with the thoughts and decisions made by political and military leaders who were fighting a war for national survival. Why did they not recognize that wars must be fought for long-term advantages? Why did they not see the close relationship between national policy and military capabilities? Why could they not know that airpower could attain its maximum results only if centralized control enabled it to be wielded as a flexible, unitary force?

However, before we pass judgment on the past, we must ask ourselves one more question: Have we yet learned the lessons of global air warfare, and are we applying them to the future?—END

50,000 planes a year? . . . Doubters said it couldn't be done. . . . The President said it had to be done. . . . And it was and more. . . . Franklin Roosevelt's call to arms in preparation for American involvement in World War II stirred vigorous response, and incredible performance, from the small and neglected US aviation industry, which, by the time the war was over, had achieved a war-winning production miracle. Starting out with inexperienced management, "green" personnel, and facilities geared initially to turn out tens—not tens of thousands—of aircraft, the industry guided itself through a complete metamorphosis from one-part-at-a-time "job shops" in 1938 to massive assembly lines that were exceeding government schedules by 1943. In the process, a unique government-industry equal partnership was built that has proved vital to national security in the decades since victory . . .

Industry and World War II—

By Karl G. Harr, Jr. PRESIDENT, AEROSPACE INDUSTRIES ASSOCIATION

"I DON'T know how, but I have a *feeling* it can be done." These were the words of a Boeing engineer in connection with a World War II developmental problem. They might well have been the motto for the entire aircraft industry, confronted with a war assignment of building planes in unprecedented numbers under conditions that imposed one roadblock after another. To the leaders of the young industry, which had limped through the mid-thirties with very limited orders, the production demands of the government seemed all but impossible to meet. Nevertheless, the industry approached the task with what might be termed intuitive optimism, a *feeling* that it could be accomplished, even though the evidence pointed to the contrary.

The demands were not only met—they were exceeded. A substantial share of the credit belongs to firms that had little or no experience in building aviation products. They made enormous contributions to the over-all effort; one of them—Ford Willow Run—turned out the greatest airframe weight ever produced by a single plant in a single year. Others had similarly impressive records. In addition, the accessory manufacturers—the firms building a vast variety of products such as instruments, landing gears, and hydraulic and pneumatic systems—moved with great effectiveness in performing their role as a vital part of an unexcelled development-and-production effort.

The war production story is familiar in terms of numbers. The industry turned out more than 300,000 aircraft during the war years, 95,000 in a single year. Airframe weight produced topped the two-billion-pound mark; engine deliveries totaled more than a billion horsepower from 1940 through 1945. In terms of production dollar value, the industry leaped from forty-fourth rank in the national economy to first.

These are truly impressive figures. They tell a statistical story of a production achievement unparalleled

in industrial history. But, as is so often the case with statistics, they only hint at the story: The *how* of the accomplishment, the myriad difficulties that had to be surmounted, the willingness, resourcefulness, and dedicated responsiveness to challenge on the part of the industry's people, which made possible the achievement, make up the rest of the story.

Had it simply been a case of "cranking up" a production machine already in being, accelerating deliveries of tested, proven aircraft by the addition of personnel and tools, the industry's job would still have been a mighty one. But the mass-production machine did not exist; it had to be created. There were too few tested aircraft types available; there were too few skilled people, too few facilities, too few tools.



The 1938 British order for 200 Hudson bombers was a record in the industry for the prewar period, but scarcely any indicator of the production miracles to come during World War II. Above, the last of the Hudsons rolls off the line.



President Roosevelt called for 50,000 planes a year. The industry, by the time the war was won, exceeded the request. At left, the President confers with (left to right) Douglas Aircraft's Donald Douglas, California Governor Culbert Olson, and Frederick Conant, Douglas manufacturing executive, at Douglas Long Beach, Calif., plant.

Embryo to Vigorous Maturity

"The air industry was called upon," said the late Robert Gross, wartime President of Lockheed Aircraft Corp., "to build thousands of something it had built only dozens of before. It was like a youth who is suddenly expected to go to college before he was graduated from primary school."

To understand the enormity of the accomplishment, the real triumph of the aircraft industry's war record, one must picture the aircraft manufacturing complex as it existed in the years immediately preceding the wartime expansion.

A good departure point is 1938. In that year, government appropriations for all military aviation—research and development, as well as production—amounted to \$122 million, a substantial figure by comparison with earlier years, but hardly one to reflect the urgency of the day. Military aircraft deliveries for the year totaled 900 units. The entire industry employed some 36,000 persons and ranked, in terms of labor force, just behind the knit-hosiery industry. In those days, a contract for fifty planes was considered an enormous order.

In 1938, expansion of the industry's productivity got under way, but it was expansion only in the relative sense. The major customers were not the military services of the United States, but those of England and France. In June 1938, Lockheed received an order from the British Air Ministry for 200 airplanes, the largest order ever received by an American aircraft manufacturer in the years between the wars. The plane was a conversion of the company's Model 14 transport, which became the Royal Air Force's highly effective Hudson Bomber. Lockheed was to build almost 3,000 Hudsons before the end of the war.

An interesting sidelight is the fact that the Japanese had a curious role in the contract award, and unwittingly made a contribution to US productivity. At the time the British Air Ministry was considering the

award, Lockheed was down to rock bottom. Its only business was a Japanese order for Model 14s, and there was "nothing else in sight but the end of the line."

"If we hadn't had this business," said a Lockheed executive, "our factory would have been empty and the British would hardly have dared place contracts with a company that was not in production. So perhaps we owe the Japanese a vote of thanks for having placed us in a position to plunge into large-scale production."

A number of other aircraft and engine plants similarly received foreign orders, and production picked up appreciably in 1939. The delivery rate, however, was certainly not one to prepare the industry for what was to come. Even with foreign orders, only 2,250 military aircraft were produced in 1939.

Then in May of 1940, President Roosevelt tossed his memorable bombshell—a demand for 50,000 warplanes. "When the President called for his famous 50,000 airplanes," said H. M. Horner, then General Manager of Pratt & Whitney and now Chairman of United Aircraft Corp., "we didn't know whether he meant an annual rate or a total force of 50,000. Later on, he said he meant 50,000 a year. I think that would really have shaken us up, if we'd believed that at the time." Other members of the industry were shocked even by the 50,000 total figure.

The President immediately set up governmental machinery to start the great expansion, but several months were to pass before the intent was backed by firm contracts.

There were many reasons for the delay. To most Americans, the war in Europe was a distant conflagration, one which could not possibly spread to our shores over 3,000 miles of water. Hence there was no adequate mobilization plan.

There were not many aircraft models in production.

(Continued on following page)

More of Consolidated-Vultee's B-24 Liberators were built during World War II than any other single type of American aircraft. It was designed and built in a remarkably short time. Design studies began in 1939, and the B-24 was in service by the middle of 1941. B-24s served effectively in all theaters of operations.



Although US forces employed nineteen major models during the war, only four of them were in production status in mid-1940.

Until July 1940, the military services did not have the authority to contract with manufacturers without going through the time-consuming business of obtaining and evaluating competitive bids. In the absence of firm contracts, banks would not undertake financing of the many new facilities the industry needed, and there was as yet no provision for government plant financing. Displaying the sense of urgency that was to characterize the industry's effort throughout the war, some companies put up their own meager funds to start a limited program of plant expansion; others, however much they would have liked to contribute, simply did not have the resources.

There was a delay in establishing a pattern of government/industry relationships on such matters as schedules, contractual arrangements, and profit limitations. There was also a need for a plan to draw other established industries into the aircraft-production program. Incredible as it seems from the infallible view of hindsight, the military services had sponsored no premobilization coordination between aircraft companies and other industries, with the single exception of a plan jointly developed by the Army Air Corps, Wright Aeronautical Co., and Cadillac Division of General Motors Corp.

These and many other difficulties temporarily stalled the war-production effort. As a result, there were only 6,000 planes built in 1940. By mid-1941, government and industry had ironed out some of the major difficulties; the Reconstruction Finance Corporation was providing funds for new facilities, contracts were flowing to manufacturers, and a number of new aircraft types became far enough advanced for mass production. Output climbed to almost 20,000 planes. The industry had moved from first to second gear, but it was still a long way from high.

Then came Pearl Harbor, and with it an influx of new problems and a compounding of some of the earlier ones. Three weeks after the attack on Hawaii, the Production Division of the National Defense Advisory Commission threw away the seemingly unattainable goal of 50,000 planes a year and set a new target: more than 66,000 planes annually by 1944.

Among the new problems was labor. In the pre-Pearl Harbor expansion, the industry had built up a

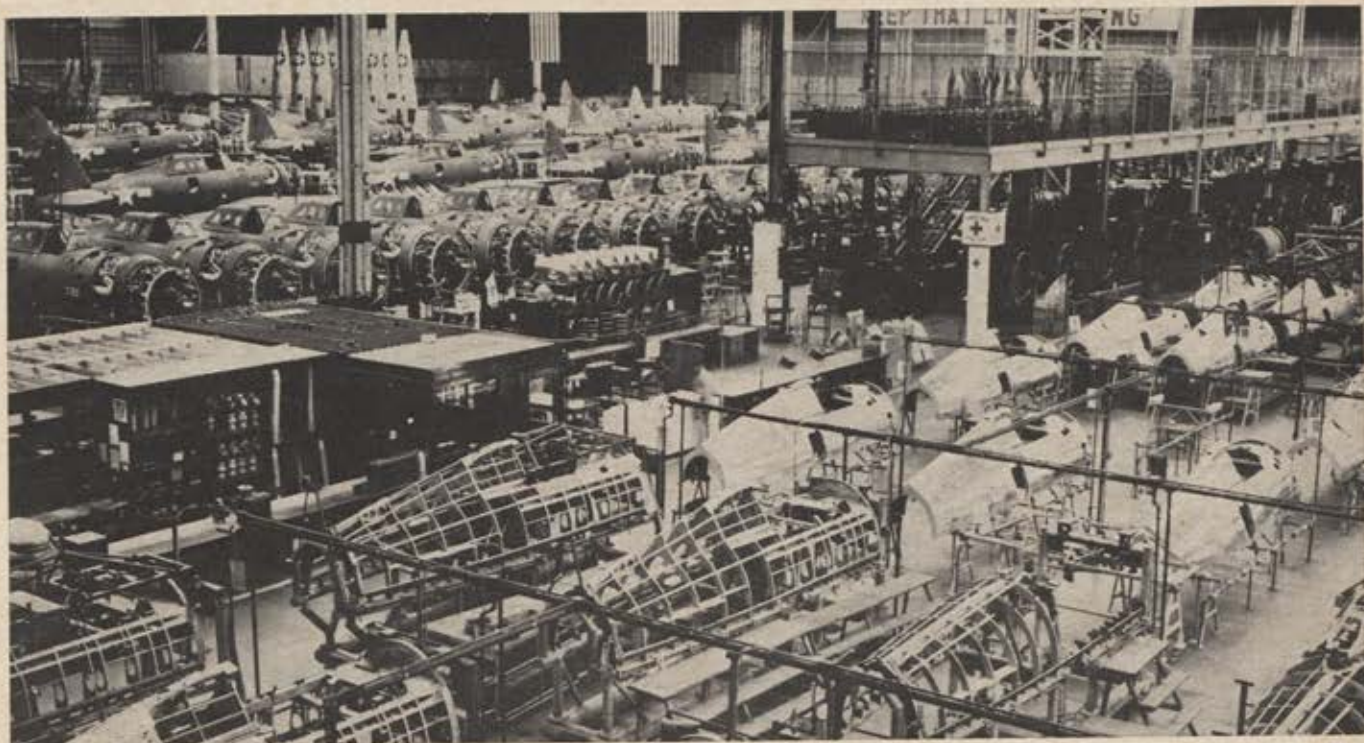
strong and competent personnel force of about 350,000. Despite the draft initiated in 1940, manufacturers had been able to keep most of their skilled workers, thanks to a liberal deferment policy of Selective Service, which recognized that defense production was as vital to the war effort as front-line manpower. But after Pearl Harbor, there came a burst of patriotic fervor, and the young men of the aircraft industry volunteered by the thousands.

The industry launched an intensive recruiting drive to fill its plants. Men of every age and all walks of life, exempted from service by reason of disability, age, or family considerations, were mustered into manufacturing service. Bookkeepers, farmers, salesmen, and bootblacks became riveters and welders. Women were hired by the tens of thousands, not only to take the place of those who had gone to war, but to meet the new demands of increased production. Housewives, grandmothers, and beauty-parlor operators became inspectors, expeditors, turret lathe operators, and tractor drivers. Even youths still in high school joined the effort; manufacturers and school boards worked out plans whereby the youngsters could go to school for four hours and work four hours daily.

Round-the-clock production, in being to some extent before Pearl Harbor, became standard practice. To take advantage of labor sources outside the traditional centers of aircraft manufacture, plants were built in other areas, notably the Midwest. Small "feeder" plants, making parts of an airplane or engine, were set up to make use of workers who were beyond the commuting range of the main plants.

These measures provided a sufficiency of bodies, but a plant full of people does not constitute an efficient work force. The new labor had to be trained, and this job fell, for the most part, to the shop supervisor or foreman. He was charged with "getting out the work" in the face of ever-heavier schedules, while at the same time contending with the massive problems of welding inexperienced help into an effective production team.

Executives also faced new responsibilities far removed from the technical considerations of turning out airplanes. Gasoline and tire rationing made it necessary to set up company-operated bus services. One company ran as many as 117 vehicles covering 12,000 miles a day to keep employees on the job. Manufacturers also organized car pools and in some



Design work on Republic's P-47 Thunderbolt started in 1940, and in short space of ten months an embryonic production line was operating. Production continued while bugs were ironed out, and six models were built by the time World War II ended.

instances created company stores for the purchase of bicycles. Because of the large influx of female workers, firms established women's clinics, where counselors provided answers to domestic problems and arranged for child care. The industry went into the restaurant business in a big way; it was necessary to create commissaries capable of serving 50,000 or 60,000 meals a day.

One of the major headaches of war production was design change. Development of an airplane never really stops until the craft is retired from service. The basic design is constantly changed. In peacetime, such changes are usually a normal part of the production cycle. In wartime, with the plant exerting every effort to get maximum production, design change was an extremely disruptive influence.

There were many reasons for the changes: "Bugs," which escaped detection during service testing, would be discovered; someone in the using service or the company's own design staff would come up with an idea to improve performance; or the changing tactical situation in a war zone would dictate new requirements. As more and more planes entered service and more and more pilots gained combat experience, there came a constant flow of complaints and suggestions from operational commanders, many of them resulting in change orders.

Some changes were easily handled, but others involved major redesign. This necessitated work stoppage on one model and redesigning and retooling for a new one. As soon as the line was running efficiently again, there would inevitably come a new change. And the changes had to be made immediately. In many cases, companies bypassed the red tape and instituted changes backed only by a phone call from one of their

military customers. It was possible for a plane which had undergone a major redesign to roll out the door before the formal change order reached the plant.

Eastern Aircraft Division of General Motors Corp., Grumman's licensee building the Navy F4F Wildcat, was given a change order to increase the number of guns on the fighter. That sounds like a relatively simple change, but it involved more than 4,000 engineering orders.

The Republic P-47 Thunderbolt, one of the outstanding planes of the war, serves as a good example of the wartime developmental and change pattern. Design work started in July 1940, and in the short space of ten months Republic had an experimental model flying and an embryonic production line. Then, in the initial flight-test program, a number of bugs were discovered. They were ironed out by design changes. The first planes started to roll off the line before the test program was completed, and advanced testing uncovered further deficiencies, necessitating restriction of the first lot of aircraft to noncombat use. On the line, the deficiencies were again corrected, and Republic started turning out the solid, high-performance
(Continued on following page)

Honor graduate of Princeton, former Rhodes Scholar, holder of an Oxford University doctorate, graduate of the Yale Law School, World War II Army intelligence officer, Karl G. Harr, Jr., became President of the AIA in 1963. He had previously served in high posts in the Department of State and Defense and as a special assistant to the President.





This is how the production line at Pratt & Whitney's East Hartford, Conn., plant looked during the war, when P&W was building the R-1830 engine. "Impossible" deadlines and frequent design changes made job difficult, but it was done.

ance aircraft. But despite the extremely rapid start of the program, the P-47 did not get into combat service until 1943. When it did, there came more change orders as combat employment of the plane turned up new requirements.

A number of the changes involved major redesign. For instance, when it was discovered that the Army's daylight bombers could not operate effectively without fighter escort, the P-47 was one of the types selected for conversion to escort duty. Extension of both the range and the speed of the airplane required major changes, such as installation of a new engine and belly tanks, each of which in turn called for other changes in the airframe structure. By the end of the war, Republic had produced in quantity six major models of the P-47 and within each model—B, C, D, G, etc.—there were separate production "blocks," the planes within one block differing considerably from the others.

Similarly, the R-1830 engine built by Pratt & Whitney and its licensees was categorized as a single engine type. Actually, there were six major types under that one designation and variations within types—"dash numbers"—which brought the total to twenty-four models, none completely interchangeable with the others. It was a wearing experience for the production engineering staffs, faced with continual changes and forced to make them under the pressure of terrific deadlines.

Even in 1942, a large part of the industry was still employing the "job-shop" approach to production. The job shop was made up of a number of general-purpose tools, with similar types of equipment grouped together in one area. Parts were made in lots, then sent off to an assembly area.

This type of work was adequate and even desirable for the low-volume production of the prewar era, but completely unsuitable for high-volume turnout, since

it was geared to intermittent rather than continual production. It became apparent that the industry could never hope to meet the government's demands through the job-shop approach. A switch to line production was necessary.

Line production, or the assembly-line technique, in which the basic product and its various parts are fed into work areas in a controlled, progressive flow, had been employed for some time by the automobile companies and other American industries. It was, however, new to aircraft manufacturers, who in the lean years had never had an order requiring such methods.

The conversion required a great deal more than rearrangement of the plant and its tools. Channels were established for the flow of parts and there was an incredible amount of detail involved in getting the right part to the right place at the right time. New tools, processes, and techniques had to be devised to meet the demands of line production. It would have been a difficult task at any time, but it came in a period when the industry was still breaking in inexperienced help, amid frequent government-ordered schedule and design changes. The design changes constituted a particular problem in the conversion process. The automobile industry was successful in utilizing line-production methods primarily because a company could freeze the design of an auto before sending it into mass production. The exigencies of war made it impossible to freeze aircraft designs. The production teams not only had to convert to an entirely new manufacturing technique, but also adapt it to the necessity for continuing on-line changes.

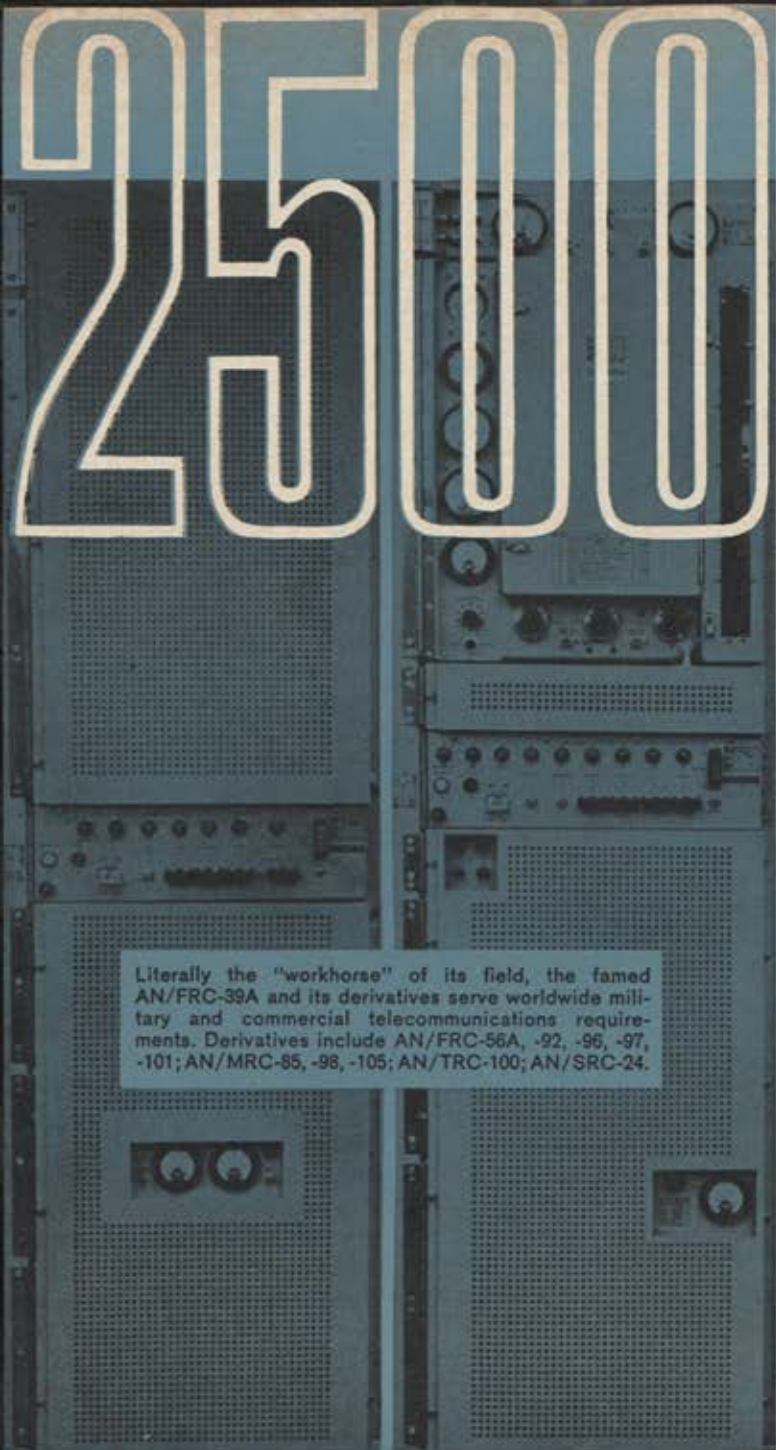
A postwar report on aircraft production, prepared by the Division of Research of Harvard University's Graduate School of Business Administration, had this to say on the problem of conversion: "The fact that the aircraft industry was ultimately able to introduce a high degree of flexibility into production procedures, and, thereby, to make effective use of line-production techniques in spite of change, constituted an outstanding contribution to production management.

"While techniques were borrowed from other industries," the report continued, "the special characteristics of airframes and engines made it impossible to adapt the established techniques of any other industry without revisions. To meet wartime production goals, the manufacturers of airframes and engines were not only forced to do, on a vastly greater scale, a job that they had already been doing in peacetime. They had to do an essentially different job which neither they nor others had ever done before."

Nonaviation firms had to dismantle their plants and rebuild them for a vastly different type of work, they had to learn about tolerances undreamed of in their peacetime production, they had to retrain even their most skilled people, they had to find subcontractors where they were almost nonexistent since every established aviation supplier was already producing at full capacity for aircraft industry firms. They asked from their licensors process sheets, time studies, routing sheets, and other essentials of their peacetime line-

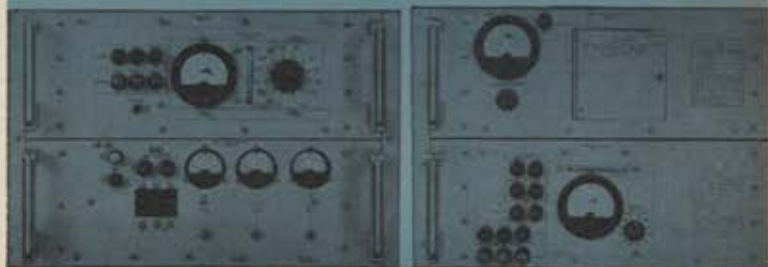
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2500 2600



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ASSOCIATE PRIME CONTRACTOR FOR THE AIR FORCE'S TITAN III PROGRAM.



Boeing's design group foresaw the need for a follow-on to the B-17 that would be capable of spanning the Pacific Ocean for "super-bomber" missions in the Far East. Out of their forecast, and after many design changes and performance enhancements, came the B-29. It devastated Japan, hastened the end of the war.

production operations, only to find that such things did not exist in an industry barely under way on the massive task of converting from job-shop to assembly-line methods.

The aviation firms, on the other hand, had to divert valuable management and engineering talent to the task of putting the licensees in business at a time when they could not spare a single worker from their own programs. They had to build the initial parts, components, and assemblies to provide the licensee with a "shakedown" assembly line. Pratt & Whitney, for instance, had to contribute 100 man-years of production and engineering talent to educate its licensees—Ford, Buick, Chevrolet, and Nash-Kelvinator—in the art of aircraft-engine production.

The pressures were certainly not conducive to harmonious relations, yet the introduction of these new companies to aviation production was carried out with a minimum of friction.

In addition to the licensees, other industries felt the impact of expanding aircraft production. The aircraft industry was a technological "feed-bed" for these other industries, forcing them into enormous expansions parallel to the growth the airplane builders were experiencing. The most notable example was the aluminum industry. Born in the latter years of the nineteenth century, the aluminum industry grew with the nation at a normal rate until the early thirties. In that period the aluminum industry expanded considerably as its high-strength, lightweight metal gradually found its way into aircraft production use, first as a structural material, later as wing and fuselage skin. When the big aircraft production buildup started in 1939, the aluminum industry similarly expanded to a multifold increase in production during the war years.

A case history is that of Aluminum Company of America, pioneer of its industry and by far the major supplier during World War II. In 1938, Alcoa produced 287,000,000 pounds of aluminum; then, as the aircraft manufacturing companies started to expand, so did Alcoa. For aircraft structures, skins, engines, propellers, and many other applications, Alcoa produced forgings, rivets, extrusions, wire, rods, bars, tubing, and a variety of sheet. The company also developed allied applications, such as aluminum landing mats for speedy construction of landing fields, and aluminum

gasoline drums for saving weight in the air transport of fuel. By V-J Day, Alcoa had produced 11,400,000,000 pounds of alumina—the oxide of aluminum used in preparation of metal; smelted 5,500,000,000 pounds of aluminum; and fabricated 2,700,000,000 pounds of sheet, 450,000,000 pounds of extruded shapes, 500,000,000 pounds of forgings, and 400,000,000 pounds of castings. Although much of this production went into nonaviation uses, aircraft requirements accounted for the major part of the expansion.

Production, of course, was not the industry's only assignment in the hectic war years; there was also research and development, which was carried out on a scale never before attempted. A good portion of the effort went into development and the improvement of aircraft, engines, and other equipment in existence at the time of Pearl Harbor or shortly thereafter. But the industry was also heavily engaged in a broad program of research on new plane designs; guided bombs and missiles; and a wide range of auxiliary products, from navigation systems to survival equipment.

Industry made a major contribution in this area, by developing in its own "think-shop" ideas that were later translated into increases in US combat effectiveness. A notable example was Boeing's Design 341, started early in 1939. At that time, Boeing's B-17 Flying Fortress was in early-production status, and its range of 3,000 miles constituted the maximum distance for which there was an official requirement. But, long before anyone was thinking in terms of bombardment

(Continued on following page)



Boeing's B-17 was used against Germany and gave the Nazis a bitter taste of the airpower they had used against Europe in their drive to enslave the Continent. Based in England, the B-17s became a familiar sight en route to targets.



General Motors production expert, Lt. Gen. William S. Knudsen, "drafted" by FDR, headed logistics. Above, he meets with Boeing's J. E. Schaefer, AAF's Brig. Gen. K. B. Wolfe.

missions spanning the vast overwater routes of the Pacific, Boeing's design group foresaw a need for a "superbomber," one with a range at least a third greater than that of the B-17. The group had a year head start before the requirement became official, a year that hastened the entry into service of what was to become the B-29.

Development of the B-29 also illustrates the flexibility of the industry design teams—their ability to adapt to constantly changing requirements. Design 341 started life as a 48,000-pound airplane with a range of 4,500 miles and a speed of 390 miles per hour. The Air Corps requirement demanded 5,333 miles' range, greater speed and altitude, and the weight went up to 85,000 pounds. And in other areas the Air Corps

wanted more: more armament, powered gun turrets, leakproof fuel tanks, armor plate, higher cabin supercharging, and a short-range bomb capacity of eight tons. And it wanted these things with no sacrifice in performance.

Boeing went back to the drawing board and came up with Design 345, a larger airplane in every respect, weighing in at 112,000 pounds and offering performance comparable with the original design. Further additions sent the design gross weight up to 120,000 pounds and by the end of the war crews were flying the airplane at 140,000 pounds.

Throughout the industry, design teams maintained this type of flexibility. They watched closely the developments of the accessory manufacturers and were quick to incorporate, wherever possible, advances in equipment, such as new superchargers, safer fuel tanks, better deicing equipment, new armament, and many other advances in minor, yet important, components.

Nor did the responsibility of the manufacturer end when a plane was accepted by the military. Some companies sent large staffs overseas to set up repair and modification centers. Lockheed, for instance, operated a huge base in Belfast, Northern Ireland, which at its peak employed about 6,000. In two and a half years, this base modified more than 3,000 planes, serviced 11,000 more, and overhauled some 450,000 components. In addition to this type of service, all manufacturers sent into the combat areas teams of technical representatives, who reported to the home office on how the company's aircraft were performing and what could be done to make them better.

An Honor Roll of Industry . . . Who Built

Fourteen companies engaged in production of combat-type and large transport aircraft produced the bulk of all airplanes manufactured during the wartime expansion period 1940-44.

Because of the differences in weight of the various types, total weight of airframes produced, rather than number of units, was the primary criterion of a company's production record. On a company basis, Douglas Aircraft Co., operating six major plants, ranked first. According to postwar statistics compiled by the Air Technical Service Command, Douglas produced 306,573,000 airframe pounds, or 15.3 percent of the total in the combat/large-transport category. In second place was Consolidated-Vultee Aircraft Corp., predecessor of the Convair Division of General Dynamics Corp. Consolidated turned out 291,073,000 pounds, or 14.6 percent of the total in that category. Boeing Airplane Co., now The Boeing Co., was third with 226,477,000 pounds, 11.3 percent of those in the same category.

Next, in order of rank, came North American Aviation, Lockheed Aircraft Corp., Curtiss-Wright Corp., Glenn L. Martin Co. (now The Martin Co.), Ford Motor Co., Republic Aviation Corp., Grumman Aircraft Engineering Corp., Bell Aircraft Corp. (now Bell Aerospace Corp.), Eastern Aircraft Division of General Motors Corp., Chance Vought Division of United Aircraft Corp. (now an element of Ling-Temco-Vought, Inc.), and Goodyear Aircraft Corp.

From the standpoint of production in an individual plant, Consolidated-Vultee's San Diego plant ranked first

with 180,702,000 airframe pounds. Other leaders on this basis were Boeing Seattle, Douglas Long Beach, Ford Willow Run, and Martin Baltimore.

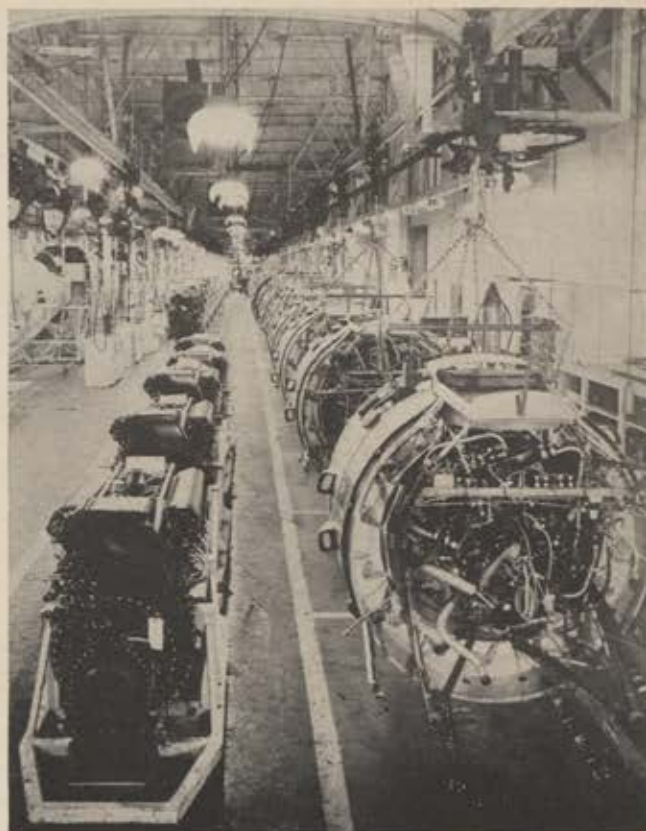
Additional contributors to aircraft production, either building models of their own design or working as subcontractors on major programs, included Brewster Aeronautical Corp., McDonnell Aircraft Corp., Northrop Aircraft, Inc. (now Northrop Corp.), and Ryan Aeronautical Co. Major producers of trainers, light cargo, and utility aircraft were Aeronea Aircraft Corp., Beech Aircraft Corp., Bellanca Aircraft Corp., Cessna Aircraft Corp., Columbia Aircraft Corp., Fairchild Engine & Airplane Corp. (now Fairchild Hiller Corp.), Fleetwings Division of Kaiser Cargo, Inc., Globe Aircraft Corp., Howard Aircraft Corp., Piper Aircraft Corp., Sikorsky Aircraft Division of United Aircraft Corp., St. Louis Aircraft Co., and Taylorcraft Aviation Corp.

Horsepower delivered was the guideline for engine production. Wright Aeronautical Co., with three major plants, led in production of engines for combat/large-transport aircraft. Of a 1940-44 total of slightly less than one billion horsepower, Wright produced 24.6 percent. Pratt & Whitney Aircraft, operating two main plants, contributed 17.2 percent of the total horsepower and Allison Division of General Motors, one plant, 10.8 percent. Collectively, Pratt & Whitney's licensees—Ford, Chevrolet, Buick, and Nash-Kelvinator—accounted for 30.4 percent of the total. Studebaker Corp., Wright's licensee, produced 9.9 percent

The industry group which fell heir to the heaviest burden was management. Many of the larger technical problems filtered up to the executive level, but management was also faced with an administrative job of enormous proportions. First there was the task of building an administrative machine from scratch, a machine that could direct the output of as many as 100,000 persons in a single company which had had only three or four thousand at the start of the expansion. Management was confronted with hundreds of decisions daily, and the decisions had to be communicated throughout the organization to ensure that each activity of the company was coordinated with the many other activities. There were never enough qualified managerial personnel available throughout the war.

As government production demands mounted, new problems were thrust upon company managements by the necessity for opening branch plants. This diluted the already scarce supply of managers and complicated the task of intracompany coordination of operations. Even the addition of one branch plant placed considerable strain on management, but some of the larger firms were assigned responsibility for several plants. Douglas, for instance, had six major plants in addition to its "feeders," spread through California, Oklahoma, and Illinois. Consolidated-Vultee had four large plants in four different states. Curtiss-Wright's Airplane Division operated five plants while its Engine Division had three more. These and other manufacturers' multiple responsibilities spread very thin the pool of production and administrative executives.

(Continued on following page)



Three conveyor lines at the North American plant at Inglewood, Calif. At far left, elevated, the assembly line for B-25 aft sections. Center, engines for P-51 Mustang fighters. Right, Wright engines being readied for the B-25s.

and Helped Build What in World War II

and Packard Motor Car Co., a licensee of Rolls-Royce, Ltd., 7.1 percent.

The major builders of smaller engines were Air-Cooled Motors Corp., Continental Motors Corp., Jacobs Aircraft Engine Co., Kinner Motors, Lycoming Division of The Aviation Corp. (now Avco Corp.), Menasco Manufacturing Co., Ranger Division of Fairchild, and Rohr Aircraft Corp. (now Rohr Corp.).

In a special category was General Electric Co., which developed the I-16 and I-18 turbojet engines during the war years and built in limited quantities the I-40 (later J-33) which never saw combat service.

Finally, there were the accessory manufacturers who supplied thousands of individual items vital to the operation of the aircraft and engines. The more important, with a sampling of their product lines, included:

Aeroproducts Division of General Motors Corp. (propellers); Aerojet Engineering Corp., now Aerojet-General Corp. (jet-assist takeoff rockets); AiResearch Manufacturing Co., now AiResearch Division of The Garrett Corp. (cooling and pressure control systems); American Brake Shoe Co. (forgings); American Propeller Corp., a subsidiary of The Aviation Corp. (propellers); Aluminum Company of America (a wide variety of aluminum products); The B. G. Corp. (spark plugs, ignition harnesses); Bendix Aviation Corp., now The Bendix Corp. (literally hundreds of separate products among the company's many divisions); Chandler-Evans Corp. (carburetors, pumps);

Cleveland Pneumatic Tool Co., now Pneumo Dynamics (landing gear units and pneumatic tools); Curtiss-Wright Propeller Division (propellers); Firestone Tire & Rubber Co. (tires and rubber products); General Electric Co. (armament systems, superchargers, ignition systems, generators, electrically heated flying suits, etc.); B. F. Goodrich Co. (tires, deicers, hose, fuel cells, exposure suits, etc.); Hamilton Standard Propellers Division of United Aircraft Corp. (propellers); Hercules Powder Co. (explosives); Hughes Aircraft Co. (aircraft radar and electronics); Jack & Heintz, Inc. (instruments); International Business Machines (fire-control instruments); International Telephone & Telegraph Corp. (electronic systems); Kollsman Instrument Division of Square D Co., now Kollsman Instrument Corp. (instruments); Link Aviation Devices, now a division of General Precision, Inc. (training devices); Minneapolis-Honeywell Regulator Corp., now Honeywell Inc. (autopilots); Pacific Airmotive Corp. (test stands); Radio Corp. of America (radio equipment); Reynolds Metals Co. (aircraft aluminum); Rohr Aircraft Corp. (superchargers, fuel tanks); SKF Industries (ball and roller bearings); Solar Aircraft Co., now Solar Division of International Harvester Co. (exhaust systems, cowlings, heat exchangers); Sundstrand Corp. (tooling); Thompson Products, Inc., forerunner of TRW Inc. (valves, pumps, hydraulic couplings, oil filters, superchargers); and Westinghouse Electric Corp. (generators, voltage regulators, switches, radio equipment, starters).—END

Looking like the front end of fish, Constellation nose sections are lined up in assembly docks at Lockheed's Burbank, Calif., plant during early phase of production process. The fuselage of Constellation was built in eight separate sections, all finally joined in a huge mating rig.



Another factor adding to the management burden was the number of models some companies were asked to build. Each model, of course, had its own facilities, tools, and supplies, so administering it was almost like administering a separate company. Some of the larger manufacturers had ten or more production lines. Lockheed, for instance, built twelve types of aircraft, Douglas eleven, and Pratt & Whitney ten engine models.

Subcontracting posed still another administrative problem. Unlike the licensee, who built entire airframes or engines, the subcontractor produced only small parts or assemblies. It was the complex task of the prime contractor's management group to control the flow of subcontracted items from thousands of suppliers and ensure that they reached the assembly line at the right time and in acceptable condition.

Management had one more major load—maintaining contact with a great many government agencies. In the preexpansion era, a manufacturer with a single low-volume production contract had one government manager, who usually was familiar with the company's operation. In the war years, company management teams might have to confer, within a single week, with a number of different departments of the Army Air Forces and the Navy Bureau of Aeronautics, the War Production Board, the National Labor Relations Board, the War Labor Board, and a variety of other government agencies. Top management, therefore, had to spend much of its time on governmental coordination, forcing delegation of decision-making authority to lower levels and compounding the problems of second-echelon management.

The management load was lightened somewhat by the addition of top men from other industries, but, as production expansion moved into high gear, companies used this remedy less and less; and it was felt that the addition of green management personnel at that stage of the effort would only impair the efficient teamwork of the existing management. Throughout the war years, the industry's management groups operated under great strains.

These were the major problem areas; there were many others. In light of them, the production record becomes incredible instead of remarkable. By the end of 1942, the industry was in high gear; it produced 47,675 planes that year. In the following year the monthly production rates began to exceed government schedules and the yearly total amounted to 85,433. Finally, in 1944, the peak year, more than 2,000,000

industry employees sent 95,272 planes off to the war.

The models and the records of US planes in World War II are beyond the scope of this article.

Among some of the major airframes were North American's B-25 and P-51; the Glenn L. Martin Company's B-26 and PB4Y flying boat; Bell Aircraft's P-39 with Allison engines played an important role on the Russian front; Northrop created the first US night fighter, the P-61; and Chance Vought's F4U and the Grumman F6F were widely used by the Navy.

Utility aircraft producers, such as Piper, Beech, Cessna, and others, not only turned out training aircraft. They also built major aircraft sections such as wings and fuselages for bombers, fighters, and transports as subcontractors.

The transport aircraft came of age. Supply by air was carried out in every theater. The memorable Douglas C-47 was joined by the C-54, the Curtiss C-46, and the Lockheed C-121.

Much of the experience acquired by the industry in the war years went for naught, because the technological revolution of the fifties completely changed the character of the industry. Mass production became a thing of the past. In its place came low-volume production of weapon systems of vastly greater destructive capability than the planes of World War II. But some of the experience was invaluable. The government/industry relationship which was established, with industry evolving into a hardware-producing full partner, established a framework for a partnership that has grown continually stronger in the postwar years. And the great wartime emphasis on research and development produced a foundation for what was to become the primary role of the aerospace industry.

Certainly the managerial techniques developed in the handling of large volume orders served the industry well in the postwar technological revolution, when management of contracts running into the hundreds of millions of dollars became as important a function of the aerospace firm as fabrication of equipment.

Perhaps the most important effect was the industry's demonstration of its ability to rise to a challenge, a demonstration that founded national confidence in the industry and led to its later assignment of new responsibilities in the field of missilery and space exploration. To borrow a couplet from Tennyson: "Men, my brothers, men the workers, ever reaping something new: that which they have done but earnest of the things that they shall do."—END

Development of the H-bomb, strategic missiles, and nuclear submarines all owe a debt to the pattern of organized science that resulted from the mobilization of the scientific community during World War II. Unprecedented funds and freedom coupled with able management provided scientific and technological superiority that was the key to victory. This organization—with government managing science and scientists advising government at the highest levels—has continued, stimulating a technological revolution so massive that even the scientists themselves have difficulty coping with it. World War II began it; the critical problem now is where we find the wisdom for . . .

Managing the Explosion: Technology in World War II and After

By J. S. Butz, Jr.

TECHNICAL EDITOR, AIR FORCE/SPACE DIGEST

EVEN with the benefit of twenty years of hindsight, it is still not possible to evaluate thoroughly the tremendous influence that World War II exerted on science and technology.

It is much simpler to obtain agreement about the opposite effect—the influence of science and technology on World War II.

Few dispute that scientific and technical superiority were the keys to victory in the 1939-1945 war. The outcome in almost every major theater was determined largely by the quantity, performance, maintainability, and durability of weapons and equipment. More than in any past conflict, the availability and quality of weapons outweighed human courage, endurance, and skill.

Further, for the first time, scientists and engineers were brought into the highest levels of decision-making. They were granted unprecedented sums of money and given parallel freedom to spend it as they saw fit. The scientific and engineering community used its freedom to produce weapons of unprecedented power and effectiveness. Best-known examples include radar, the proximity fuze, and the atomic bomb. The full list is practically endless, and scientists and engineers, in and out of uniform, did far more than create new weapons. They followed equipment into the field and made innumerable "quick fixes" on design deficiencies and to overcome shifting

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Radar was one of the major technical breakthroughs of World War II. The British were the first to develop this technology and to get a workable system operational in the field. The 360-foot-high masts at left were part of the first system, which was a crucial factor in the Battle of Britain.

TECHNOLOGY IN WORLD WAR II AND AFTER

enemy defenses. They were indispensable in analysis of new enemy weapons and tactics and in devising effective countermeasures.

In short, the science and engineering community was drawn into its first close partnership with the military. It was a new experience and a crucial venture. If the venture hadn't been successful and if the partnership hadn't been effective, the Allies would not have won World War II or, at least, the price of victory would have been unconscionably high.

Over the long run, however, the achievements of World War II, important as they were, are of less interest than the effect of the war on the nation's community of scientists and engineers. The past twenty years have proven rather conclusively that this community must play an ever-broadening role in society. We are in the midst of a technological and scientific revolution, which already has caused major political, economic, sociological, and military upheavals. Much more change is on the way.

Dr. Glenn T. Seaborg, Chairman of the Atomic Energy Commission, described the current revolution in the following terms to a class at George Washington University. He said the progress in the fields of science and technology during the past several decades was greater than in all previous history. As for the future, he said the rate of discovery was increasing rapidly and that the students should be prepared for much more progress during the remainder of their lifetimes than they had already seen from their childhoods to commencement day.

In the light of such predictions, and in view of the remarkable technical achievements in rocketry, communications, weapons, automation, etc., we have witnessed during the past two decades, it seems certain that the most astute management of our technical resources is going to be necessary to maintain national safety and world leadership.

Such a management structure is a many-tiered affair. It involves scientific and technical counsel for the highest civil and military officials and planning groups. And it involves advice for the Congress as well as the expertise needed for detailed planning of research-and-development projects and the construction of hardware. Vannevar Bush, who headed most of the US scientific and technical effort during World War II as the Director of the Office of Scientific Research and Development (OSRD), described the government organization, complicated by the technical management requirement, as "an intricate maze of affairs that the applications of science have so greatly elaborated."

A number of major changes in government operations have occurred since Dr. Bush's day. But certainly, any examination of the US record in managing technology should begin with his era.

In one extremely significant way, World War II marked the beginning of the current technological revolution. For the first time, organized science was put to work on a number of advanced tasks. The over-all results startled most scientists as well as laymen.

Most famous of the large technical projects was the Manhattan Engineering District, which produced the A-bomb. Thousands of scientists and engineers worked on other large projects to develop the proximity fuze, radar, antisubmarine weapons, and the like.

Few US weapon projects which were pursued vigorously failed. A great deal was learned about organizing large scientific and engineering groups and coordinating their work successfully. The World War II experience left little doubt that organized science was an extremely powerful force. It could push the technical state of the art in virtually any desired direction if the proper support was provided. And organized science made it possible to attack problems of a new order of complexity and to build systems of much greater effectiveness than any of the past.

Subsequent experience has proven the most optimistic predictions about the power of organized science and technology. Development of the H-bomb, strategic missiles, and the nuclear submarine are cases in point. Each of these developments was a true adventure into the unknown. Each of them added to the general store of knowledge about effective techniques for increasing the power of organized science and technology.

Organized science also has been put to the test on a lesser scale in civil industry and some areas of research, notably medicine. Here the results also have been extremely encouraging. Great advances have been made in nearly all areas, and much greater progress is forecast.



Dr. Vannevar Bush, wartime leader of the bulk of the US research-and-development effort, won worldwide acclaim for the achievements of his organization and his management techniques. Today, many scientists and engineers are pressing for a return to Dr. Bush's type of management.



The Navy's nuclear submarine force (*USS Skipjack*, above) is a postwar example of the creative power of large teams of scientists and engineers who are given a clearly defined goal and the resources and support needed to reach that goal.

Today, the organized science and systems engineering experience of the past twenty-five years, coupled with the awesome power of the relatively new electronic computer, has removed virtually all of the limits on future possibilities. Government officials and prominent scientists generally report that just about anything is possible today. Going to the neighboring planets, operating 100-man stations in earth orbit, piping water from arctic regions into desert areas, and desalinization of seawater are but a few of the enterprises considered attainable.

But US technical and financial resources are not infinite. Priorities must be assigned to prospective ventures, and our organized scientific capacity must be wisely used if the nation is to be truly benefited.

Here is one of the critical issues of our time. In which direction are we going to progress? What basic philosophy is to be adopted for assigning priorities? How are we going to use our organized scientific capacity to best advantage? Is it desirable to make full use of this capacity and to see it grow?

On this issue and in answering these questions there is one basic point of agreement. The US must maintain world technological leadership. Technological leadership has become synonymous with military and economic strength. Few people in or out of government suggest that the US should abdicate technological and scientific leadership in any critical field.

Beyond this broad agreement, however, there are widely divergent opinions. Many philosophies have developed for the future application of our technological might. Agreement hasn't even been reached on the reasons why the US has developed a strong organized science and technology capacity, or just how strong that capacity is relative to that of our friends and enemies.

Dr. Bush was one of the first to try to explain this new phenomenon by which science and industry could create revolutionary systems. A few years after his World War II experiences he wrote at length about his conclusions. Dr. Bush attributed US success almost solely to the fact that this nation is a democracy. He became convinced that, in a regimented

totalitarian society, it was impossible to properly select and conduct large applied-science programs. In his view, public opinion in a democracy will dictate the proper programs to pursue, whether they "lead to new cures for man's ills, or new sources of a raised standard of living, or new ways of waging war." Dr. Bush also believed that leaders in a democracy, who are responsible to the people, will have better sense than to tamper with, or badly manage, such applied-science programs once they are selected.

In the long run, according to Dr. Bush, the democratic world would develop great new strength because of its success with applied science, and consequently would be able to overcome the totalitarian nations and create a world ruled by law.

Quite a few people disagreed with Dr. Bush and still do. But, at the same time, many of the men who worked under him during the war rejoiced in the fact that President Roosevelt had the good sense to give Dr. Bush a free hand, and that, in turn, Dr. Bush had the good sense to select competent leaders for major projects and to give them a free hand.

Many men whose work was controlled by Dr. Bush's Office of Scientific Research and Development during World War II still regard his administration as a model for managing advanced developments. They insist that such reminiscences are not a nostalgic harkening back to the "good old days," and that his policies were not simply expediciencies demanded by war. Dr. Bush's support of projects once a decision had been made to proceed, his efforts to keep red tape and reporting to a minimum, and the freedom he allowed project leaders won him a host of admirers.

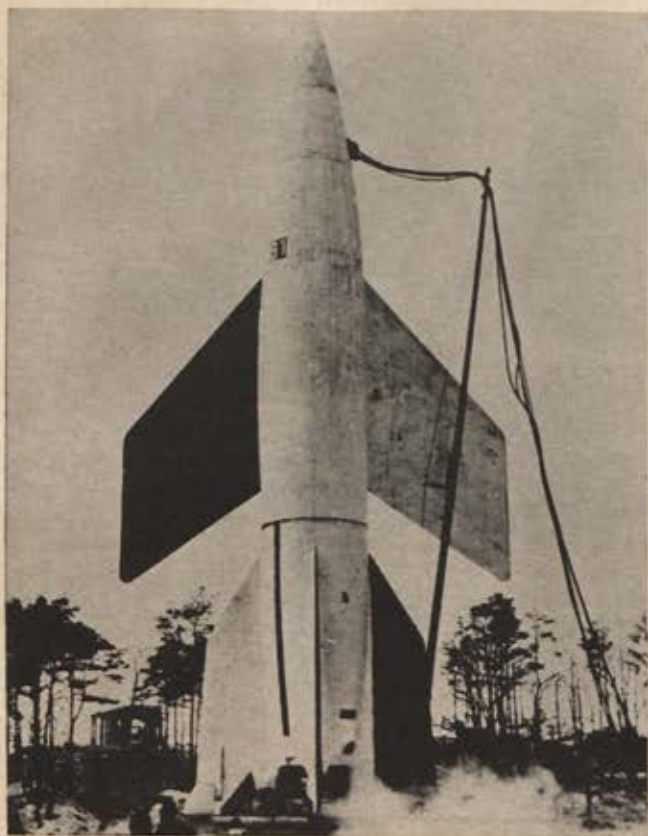
Dr. Bush himself was not infallible, as indicated by his refusal to accept the significance of the intercontinental ballistic missile in 1949. He thought that "such a thing is impossible and will be impossible for many years. . . . I think we can leave that out of our thinking."

Likewise it is possible to disagree with him strongly about the relative effectiveness of Allied, German, and Japanese technology programs. Consider the substantial German achievements of operating the first rocket-powered and first turbojet-powered fighters and the first long-range ballistic missile, the V-2.

In many instances the Germans had great success with building prototypes quickly, often in a matter of weeks, and in designing simply so that production could be carried out by relatively unskilled labor at widely separated points. German aeronautical scientists were three to five years ahead of any Allied nation in supersonic aerodynamic theory and in the operation of supersonic wind tunnels.

The US also made its share of mistakes. For example, the refusal of all scientific authorities in this country to back turbojet research and development until the English offered positive proof of feasibility must be considered a serious error.

C. P. Snow, the distinguished English novelist and essayist who has experience as a working scientist, reached the conclusion that Hitler's "total lack of
(Continued on following page)



Creation of the highly advanced V-2 weapon system in Hitler's Germany is clear evidence that major breakthroughs in technology can be achieved under totalitarian rule. The V-2 was a technical success despite political interference and difficult technical problems peculiar to wartime Germany.

scientific comprehension was fortunate for the world." Probably most people who review Allied and Axis technical achievements in World War II, including the dismal German failure with nuclear weapons and the brilliant American success, would agree that the victor's edge in the technical excellence of weaponry was often nonexistent and quite small during most of the war.

Sir Charles disagrees categorically with Dr. Bush, and most emphatically does not believe that the democracies enjoy any special advantage in utilizing the powers of organized science. All nations have suffered during the past twenty-five years, according to Sir Charles, because no government has been able to lift major decisions on science and technology policy out of the "closed politics" category. By this he means decision-making with "no appeal to a larger assembly—larger assembly in the sense of a group of opinion, or of an electorate, or on an even bigger scale what we loosely call 'social forces.'"

Sir Charles defines three basic types of closed politics. He traces their employment by enough oligarchical governments of the past to show that there is no feature of English or American parliamentary governments which makes them exempt from the problems of closed politics. He defines the three types as: committee politics; hierarchical politics, common to all military services, large industry, and bureaucracies; and "court" politics, in which elected and appointed

leaders of the government are supported by advisers.

Elected representatives of the people serve almost no function in any of these three forms. And, as Sir Charles puts it, "The most obvious fact which hits you in the eye is that personalities and personal relations carry a weight of responsibility which is out of proportion greater than any they carry in open politics."

Certainly the major US science and technology decisions resulted from closed political action. The decision to build the A-bomb, the H-bomb, the strategic missile systems, as well as more recent decisions not to build certain weapons, were closed decisions. Sometimes there have been public airings of issues by congressional committees, but these are after-the-fact inquiries which cannot change the past events they examine.

It is difficult to feel very comfortable about the fact that crucial life-and-death decisions for the nation are, in the final analysis, made on the advice of small groups of scientists and engineers. These scientists themselves must be uncomfortable, for the really tough decisions have been the ones to push ahead, to give the nation and the world vast new powers for evil as well as for good. In almost every case, such decisions have been delayed a considerable length of time. Shouldering an essentially private responsibility for weighing the moral and humanitarian considerations of such decisions against the basic question of national safety has never been easy for our most influential scientists, and it never will be.

As yet no one has devised a means of presenting major science and technology policy decisions unemotionally to the electorate or any relatively large assembly. Without vast improvement in the public's scientific literacy, such decisions will remain "closed."

The Congress, with its various committees, has performed a great service over the years by providing a forum for the open expression of all shades of opinion.

Science, engineering, and management leaders from industry and the universities have participated wholeheartedly in this debate. Still it is obvious that such public discussion has not reversed the trend toward closed politics. The true power over US science and engineering policy is being concentrated more and more in the hands of a few individuals in the Office of the Secretary of Defense and on the White House staff.

Probably the greatest impetus for this centralization of power is rising costs. All types of defense systems cost many times more today than they did in World War II. For example, Vannevar Bush was in charge of approximately 30,000 men who worked on new weapons and medicine in the OSRD. Collectively this group spent half a billion dollars during the whole war. The Manhattan Project, a separate bookkeeping item, cost \$2 billion. The Boeing B-17 bomber required 200,000 engineering man-hours from the beginning of design to the flight of the first production model.

By today's standards, these figures are ludicrous. Virtually any new weapon system is a multibillion-

(Continued on page 71)



Centrinauts: a new breed of men

Despite copy book maxims, you *can* make progress while going around in circles or lying flat on your back. Several U.C.L.A. college students, dubbed

"The Centrinauts," proved this fact recently in the Douglas Biotechnology Laboratory.



WEIGHTLESSNESS is simulated by floating for hours in a warm pool. The Centrinaut then takes his place in the centrifuge and is subjected to high G forces to determine whether he can "take" the strains of re-entry.

Their reactions—heart-beat, muscle-tone, blood-pressure and others—are being taped under conditions simulating those on space missions. And Douglas scientists are gaining valuable insights from them on how astronauts will react in current manned space programs.

But manned spacecraft require knowledge in many scientific areas. So a wide array of Douglas laboratories are doing advanced research in fields ranging from man-machine relationships to inter-planetary space flight.

DOUGLAS

MISSILE & SPACE SYSTEMS DIVISION



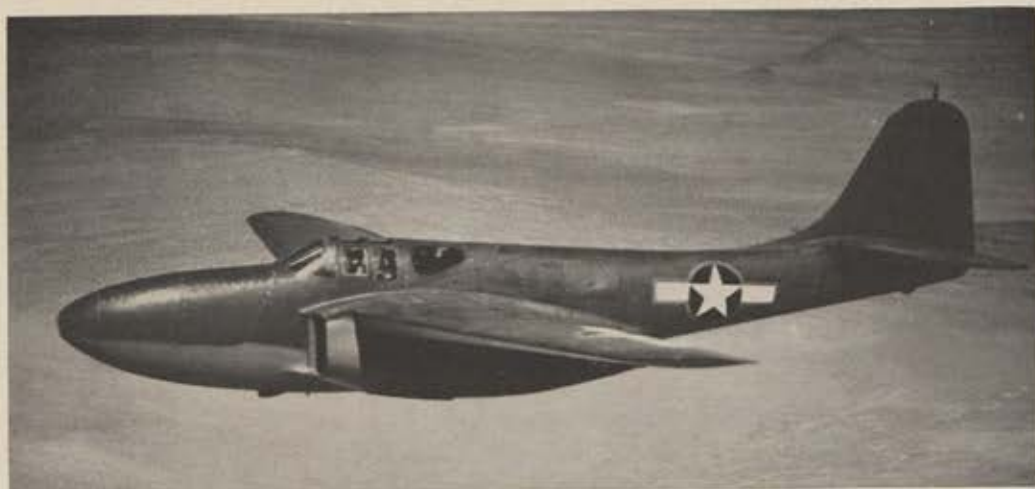
With the introduction of the KS-50-08 Astro Tracking System, Kollsman has provided a "dawn-to-dawn" capability for long range bombing and missile navigation and guidance. Now, accurate true heading and precision navigation have become a twenty-four hour reality. Now, precise location can be pin-pointed around the clock, anywhere in the world or out of it, because the daylight capability of this Kollsman system automatically delivers true heading data at all times... and position fix for virtually all of the mission time. What's more, the KS-50-08 can be integrated with any computerized Doppler or inertial system, to improve the overall navigational capability of any aircraft. This all-day, all-night Astro Tracking System, plus the more than 3,000 dependable star trackers used in military aircraft and missiles, is demonstrating the capability for meeting critical requirements which has made Kollsman the leader in the development and manufacture of celestial navigation systems.

For more information on this and other systems, including space navigation and guidance, write to Kollsman Instrument Corporation, Elmhurst, New York 11373.

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Failure of the US to pursue jet engine development until the English proved feasibility beyond question must be regarded as a US failure in advanced planning. The Bell P-59, at left, the first US jet, was several years behind the first British and German efforts.

dollar affair. The B-58 bomber required nearly ten million engineering man-hours, and the B-70, fifteen million man-hours before first flight.

At these prices, it is obvious that the nation cannot afford many major systems in its defense arsenal. As a result, the Administration policy has been to exercise ever-closer control on all planning and on the allocation of funds for new projects.

The other major new element of US science and technology policy is the assertion, by some, that the technological revolution has leveled off so far as weaponry is concerned. One of the strongest expressions of this idea appeared last October in the *Scientific American* in an article by Dr. Jerome B. Wiesner and Dr. Herbert F. York, close scientific advisers to the Eisenhower and Kennedy Administrations. In their judgment, "this dilemma [the problem of national security in the nuclear age] has no technical solution." Drs. Wiesner and York believe we have entered a "stalemate of the arms race." They further believe that it is unrealistic to hope for development of a completely successful antimissile system, or any other weapon that could break the current arms balance between the US and the USSR.

Many physicists disagree and assert that knowledge is increasing so rapidly in their field, as compared to twenty years ago, that basic new weapons will inevitably become feasible in the relatively near future. They are talking of weapons with unquestionable stalemate-breaking potential. One is a high-energy type of laser operating in the high-energy gamma-ray portion of the spectrum as opposed to current lasers in the visible light portion. If such a device could be produced it would be a true "death ray" capable of destroying any known structure. Emplaced on earth it would be a truly effective antimissile weapon, and if it could be placed aboard space vehicles, it could dominate the earth.

On more familiar ground, many scientists and engineers assert that vast improvements are possible in all types of weapons and equipment. Powerful new technologies in materials, and design and manufacturing techniques, are now ready to be taken out of the research stage and put into development.

The main point is that current US science and

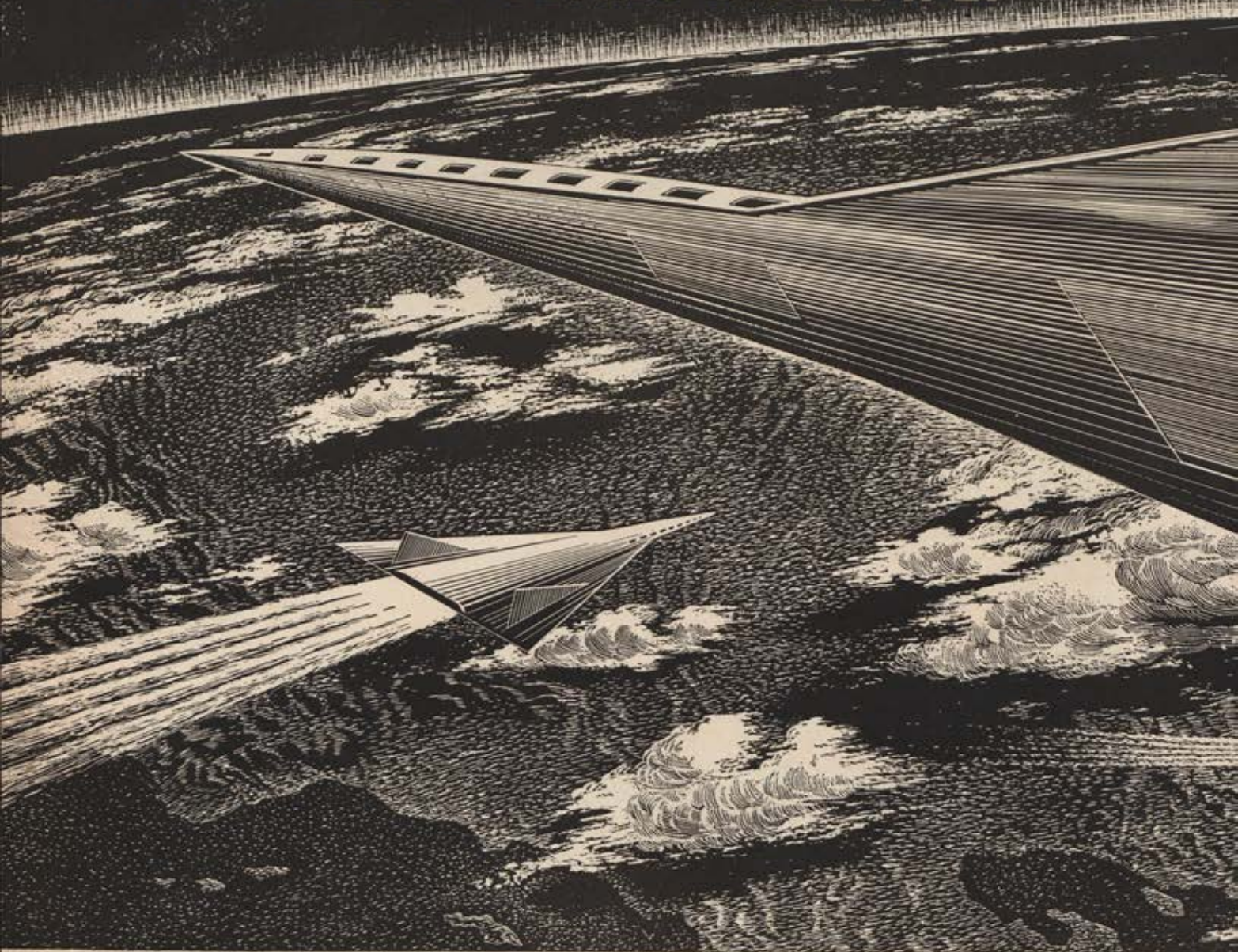
technology policy does not appear to be supported by the majority of the science community and industry. Pressures are steadily increasing to change this policy.

Basically, there are two criticisms. One calls for a relaxation of central control over all DoD research-and-development projects. Many industrial leaders believe that more than half of the cost of today's projects is consumed in making formal reports of immense detail to this central authority through many levels of administration, which have the power to hold up work but are not able to give a go-ahead. It is widely believed that this method of cutting costs is the only one which could be truly effective today and could reverse the trend of rising price tags on major systems. Dr. Bush's administration of the US weapon-development effort is often referred to as the ideal management policy in terms of cost/effectiveness.

The second major criticism is that the construction of advanced hardware has slowed dramatically in the US during the past four years. Welko Gasich, a vice president of Northrop, concisely expressed the concern of thousands of scientists and engineers when he stated recently, "You cannot advance technology through paper studies; you must build hardware and test it." Gasich and a number of other industrial and scientific leaders are pressing for a resurrection of the policy of building research-and-development prototypes. They have strong arguments that in the long run such prototypes would save money and advance technology at a much more rapid rate even if operational systems are not built.

The outcome of this push for a return to the basic science and technology policies of World War II is far from clear. The whole question of the proper mechanism for establishing such policies is one of the most difficult now facing the nation, as it was in World War II. Probably responsible criticism from industry and the science community is the only hope for removing such crucial policy decisions from the realm of closed politics and the personal choices of a few men. The electorate can only hope that all men who are qualified to make such criticism will give the nation the benefit of their opinions.—END

LOOK WHAT'S HAPPENED TO MARQUARDT'S "FLYING STOVEPIPE!"



SCRAMJET OPENS NEW ERA FOR AIRBREATHING PROPULSION

FIRST, THE SUBSONIC RAMJET: Marquardt produced America's first operational subsonic ramjet in 1945. A clean and simple aerodynamic tube, it was aptly described as a "flying stovepipe."

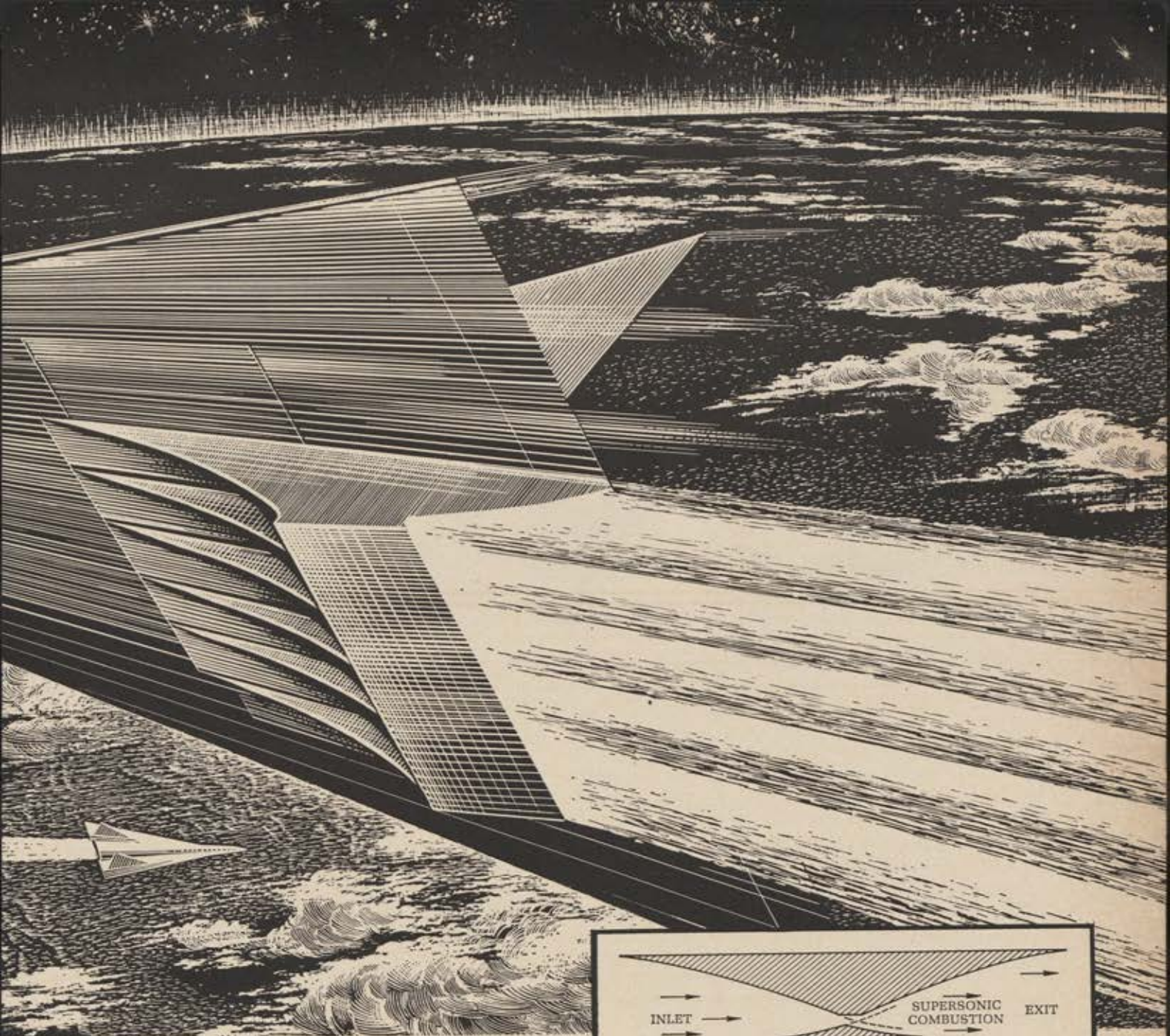
THEN, THE SUPERSONIC RAMJET: To achieve supersonic capabilities, the ramjet engine became necessarily more complex. Diffusers, sensors, inlets, controls, grids, flame holders, exit nozzles — each representing a significant development — served to improve the efficiency and quality of internal air flow, compression, combustion, and thrust. This engine today powers the Bomarc interceptor missile. The supersonic ramjet engine, which has no rotating parts in its operating cycle, remained a relatively simple airbreathing propulsion system — but it no longer resembled the old "flying stovepipe."

AND NOW, SCRAMJET: Today, airbreathing technology has entered the era of SCRAMJET—a propulsion system using to full advantage the ramjet's inherently simple fixed geometry design for hyper-

sonic acceleration and cruise performance—a return to the classic simplicity of the "flying stovepipe."

THE SCRAMJET MISSION: SCRAMJET, the supersonic combustion ramjet engine, performs most efficiently at flight speeds above Mach 6; its range capability expands rapidly as its speed increases. Potential new applications for both space and military missions are under study. These include: hypersonic cruise aircraft, recoverable launch vehicles, and defense and tactical missile systems.

ADVANCED RAMJET CAPABILITY: For two decades, The Marquardt Corporation has pioneered simple airbreathing propulsion systems. Marquardt's capability has been enhanced materially by the recent amalgamation with the General Applied Science Laboratories (GASL), Westbury, New York. Under the direction of Dr. Antonio Ferri, GASL has made significant contributions to the advancement of and the renewed interest in airbreathing propulsion, particularly in the hypersonic regime.



HOW SCRAMJET WORKS

In the classic ramjet the incoming air is slowed down to subsonic speeds, mixed with fuel, and burned in a low velocity combustor air stream. In the Scramjet, the total process is supersonic: air flow, mixing and combustion. The Scramjet, offers a higher performance capability over a broad Mach range, reduced cooling requirements, fixed geometry, and minimum structural complexity.

OTHER ADVANCED CYCLES: Marquardt's research, development, and production activities in air-breathing propulsion have served as basic building blocks for many new and interesting engine cycles. Individually and in combination, these advanced cycles offer exciting propulsion possibilities for launch vehicles and missiles which will allow improved operational capability. Marquardt is currently evaluating these concepts under active contract.

PROFESSIONAL CAREER OPPORTUNITIES: Marquardt is offering long term career opportunities in airbreathing propulsion technology to experienced aerospace engineers and scientists, test facility personnel and technicians. Qualified personnel are invited to submit resumes to Professional Personnel Dept. 135, The Marquardt Corporation, 16555 Saticoy Street, Van Nuys, California, or to Personnel Dept., General Applied Science Laboratories, Inc., Merrick & Stewart Aves., Westbury, New York. Marquardt is an equal opportunity employer.

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Although others, including America's Goddard, had done pioneer work in rocket research, it was the German team at Peenemünde, seen here from above, that successfully developed history's first long-range ballistic missiles. Happily for the Allies, the V-2s came too late, but the rockets presaged man's entry into space.

"WE aim at the stars but sometimes we hit London." That was the ironic remark a few years back by comedian Mort Sahl commenting on the exploits of the World War II German rocket research-and-development team at Peenemünde near the Baltic Sea. They were the group who built and hurled some 1,500 of history's first long-range ballistic missiles through space at England in the final stages of the European war.

Happily for the Allies, the V-2s were too little and too late to affect the outcome of World War II. Allied bombings after discovery of the secret facilities at the German research center by a British woman photo-reconnaissance expert; the destruction of launch pads in Holland; the blasting of industry in Germany; the low priority of German rocket research and development during most of the war; political intrigues among the Nazi bully boys for control of the V-2 project when, too late, its military importance was seen; and the particular stupidity of Adolf Hitler—all these combined to prevent the V-2s from becoming a weapon able to turn back the overwhelming Allied power that ended the "Thousand-Year Reich" after it had been in its bloody ascendancy for only twelve years.

Now, a couple of decades after the smashing of the Nazi empire, Mort Sahl's crack might be rephrased: "We aim at Moscow but we hit the moon."

This tells in capsule form the story of how far the missile/space revolution has come in a very short time. The course of this great revolution is an example of how all-encompassing and simultaneous history is.

Twenty-odd years ago, while Allied piston-engined bombers were pounding Germany and Japan, while US and British scientists worked feverishly on nuclear weapons to forestall similar Nazi efforts they thought might be under way, while British and German aero-

Aerospace power, now extending beyond the envelope of the atmosphere to encompass infinite space, can endow man with a cosmic outlook for the first time. In war and peace, this greatest technological advance of our time has made us all eyeball-to-eyeball neighbors. The history of aerospace is filled with ironies and its future may well determine how effectively man deals with his enormous problems of . . .

By William Leavitt

ASSOCIATE EDITOR, AIR FORCE/SPACE DIGEST

nautical pioneers worked on the turbojet engine, while radar was turned into an efficient anti-aircraft tool, the Peenemünde team, working to destroy, was perfecting a new kind of weapon system that in a few short years would change forever the nature of war, while at the same time irrevocably altering man's view of himself and the universe.

There is no end to the irony of the technological history of World War II and its aftermath. The nuclear bomb developed for possible use against the Nazis was used instead against the Japanese. The jet, which the Germans might have used devastatingly against Allied bombers, came along too late in the war to be an effective weapon. And the postwar missile/space powers are the US and the USSR, not Germany. The American missile/space status is doubly ironic. The great "loner" rocketry pioneer, Dr. Robert H. Goddard, whose work helped inspire missile/space-minded Germans, died in relative obscurity in 1945 after playing a minor role in the US war effort, designing rocket-assist devices for aircraft takeoff.

Among the principal architects of the current American missile and space capability are such Peenemünde veterans as Dr. Walter Dornberger, who headed the German missile program during World War II, and Dr. Wernher von Braun, one of his principal assistants.

It is intriguing to recall that once during World War II Dr. von Braun was arrested on charges that he and others were "sabotaging" the rocket weapon effort by believing that travel in space was the most important, and real, reason for spending the Third Reich's money on all that expensive equipment. Yet, it was only a few years later that, as an American research-and-development expert, von Braun got the chance to aim at the stars. As to Soviet missile/space prowess, there was a rocketry tradition in Russia that dated back to the late

Survival and Advance in the Space Age



Two decades after the end of the second World War, a fantastic fruit of military rocketry research was plucked—man's first close look at a neighbor planet, Mars. It appears to be a lifeless crater-pocked body. Missiles have come into their own as weapons but are also the carriers for man's probes into space.

nineteenth century and Konstantin Tsiolkovsky's theoretical studies of rocket-powered flight into space. The Russian experience also included energetic rocket research in the 1920s and '30s.

And as Raymond Garthoff (*see AIR FORCE/SPACE DIGEST, December 1957*) has pointed out, although many of the German World War II rocket experts were transported eastward after the war and helped the Soviets considerably, the Russians were by no means without native talent during their surging effort in the early 1950s to build nuclear-weapon-carrying ICBMs. Those weapons turned out to be powerful enough for orbital launchings that dazzled the world and shocked the US first into a crash missile development program and later—after Sputnik—into starting a space program the size and cost of which no single American, no matter how prescient, could have predicted ten years ago.

If there is a lesson to all this simultaneity and a thread of meaning to all the irony, it is perhaps the truth that airpower, in the fullest sense of its meaning, has been one of the most significant technological advances of our century. Starting with wood and wire, evolving into transcontinental aerial destroyers and time-shrinking passenger and cargo transporters, airpower has reduced the world in size and linked mankind irrevocably. The atom bomb itself was a child of airpower. Radar was developed to combat the airplane but today helps guide it through the air as well. The jet was developed to enhance the airplane's performance first in war, later in peace, and now in both. The ICBM and its predecessor, the aerodynamic cruise missile, were developed to fly unmanned through air and space, to deploy airpower even more awesomely than the clouds of bombers over Europe and Japan ever did.

Now, not only does the ICBM concentrate this awful power on missile pads and under the sea, but as a space booster it sends astronauts into orbit, scans the earth's surface in strategic-reconnaissance patrol, relays messages, and searches, already as far as Mars, for the answer to man's age-old question: Are we alone?

In an age of social turmoil, can we live with this revolution? The answer is that we must.

"A glimpse into the last quarter of this century," writes Dr. Simon Ramo, Vice Chairman of the Board of TRW, Inc., and a principal author of the US missile program, "indicates very clearly that our greatest challenge, and greatest need, is to learn to live with the technological revolution we have effected. Historians . . . may very well say that the twentieth century was the one in which man struggled with a tremendous imbalance—the mismatch between his rapidly accelerating scientific and technological advance on the one hand and lagging social advance on the other. This gap, already noticeable and widening at an alarming rate, should reach its broadest points toward the end of this century."

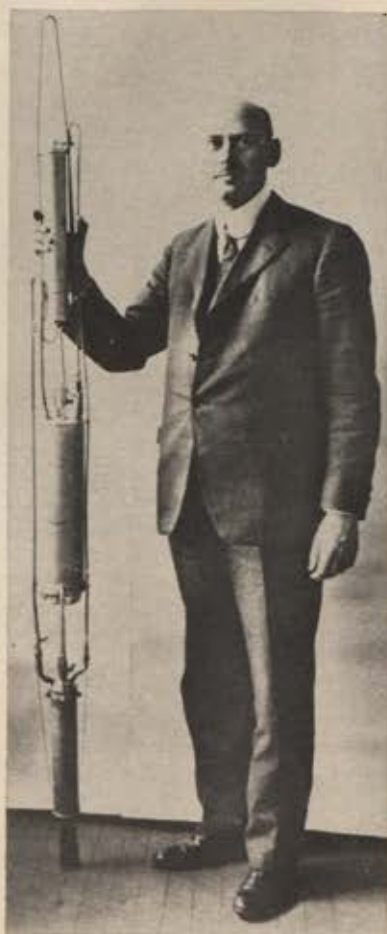
Dr. Ramo comments on the potential impact on man and society of the vast extension of airpower into far space:

"It is truly a thing apart," he says. "I am referring to our quest of new planets . . . our investigations of the universe which surrounds us. . . . This is in a class by itself in the impact it will have on thinking men everywhere. To see why this is so, it is efficient to chart some societal characteristics for the last decades of this century and note the powerful dichotomy that exists for every man on earth as he contemplates how, on the one hand, things appear to be 'here on earth' and how they compare with, or contrast with, the now-achiev-

(Continued on following page)

A prophet unrecognized in his own land, Dr. Robert H. Goddard first successfully fired his liquid-fueled rocket in 1926.

While Germans built World War II rockets, he worked in obscurity on rocket-assist plane takeoff.



able new world beyond this old world we know so well.

"... We can make deserts habitable and level mountain ranges, but we cannot substantially stretch this tight hard little planet. Now, more and more, we will all be living with the concept of a limited horizon and the challenge of a limitless one. [But] beyond this planet there will indeed be room: the wide open spaces we once sang of here on earth we now see in a literal cosmic sense.

"... Resources here on earth constitute a closed package with a limited amount inside. We can learn more and more about how to use those resources to greater advantage, but in the automated society of the future this will become increasingly a controlled operation. The resources will be rationed, perhaps fought over if they are not, and our lives on earth will be influenced by one pervasive idea: What is here in the way of resources must gradually be divided into smaller and smaller allotments as the population continues to increase at a rate greater than our abilities to stretch these resources by more imaginative utilization of them.

"Meanwhile, out there in space there are new resources to tap. There are the moon and planets and their moons. There is the sun itself from which we receive our energy and which perhaps can be tapped for greater portions. There may be as yet undiscovered principles that will enable us to release this energy and convert it in novel ways. There is a new resource

frontier. We cannot even guess at the scope of it.

"... We will, in effect, if we confine ourselves only to life and inactivity on this small and inadequate planet, consume all our energies and set all our objectives to finding better ways of crowding ourselves together, of measuring our progress in terms of how we increase our problems—greater industry to pollute our water and air, more cars to jam our highways, more nerve-jangled members of affluent society. At the most, we seem to strive for a treadmill pace wherein we hope that our problems don't gain on us. But also we know we are not gaining on them.

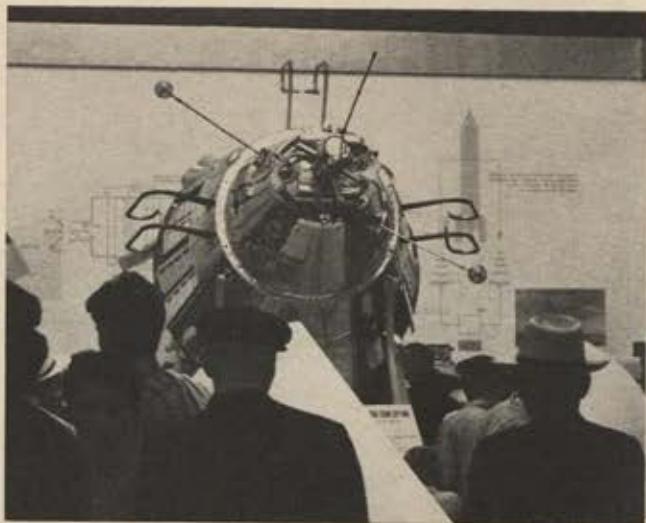
"Here on introverted earth," he writes, "we are constrained, semiautomated, bound with an increasingly planned economy and society down to infinite detail (and where it isn't planned well, we have breakdowns). Here man is an anonymous cog or will be threatened with being one. ... Here it will become increasingly difficult to innovate, maintain individuality, to step away from it all and philosophize as to why we are here. ... Man's mission on earth is something more than mere survival, something more meaningful than just maintaining himself in comfort and conformity.

"But when we talk of outer space, when we see the results, when we participate in choosing what to do, our minds can soar beyond the tuggings of the physical and social gravity of the earth and the confinement that this imposes on us. We can savor the idea of a world away from it all; the idea of a planetoid of our own; the possibilities of colonization, of spreading man out away from this regimented, controlled anthill—these are the extrovert opposites to the introverted semiautomated society of the earth."

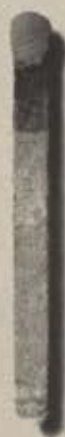
The dichotomy of the future, between our introverted limited earth, ever-more crowded, and the vista of space, must affect our thinking, Dr. Ramo says, and one of the important results must be a rise in the position of the science of social relations:

"The unsolved problems of man-to-man relationships must assume increasing importance relative to efforts

(Continued on page 79)



Russians view model of Sputnik III, early orbital vehicle. Although US had seen significance of military rocketry, Russians got the jump on America in 1957 with Sputnik I.



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Names of Russian Cosmonauts became household words around the world as space race got under way with USSR in lead. Above, Gherman Titov, second Russian into space (left), Khrushchev, and first Cosmonaut Yuri Gagarin.

to provide more physical science progress. But meanwhile, our space programs carry us away from this earth where observations, where the rules of the game of observation, are different. No longer insulated by the atmosphere, the gravitational and magnetic fields of this arbitrary observation point, we will learn of the new physical laws of the universe. We may be seeking actively to make contact with other heavenly bodies. We may seek and, indeed, we may be the recipients of communications with intelligent life elsewhere in space.

"We shall have to live with the idea of solving those priority problems here on earth which interest us most, and, from the standpoint of the needs of our society, seem most compelling. At the same time, we must have free rein to pursue our search for the secrets of the universe beyond."

A science-fiction dream? Only if we look at it from the narrow point of view of those who thought the wheel not worth the trouble, or those who scoffed at steam. History teaches us that uncommon men with broad vision are the inspirers. Such ideas as those sketched out by Dr. Ramo are hardly run of the mill. True, he sees a future ugliness if man turns only inward on his planet. But also he foresees a climactic time ahead during which man—space-age man—will, under the dual pressures of terrestrial and cosmic thinking, truly begin to solve his overwhelming problems.

"I believe the last two decades of this century will be critical," Dr. Ramo says. "The imbalance I spoke of at the outset, the widening of the breach between scientific and social progress, will continue inexorably toward its climax at the turn of the century. This buildup of tension is inevitable if the ultimate solution is to be reached, for I believe that somehow nature—human nature—will take its course. Man must achieve a confluence of that frame of mind and skill level and awareness of his problems before he will apply himself to the solution. In other words, things will get worse before he realizes that he must make them better."

"I am mindful of the acutely ill child whose fever builds and builds until the crisis is reached and the fever drops off and the youngster begins to rally. I think our fever is building now, and we are in for a

long siege of increasing danger and discomfort. But I am hopeful that the crisis will pass at a not-too-distant date."

Seen in such terms, the space age we now live in began before anyone realized it, when man first successfully raised his puny body—and its not-so-puny braincase—off the ground, when he first flew. That revolutionary day marked, in Arthur C. Clarke's phrase, "childhood's end." But the end of childhood does not, of course, mark the beginning of adulthood. It is a transition. The transition continues. When man left the earth, not on his own muscle power, which had been an idle dream, but by his own brainpower, which is the true strength of dreams, he was for the first time able to see the small planet of his birth from space. From a few feet at first, then hundreds, then thousands, and now from space. Now he has traversed space around his planet and his electronic eyes have preceded the inevitable look he will take with his own eyes of his neighbor planets in our solar system.

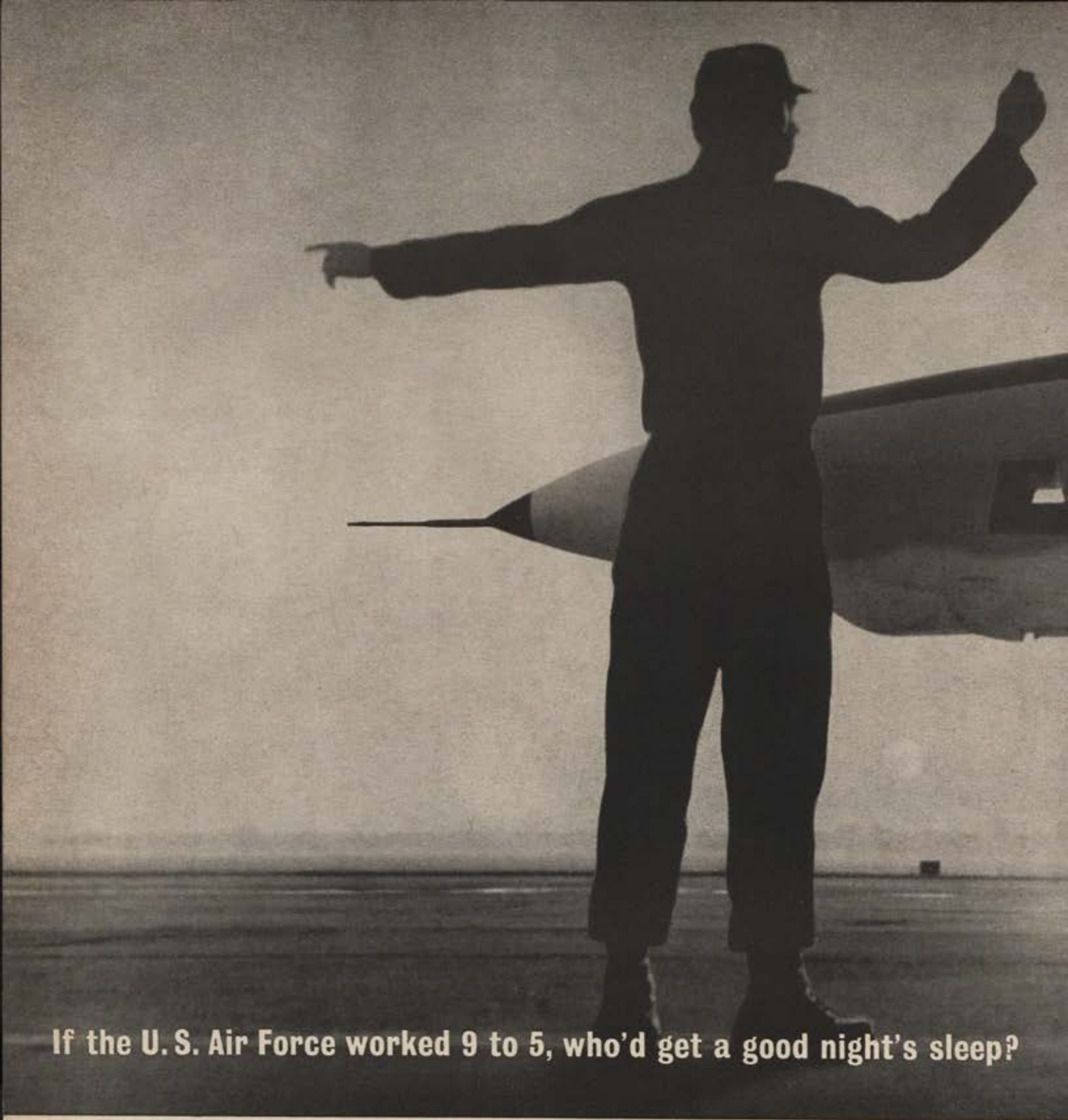
To some, who view and intimately experience the pain and travail on our planet, indeed in our own country, the cost in time, energy, money, and talent of this cosmic expansion of man's intellect and frail physicality, may seem an ironic waste, when there is so much to do on earth.

During the recent and tragic Los Angeles riots one of the citizens of the wrecked area, who was asked why it had all happened, said quite feelingly: "Well, we see all the good things of life that we don't have, we see them on television, and we see all this money spent on rockets, and, well, it makes us mad."

In his way, the man, in a single sentence, summed up the story of our space-age times and the imbalances and simultaneities that make it so incredible, so terrifying, and so hopeful. A century or so ago, the instant togetherness of mankind on this planet was unimaginable. Today, we are linked, neighborhood to neighborhood, city to city, country to country, continent to continent, by airpower and technology, by the airplanes, the missiles, the communications satellites, by the television sets that give us electronic extensions of our basic senses of sight and sound. Properly used, that technology can help answer the Angelino's appeal for his share of earth and space.—END

US entered race in earnest with first successful US manned orbital flight by Astronaut John Glenn, shown beaming after his 1962 flight.





If the U. S. Air Force worked 9 to 5, who'd get a good night's sleep?



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But the Air Force is on the alert, as it has been all through the night,
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When you support the Air Force, you're doing your country a big favor.
But you're doing a bigger one for your children...and your children's children.
Pleasant dreams.



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Office of the SECRETARY of the AIR FORCE

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(As of August 10, 1965)



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The public's interest in national defense seems to be directly proportional to its sense of security. Since America has been relatively secure for twenty years, it has tended to forget that it is yesterday's heroes who have kept the peace. Military men don't expect constant cheers but there is a relationship between . . .

Public Opinion and National Security

By John A. Lang, Jr.

ADMINISTRATIVE ASSISTANT TO THE SECRETARY OF THE AIR FORCE

The author, Mr. Lang, enlisted in the US Army Air Forces in May 1942, and after four years of active duty, including tours in North Africa, Italy, and Alaska, was separated as a major. He has worked for the Department of the Air Force since 1961 when he took over as Deputy for Reserve and ROTC Affairs. He was made Administrative Assistant to the Secretary of the Air Force in 1964.

AT A social gathering last February, shortly after Gen. Curtis E. LeMay retired as Chief of Staff, USAF, I overheard a young lady, age eighteen, an honor student just accepted at a leading New England university, straightforwardly admit she had never heard of General LeMay. It provided a good opportunity to deliver a short, pointed lecture on why I believe General LeMay has a reasonable claim to lasting fame.

What I first thought was an isolated incident came into clearer focus when I subsequently read in the Sunday New York Times (March 21, 1965) a report on the results of a poll of 450 college freshmen at Antioch College. The poll, probing the "scale of personal values" among students, asked them to name the ten most prominent human beings who have lived during the twentieth century. The students did not mention one military leader—not even Generals Eisenhower, MacArthur, Marshall, or Pershing were cited.

This could not be rationalized as just one Midwestern college in a limited sampling. A long report in Newsweek (March 22, 1965) on the attitudes of a national cross section of college students rated the

"military institution" far down the list of national institutions which evoke their respect and admiration. Sixty percent reported "only some," or "hardly any" confidence in the military institution.

My first reaction that "fame is fleeting" has been overtaken by another. It could be that this attitude of general indifference among our young people is a backhanded compliment to the military institution. Maybe it shows that we have attained a solid measure of national security since the end of World War II.

If the Soviet Union, or some other power, conspicuously threatened us with instant extinction, young Americans today would have no problem identifying Gen. Harold K. Johnson, Adm. David L. McDonald, and Gen. John P. McConnell. An informal poll I have taken at social gatherings since the matter first came to my attention discloses that less than ten percent of those interviewed can correctly identify these distinguished officers as the chiefs of the Army, Navy, and Air Force, respectively.

I make no claims for this poll as having been carefully administered or statistically weighted to give it scientific balance, but it means enough for me to have

concluded that public opinion has drastically changed. During World War II, for example, the names of great military leaders became household words when the indispensable skills of these men stood between us and national disaster.

Perhaps, as the *Newsweek* college survey reported, we live in "an age of antiheroes." Or perhaps the virtual anonymity of our present military leadership is unspoken tribute to the job that has been done since World War II.

To put this proposition another way, public interest in national defense is directly proportional to its sense of security. In the pioneer fort, security from attack was uppermost in the minds of the people, and the rifle-toting frontiersman was seldom out of sight. In 1917 and 1941, when our sons, brothers, and fathers were being called to the colors, uniforms appeared all around us. Each time the index of identification with the military man zoomed.

After Korea, he faded again into the background of public consciousness. There he has remained until recently. While the Vietnam situation has stepped up somewhat, we are not yet drafting sons, brothers, and fathers in great numbers. We still retain a large military force to meet the danger of low-level conflicts like South Vietnam or the possibility of a large ground war, but that force is not pushed on the public consciousness as it was during two world wars. General aggression is now contained at intercontinental range, so relatively efficiently and inconspicuously that Americans are not constantly reminded either of the deterrent job being done, or what Herman Kahn described as "the unthinkable" alternative.

Only in the spring, when we prepare the military budget and our personal income-tax returns, do we turn reluctantly to thoughts of \$50 billion defense appropriations and the self-denials they may require in the private sector of the economy. Otherwise, the men who keep the lonely, silent vigil of deterrence—as in a silo under the soil of South Dakota, or in a submarine under the arctic ice floe—are out of earshot, out of sight, and apparently out of mind.

Why is the public regard for the military man at such a low ebb? I can think of at least four reasons: inconspicuousness, already mentioned, is just part of the answer. Second, there is a sense of national guilt which some psychologists tell us followed Hiroshima. It may not be well articulated, but it is there.

Third, our self-consciousness about being the most powerful nation on the globe is a feeling that we are just learning to live with. Our national interest has involved us in the Congo, Santo Domingo, and South Vietnam. Many Americans don't like it, but we have to help smaller nations resist Communist bully-ragging if the world is not simply to dissolve into anarchy.

We cannot withdraw, as we did prior to World War II, from commitments which affect the destinies of other nations. We vote for billions in foreign aid each year, and many of us volunteer for humanitarian service abroad. Since 1961, over 150,000 Americans have applied for service in the Peace Corps. They are presently volunteering in growing numbers. Such idealism is typically expressed at Antioch College, where the students chose the late Mohandas Gandhi as their num-

ber-one subject of admiration in the twentieth century.

And, finally, young Americans are responding to an intellectual force which predates our Revolution. Distrust of standing armies was part of England's legacy to the United States. For centuries after the Norman invasion of 1066, Britain was free from that danger. Attempts by the Stuart kings to raise armies for wars of conquest had led to the Petition of Rights in 1628 and the Glorious Revolution in 1688. The Bill of Rights the following year made permanent the authority of Parliament over the Army.

During the eighteenth century, this sense of distrust of the military found its way into colonial proclamations. Defiance of the Crown culminated in Jefferson's ringing indictment of George III. "He has kept among us, in time of peace, Standing Armies without the consent of our legislature," said the Declaration of Independence. "He is affected to render the Military independent of and superior to the Civil power."

In 1783 a new Republic stood almost alone. A world of absolute monarchy in continental Europe was still being supported by large standing armies. As a central feature, the Constitution adopted in 1787 established civilian control in government over the military. Congress alone was given the power to raise and support armies and to vote money for military purposes. Further safeguards were incorporated in two amendments: (1) a well-regulated militia being necessary to the security of a free state, the right of the people to keep and bear arms shall not be infringed; and (2) quartering of soldiers on householders, without their consent, is forbidden in time of peace, and allowed in time of war only under strict limitations of the law.

Our national defense, from the outset, was a military, not a militaristic, system. Although we frequently elevate individual military heroes to high political office, the profession of arms has taken no hold on American imagination, except in time of war or national emergency.

More than half a century ago, Rudyard Kipling deplored England's treatment of Tommy Atkins, "the brute," yet "Savior of 'is country, when the guns begin to shoot." In that romantic day, so far removed from today's nuclear reality, disinterest could contribute only to a setback for the Empire, perhaps at some remote station in Asia. Popular indifference in the missile-space age, however, could have more serious consequences.

The Pentagon does not expect a ticker-tape parade up Broadway every time SAC flies a difficult mission or a Polaris submarine completes a two-month-long patrol, but public ignorance of their larger meaning in keeping general aggression away from our doorstep could impair their effectiveness.

This is not a manufactured issue. We are frequently asked a question that goes something like this: "Is the Air Force doing everything possible to prevent the accidental triggering of a nuclear war?"

How does the Air Force convince the skeptic that a nuclear war accidentally triggered from our side is highly improbable? How can we document in unclassified print that no expense, no technological safeguard, has been ignored to avoid the possibility of accident?

(Continued on following page)

In the short run, fact versus emotion is an unequal encounter. Motion pictures and books have, in the past several years, played on our suspicion of the skills and integrity of the professional military man. In the movie "Fail-Safe," an exciting melodrama wound up with a cataclysmic nuclear exchange as Moscow and New York City dissolved into atomic dust. Just as the curtain rang down, the producer did his duty. He recorded a twenty-second Air Force verbal rejoinder that the events dramatically depicted for the previous 111 minutes could not have occurred. That disclaimer was accompanied by audible snorts of audience disbelief in the downtown Washington movie theater where I saw this film.

A related—and obviously profitable—theme in current literature also exploits the fear of a military takeover of our society. *Seven Days in May*, an artful fiction, reached such a conclusion. Yet one could cite almost endless facts to document just the opposite one. Since the end of World War II, when the atomic bomb was placed by law in the hands of the civilian Atomic Energy Commission, civil authority over the military in national affairs has actually been strengthened by statute or precedent. The power which Secretary McNamara, a civilian, exercises over the Pentagon amply supports this conclusion.

Professor Samuel Huntington of Harvard has observed the traditional American tendency to view civilian control of the military establishment "in *quantitative* rather than *institutional* terms." Between the two world wars, he writes, the US solved the problem of civilian control by maintaining a bare minimum military force. But since V-J Day, it has become necessary to spend annually nearly ten percent of our GNP on national defense. From this fact, it is superficially logical to assume that civilian control of our society is threatened. We may forget that the strength of that civilian control depends, not on the size of our armed forces, but on the strength of our political institutions and the ideology of our country. Both at this time have never been in better shape.

Within the past few years, another professor at a reputable Eastern university parlayed the misinformation, and gross ignorance, of our military establishment into a national campaign to halt "overkill." Central to his argument was a most attractive suggestion that our defense dollars could be spent wisely to fulfill neglected social needs instead of buying more sophisticated weapons to kill people.

He compared the \$112 million we might spend for fourteen B-52 bombers or eight Atlas ICBMs with the comparable cost of a national "School Lunch Program." That sum of money, he contended, could feed 14,000,000 children for a whole year. Who among us would wish to deprive any school child of a nourishing meal?

This kind of comparison conveys a "sense of realism," which the professor said is lacking in Pentagon discussions of national defense. I am reminded of the words of Sir John Slessor, the distinguished British military leader and philosopher, who has a different sense of realism:

"It is customary in democratic countries to deplore

expenditure on armament as conflicting with the requirements of the social services. There is a tendency to forget that the most important social service that a government can do for its people is to keep them alive and free."

When people no longer feel an imminent threat to their safety, they begin to wonder whether the expensive insurance policy they have taken out is worth the high premiums. That irony applies not only to national defense but to more personal situations. We have been reading about New York City, where heavy police patrols have been assigned to guard subway cars and stations round the clock. The visible presence of a "blue-coat" is intended to deter violence and vandalism.

Law-abiding New Yorkers unanimously agree that the subway policeman performs a vital service just by being there. But another problem could arise. Suppose the present crime wave temporarily abates and the subway police are not promptly withdrawn. Some citizens might begin to wonder whether a large, expensive police force itself constitutes a threat to our democracy.

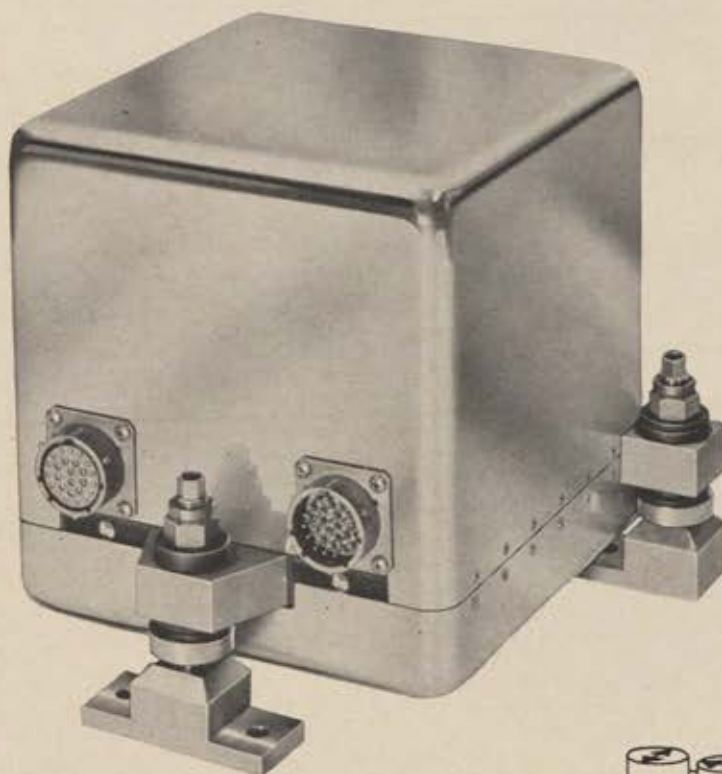
This change of heart has actually occurred on the international scene since the end of World War II. The United States and the Soviet Union have reached an accommodation on a live-and-let-live basis on such issues as the limited nuclear test-ban treaty and the "hotline" communication tie. The Department of Defense welcomes this progress as much as any segment of our society. We are, in fact, surveying other possibilities in Geneva and in the United Nations leading to a further reduction in world tensions. But we believe it is premature to suggest that maybe the free world's policeman ought to leave his weapons at home or, as some would have it, turn them in at the station house as a unilateral expression of his good intentions toward the rest of the world community. In any role he plays, as Sir William Gilbert put it simply: "A policeman's lot is not a happy one."

Tolerating the policeman simply to keep his gun and nightstick in good repair may not be enough to discourage potential lawbreakers. They never cease to update their techniques and hardware of aggression. The international police force must stay current, and that depends to a great extent upon having a steady flow of talented young men who prize respected military service above financial reward. The two college polls I cited do nothing to further this objective.

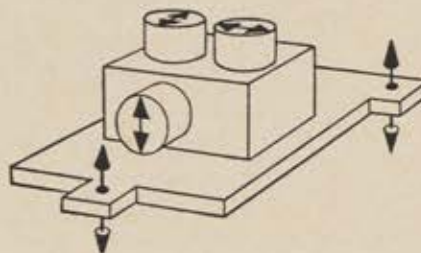
When young Americans ask, in effect, "What has General LeMay done for us lately?" they repay in base coin the sterling contribution of one who gave so much after the guns began to shoot. Since the end of World War II, it was General LeMay—in case anybody has forgotten or never learned—who forged SAC into the shield of deterrence which, in the view of Sir Winston Churchill, has prevented World War III. Such indifference also discourages young men who would emulate General LeMay's inspiring example and seek a career in the professional military service.

I do not expect that our national sense of values shall be changed until Americans begin to regard the "peace-keepers" as just as important as the "peace-makers."—END

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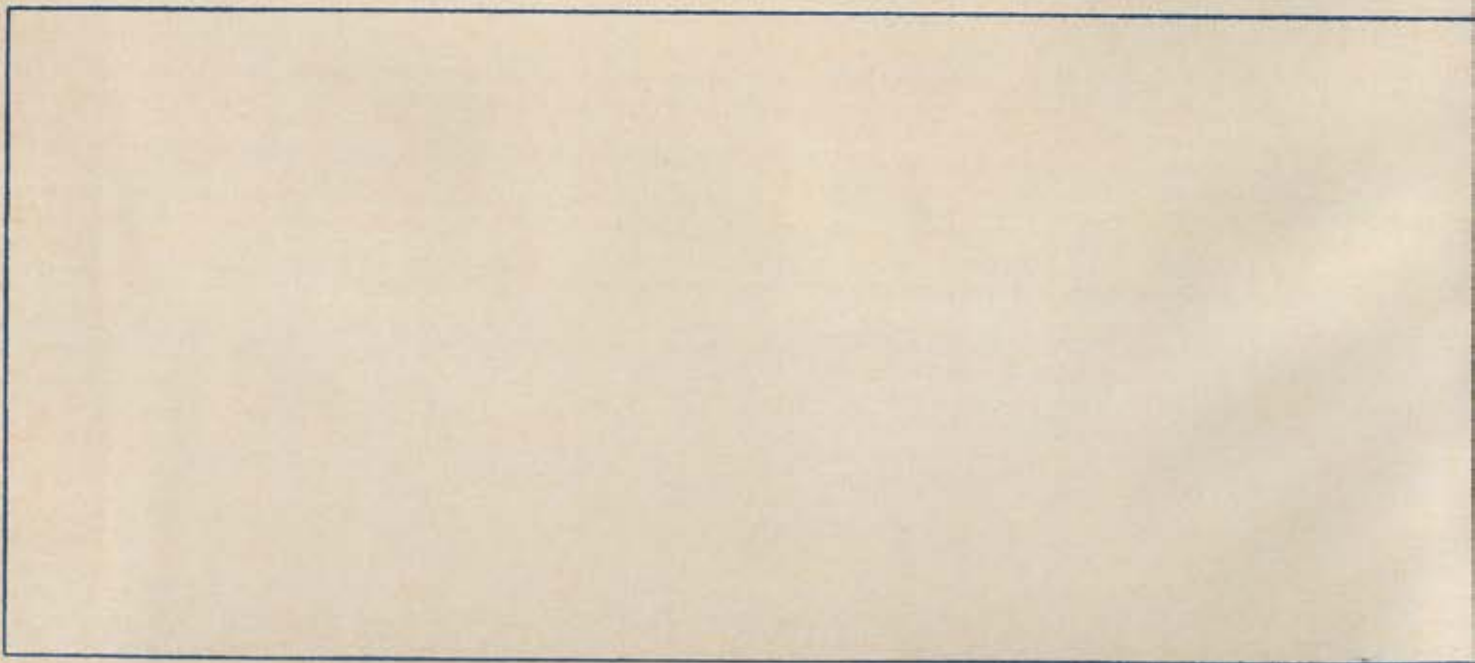
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The Strategic Air Command

THE continual evolution of the Strategic Air Command was dramatized on the last day of November 1964 when Gen. John D. Ryan assumed command as SAC's Commander in Chief, and Gen. Thomas S. Power retired from the Air Force. This change of command symbolized both the continuation of SAC's mission and the dynamic nature of the command's leadership and organization.

General Ryan, a veteran SAC commander, has led every level of SAC combat unit from bomb wing to overseas numbered Air Force. He is also an outstanding staff officer, having served as the SAC Director of Materiel for four years and more recently as the Air Force Inspector General. It was from this post that General Ryan was assigned to SAC as Vice Commander in 1964.

Soon after assuming command, General Ryan said, "Although the command of SAC has passed to other hands, its striking power rests on a great many people whose dedicated efforts and outstanding professionalism have helped create and are maintaining the free world's primary deterrent to aggression and nuclear war." General Ryan also replaced General Power as Director of the Joint Strategic Target Planning Staff of the Joint Chiefs of Staff.

Lt. Gen. Joseph J. Nazzaro was assigned to replace General Ryan as SAC Vice Commander. General Nazzaro has performed outstanding service in a number of SAC and USAF command and staff assignments and since 1962 had been Commander of SAC's Eighth Air Force.

The President's Visit

SAC's mission had been highlighted a few months earlier when President Lyndon B. Johnson visited SAC Headquarters at Offutt AFB, Neb., while escorting the new NATO Secretary General, Manlio Brosio. The almost three-hour stop included a briefing on the command and a tour of the underground command post. With the President and Secretary General Brosio were Deputy Secretary of Defense Cyrus Vance, Undersecretary of State George Ball, NATO Ambassador



Gen. John D. Ryan replaced Gen. Thomas S. Power as Commander in Chief, SAC, in November 1964. A 1938 West Point graduate, he has served with bomber units during much of his career, flying fifty-eight combat missions during World War II. He has been the Inspector General of the Air Force and prior to his assignment as Commander was Vice Commander in Chief of SAC.

Thomas K. Finletter, Chairman of the Joint Chiefs of Staff US Army Gen. Earle G. Wheeler, and then Air Force Chief of Staff Gen. Curtis E. LeMay.

While in the underground command post, President Johnson used the SAC Primary Alert System to talk directly to the SAC command post at Torrejon, Spain, and simultaneously to all of SAC's global unit command posts.

During his stay at Offutt, the President voiced high praise for the Strategic Air Command and its men. "The strength and skill of the command," he said, "are absolutely vital to the peace of the Atlantic world."

The Bomber Force

While fewer bombers than missiles are on alert in SAC today, the overwhelming majority of the command's nuclear strike power still is the responsibility of the combat crews of SAC's bomber force. In the summer of 1965, SAC had about 600 B-52s, about eighty B-58s, and a rapidly diminishing number of B-47 bombers.

In the late summer of 1964, SAC's bomber force completed its seventh year on continual ground alert. Starting with a small number in July 1957, the alert force was first increased to one-third of the bomber and tanker strength; then in July 1961 it was further increased to one-half.

The ground-alert force is comprised of fully loaded aircraft parked near the end of their runways, with combat crews living in nearby alert facilities on around-the-clock duty. Exercised frequently to ensure their readiness, alert crews can routinely launch the entire force well within the warning time expected for a nuclear missile attack—about fifteen minutes.

There is no way to measure the impact of the presence of US Air Force strategic bombers on alert on the conduct of world affairs over the past seven years. It is not, however, hard to imagine the fate of the non-Communist world if this alert force had not been in existence.

Another anniversary of great significance that occurred this year was the completion of ten years of service in SAC by the Boeing B-52 bomber.

In June 1955, the first SAC B-52 was assigned to the 93d Bomb Wing. Today, ten years later, that same bomber is still in service, now with the 22d Bomb Wing, March AFB, Calif. Since June 1955 SAC B-52s have flown more than 2,400,000 hours. One B-52 of the 7th Bomb Wing at Carswell AFB, Tex., has logged more than 5,640 flying hours.

From the oldest "B" model to the long-range turbofan-powered B-52H, the B-52 has been extensively modified over the years to meet the challenge of flying at all altitudes with varying loads.

Manned by SAC combat crews, these remarkable aircraft can carry either conventional or nuclear weapons—including a pair of Hound Dog air-to-ground missiles—to any part of the world. Each of them can carry nuclear weapons equivalent to the explosive power of all the bombs dropped by all the bombers on both sides in World War II.

This aircraft's versatility was dramatically demon-

strated when SAC B-52 bombers based at Guam were ordered to attack a Viet Cong jungle redoubt at dawn on June 18 with conventional nonnuclear 750- and 1,000-pound bombs. Other similar attacks have since followed.

The B-52 is programmed to carry on into the 1970s as the free world's key strategic bomber.

Daedalian Trophy for Flying Safety

In May of 1965, the Order of Daedalians presented to SAC for the fourth time its annual flying safety award—the Daedalian Trophy. The trophy is awarded to the Air Force major command that has flown more than 100,000 hours and has achieved the lowest adjusted aircraft accident rate during the calendar year.

During 1964, SAC flew 1,373,403 hours with only nineteen major aircraft accidents, compared with twenty-one such accidents in 1963 and thirty-two in 1962. In winning the trophy, SAC was cited for successfully accomplishing its global mission with a record low accident rate of 1.4 per 100,000 hours.

The Missile Force

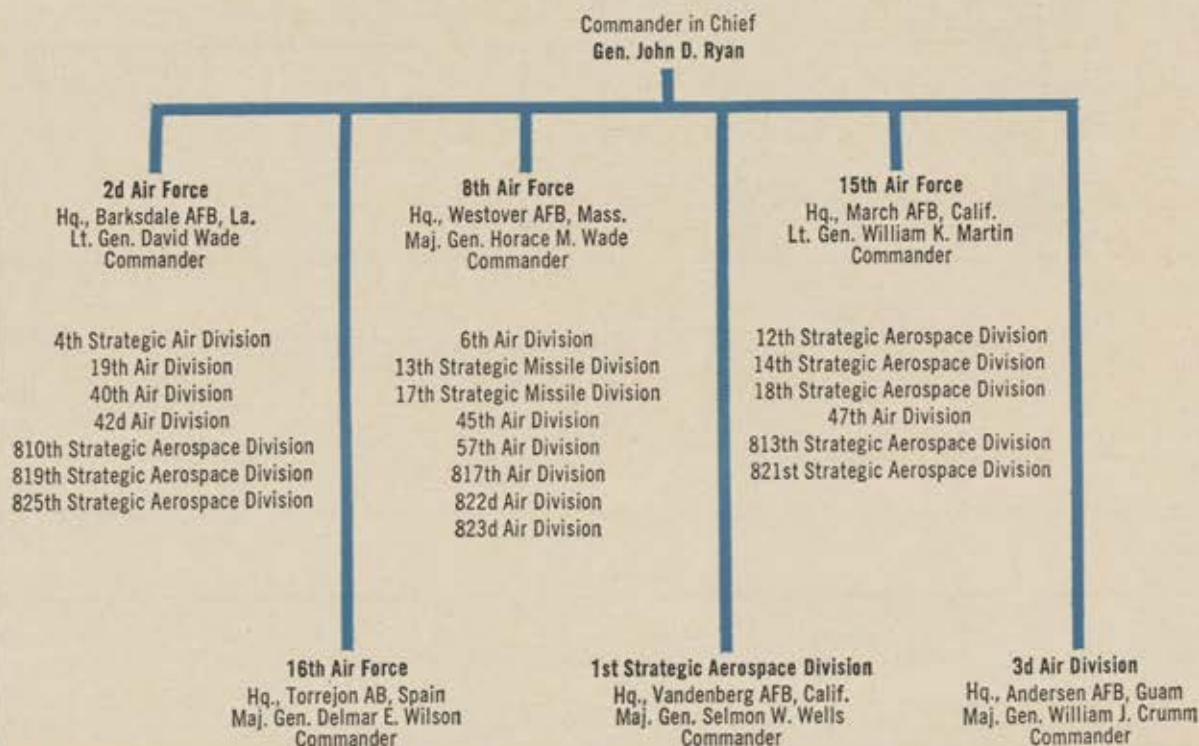
Quick-reacting, hardened for defense against surprise attack, impossible to stop in a mass attack, the ICBM is an ideal complement to the versatile manned bombers in SAC's 1965 mixed force.

Missile combat crews must have practice and experience to perfect their professional skills just as SAC aircrews must fly to keep up their proficiency. Normally, this launch experience comes from periodically firing missiles into the Air Force Western Test

(Continued on following page)

STRATEGIC AIR COMMAND

Headquarters, Offutt AFB, Neb.

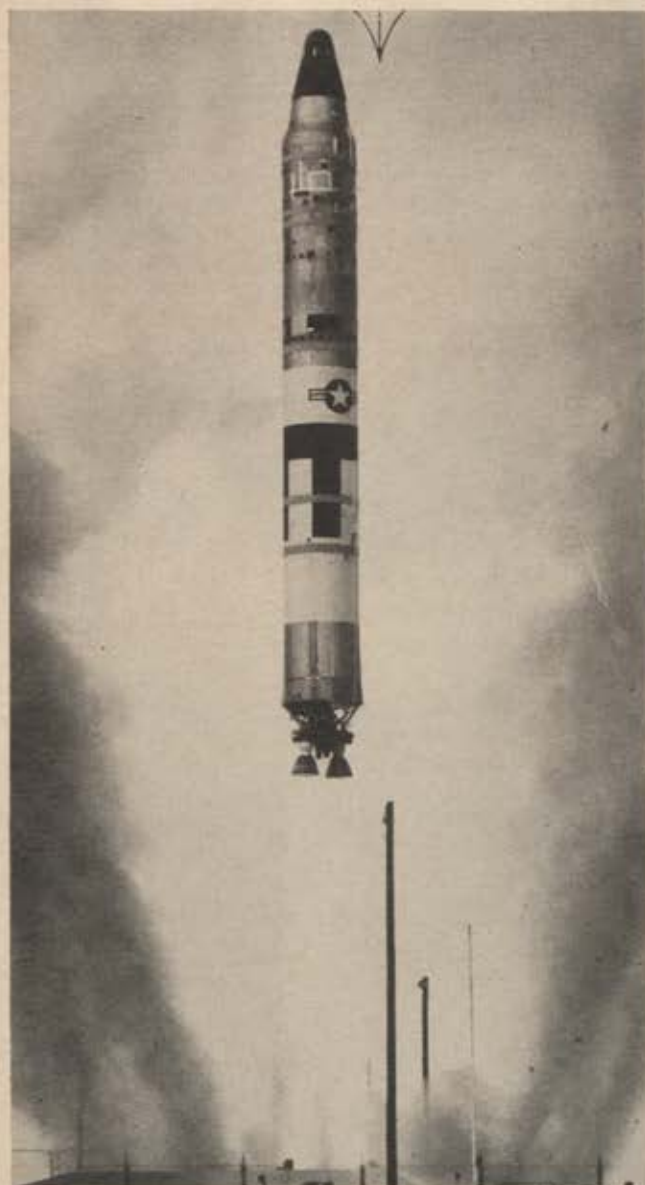


Range from Vandenberg AFB, Calif. This March, however, a SAC missile combat crew successfully launched a special test Minuteman missile direct from its operational site at Ellsworth AFB, S. D. Called "Long Life," this missile launch was designed to travel less than two miles from its site while propelled by a partially fueled first-stage engine.

An operational Minuteman can place its nuclear warhead on a target more than 5,000 miles away.

A launch from an operational base is particularly valuable as it provides the positive verification of missile launch reliability of the operational site.

Such a launch not only tests the missiles and their combat launch crews, but exercises the entire operation of support elements. Every support facet of an ICBM complex has a direct bearing on the ability of the combat missile crew to launch its missile within seconds after receipt of an authentic launch order. Each support element must be constantly at peak



A Titan II missile lifts from its silo at Vandenberg AFB during a combat crew proficiency launch. The Titan II completed shakedown and demonstration phase this year.



A highlight of the year was President Johnson's visit to SAC Headquarters at Offutt AFB, Neb., while escorting the NATO Secretary General, Manlio Brosio of Italy, right. The President is testing the SAC Primary Alert System, the famous "red telephone" in the underground command post.

operational efficiency. Communications must be flawless, command and control must be instantly effective, missile maintenance must be without error. Transportation, supply, food service, administration, base engineering, and the many other vital support services must function with the smoothness and regularity of a fine clock mechanism.

The launch from the Ellsworth AFB site was a complete success, witnessed and photographed by newsmen from all over the country.

Minuteman Buildup

After approximately five years of intensive construction effort, the SAC Minuteman ICBM force is nearing its planned peak. At the end of the six-month period covered by this report, the 200-missile Minuteman wing, spread over parts of three states and based at F. E. Warren AFB, Wyo., was complete and operational. This gave SAC an operational missile force of 800 Minuteman missiles plus fifty-four Titan II missiles, for a total of 854 ICBMs.

Still in the future are the announced additional squadron of fifty Minuteman missiles for Malmstrom AFB, Mont., and the first wing of 150 Minuteman II missiles now under construction near Grand Forks, N. D. When complete, the SAC Minuteman force will total 1,000 operational missiles.

Titan DASO Complete

The Air Force Titan II, the free world's most powerful ICBM, completed its demonstration and shakedown operations (DASO) with five successful launchings on target by SAC crews from Vandenberg AFB, Calif. DASO launches follow contractor demonstrations and are conducted in a realistic operational environment to determine weapon system capabilities when missiles are prepared and launched by SAC personnel.

(Continued on page 99)



SHARP-CHUTER

America's Minuteman missile is best known for intercontinental marksmanship. But its technology also contributes "bull's-eye" accuracy for tomorrow's all-weather parachute drops—at high or low altitudes.

NAA/Autonetics designed and built the guidance systems for Minuteman I and II, and is now applying its Minuteman II microelectronics experience to fully-integrated strike avionics systems.

In an airborne troop carrier, these systems can pinpoint the "drop zone" day or night, in any weather.

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After seven years of continual alert, SAC combat crews continue to test their readiness to launch the US bomber-tanker force. Here, crews run to B-52 bombers armed with Hound Dog missiles while practicing procedures needed to put fifty percent of the force in the air in fifteen minutes.

Launches from the 155-foot-deep silos were conducted by Titan II crews from Vandenberg and by crews from operational missile wings at Little Rock AFB, Ark., and McConnell AFB, Kan.

Tanker Single-Manager

As US forces have become more widely committed to blocking Communist aggression on a worldwide front, SAC's mission as a single manager for all Air Force aerial refueling has gained greater stature.

Today, besides refueling SAC's own extensive alert and training flight activity, SAC tankers refuel all Tactical Air Command fighters on training missions or overseas deployments. For example, TAC's fighter deployment and other activity in the Far East are refueled by SAC KC-135 jet tankers.

During 1964, SAC's tankers flew 4,450 sorties in support of TAC operations, plus additional sorties in support of other worldwide Air Force operations. In a typical deployment last January, twenty-two SAC

KC-135s refueled a squadron of USAF F-4C Phantom IIs of the Tactical Air Command several times on their way to Naha AB, Okinawa. This was the first time these fighters had been deployed overseas. Aerial refueling, in effect, multiplied by several times their normal range of about 1,600 miles.

Later this spring, two F-105 pilots, with SAC refueling, set an unofficial nonstop distance record for an operational flight in the Thunderchief tactical jet fighter. The aircraft flew nonstop from Hickam AFB, Hawaii, to Kadena AB, Okinawa—a distance of 5,730 miles—in nine hours and forty-four minutes. The normal operational range of the F-105 is 1,500 miles.

In January, the Air Force realigned its aerial tanker forces in the Western Pacific with assignment of approximately fifteen SAC KC-135 jet tankers to Kadena AB, Okinawa. The 4252d Strategic Wing was activated at that base to care for the SAC aerial tankers, which will be on rotation to Okinawa from bases in the United States. The wing is a unit of SAC's 3d Air Division at Andersen AFB, Guam.

Reconnaissance

A major step toward the operational date of the new Air Force SR-71 long-range strategic reconnaissance aircraft was taken this January when the 4200th Strategic Reconnaissance Wing was activated at Beale AFB, Calif. The 4200th Strategic Reconnaissance Wing of the Strategic Air Command will be the only SR-71 unit in the Air Force.

As President Johnson announced last summer, the SR-71 is the most advanced strategic reconnaissance plane in the world. It will fly at more than three times the speed of sound and operate at altitudes higher than 80,000 feet. In just one hour of flight an SR-71 can cover with its reconnaissance "eyes" an area of 60,000 square miles.

The SR-71 uses the same J58 engines as the YF-12A, which recently set seven records in a single day, including speed over a straight course (2,062 mph) and sustained flight at an altitude of 80,000 feet.—END

The 4200th Strategic Reconnaissance Wing was activated in January 1965, to make preparations for receiving the SR-71. This unit will be the only one in the Air Force to fly the triple-sonic, long-range, advanced, strategic reconnaissance aircraft. When the wing receives the aircraft, it will be capable of surveying 60,000 square miles each hour in the air.





The Tactical Air Command

SHORTLY before he retired on July 31, Gen. Walter C. Sweeney, Jr., said of the Tactical Air Command, "We have come a long way, but we can never rest on our laurels." It was a clear and concise way of preparing TAC personnel for FY 1965, a period during which the command's rapidly expanded resources and capabilities would be taxed to the utmost, and be directed by a new Commander, Gen. Gabriel P. Disosway.

Not only was FY 1965 the culmination of TAC's four-year accelerated growth program, but it also proved to be a year of unprecedented operational commitments across the board and around the world. From Southeast Asia, to the Congo and the Dominican Republic, TAC resources and know-how played a vital role in national response to critical situations.

It could be said that the climax came in August, when the Gulf of Tonkin incident accelerated air operations in Vietnam, requiring increased TAC support for the US Air Force effort. The normal rotation of units in support of Pacific Air Forces was substantially increased, and, in the ensuing months, more than 300 fighter, reconnaissance, and assault airlift forces were deployed to the Pacific.

Meanwhile, in November, the Congo crisis occurred and TAC assault airlift forces, operating as an element of CINCPACAF (Middle East, Africa South of Sahara, and Southern Asia), figured in the rescue of some 1,500 refugees and hostages from rebels. The 464th Troop Carrier Wing of TAC was later awarded the Mackay Trophy for this "new milestone in the precision employment of tactical airpower under unusually arduous conditions." It was the second consecutive year a TAC unit won the coveted USAF award.

Less than six months later, TAC's assault airlift forces were again committed to a unified command response to an emergency, this time in the Caribbean, as a major part of the US Atlantic Command's humanitarian airlift to the Dominican Republic. In a very short period of time, the AFLANT airlift forces transported more than 16,000 tons of supplies and 16,500 troops in 1,650 sorties from the staging base at Pope AFB, N. C. It was the most massive airlift effort ever

Gen. Gabriel P. Disosway assumed command of TAC on August 1, 1965. He came from a two-year tour as Commander in Chief of US Air Forces in Europe. He is a 1933 West Point graduate.

In 1958-59 he was Deputy Commander of USAFE. In 1960-61 he served as Vice Commander of TAC and then was DCS/Programs and Requirements, at Hq. USAF.



accomplished in a compressed time period—seven days.

All of these unscheduled actions were accommodated without appreciably slowing down TAC's routine efforts in training, exercising, evaluating, refining, improving, and maintaining a maximum combat readiness to meet just these kinds of contingencies. It could have been this particular quality that General Sweeney had in mind when he admonished his officers and airmen not to rest on their laurels, no matter how far they had come.

Just as FY 1965 was a year of test for TAC's ability to meet diversified contingencies, it also was a focal point for adding up key achievements during General Sweeney's four-year tenure. Shortly after the close of FY 1965 he turned over the command to Gen. Gabriel P. Disosway and retired from active duty after thirty-five years of distinguished service, during which he contributed significantly to the growth of United States airpower.

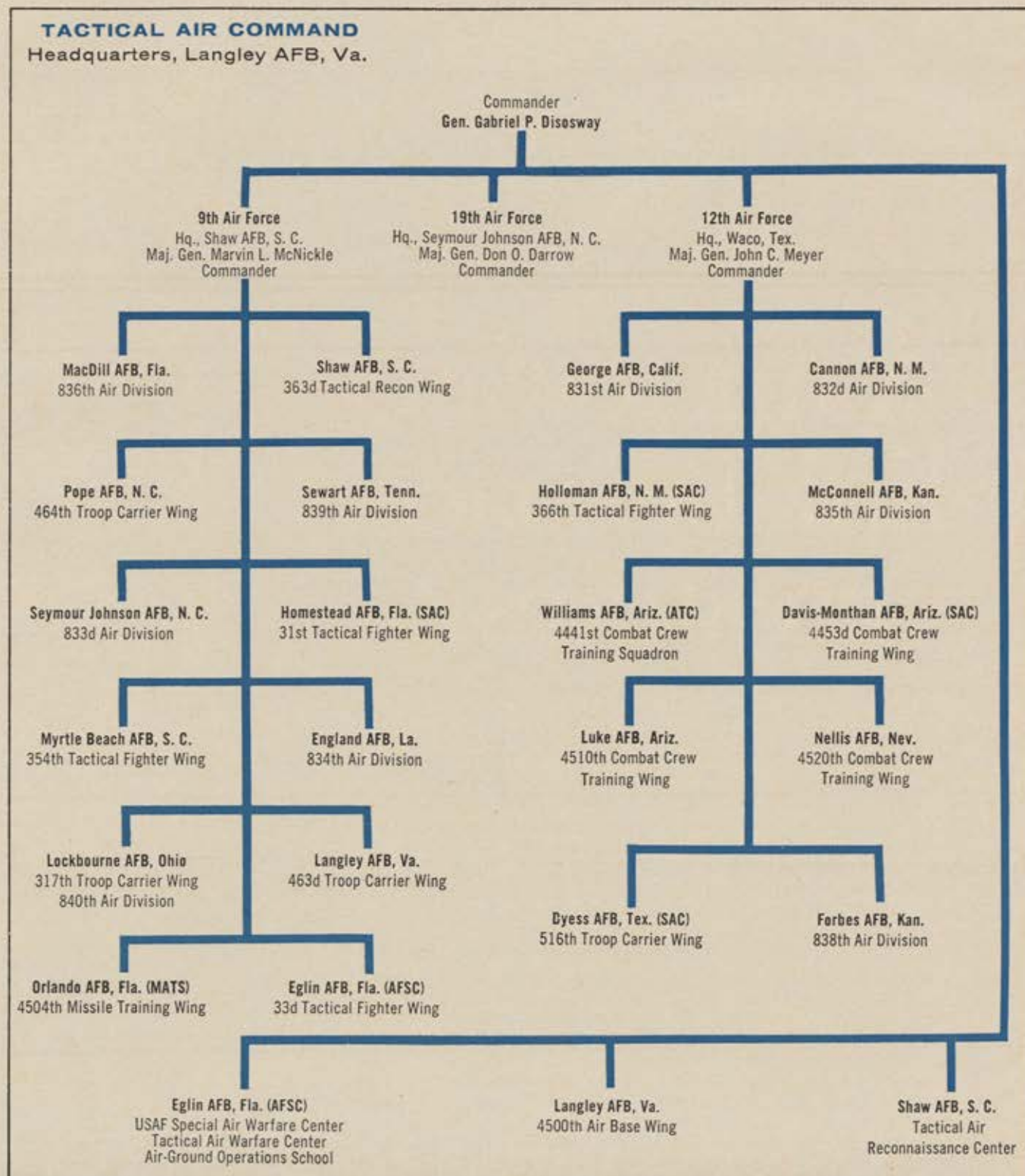
FY 1965 was the culmination of TAC's rapid build-up. In 1961 the command had seven tactical fighter wings with an inventory of fewer than 600 jet aircraft. Today there are fifteen wings of more than 1,400 tactical fighters, including a large number of the F-4C Phantom II, the newest member of the USAF jet inventory. TAC's assault airlift force not only has increased in size—from four to six wings with two more programmed—but in performance quality as well. The

versatile C-130 Hercules has made the difference, and there are now more than 315 in the inventory. Aerial reconnaissance, one of TAC's most vital responsibilities, also has been greatly enhanced with the addition of a second wing and introduction of the RF-4C version of the Phantom II, which is being equipped with advanced sensors, radar, and photographic equipment.

From a personnel standpoint, TAC has experienced an equally dramatic growth. In four years, personnel strength has increased about seventy percent, to a total of about 75,000 officers and airmen. This force is

augmented by 60,000 Air Force Reservists and Air National Guardsmen. These Reserve Forces have been drawn closer to the Regular forces in every respect. General Sweeney recently emphasized this when he said: "Today, TAC and its Air Reserve Forces are closer together in mission recognition, combat readiness, and professionalism than ever before. The statement that 'our Reserve Forces are vital to our national defense' is absolutely true and not in any sense a cliché."

(Continued on page 104)





A microwave link by space creatures?

Henry Magnuski, Motorola's internationally recognized leader in microwave research, ponders the possibility that intelligent creatures in outer space, a thousand or so years ago, may have sent Earth some mysterious microwave signals.

Recently, a segment of the scientific community has been knee-deep in confusion, if not controversy, about CTA-21 and CTA-102, mysterious points in outer space which emit strong, short microwave signals.

As of publication time, no one knows exactly what is causing these signals... but a lot of people have strong opinions. Some say planets; some say they are gaseous disturbances like other "radio" stars; some say they were sent by space-creatures of a super intelligence!

Don't laugh. Some well-respected astronomers take the "super-intelligence" theory quite seriously (but don't take that medieval "monster" I'm pictured with seriously). The Russians even laid claim to detecting an "intelligent" 100-day pattern to the signals. In my opinion they laid an egg, and most British and American astronomers agree.

So, the controversy rages. Although I accept only the "gaseous disturbance" theory, I'll never be able to prove it, unfortunately.

Why not? It's simply a matter of time and distance. Best estimates put CTA-21 and CTA-102 about 1,000 light-years away, so the microwaves our radio telescopes are picking up now were sent about 1,000





ONE MAN BAND

A solid, down-to-earth microwave development is the Motorola MP-7... truly a portable one-man field terminal. It can be used for high-speed data, high-density voice, multi-channel remote control and telemetry, closed-circuit TV, radar relaying, troposcatter trunking, portable command post trunking, downhill radio transmission... *you name it. MP-7's got it!* This solid-state equipment also fits readily into existing shelters for radio-remoting of many outputs from other electronic equipment. Developed on company funds, and currently in production, MP-7 is operating in the field as a finalized system terminal.



Complex data transfer system installed at Edwards AFB high speed test range.



Portable MP-7 microwave unit for tactical use.

BACK IN THE IVORY TOWER

Our special microwave group is vigorously applying the latest thinking in advanced micro-miniaturized circuitry (much of it theirs) to the design of microwave components and systems. In their own words, they are placing "particular emphasis upon the integration of devices such as tunnel and back diodes, varactors, microwave transistors, and ferrite devices, into miniaturized assemblies offering improved performance."

They are working in these four general categories:

THIN FILMS — deposited layers of semiconductors, or metal, on a suitable substrate.

HYBRIDS — a combination of thin film, semiconductor, and microminiaturization techniques.

MONOLITHIC — totally integrated semiconductor circuits.

THICK FILMS — a combination of high dielectric materials, etched microwave strip transmission lines and semiconductors.

If you receive our **ENGINEERING BULLETIN**, you already know that we're pretty far along in our R&D... if not send us the coupon below and I'll mail you the appropriate issue. In any event, I don't want to leave you thinking that because we're not trying to signal CTA-102 or CTA-21, we're not forging ahead with some highly erudite microwave projects.

years ago. Thus, even if we could answer these signals today (and Earth engineers aren't close to having the power or technology yet), it would take another 1,000 years for our answers to arrive at the CTA's; and who is to say the "senders" will still be there?

Even if they did read us, it would take still another thousand years for any "intelligence" to answer us... unless microwaves can be made to travel faster than the speed of light. Who has the time to wait? And another thing — if these creatures are so blasted intelligent, why didn't they send us a more readily decipherable signal in the first place?

Maybe I'm skeptical because I don't like the idea of anyone being 1,000 years ahead of Earth's technology. So, for the foreseeable future, anyway, our staff — which includes some of the world's outstanding microwave systems engineers — is concerned more with designing and developing the kinds of microwave systems that meet some rather urgent needs right here in the confines of our own galaxy (which, of course, does not preclude some rather far-out techniques).

KEEPING AN EYE ON EDWARDS

The Air Force Flight Test Center and NASA's Flight Research Center at Edwards AFB has a requirement to keep a close eye on a variety of test activities over hundreds of miles of their high-speed test range.

Motorola designed, engineered, installed, and maintains a microwave and multiplex system (a "turnkey" job) that does just that. The system allows several control centers to continuously communicate with, receive, record, and display flight test data from test vehicles in real time as they proceed over any point of the flight range. Data may include four 500 kc telemetry composite signals, one timing signal, five intercom signals, one wideband search radar signal, and 60 control and monitoring signals. There are some unique innovations engineered into this system, but they're a bit too complex to discuss here.



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Pace of overseas deployment of TAC's mobility forces has steadily increased to an annual average of 2,000 Atlantic and Pacific crossings by jet aircraft. Since retirement of TAC KB-50 tankers, all refueling of TAC fighters is handled by SAC KC-135s, shown here with F-4C Phantom II.

During Goldfire I exercise in Missouri last November, Gen. Walter C. Sweeney, Jr., then TAC Commander, confers with Maj. Gens. Gilbert Meyers, center, Tactical Air Warfare Center Commander, and John C. Meyer, Commander of TAC's Twelfth Air Force.



Clear evidence of TAC's physical growth is seen in the expansion of its base structure. In 1961, there were eleven TAC bases, and units operating as tenants on five other installations. As of July 1, the TAC family of bases had grown to sixteen, with tenant units on seven bases of other USAF commands.

During the four-year period of accelerated expansion, TAC has been equally busy improving combat capabilities, with particular emphasis on across-the-board support for the Army. The USAF Tactical Air Warfare Center, established in 1963, and made a permanent facility in FY 1965, was an outgrowth of this emphasis. A special series of joint test exercises, called Indian River, helped develop, evaluate, refine, and apply USAF joint forces concepts and doctrine which were later painstakingly examined in STRICOM-sponsored Exercise Goldfire I.

In addition to the Indian River and Goldfire exercises, TAC engaged in a number of other highly significant operations, domestic and overseas, that tested the command's flexibility, mobility, and combat effectiveness. Among them were Quick Kick VII and Short Count in the Caribbean; Tropic Lightning in Hawaii; Polar Strike and Northern Hills in Alaska; Winter Trail in Norway; and Eagle Jump, One Shot, Cherokee Trail, and Silver Hand in the US.

Two of these had added importance, since they involved the first overseas exercise deployment of the

new F-4C. These were Northern Hills and Winter Trail. Previously, however, the F-4C had demonstrated its fast-reaction, global mobility when a flight of four from MacDill AFB, Fla., made an unprecedented eighteen-hour, 10,000-mile endurance flight around the US, with seven in-flight refuelings from KC-135 jet tankers. Shortly afterward, a squadron of Phantoms was deployed to Okinawa for a routine rotational tour with the US Pacific Air Forces, cutting a day from the normal three-day schedule for Pacific deployments.

Although worldwide mobility is not new to TAC, in recent years the pace has been steadily increasing until now an annual average of 2,000 Atlantic and Pacific crossings by jet aircraft is normal. Consequently, temporary duty away from home—both for deployments and exercises—has become a way of life. The average TAC aircrew member spends on the order of 150 days a year away from his home base. This will likely increase with the continued expansion of air activities in Southeast Asia. TAC's involvement there is graphically demonstrated by the fact that in FY 1965 more than 600 combat citations—including three Air Force Crosses, seven Silver Stars, and seventy-two DFCs—were awarded TAC personnel.

The accent on professionalism in TAC was reflected in special combat-readiness training programs, such as:

- Red Rio—Low-level delivery techniques, flying below radar and ground defenses to reduce time of exposure and increase weapon-delivery proficiency.
- Main Course—Joint operational training for assault airlift crews and combat control teams under realistic combat conditions.
- Trip Switch—A night-attack competition for tactical fighters, similar to the continuing daytime Match Point proficiency competition.
- Blue Ghost I—A radar navigation and bombing competition for F-105 and F-4C all-weather fighter crews.

(Continued on page 106)



C-130 Hercules transport comes in for dirt-strip landing during Goldfire I. Exercise, conducted under supervision of US Strike Command, demonstrated ability of Tactical Air Command's fighters and transports to furnish across-the-board support to US Army ground forces in battle zone.



ALL THE ADVANTAGES OF THE HUEY ..PLUS TWIN ENGINE RELIABILITY

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Bell Helicopter Company has already flight tested the UH-1 powered by the T-67 twin power plant. Single engine flight has been successfully accomplished up to 17,000 feet altitude and at temperatures up to 100° F. All flight test results were outstanding.

The UH-1 has proven itself as an aerial crane, a trainer and an executive transport. It has demonstrated excellent night and instrument flight characteristics. Twin engines now add a new dimension in safety to these flight operations.



BELL HELICOPTER COMPANY

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• Aunt Mary—Fast-reaction, high-speed, low-level training for tactical reconnaissance aircrews.

In addition, new techniques and equipment are being developed and tested for a closer relationship between tactical airpower and Army ground forces. One example is the forward fighter operating base (FFOB), a 5,000-foot runway of pierced aluminum matting and arresting gear, to permit the F-4C to operate on the edge of the battlefield. Another is the Airborne Battlefield Command and Control Center (ABCCC), a portable communications capsule that fits snugly into the C-130 and gives the air commander the flexibility of controlling his forces while airborne or from a temporary ground command post.

Continued improvements and refinements have been made in the Tactical Air Control System (TACS), the heart of the vital command-and-control function of tactical airpower in unilateral and joint operations. Streamlining has been the goal and rapid reaction to air-support requests the end result; enabling an Army commander, as low as the company level, to get immediate response from fighters, aerial reconnaissance, or assault airlift.

Air Commando operations, constantly honed by the Special Air Warfare Center, have been expanded and steadily upgraded, with the application of lessons learned in Vietnam. New methods of airborne delivery of supplies and personnel rescue in dense jungles and in darkness have been developed, improved aircraft and armaments have been tested and adapted, and an accelerated training program produced more than 250

aircrews comprising more than 600 personnel during the year.

TAC's contributions to national defense, and tributes to its professionalism, are reflected not only in the individual and unit combat citations, but also in major awards. As mentioned earlier, TAC's 464th Troop Carrier Wing won the Mackay Trophy for outstanding operations during the Congo crisis. The equally important Kolligian Trophy for extraordinary alertness, ingenuity, and proficiency was awarded to Capt. James W. Anderson, a fighter pilot with the 481st Tactical Fighter Squadron. He was cited for leading his element of three aircraft to a safe landing in the Philippines under extremely hazardous conditions. TAC's 612th Tactical Fighter Squadron was awarded the 1964 Colombian Trophy for meritorious achievement in flying safety, based on its record over the past three years, during which it had served several rotational tours in Europe and in Southeast Asia.

As a final measure of the dynamic change in TAC over the past four years, two points merit recognition. First, until 1961 TAC was responsible for providing combat support for overseas combat theaters. Since that time, with the inception of US Strike Command and the inclusion of TAC within the US Atlantic Command structure, it has become a combat command with specific theater responsibilities—as during the Cuban crisis in 1962. Secondly, four years ago TAC's total resources were set at slightly less than \$3 billion and today the value is almost double that figure. —END



CE 1-3 crewman signals F-4 is "ready" for take-off.

F.O.B.

Forward Operating Base fighter-support for front line troops. All American's CE 1-3 mobile ground-based catapult is air transportable and quickly assembled . . . ready to launch the F-4, F-104, A-4 and other jet aircraft from any runway. Simple in design, a small wheeled shuttle, attached to a launch cable, tows high performance jets to flight speed in less than 2000 feet. USAF pilots flying F-4 aircraft were recently launched after only a short briefing. For Forward Operating Base arrested landings, All American makes the Model 44 and M-24 rotary "Water Twisters"®. With these proven products, the USAF can give tactical support from forward bases that will accommodate joint service operation when desired. For more information contact:



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The need — A realistic jet target to simulate the supersonic threat in both high and low altitude "enemy" attacks.

The answer — Ryan's new supersonic XBQM-34E Firebee now being developed under contract to the United States Navy.

Designed to fly at speeds above Mach 1.5 and at altitudes well over 60,000 feet, the XBQM-34E will also handle low level Mach 1.1 missions at an earth-hugging 50 feet.

The supersonic successor to the famed Firebee,

world's most "shot at" jet target missile, adds a new dimension to target capability. While providing air defense crews with longer tracking time and the challenge of supersonic performance, the new "bird" can also perform all of the subsonic mission requirements of the present Firebee.

In production, the supersonic version will be available to all the military services . . . at a cost not much greater than the current Firebee.

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The Air Defense Command

THE AIR Defense Command (ADC) passed a historic milestone on June 27, 1965. This date marked fifteen years of general twenty-four-hour runway alert by ADC aircrews against enemy bomber attack. The outbreak of the Korean conflict, which occurred two days before the original alert order in 1950, is for many Americans a distant memory, but the requirement for an active air defense has endured.

Existing threats from enemy aircraft and ICBMs, combined with the potential threat from aerospace, caused the ADC alert posture to expand far beyond the physical presence of armed fighter interceptors in alert barns. Around-the-clock electronic surveillance of aerospace and highly sophisticated hardware now complement the fighters.

The primary mission of ADC has remained unchanged since that first alert—to discharge Air Force responsibilities for the aerospace defense of the United States. This task involves providing, equipping, and training forces to detect, identify, intercept, and, if necessary, destroy aircraft or missiles attacking this nation. As the US Air Force component of the US-Canadian North American Air Defense Command (NORAD), ADC's area of responsibility extends from the Arctic to the Gulf of Mexico.

To perform its vital mission, Air Defense Command must have highly qualified people, the most modern equipment and weapons, and a vast communications network. Its extremely effective fighting force represents a capital investment of \$8 billion and requires an annual operating budget of \$1.4 billion.

Lt. Gen. Herbert B. Thatcher, who flew an F-51 Mustang over Long Island on the first day of alert in 1950, commands the Air Defense Command from his headquarters at Ent AFB in Colorado Springs, Colo. ADC is composed of more than 100,000 personnel assigned to forty-eight different types of organizations at 394 bases and stations throughout the US and Alaska, Canada, Newfoundland, Iceland, Greenland, and England.

ADC missions are exercised through five geographically oriented SAGE (Semi-Automatic Ground Environment) air divisions, the 73d Air Division (Weapons),



ADC Commander Lt. Gen. Herbert B. Thatcher served as a World War II combat wing commander and operations officer in the European Theater. A 1932 West Point graduate and a military flyer since 1936, he served with USAFE; with the Joint Chiefs of Staff; and as Chief of Staff, UN Command, US Forces in Korea, before assuming command of ADC in 1963.

which operates the training centers and firing ranges at Tyndall AFB, Fla., and Perrin AFB, Tex., and the 9th Aerospace Defense Division—the only one with global responsibilities. The 9th ADD operates the command's far-flung space detection and tracking facilities, including the three BMEWS (Ballistic Missile Early Warning System) sites in Alaska, Greenland, and the United Kingdom.

ADC's counterforce stable includes Bomarc-B ground-to-air interceptor missiles and thirty-eight fighter squadrons equipped with supersonic F-101 Voodoo, F-102 Delta Dagger, F-104 Starfighter, and F-106 Delta Dart aircraft. These fighters are armed with an arsenal of air-to-air missiles and rockets ranging from the large AIR-2A Genie to the pencil-thin conventional AIM-9B Sidewinder.

In addition, ADC is responsible for supervising the training of twenty-one Air National Guard fighter squadrons which pull around-the-clock alert with their Regular counterparts.

New Defensive Systems

The capabilities of ADC to provide the CINC-NORAD with weapons and manpower to defend North America were greatly enhanced during the year with the announcement by President Johnson of development of a new long-range, trisonic fighter-interceptor and operational status of systems capable both of inter-

The record-breaking, 2,000-mph YF-12A is being tested to determine if it will meet ADC requirements for an Improved Manned Interceptor to defend against supersonic bombers and airborne stand-off missile launchers. This prototype fighter-interceptor employs the ASG-18 fire-control system and is armed with high-speed, nuclear-tipped AIM-47A air-to-air missiles.



cepting and destroying armed satellites in space. The Lockheed YF-12A, unveiled September 30, 1964, at Edwards AFB, Calif., may be the answer to the Air Defense Command's requirements for an Improved Manned Interceptor (IMI) to defend this country against supersonic bombers and standoff airborne missile launchers.

The YF-12A proved its high-speed cruise capability on May 1, 1965, breaking seven official world records. The aircraft was clocked at 2,062 mph. This prototype fighter-interceptor employs the ASG-18 fire-control system and is armed with high-speed, nuclear-tipped AIM-47A air-to-air missiles. An ADC crew maintained one of the record-shattering aircraft in the speed-run series.

The existence of two antisatellite systems was revealed by President Johnson in September. The systems, operated by the Army and the Air Force, are under operational control of the Continental Air Defense Command (CONAD). The Air Force system,

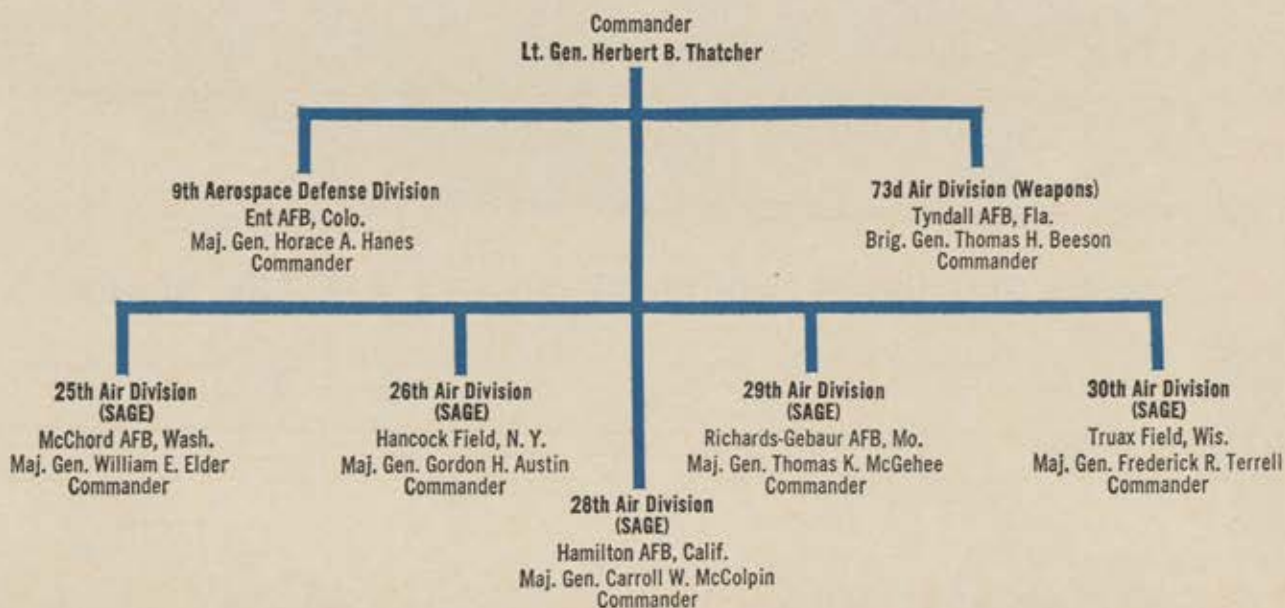
employing the Thor missile, is manned by ADC crews. It is operational in every sense of the word. Both the Thor and the Army Nike-Zeus systems have been tested effectively and have intercepted satellites in space, their missiles passing so close as to be within destruct radius of their warheads. The completion of these systems was termed a rare achievement, because the United States has in effect discouraged the development of an offensive weapon in space by perfecting an operational defensive capability before an offensive capability exists.

Over-the-horizon (OTH) radar, also announced by the President, was called one of the most dramatic examples of new developments in national defense. The OTH consists of a family of systems that bounce radar signals off the ionosphere and send them back to earth far beyond the horizon, thereby differing from the normal radar-detection capability, which is limited to line

(Continued on page 111)

AIR DEFENSE COMMAND

Headquarters, Ent AFB, Colo.





SOME OF OUR PRODUCTS NEVER GET OFF THE GROUND



They aren't supposed to. ■ Like this helmet mounted radio receiver for field communications. Or its companion miniature transmitter. ■ The U. S. Army Electronics Research and Development Laboratories, Ft. Monmouth, New Jersey, have contracted for these new all-transistor units for service test use. For the first time, communications travel with the squad, lighten the load that soldiers must take into battle, and—in many cases—provide the

means to save lives by doing away with hand signals or shouted commands. Fighting men are able to react to orders *instantly*—regardless of their field positions, the size of their units, or the combat conditions surrounding them.

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TSgt. Carl Heberling is a Duty Space Surveillance Technician with 1st Aerospace Control Squadron. He works for Spacetrack, which, with the help of several Philco 2000 computers, maintains an up-to-date catalog on every man-made object that has been put into space by any country.

of sight. OTH will provide detection of missiles within seconds of launch at a distance of several thousand miles. While not replacing BMEWS, these radars will almost double the present fifteen-minute warning time of an ICBM attack. The new radar also has a capability against aircraft.

Space Observations

ADC's space traffic tabulators announced two new records during the fiscal year. In February, the 9th Aerospace Defense Division, which operates the Air Force Spacetrack system, cataloged its 1,000th man-made space object. It was the Titan III space rocket launched from Cape Kennedy, February 11. At the end of June 1965, 618 objects were still in space.

In early June 1965, BMEWS produced its five millionth report on the precise position of a space object. Although BMEWS is designed primarily for early warning of ICBM attack, it provides a bonus for satellite trackers by recording a large percentage of all usable observations of earth-orbiting satellites.

Spacetrack is the Air Force agency of the NORAD SPADATS (Space Detection and Tracking System). SPADATS is operated for NORAD by technicians of the 9th ADD's 1st Aerospace Control Squadron.

Air-to-Air Refinements

ADC pilots at Tyndall AFB, Fla., last February marked a first by intercepting a Bomarc drone target flying at more than 1,500 mph, at an altitude of more than 50,000 feet. The intercept was made by two F-101s

and an F-106 within five minutes after the drone lifted off its launch pad and streaked down the Air Force Gulf of Mexico Missile Range. This intercept proved the feasibility of using the obsolete Bomarc-A to test the capabilities of ADC fighters.

A month earlier, another refinement in fighter-interceptor aircrew training was introduced into the system when ADC's 4750th Test Squadron at Tyndall began employing a supersonic tow target on air-to-air firing missions. The twelve-foot-long, pencil-shaped TDU-9B target is towed by an F-101 at speeds reaching Mach 1.5. The target's distance behind the F-101 varies from four to eight miles. It has a self-contained electronic scoring capability. The TDU-9B provides more missions per target vehicle and a more realistic target presentation at a wide range of speeds and altitudes.

Air Defense Highlights

In July 1964, the last FPS-3 radar, introduced into the command system in the early 1950s, phased out at Havre AFS, Mont. A month later the last Texas Tower off Nantucket Island, Mass., was dismantled by a civilian salvage firm. The Laredo, Tex., Spacetrack sensor, which had been outmoded in the rush of space technology, was inactivated.

The first increment of military personnel moved into the new NORAD Underground Combat Operations Center in Cheyenne Mountain near Colorado Springs in October. Construction of the COC entered its final phase with the installation of buildings and command-and-control equipment.

In November, the Secretary of Defense announced the phaseout of sixteen ADC radar installations and the realignment of other ADC organizations.

ADC moved another step forward in the moderniza-
(Continued on following page)



A flight of ADC F-101 Voodoos streaks over San Francisco's Bay Bridge. Two Voodoos and an F-106 scored a first by intercepting a Bomarc drone at more than 50,000 feet.



EC-121 Warning Star aircraft provide offshore radar coverage on the East and West Coasts of the United States for ADC. The 552d Airborne Early Warning and Control Wing at McClellan AFB, Calif., which won an Air Force Outstanding Unit Award this year, is equipped with these aircraft. ADC has another EC-121 radar picket unit, the 551st Airborne Early Warning and Control Wing, located at Otis AFB, Mass., to patrol the East Coast.

tion of its base supply system as it began implementing a new UNIVAC computer system at command installations. Called the 1050 II, the system is designed to improve inventory control programs while increasing response to modern-day support needs. ADC was the first major air command under the Air Force-wide program to implement the UNIVAC supply computer. Richards-Gebaur AFB, Mo., was the initial command installation to put the system into effect. Fourteen other bases are scheduled to follow.

Top awards were won by several ADC units during the year. The coveted Hughes Trophy, awarded to the best Air Force air defense unit, was won by the 329th Fighter Interceptor Squadron, George AFB, Calif. Portland Air Defense Sector won the Smith Trophy for its outstanding performance in ground environment.

Air Force Outstanding Unit Awards were earned by the 552d Airborne Early Warning and Control Wing, McClellan AFB, Calif., and an Air National Guard unit—the 163d Fighter Group, Ontario, Calif. The McClellan wing, like its twin, the 551st at Otis AFB, Mass., flies EC-121 radar picket aircraft.

Cost reduction continued as a top-priority program. At year's end, ADC hoped to better its Fiscal Year 1964 record when its quota of \$16 million was exceeded by 270 percent.

What of the Future?

Summing up, the aerospace defense picture looked like this at year's end:

ADC was capable of performing well all four of its basic functions—detection, identification, interception, and destruction—against today's bomber threat and the potential threat from space. Against ballistic missiles, however, the position was not as good. Two of the four functions—detection and identification—were being performed. Meanwhile, ADC planners were working hard to fulfill the remaining two, interception and destruction.

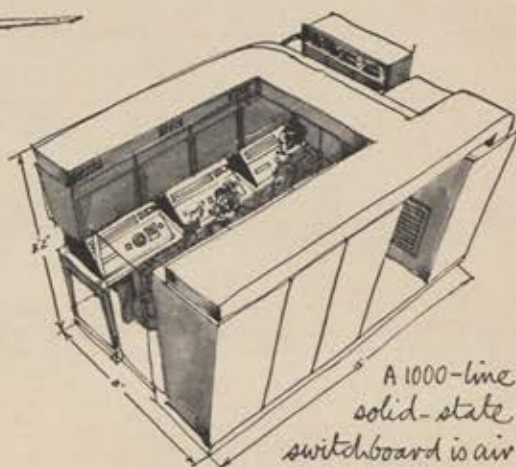
ADC—alert, informed, and aroused—with vast experience in aerospace defense and faith in the abilities and accomplishments of Americans looks confidently to the future.—End

Pikes Peak forms the backdrop for the takeoff roll of these F-102 Delta Daggers at Peterson Field, Colo., which is the ADC Headquarters flight facility. ADC has thirty-eight fighter squadrons equipped with F-101 Voodoos, F-104 Starfighters, and F-106 Delta Darts, as well as F-102s. In addition, the command is responsible for the training of twenty-one Air National Guard squadrons.

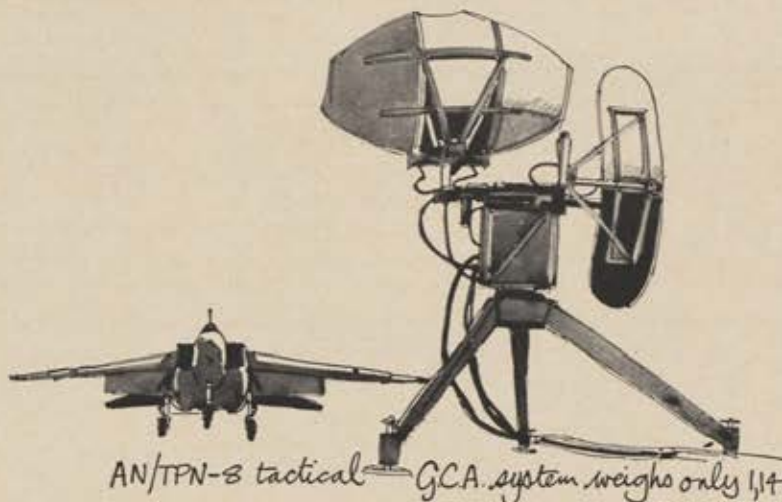




ITT's compact troposcatter field unit AN/TRC-112 is in full operation 30 minutes after landing



A 1000-line solid-state switchboard is air transportable.



AN/TPN-8 tactical GCA system weighs only 1,140 lb.

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How about a tactical GCA radar that goes to work within one

hour? AN/TPN-8 is it. Transport it by helicopter or truck to forward airstrips for precision range, azimuth and elevation information. Developed by ITT Gilfillan, AN/TPN-8 is ready for delivery.

And so it is with a wide range of ITT limited warfare devices—tactical displays, man-pack communications, DME ground beacons—they're designed to move.

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ITT



The United States Air Forces in Europe

INTRODUCTION of a potent new weapon system, expansion of tactical reconnaissance capabilities, and a change of command were top developments in the United States Air Forces in Europe (USAFE) during a year that rounded out two decades of continuous overseas commitment to free-world defense.

Twenty years old on August 7, the command held observances which highlighted its combat-ready role in NATO and stressed the anniversary's significance in terms of sustained United States military service abroad.

USAFE's identity as one of the oldest and largest of America's overseas air arms dates back to August 7, 1945, when it became the successor to the wartime United States Strategic Air Forces in Europe. During fifteen of the twenty years since then, the command has been the largest single contributor of tactical airpower to NATO's deterrent strength.

Command-wide birthday celebrations were preceded on July 21 by a change of command ceremony at USAFE Headquarters, Wiesbaden, Germany, in which Gen. Bruce K. Holloway succeeded Gen. G. P. Disosway as Commander in Chief.

General Holloway came to USAFE from the US Strike Command (STRICOM), where he was Deputy Commander in Chief. He was promoted to four-star rank on August 1. General Disosway left USAFE after a two-year tour to become Commander of the Tactical Air Command.

At a previous ceremony on July 20 at Ramstein, Germany, General Holloway took over command of NATO's Fourth Allied Tactical Air Force (4th ATAF) from General Disosway. The USAFE Commander in Chief has a dual command responsibility in 4th ATAF, the international command to which the great bulk of USAFE's units are committed for NATO control, along with tactical elements of the French, Canadian, and West German Air Forces.

In entering a new decade, USAFE had adopted the motto, "Vigilance for Freedom," to reflect its continuing combat-ready role in Western defense. The officially registered motto was selected in a command-wide competition held in anticipation of the twentieth anniversary celebration.

Gen. Bruce K. Holloway assumed command of USAFE in July of this year, replacing Gen. Gabriel P. Disosway. He had been Deputy Commander in Chief of the US Strike Command. He flew with the "Flying Tigers" during World War II. Before his STRICOM tour he was Director of Operational Requirements at Hq. USAF.



USAFE also has given new emphasis to development of its tactical mission capabilities through introduction of the versatile Mach 2-plus McDonnell F-4C Phantom II aircraft and the formation of two new tactical-reconnaissance squadrons through a process of realignment and expansion.

Both the tactical fighter and RF-4C reconnaissance versions of the Phantom were included in programming designed to strengthen the powerful weapons arsenal which supports USAFE's around-the-clock alert status. In the United Kingdom-based Third Air Force, especially, 1965 has come to be regarded as the "Year of the Phantom."

Deliveries of the RF-4C began on May 12 with an initial transatlantic flight of two aircraft from Shaw AFB, S. C., to RAF Station Alconbury, England. These and other aircraft arriving in a progressive program of transition from Douglas RB-66 Destroyers were assigned to the 10th Tactical Reconnaissance Wing, a Third Air Force component.

Initial deliveries of the F-4C tactical fighter were scheduled to be made to the 81st Tactical Fighter Wing, another Third Air Force unit at RAF Station Bentwaters-Woodbridge, England. The 81st had been the only USAFE unit equipped with McDonnell F-101 Voodoo tactical fighters.

Actually, the F-4C made its debut in the European area in February, when eighteen Florida-based TAC Phantoms flew to Orland Air Base, Norway, as part of STRICOM operationally ready forces participating in

USAFE F-105 Thunderchiefs lift off the runway at Wheelus AB, Libya, where rotational training is provided for the command's tactical units. Pilots and aircraft from bases in Europe and in the United Kingdom participate in gunnery and bombing training to sharpen USAFE's combat proficiency.



NATO's Exercise Winter Trail. The nonstop air-refueled flight was made in 8½ hours. Operating in sub-zero arctic conditions in Norway, the Phantom proved its adaptability to extremes in the European climate.

Third Air Force, one of USAFE's two major operational subcommands, gained another reconnaissance organization when the 26th Tactical Reconnaissance Wing was activated on July 1 at Toul-Rosieres Air Base, France. This base has the distinction of being the only Third Air Force installation in continental Europe.

Two former squadrons of the 10th Tactical Reconnaissance Wing operating from Toul were reassigned to provide a nucleus for both the new 26th Tactical Reconnaissance Wing and the 25th Tactical Reconnaissance Group, also activated by USAFE on July 1.

The 25th, located at Chambley Air Base, France, is assigned to Seventeenth Air Force, the second of USAFE's operational subcommands. The Seventeenth operates primarily from bases in Germany and France. For its reconnaissance mission, its capabilities include the 66th Tactical Reconnaissance Wing, operating at

Laon AB, France, with McDonnell RF-101 Voodoos.

USAFE's mixed-force capabilities also were reinforced during the year through completion of the first hardened sites for the Mace-B surface-to-surface tactical missile. Providing enhanced survivability, the new Mace-B complexes are assigned to the 71st Tactical Missile Squadron at Bitburg Air Base, Germany. Currently, the Mace-B and the less-advanced Mace-A missiles deployed in Europe by the Air Force are under the control of USAFE's 38th Tactical Missile Wing.

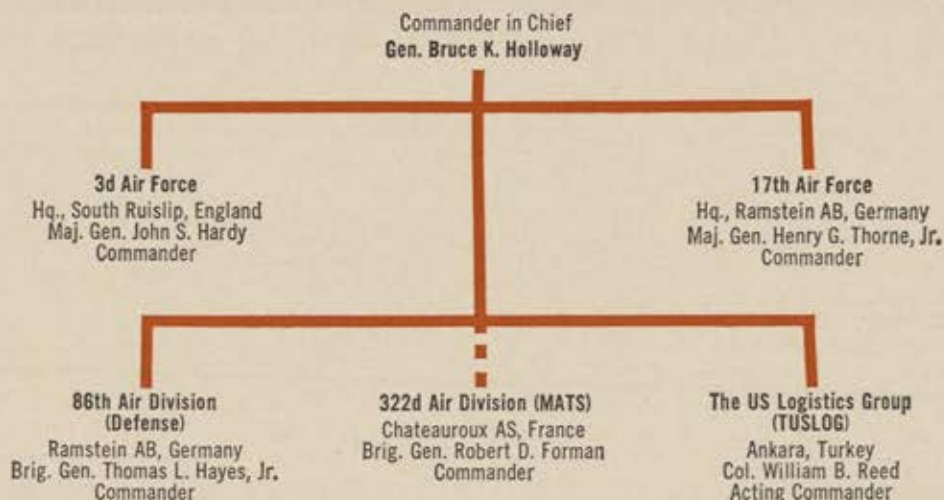
Two major changes were made during the year in USAFE's air defense structure and responsibilities. At the end of December 1964, the 65th Air Division (Defense) was inactivated after completing a program of training which prepared the Spanish Air Force for its final takeover of all air defense responsibilities in Spain.

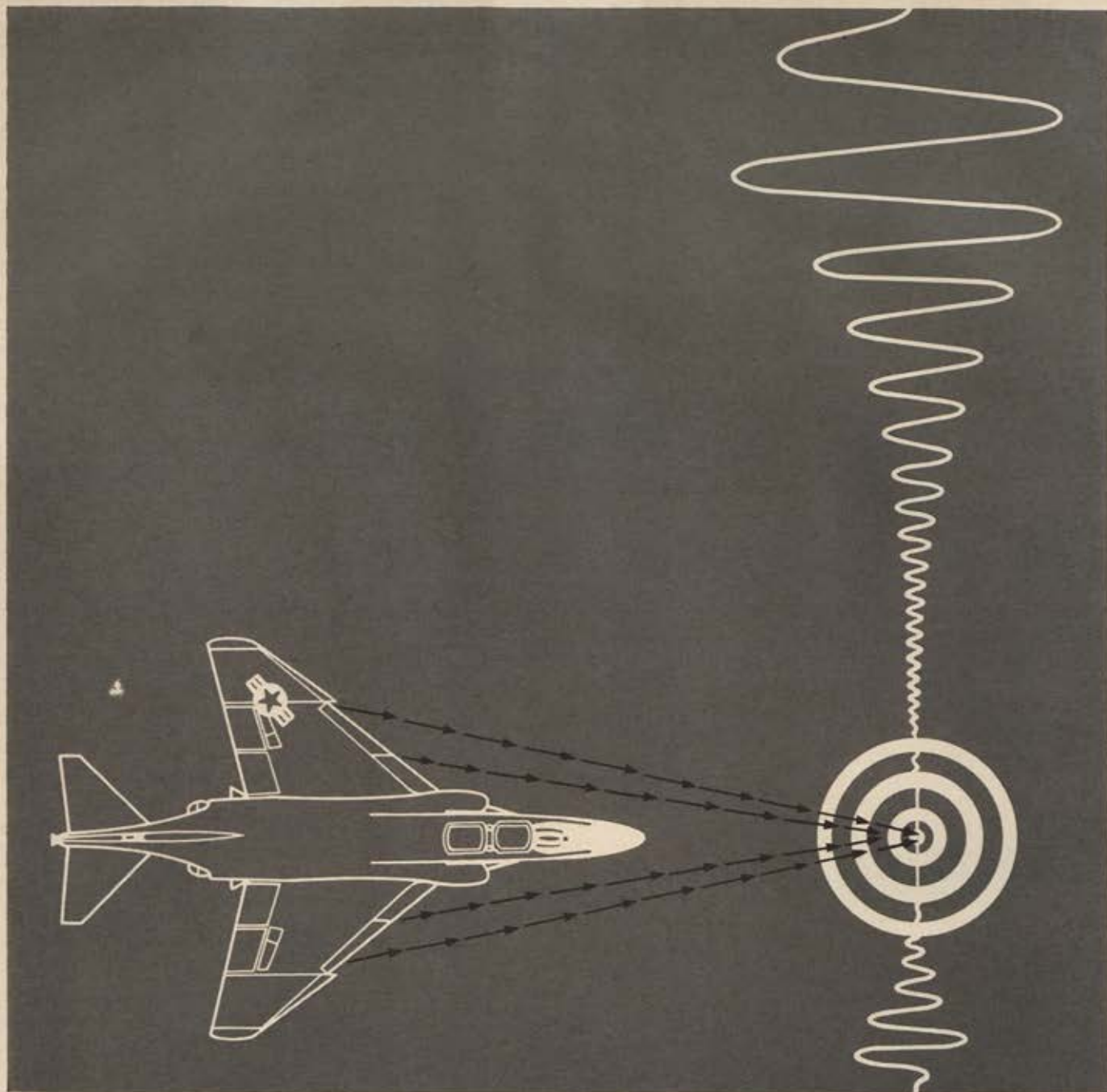
On May 20, 1965, the 86th Air Division (Defense), with headquarters at Ramstein Air Base, Germany, was reassigned from Seventeenth Air Force and placed directly under Headquarters USAFE. Only the di-

(Continued on page 117)

UNITED STATES AIR FORCES IN EUROPE

Headquarters, Lindsey AS, Wiesbaden, Germany





It takes more than a trigger and a computer to make a weapons system trainer.

Take our F and RF-4C Weapons System Trainers (the United States Government did).

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They not only train crews in the flight and handling characteristics of the aircraft, but simulate the en-



tire tactical mission . . . including search, target acquisition, lock-on and weapons delivery.

Subsystems are realistically simulated . . . such as radar land mass simulation for training in low level tactics, terrain avoidance/terrain following and navigation. Simulated combat conditions include complete ECM and ECCM. The development of these complete weapons system trainers by Link is the result of a team effort involving the U.S. Naval Training Device Center, BUWEPS, and Aeronautical Systems Division of AFSC in cooperation with the using agency, Tactical Air Command.

This complete capability is the outgrowth of more than 30 years

of experience in simulation. It demands more than hardware or skill in computers. It includes a knowledge of human factors engineering and the back up of a 300-man customer service organization. Simulation is also an art — the art of artifice — which takes skill and practice to develop. The F and RF-4C weapons system trainers are further examples of why Link remains in the forefront of this art. General Precision, Inc., Link Group, Binghamton, N.Y.

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The McDonnell F-4C Phantom II tactical fighter made its initial appearance in the USAFE area at NATO's Exercise Winter Trail in Norway in February. Here, one of eighteen TAC Phantoms, which crossed the Atlantic nonstop using aerial refueling with other STRICOM operationally ready elements, awaits action under subzero arctic conditions.



vision's 601st Tactical Control Group, also at Ramstein, remained under Seventeenth.

The 86th's air defense network straddles the center of NATO's first line of air defense in Central Europe. Four squadrons of Convair F-102 Delta Daggers perform the intercept mission. Air surveillance is provided by five aircraft control and warning units.

Over-all, USAFE's combat-ready power is provided by twelve tactical organizations. In addition to the 86th Air Division, these include: three tactical fighter wings and two reconnaissance wings under Third Air Force; and three tactical fighter wings, a tactical missile wing, a reconnaissance wing, and a reconnaissance group under Seventeenth.

For its offensive mission, USAFE's changing inventory of weapons includes the North American F-100 Supersabre, the Republic F-105 Thunderchief, and the McDonnell F-4C Phantom II. All told, the command

has an inventory of more than 1,000 tactical aircraft.

Combat readiness is maintained through continuous operational readiness inspections and a command-wide rotational training program provided at Wheelus Air Base, Libya, by the 7272d Flying Training Wing, under Seventeenth Air Force. In addition, USAFE units participate in a NATO-sponsored squadron exchange training program, an air-ground controller's school, recurring NATO tactical air exercises, and joint training operations with US Army forces in Europe.

Besides Exercise Winter Trail, which tested allied mobile force capabilities under arctic conditions, NATO interest during the year centered on Nordic Air, June 12-27, a joint British, US, and Danish exercise. This operation, focusing attention on western and central Denmark, included the largest airdrop of troops in Europe since World War II.

(Continued on following page)



The close cooperation among the US services and European armed forces is reflected at left. At the USAFE Air Ground Controller's School, Ramstein AB, Germany, TSgt. Thomas A. Swindler, USA, explains the air-ground communications system of an armored personnel command truck to, left to right, 1st Lt. Dennis L. Willis, F-105 pilot; Maj. Robert D'Helf, Belgian Army; and 1st Lt. Larry Wright, F-105 pilot. The briefing is part of the school's Forward Air Controller Course.



Hardened sites for the Mace-B surface-to-surface tactical missiles became operational during the year at USAFE's Bitburg AB Germany. The sites provide increased survivability for the Mace-B missiles assigned to USAFE's 71st Tactical Missile Squadron, part of 38th Tactical Missile Wing.

The 322d Air Division (MATS), which responds to USAFE's airlift requirements, flew 2,300 US Army paratroops and their equipment from Wiesbaden Air Base to Denmark's Tirstrip Air Base in 122 missions in Lockheed C-130 Hercules aircraft. After assault drops, concentrated in the Borris area, British and Danish forces joined the US Army troops in ground maneuvers. Realism was provided by close-support missions flown by US tactical aircraft.

NATO competitions during the year included Royal Flush X, for reconnaissance crews, May 18-20, and the annual Allied Air Forces Central Europe (AIRCENT) Tactical Weapons Meet, June 12-25.

Over-all victor in Royal Flush was the Second Allied Tactical Air Force, including British, Belgian, German, and Dutch crews, but USAFE's 19th Tactical Reconnaissance Squadron, Toul, won honors for the best night crew. The 4th ATAF team, with USAFE representation, won the AIRCENT meet.

An aerial performance by the Thunderbirds, US Air Force jet demonstration team, climaxed the AIRCENT program at Chaumont Air Base, France. The Thunderbirds, on tour in Europe, also performed at the Paris International Air and Space Salon during this period.

Operation Ready Go, August 1-18, 1964, focused attention on capabilities of the Air National Guard for rapid overseas deployment. Participating were 700 Guardsmen from twenty-two states. F-100s and RF-84s, flown nonstop to Europe, participated in tactical training in USAFE.

Special operations during the year were highlighted by an airlift of Belgian paratroopers to the Republic of the Congo, which was credited with saving the lives of nearly 1,000 hostages threatened by rebels. Fifteen C-130s of the 322d Air Division (MATS) flew the Belgian troops to Ascension Island. From there they flew into the rebel-held Congo cities of Stanleyville and Paulis to airdrop the paratroopers.

Three other airlifts responded to emergencies in North Africa: two in Tunisia, where floods had destroyed a vital bridge and left many persons homeless, and one in Libya, where an explosion had started four oil wells burning. With the Air Force and US

Army cooperating, 400,000 pounds of prefabricated steel bridge parts and forty-seven Army engineers were airlifted into Tunisia to replace the destroyed span.

For USAFE, tragedy struck on April 12, when Maj. Gen. John K. Hester, Commander of the Seventeenth Air Force, died of a brain injury suffered during a parachute qualification jump at Mannheim, Germany, on April 2. Command of the Seventeenth was assumed by Maj. Gen. Henry G. Thorne, Jr., formerly USAFE Deputy Chief of Staff for Operations. At ceremonies in July, the 8th Infantry Division Airborne School field at Wiesbaden Air Base was renamed the John Kenton Hester Memorial Field.

Generally, events during the year contributed to USAFE's lengthening record of accomplishment. This record began in the immediate post-World War II period with USAFE performing the role of an occupation air force. Initially, it was engaged in disposing of US war materials and disarming remnants of the German Luftwaffe.

Within three years, however, it was called upon to help counter a rising tide of Communist pressure in Central Europe. The Berlin Airlift of 1948-49, initiated by USAFE, was the West's reaction to the Communist blockade of the divided German city.

Thereafter, USAFE's stature changed as NATO was formed in April 1949, followed by an Allied Defense Organization late in 1950. The Korean conflict further spurred NATO defense plans, and, in January 1951, USAFE began building a tactical force that led eventually to its continuing position today as a primary instrument in Western defense.

As one of three USAF tactical air forces worldwide, USAFE today has an area of interest spanning a quarter of the globe, from the United Kingdom to Pakistan. Its primary mission, however, is to provide the combat-ready tactical air units pledged by the United States to NATO. USAFE policy dictates "that every plan, operation, mission, or major action reflect the command's clear intent to support the Supreme Allied Commander in defense of the Atlantic Alliance."—END



The Berlin Air Traffic Control Center, another USAFE activity, provides corridor guidance into West Berlin's Tempelhof Central Airfield for approximately 4,000 aircraft a month. The center services military aircraft of allied nations and civilian airliners as well as USAFE planes.

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Compare it with any other twin jet in the world! Compare its total package of practical cabin size, go-anywhere utility, high speed performance, unparalleled stability, range/payload versatility, cost-effective price and operating economy, and you will choose the American-built Jet Commander . . . designed and built specifically for management missions and FAA-certified to CAR 4b, SR422b, transport category standards of safety and reliability.



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The Pacific Air Forces

THE MOST striking thing about the Pacific Air Forces (PACAF) mission is the geographical area it serves.

While world attention is focused upon the Vietnamese hot war in the California-size slice of Southeast Asia, PACAF—the air component of the Department of Defense's unified Pacific Command (PACOM)—must also keep its eyes on the rest of the forty percent of the earth's surface populated by over one and one-half billion people—roughly nine times the population of the United States—that is its responsibility.

Four of the nineteen states, representing over one-half of the area population, are Communist controlled. At least three of the remaining fifteen states are bending under Communist influence.

Working in harness with ground and naval components, USAF's tactical aerospace arm in the Western and Central Pacific and Southeast Asia is presently performing a wide variety of strike missions, reconnaissance, and theater airlift in Vietnam.

However, PACAF is always prepared to shift from the limited-war to a general-war strike force, ready to conduct offensive air operations. In such a contingency, PACAF also would conduct defensive air operations to protect the land areas of PACOM and the western approaches to the US, alone and in conjunction with other PACOM forces and those of allied countries.

Briefly put, PACAF's major missions are to:

- Provide ready, mobile, tactical jet strike forces for any contingency.
- Provide peripheral air defense from the Pacific area against enemy attack on the US and the area it controls.
- Support air aspects of the US Military Assistance Program (MAP) in allied nations and, in addition, assist air forces of friendly nations in the air defense of their homelands.
- Perform routine and emergency aerial reconnaissance.
- Support joint PACOM operations.
- Participate in the peacetime application of airpower by providing assistance to all peoples during natural disasters.

Gen. Hunter Harris, Jr., became Commander in Chief, PACAF, in August 1964 after nearly two years as Vice Commander in Chief of SAC. A native of Texas and 1932 West Point graduate who won his wings in 1933, he served with the Eighth Air Force in Europe during World War II. He has held a number of important operational and staff posts since the war.



To accomplish PACAF's mission across this wide area of responsibility, the bulk of the command is divided into two theater air forces and two combat air divisions.

Controlling units in Japan, Korea, and Okinawa is the Fifth Air Force, which accomplishes the air defense alert phase of its mission through cooperation with Japan Air Self Defense Force (JASDF) and Republic of Korea Air Force units.

Thirteenth Air Force, headquartered in the Philippines at Clark AB, maintains similar relations with the Philippine Air Force and Chinese Nationalist Air Force on the island of Taiwan.

Conducting the intratheater airlift is the 315th Air Division operating from bases throughout the West Pacific and Southeast Asia.

The 2d Air Division in the Republic of Vietnam is responsible for the airpower buildup of the Vietnamese Air Force. The unit combines the multiple skills of conducting tactical air strikes, airlift, and reconnaissance. The division was a subordinate of Thirteenth Air Force and served as the operational air component for Southeast Asia under the Military Assistance Command, Vietnam/Thailand. On July 8, 1965, the 2d Air Division was assigned directly under Hq. PACAF and is now responsible for all Air Force tactical strike and support operations in North and South Vietnam and doubles as the operational air component command for Southeast Asia under the

Military Assistance Command for Vietnam/Thailand.

In Hawaii at Hickam AFB, PACAF Headquarters are co-located with Pacific Air Force Base Command (PACAF BASCOM), the unit responsible for logistical and housekeeping support of bases in the Central Pacific and for the other using commands, including SAC, MATS, TAC, AFSC, and AFCS.

PACAF's inventory of weaponry and aircraft range from the newest of the supersonic Century series for tactical strikes and aerial reconnaissance to the light prop-driven observation aircraft and rescue helicopters now skimming jungle rooftops in Vietnam.

Early this year Vietnam-based USAF jets were used for the first time on in-country air strikes.

The B-57 Canberra jet bombers, F-100 Supersabres, and F-105 Thunderchiefs have been added to PACAF's air arsenal of World War II-type fighter-bombers in Vietnam. Still flying the forward air control missions are the single-engine aircraft such as the TO-1D or O-1F.

Also on hand for the heavier jobs are the 315th's C-130, C-124, and C-123 cargo transports and the C-135 air-evacuation planes.

Units of the Tactical Air Command back up the frontline force with a US-based Composite Air Strike Force (CASF), which has quick nonstop deployment capability through in-flight air refueling.

In addition, the seven-nation alliance of the South-

east Asia Treaty Organization (SEATO) sharpens its air reflexes with its annual major joint exercises. The US also is a member of the Australia-New Zealand-United States (ANZUS) alliance.

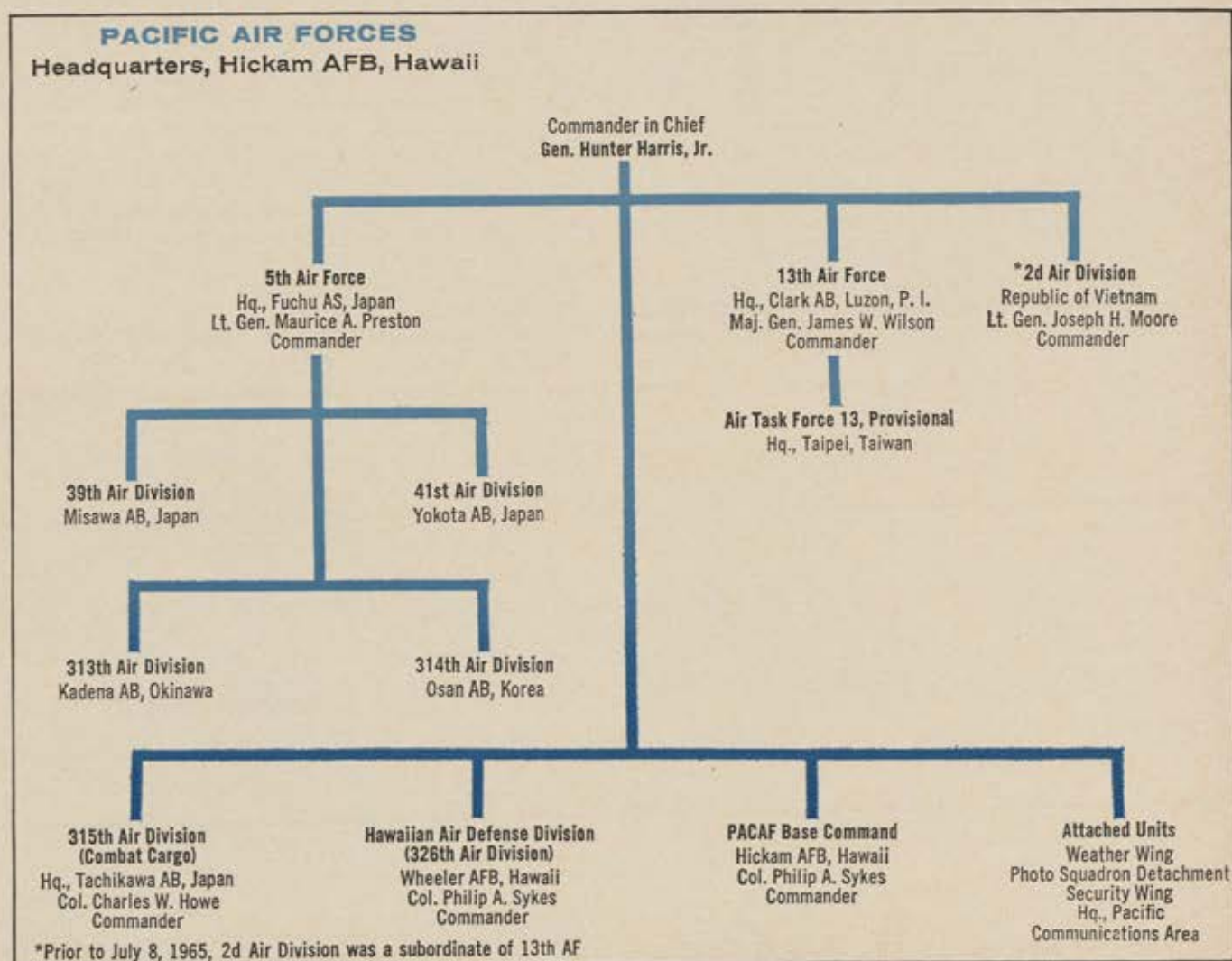
The major air buildup in South Vietnam started last August with the Gulf of Tonkin incident. For the first time, PACAF units were augmented by F-105 jet aircraft. F-4C units followed in December. With the bombing of Dong Hoi, Quang Binh, and Vinh Linh, in North Vietnam on February 7, the air war entered an accelerated phase. In February, the first air strikes were carried out on North Vietnamese targets, the first time USAF jets operated north of the seventeenth parallel.

By May of this year, 1,400 Air Force tactical jet fighters had flown the Pacific since 1960 without incident. Increased air utilization during this same period is exemplified by the great increase in air strikes. The last week of December recorded nearly 17,500 sorties flown by the combined USAF and VNAF forces. During the last week of June more than 23,000 sorties were flown.

PACAF activities and achievements during the past fiscal year include:

- July 1964—US Air Force HU-16 amphibious aircraft were deployed to provide search-and-rescue capability throughout Southeast Asia.

(Continued on following page)



PACIFIC AIR FORCES

Itazuke AB, Japan, was placed on Dispersed Operating Base status (DOB) in line with reduction of US Air Force air defense forces in Japan and growing capability of JASDF to carry out that mission.

Gen. Hunter Harris arrived from his post as SAC Vice Commander in Chief to replace Gen. Jacob E. Smart as Commander in Chief, Pacific Air Forces.

• **August 1964**—US Air Force HH-43B air-rescue helicopters were deployed to Southeast Asia with rescue and recovery crews and equipment.

The Gulf of Tonkin crisis triggered deployment of tactical air strike and support units from CONUS bases to PACAF and increase of airlift and air reconnaissance forces.

The first of a squadron of twelve Boeing HC-97s replaced the HC-54 equipment of the 76th Air Rescue Squadron at Hickam AFB, Hawaii. The HC-97s enabled the squadron to nearly double its range on search-and-rescue missions.

The first contingent of Royal Australian Air Force men and aircraft arrived in Vietnam August 10.

Two squadrons of B-57s arrived at Bien Hoa from the 405th Fighter Wing, Clark AB, Philippines.

• **September 1964**—The USAF-Vietnamese Air Forces flew a new high of 1,690 operational missions against the Viet Cong during the week of September 6-12. Of this total, 1,002 were combat operational.

Six Air Force F-105 Thunderchiefs arrived at Hickam AFB from Kadena AB, Okinawa, to participate in the joint US Army-Air Force Exercise Long Sabre I.

• **October 1964**—The 19th Air Commando Squadron (Troop Carrier) was organized at Tan Son Nhut Airfield, Vietnam, and was assigned to the 315th Troop Carrier Group (Assault).

A Sino-US joint Army-Air Force airborne defensive maneuver, Exercise Sky Soldier/Tien Bing VI, was held on Taiwan. PACAF contributed US Air Force C-124s, C-130s, RF-101s, F-105s, F-100s, and B-57s. Nearly 2,500 Chinese and American paratroopers par-

ticipated in the exercise. They jumped from USAF C-124 and C-130 aircraft and Chinese Air Force C-46s and C-119s. The troops were dropped on the west coast of central Taiwan.

Exercise Tropic Lightning, a continuing joint Army-Air Force exercise, was initiated in Hawaii. Air Force F-105s, deployed to Hickam, provided close air support to the 25th Infantry Division on field maneuvers.

General Harris announced changes in his headquarters staff organization to streamline operational control of his forces and place increased emphasis on the combat readiness of Air Force units in the Pacific.

• **November 1964**—PACAF's 315th Air Division airlifted the first Marine Hawk Battalion to Da Nang AB.

PACAF's request for an additional \$10.8 million to support Southeast Asia was granted.

In the largest single ceremony held by USAF units in the Republic of Vietnam, officers and airmen of the 34th Tactical Group were presented thirty-eight individual decorations and awards.

Vietnamese Air Commodore Nguyen Cao Ky, VNAF Commander, personally led a large-scale tactical fighter-bomber attack on November 8, which destroyed more than 100 Viet Cong structures. The strike destroyed a large Viet Cong headquarters area near Bien Hoa AB.

In an unprecedented attack on US forces in South Vietnam, Viet Cong mortars bombarded US aircraft and the barracks areas at Bien Hoa AB, wounding twelve personnel, none seriously. Five USAF B-57 Canberra jet bombers were destroyed in the attack and fifteen others were damaged. Three A-1H Sky-raidors of the VNAF also were damaged.

On November 3 President Johnson ordered a new bomber squadron to Vietnam to replace the twenty aircraft destroyed in the Bien Hoa mortar attack.

A total of 1,329 Viet Cong were killed by VNAF and USAF A-1E and A-1H aircraft strikes during No-

Low-flying RF-101 Voodoo reconnaissance plane snaps its own shadow alongside North Vietnamese highway bridge demolished by fighter-bombers of US and South Vietnamese Air Forces. Air war in Vietnam entered new phase last February when President Johnson authorized air strikes against routes and troop facilities in North Vietnam to impede flow of men and supplies to Viet Cong.





Air resupply has been developed to fine art in Vietnam, as these crewmen demonstrate in pushing ammunition and other cargo out ramp of C-123 transport to friendly troops.

vember. This more than tripled the previous monthly high of 426 recorded in July.

• **December 1964**—The first squadron of USAF's newest and fastest jet fighter aircraft, the F-4C Phantom, landed at Hickam AFB, December 8, completing the 4,750-mile nonstop flight from MacDill AFB, Fla., in eight hours and forty minutes. During the flight the Phantoms were refueled by KC-135 jet tankers.

With the arrival of this squadron at Naha AB, Okinawa, and assignment of the fighters to the 51st Fighter Interceptor Wing, Naha became the first F-4C Phantom II main operating base in PACAF.

• **January 1965**—In the upgrading of US Air Force air defense capability in the Ryukyuan Islands, the F-102-equipped 16th Fighter Interceptor Squadron at Naha AB, Okinawa, was deactivated and replaced by a rotational F-4C-equipped squadron from CONUS. The F-102s of the squadron were transferred to the ANG.

Tactical air strikes during the week of January 7-13

accounted for fifty-seven percent of all Viet Cong enemy killed during that period.

The USAF announced it would realign its aerial tanker forces in the Western Pacific with the assignment of approximately fifteen KC-135 jet tankers to Kadena AB, Okinawa, in late January 1965. SAC KC-135s, on rotation from bases in the US, would provide an increased operational performance of the aerial tanker forces in the Western Pacific.

The USAF-supported VNAF flew a total of 17,530 sorties for the week ending January 30.

• **February 1965**—Vietnam-based USAF jet strike aircraft were utilized for the first time within South Vietnam. F-100 tactical fighters and B-57 light bombers were effectively used at An Khe to break up and drive back into the mountains a large Viet Cong force attempting to cut Vietnam in half along a strategic east-west highway in the central sector of the country. The massive jet strikes also permitted the air evacuation of a large ARVN ground force surrounded by Viet Cong in the area.

PACAF's Japan-based KB-50 theater in-flight refueling squadron (the 421st) was deactivated and its mission assumed by new KC-135 air refueling wing based at Kadena AB, Okinawa.

On February 8, USAF jet aircraft flew their first strike missions against targets in North Vietnam. A total of eighty-four F-105s and F-100s, together with VNAF A-1Hs and USAF B-57s, attacked targets north of the seventeenth parallel.

• **March 1965**—During a mission flown March 5 against a Viet Cong battalion near an outpost in Quang Tin Province, 220 Viet Cong were killed. Of that number a total of fifty were attributed to A-1H air strikes in an official report of the action, while another seventy Viet Cong kills were credited to F-100s. Thus more than fifty percent of the enemy casualties were inflicted by air combat strikes.

Later in March, F-105 Thunderchiefs flew their first
(Continued on following page)

USAF Air Commando armament specialists, A1C James J. Steed, left, and SSgt. Edgar H. Robinson, fuze 100-pound bombs on Douglas A-1E Skyraider for air strikes against Viet Cong. Developed for US Navy soon after World War II, A-1Es were all but retired when their heavy payload capacity, range, and relative invulnerability to small-arms fire proved well suited to Vietnam war. Both USAF and South Vietnamese AF fly them.





Aiming on target initially marked by forward air controller, pilot of South Vietnamese A-1H (single-seat version of Skyraider) follows other planes in his flight to drop two bombs on Viet Cong concentration in Mekong Delta south of Saigon.

armed reconnaissance mission against North Vietnam. Eight aircraft took part in the highly successful mission against targets of opportunity, which included the virtual destruction of an early-warning site at Vinh Son, about sixty miles north of the seventeenth parallel.

USAF land-based aircraft, air rescue, support equipment, personnel, and communications units were deployed throughout the Pacific Ocean area and Far East to provide recovery capability in event of a contingency landing during the three-orbit Gemini-Titan III space mission launched March 23.

- **April 1965**—Substantial tactical air-strike units, support aircraft, and personnel were deployed to PACAF from CONUS resources. Included were F-104 Starfighters, their first appearance in the air forces committed to the Pacific area.

The second unit of F-4C Phantom fighters, deployed from MacDill AFB, Fla., joined PACAF.

The first Northrop F-5 Freedom Fighters for allied air forces in the Pacific were delivered and turned over to the Republic of Korea Air Force at a ceremony at Suwon AB, Republic of Korea. These supersonic fighters replace the ROKAF F-86F Sabrejets. The Philippines and Nationalist China are also to receive the F-5, under the Military Assistance Program (MAP).

Vietnam-based USAF 30th Weather Squadron received the Air Force Outstanding Unit award.

On April 16, F-105 Thunderchiefs struck three key bridges in North Vietnam. In a space of two and a half hours, these aircraft dropped a total of 228,000 pounds of bombs on the targets and destroyed all three of them, as well as inflicting severe damage on the bridge approaches.

- **May 1965**—Additional Tactical Air Support Squadrons (Light), flying O-1F Forward Air Control missions in Vietnam, were activated, providing significant increase in target identification and marking for tactical air strikes against the Viet Cong.

Air defense capability of the Philippines was enhanced by arrival at Clark AB of the 46th TFS, equipped with F-4C Phantom II jets. The unit is on rotational duty with PACAF from CONUS.

At Quang Ngai, US airpower went into action against several battalions of attacking Viet Cong troops. In the battle, 661 strike sorties were flown against the enemy, and 743.3 tons of bombs dropped. Primarily as a result of the most concentrated air strikes of the war, an estimated 826 enemy troops were killed, 1,430 structures destroyed, and 423 damaged.

Over 2,000,000 pounds of equipment were airlifted from Okinawa to Bien Hoa AB and Vung Tau, both near Saigon, to defend the bases and relieve Vietnamese soldiers for offensive action.

The 405th Fighter Wing, Clark AB, Philippines, was named winner of the 1964 USAF-wide Daedalian Maintenance Trophy.

One thousand four hundred tactical jet fighters have flown the Pacific since 1960—a combined distance of more than 11,000,000 miles—without a single incident, accident, or loss of life. The flights, aided by in-flight refueling tankers, averaged 8,000 miles one way, although some flights total 10,000 miles between the West Pacific and US mainland bases.

- **June 1965**—A total of sixteen aircraft and some 245 Air Force officers and airmen participated in Pacific area support for the Gemini IV spaceflight.

The 1st Air Commando Squadron of the 34th Tactical Group at Bien Hoa, Vietnam, was named the first USAF unit since the Korean conflict to receive the Presidential Unit Citation.

Three Pacific Air Forces major generals were nominated by the President for promotion to three-star rank. Those nominated were Maj. Gens. Sam Maddux, then Thirteenth Air Force Commander (now Vice Commander in Chief, Hq. PACAF); Joseph H. Moore, 2d Air Division Commander; and Albert P. Clark, 313th Air Division Commander.

Strategic Air Command B-52 heavy bombers from Guam attacked a Viet Cong stronghold near Saigon.

During the first five months of the year, 430 transpacific jet fighter flights were accomplished with complete success. Tempo of Air Force jet strike aircraft flights across the Pacific Ocean increased threefold in 1965. (It is estimated that more jet fighter transpacific flights will have been made in 1965 than occurred during the previous four years.)

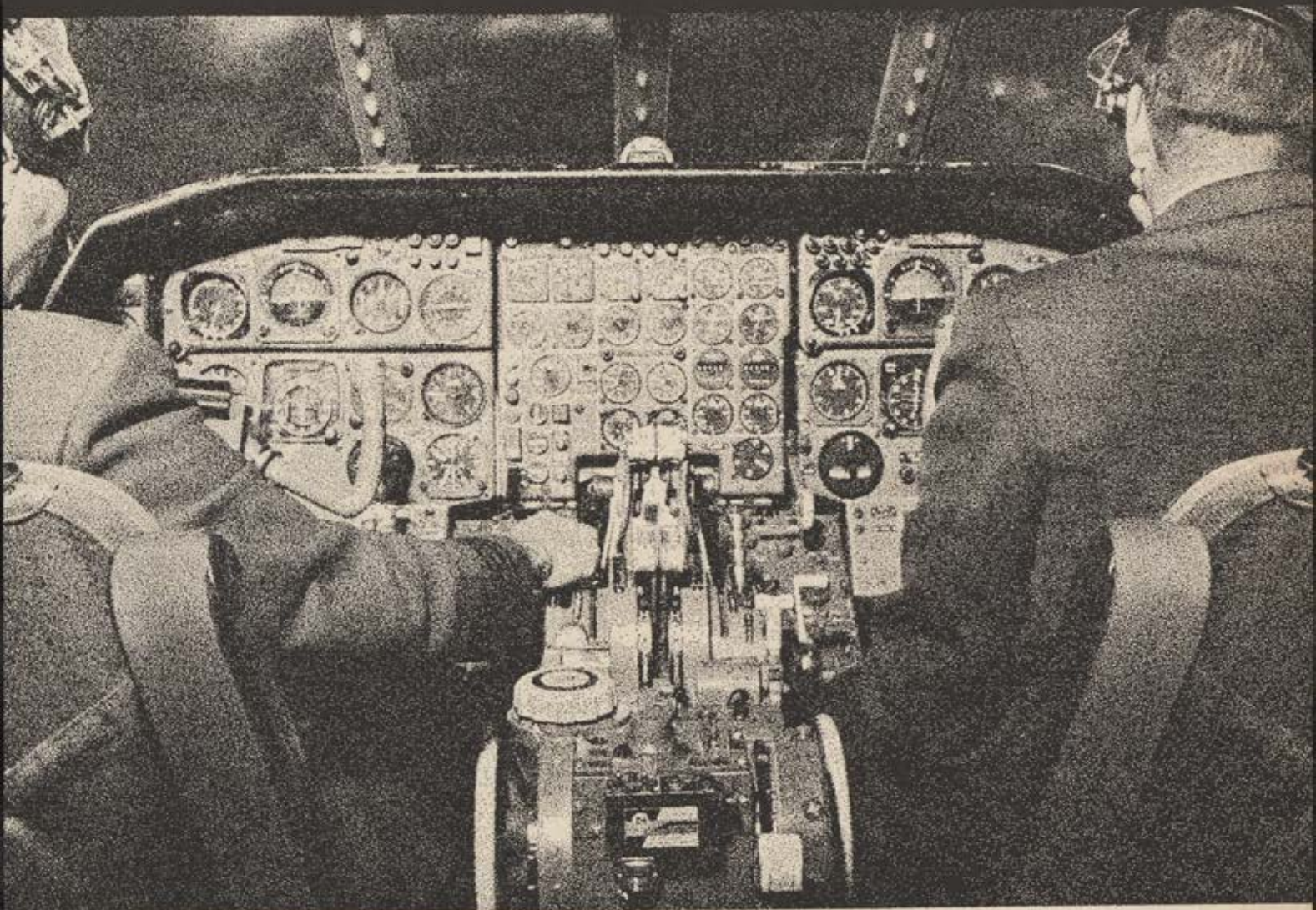
A night-strike training program was initiated for PACAF F-105 aircrews.

More than \$55 million was approved as part of the Emergency Military Construction Program for USAF bases and facilities in Southeast Asia.

In the mid-June battle of Dong Xoai, tactical airpower was primarily responsible for stalling a Viet Cong advance, and then with continuous air support decimated the attacking force. More than 300 enemy bodies were counted, with an estimated 400 believed killed in action.

Since June 1, 1964, the Air Rescue Service in Southeast Asia has recovered thirty-seven downed airmen. This has resulted in 6,121 sorties and 10,510 flying hours over enemy-held territory.—END

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The Military Air Transport Service

IN JANUARY 1940 a force of thirty-eight B-18 bombers moved a battalion of the 65th Coast Artillery—fewer than 400 men—400 miles between Hamilton and March Fields, Calif. Twenty years later, a force of 222 Military Air Transport Service (MATS) four-engine transports airlifted 21,000 Strategic Army Corps troops, together with their equipment weighing 11,000 tons, from fourteen bases in the United States to Puerto Rico—and back.

Both operations demonstrated, in different orders of magnitude, what airlift *could* do. But even the 1960 exercise—Big Slam/Puerto Pine—did not come completely up to airlift expectations. Although the need may not have been too apparent in 1940, by 1960 it was recognized as being critical.

A casual review of the MATS stories in the past five issues of this "Air Force Almanac" will show that progress in building airlift capability to meet requirements has been sure and steady. They also reveal, however, as does a study of the breadth and depth of US military commitments, that the requirements continue to multiply. This has been true of the year just past; there has been no indication that it will not continue to be so in the future.

Larger, more productive aircraft—such as the C-141 now coming into the MATS inventory, and the C-5A, now in research and development with source selection imminent—are an obvious answer to the problem. Potentially, they are far more efficient than any present transport aircraft. But in the final analysis, true efficiency is a function of those who command, control, operate, and—above all—manage these resources.

Managerial efficiency has been the hallmark of MATS during this first full year under the command of Gen. Howell M. Estes, Jr. Like Air Force Chief of Staff Gen. J. P. McConnell, General Estes feels that "... the traditional principles of military *command* are being increasingly modified and augmented by the principles of military *management*." He is applying the modern principles of scientific management to all areas of his complex global command.

Gen. Howell M. Estes, Jr., assumed command of MATS in July 1964. His prior post was Vice Commander, AFSC. Born in Georgia and a 1936 West Point graduate, he won his Air Force wings in 1940. During his AF career he has served as a pilot instructor, bomber pilot, airbase commander, and an R&D staff officer.

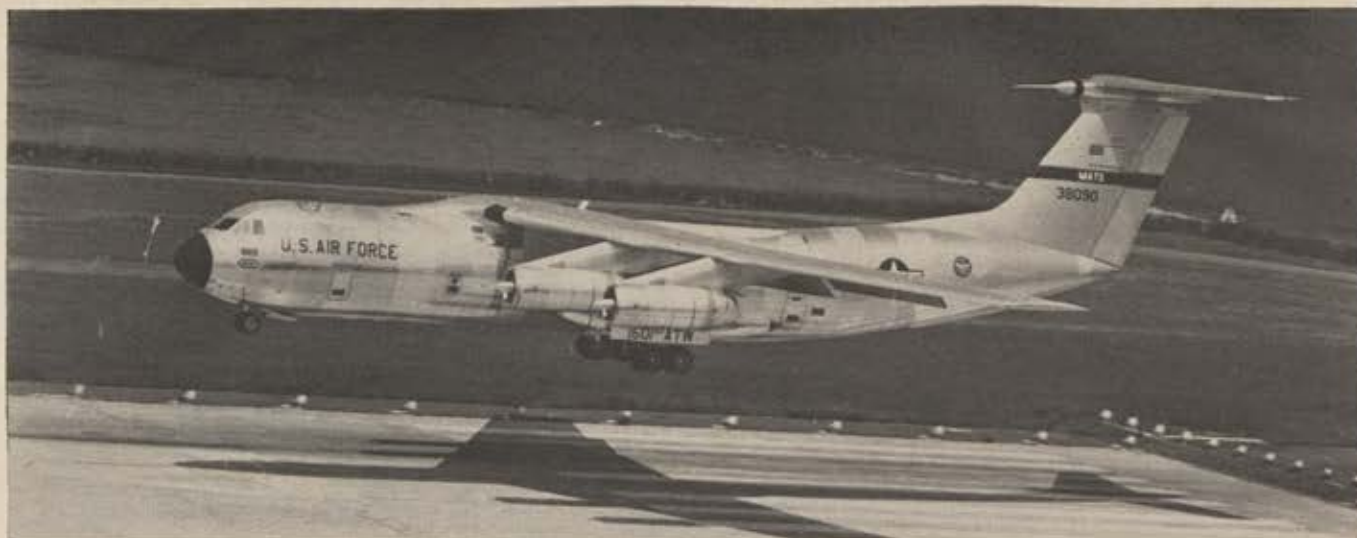


Evidences of this new trend are to be found everywhere in MATS Headquarters and the field commands:

- Application of the Program Evaluation and Review Technique (PERT) to the C-141 conversion program.
- Use of the monthly Management Review by the "corporate management" of MATS.
- Study groups determining the most efficient application of information systems and other automatic and electronic aids to complex management problems.
- The optimum array of both tried-and-true and new management systems.
- The "Lead the Force" program, highly accelerated flight operations on six C-141s, gaining rapid information on structure and systems reliability, and providing engineering and procurement leadtime for orderly updating and modification.

These and other programs reflect the emphasis on businesslike military management.

Against this background, MATS aircrews wound up calendar year 1964 with more than a million hours in the air, during which they airlifted 1,300,000 persons and 355,000 tons of cargo, and flew weather, rescue, and photomapping and geodetic missions in every part of the world. The trend increased toward greater emphasis on joint airlift tests and mobility exercises, and on special assignment airlift—the "hard-core" military missions. This left more of the routine, sched-



A Lockheed C-141 StarLifter lands at Le Bourget Airfield in Paris following its maiden flight to Europe for the June 1965 Paris Air Show. The nineteenth C-141 was delivered to USAF in April 1965. The C-141 does work of four C-124s.

uled "channel-traffic" airlift to be carried out by the contract commercial airlines, which are members of the Civil Reserve Air Fleet.

While the tempo of activity picked up still further during Fiscal Year 1965, the international situation caused a decrease in the test and exercise area. Notwithstanding, MATS participated in fifteen such operations during the year, including Indian River and the massive Gold Fire I (13,500 troops and 26,700 tons of cargo), both in support of CINCSTRIKE, and both designed to establish, test, and refine joint air-support doctrine.

For the most part, however, tests and exercises were preempted by airlift demands resulting from the Vietnam situation and the Dominican crisis.

During the first month of the Power Pack airlift to the Dominican Republic, active Air Force and volunteer Air Reserve Forces crews airlifted men and supplies into San Isidro AB at a rate of four men and six tons of cargo every three minutes. By the end of the first week, MATS aircraft had completed 673 sorties, airlifting 4,241 troops and 6,758 tons of cargo. At the peak, MATS had fifty-two C-130 and eighty-four C-124 aircraft committed to this operation.

The response of the Air Reserve Forces to the massive Dominican requirements was record breaking, once again justifying the reliance MATS has placed on its Air National Guard and Air Force Reserve airlift, medical, and technical service units since they

(Continued on following page)

MILITARY AIR TRANSPORT SERVICE

Headquarters, Scott AFB, Ill.

Commander
Gen. Howell M. Estes, Jr.

Western Transport Air Force
(WESTAF)
Hq., Travis AFB, Calif.
Maj. Gen. George B. Dany
Commander

Eastern Transport Air Force
(EASTAF)
Hq., McGuire AFB, N. J.
Maj. Gen. Donald W. Graham
Commander

Air Rescue Service (ARS)
Hq., Orlando AFB, Fla.
Col. Allison C. Brooks
Commander

Air Weather Service
Hq., Scott AFB, Ill.
Brig. Gen. Roy W. Nelson, Jr.
Commander

Air Photographic and Charting Service (APCS)
Hq., Orlando AFB, Fla.
Col. William S. Barksdale
Commander

1254th Air Transport Wing
Washington, D. C.

1707th Air Transport Wing
Tinker AFB, Okla.

1405th Aeromedical Transport Wing
Scott AFB, Ill.

The MATS airlift force delivered more than 6,000 troops and 5,000 tons of equipment to Alaskan bases for the mid-winter US Army exercise Polar Strike, held in January and February of 1965. MATS transports carried heavy Army equipment to bases like Ft. Wainwright, near Fairbanks, Alaska, flying and working in subzero weather. Here, some of the local residents travel to the unloading area at Elmendorf AFB, Alaska, by dog-sled to get a look at the big MATS transports.



began augmenting the command in 1960. During the demanding months of April and May 1965, the Air National Guard and Air Force Reserve together accounted for 8.1 and 8.3 percent, respectively, of MATS's total worldwide tonnage, inbound and outbound.

These record achievements were accomplished in flying both direct, special assignment airlift missions to Saigon and Santo Domingo, among other places, and regular scheduled airlift operations, which released regular MATS crews and aircraft for the growing multitude of special military missions. This responsive capability on the part of the Reserve Forces was especially significant in view of the MATS C-141 conversion program which, with its associated training requirements, necessarily occasioned a reduction in ton-mile capability.

As is always the case, persistent increases in airlift

requirements are accompanied by a commensurate upswing in the activities of the air-evacuation system and technical-service operations—which at *any* time are deeply involved in a myriad of complex activities.

In December 1964, the Air Weather Service (AWS), one of the MATS services, received the first of forty-three production models of a revolutionary new cloud radar, capable of determining the altitude and thickness of clouds up to 60,000 feet. Then in April 1965, AWS accepted its first two WC-135s, one for Japan and one for California. And, as in previous years, AWS continued with its upper-atmosphere sampling mission, in-depth meteorological support of the entire Air Force and other services, and support of NASA space activities.

The Air Photographic and Charting Service, another MATS service, was engaged, among its numerous

(Continued on page 131)



A highly skilled crew of the Air Photographic and Charting Service (APCS) squadron at the Western Test Range, Vandenberg AFB, Calif., handles all the photographic needs of the range users. In January 1966, APCS will be consolidated with units having similar functions into the MATS Aerospace Audio-Visual Service.



Over and Under... and everywhere in between, the Sperry C-15 Gyrosyn® is the ultimate in compact compass systems. Combining light weight (8 lbs.) with extreme accuracy ($\pm \frac{1}{2}^\circ$), the C-15 is also able to operate under severe environmental extremes (-65°F to $+160^\circ\text{F}$) and at high "G" and vibration levels. For high latitude operation in the free gyro mode, maximum drift is less than $1\frac{1}{2}^\circ$ per hour. Four isolated synchro transmitter outputs eliminate the need for a compass repeater amplifier. The DSU-4/A Flux Valve used in conjunction with the C-15 withstands temperatures from -65°F to $+392^\circ\text{F}$ and is designed to withstand a 10 "G" vibration environment without shock mounting. Because of these outstanding characteristics, light weight and ease of installation, the C-15 has been selected for the F-111A and B.

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DEFENSE PRODUCTS DIVISION
1700 MESSLER ST., MUSKEGON, MICH.

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CerAl is an electrically transparent, glass-reinforced aluminum phosphate laminate which, like plastic, is easily processed and possesses a high resistance to thermal and mechanical shock, and, like ceramics, is ideal for high-temperature applications.

These reinforced ceramic structures are capable of withstanding temperatures in the 1000°-1200°F. range for extended periods of time and up to 3000°F. for short periods. Possessing the flexibility of reinforced plastic, they can be processed in shapes up to approximately 15 feet in length and 40 inches in diameter.

an infinity of applications

CerAl is recommended for use in high temperature applications where the inflexibility and size-limitations of ceramics creates a problem. Some suggested uses are: aircraft, missile and semi-hardened radomes, printed circuit boards, such other high-temperature applications as insulation, fire walls, aircraft leading edges, and space environments.

For further information, write
Defense Products Division,
Brunswick Corporation, Muskegon,
Michigan. We invite your inquiry.

Major airlifts throughout the world are monitored by MATS Command Post at Scott AFB, Ill. The command-and-control net spreading from this point can reach MATS aircraft and installations anywhere in the world.



Airborne crash rescue service is provided by specially designed Kaman HH-43 helicopters, strategically placed in Air Rescue Service detachments at bases around the world for the protection of aircrews and passengers.



The Commander of MATS, Gen. Howell M. Estes, Jr., was at the controls of the new all-jet Lockheed C-141 StarLifter when it arrived at Travis AFB, Calif., to join the MATS global airlift force.

photographic and geodetic operations, in the process of photomapping 1,834,070 square miles of Brazil—an area larger than the United States east of the Mississippi River. This project will be an important factor in the economic development of Brazil. Meanwhile, it was announced that on January 1, 1966, the photographic units of APCS would be consolidated with units having similar and allied functions into the MATS Aerospace Audio-Visual Service. At the same time, the 1370th Photo Mapping Wing of APCS, with its geodetic and other scientific functions, will begin reporting directly to MATS Headquarters.

The Air Rescue Service, third of MATS's subcommands, during the past year saved the lives of 125 persons and directly aided more than 1,300 others. This well-known and celebrated organization, which received all twenty-seven of its HC-97s, began participation in user flight tests on the HC-130H, and started taking delivery of the CH-3C twin-turbine helicopter during the period, joined the airlift force throughout the year on many diverse humanitarian missions in all parts of the world. And, of course, as in previous years, the continued progress and success of the US man-in-space program owed a large debt to the dedicated aircrews, technicians, and pararescuemen of the Air Rescue Service.

The MATS aeromedical-evacuation system, unique in all the world, continued its missions of mercy. As in previous years, more than 10,000 patients were airlifted to the United States from overseas theaters, and 35,000 between medical facilities within the States. From January through May, this system moved seventy

percent more patients from Clark AB, Philippines, to the US than during the period from July-December 1964, reflecting the increased military activity in Vietnam.

The one word typifying all MATS operations throughout this period is "more." The delivery of the first C-141 to the 1707th Air Transport Wing's transitional training unit at Tinker AFB, Okla.—in October 1964—foreshadowed an era in which this increasing load will be accommodated with far more efficiency. In April 1965, the nineteenth C-141 was delivered, this one to an operational unit for the start of Category III (using command) testing. A measure of its efficiency is the fact that the C-141 does the work of at least four C-124s on a typical MATS channel mission.

The C-5A, in turn, will be five times as productive as the C-141—with only a minor increase in operating cost. Actual ton-mile costs, as a result, will be reduced significantly. Grossing approximately 725,000 pounds, with payload capacities up to 132 tons, the C-5A will nonetheless be able to operate from relatively primitive airfields, when necessary, thanks to advancements in landing-gear design.

It is obvious that the proper mix of C-141s and C-5As, complemented by a number of C-130Es for specialized missions, will provide not only maximum effectiveness in airlifting anything, any place, any time—but will also do it with the greatest achievable efficiency.

And that—scientific management for precise control of resources and facilities—is the keynote of MATS under Gen. Howell M. Estes, Jr.—END



The Air Force Systems Command

THE AIR Force Systems Command, under the direction of Gen. B. A. Schriever, in accomplishing its mission of advancing aerospace technology and the timely application of this technology to qualitatively superior aerospace systems for the United States Air Force, last year achieved significant progress in aeronautical, ballistic, space, and electronic activities. During Fiscal Year 1965 many programs were completed.

Representative of these was the completion of the Minuteman I program. The last of 800 Minuteman I ICBMs became operational on June 30, 1965, when the Ballistic Systems Division officially turned over the fifth wing to the Strategic Air Command (SAC) at Warren AFB, Wyo.

In May 1965 the Air Force announced its plans for the eventual replacement of the Minuteman I with the larger, more powerful Minuteman II. Ballistic Systems Division is directing this "Minuteman Force Modernization." Three squadrons of the Minuteman II are under construction at Grand Forks AFB, N. D., with an additional squadron authorized at Malmstrom AFB, Mont. Minuteman II will have a greater thrust, resulting in significant range increase over the 6,300 miles for Minuteman I.

A major highlight of this program was the complete success of the first Minuteman II ICBM launched for research-and-development test on September 24, 1964, at Cape Kennedy, Fla.

The Advanced Ballistic Re-Entry System (ABRES) program received special identification as the DoD program for advanced reentry techniques and devices. The program, which is intended to develop an understanding of reentry phenomena and establish the military worth and feasibility of advanced reentry concepts, was placed on the Designated Systems Management list in August 1964. To carry out the flight-test program, ABRES employs the Atlas and Athena test vehicles. The Athena missile, launch complex, and instrumentation tie-in between Green River, Utah, and the White Sands Missile Range, N. M., are complete, and the first successful Athena live two-stage flight occurred in July 1964. The first success-

Gen. B. A. Schriever became Commander, ARDC, later redesignated Air Force Systems Command, in 1959. He earned his military wings in 1933 and holds a master's degree in aeronautical engineering from Stanford University. As head of the AF Ballistic Missile Division, he directed the massive USAF ICBM R&D program.



ful live four-stage flight was conducted in November.

During the past year, Systems Command made notable contributions toward the nation's space programs. On June 18, the first Titan III-C was successfully launched from Cape Kennedy to become the free world's mightiest space booster launched to date. Six times more powerful than the Atlas rocket that carried the Mercury Astronauts, Titan III-C developed more than 2,000,000 pounds of liftoff thrust. Space Systems Division is program manager for developing the Titan III (SLV-5) standard space-launch system.

The newly completed Titan III Integrate-Transfer-Launch (ITL) facility at Cape Kennedy will enable the Air Force to launch several different space missions in a minimum of time. Use of the Vertical Integration Building and Solid Motor Assembly Building will sharply reduce the amount of on-pad time and allow for rapid follow-on launches.

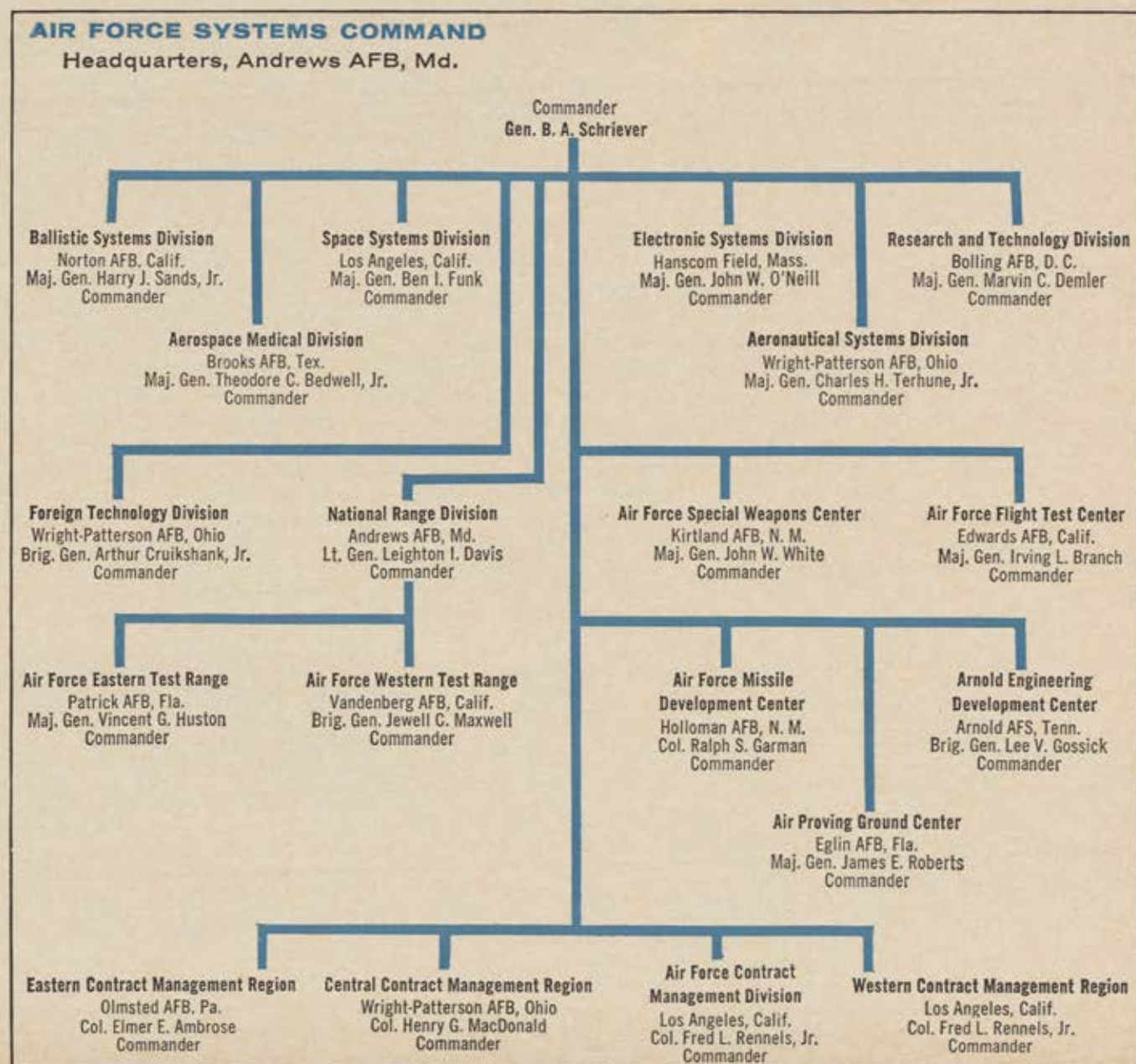
Last September the Air Force announced that a cesium contact ion engine operated satisfactorily while on the crest of a ballistic trajectory. The ion engine was teamed with the Atomic Energy Commission's SNAP-10A nuclear reactor power supply aboard an Air Force Agena spacecraft launched in April.

Looking toward the future in space, Systems Command is working on a fourfold spacecraft research program to develop unmanned test vehicles capable of maneuvering to a precision recovery site after re-

The command continued its close support of National Aeronautics and Space Administration projects; and Air Force facilities, hardware, and people were employed in support of NASA programs. On

The XB-70A flew for the first time on September 21, 1964, at the Air Force Flight Test Center, Edwards AFB, Calif., and later set a record for the highest gross takeoff weight in aviation history—more than 250 tons.

(Continued on following page)





The Advanced Ballistic Re-Entry System (ABRES) program is to study reentry techniques and devices. Here, ABRES vehicle mated to Atlas ICBM prepares to blast off.



An Air Force engineer, pressure-suited and wearing a mockup of the Modular Maneuvering Unit (MMU), floats weightless during KC-135 zero-gravity flight tests. MMU is being tested at Air Force Systems Command's Aero Propulsion Laboratory at Wright-Patterson AFB, Ohio.

The first F-111A was unveiled during an October 15, 1964, rollout ceremony, and its first flight took place on December 21. Demonstrations of sweptwing and supersonic flight were made early in 1965. The supersonic fighter was developed by Aeronautical Systems Division for both the Air Force and the Navy.

The Air Force's newest all-jet cargo aircraft, the C-141 StarLifter, was delivered to MATS in a turn-over ceremony at Tinker AFB, Okla., on October 19, 1964, and the first operational squadron received the C-141 early in 1965.

Existence of the SR-71 strategic aerial reconnaissance aircraft was disclosed by President Lyndon B. Johnson on July 24, 1964. Scheduled to become operational this year, the SR-71 can effectively cover an area of 60,000 square miles in one hour. The first flight of the long-range SR-71 occurred December 22.

The President also ordered the development of a new large transport, the C-5A, as 1964 drew to a close. On December 11, Aeronautical Systems Division asked five companies to complete project definition studies.

On a speed run at Edwards AFB, Calif., on May 1, the YF-12A long-range interceptor claimed seven official world records previously held by the Soviet Union. It flew 2,062 mph over a straight course and reached 80,000 feet altitude in sustained horizontal flight, plus setting several closed-circuit marks.

An X-15, extensively modified to increase its speed capability to Mach 8, enabled Capt. Joe Engle to fly more than fifty-three miles into space on June 29. He joined Lt. Col. Robert M. White and Maj. Robert Rushworth as Air Force X-15 pilots holding astronaut wings.

(Continued on page 139)



The first F-111A, here shown just after its first flight, was unveiled during an October 15, 1964, rollout ceremony. Its first flight took place on December 21. Demonstrations of sweptwing and supersonic flight were made in early 1965. The supersonic fighter was developed by AFSC's Aeronautical Systems Division to fulfill both the Air Force and Navy requirements.

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Today it's easier to communicate with a deep-space probe over 100 million miles away than with an aircraft 500 miles in flight across the Atlantic. It's incredible that, even today, reliable two-way transoceanic communications for aircraft just don't exist. But, Bendix Radio and a unique system known as VASR have brought such communications one step closer to reality—one major step.

VASR, VHF Aircraft Satellite Relay, is a system developed with the airborne equipment, various ground components and technical assistance of Bendix Radio Division. It consists of three terminals: (1) the ground station, (2) the aircraft, and (3) a synchronous satellite.

Using this equipment, in January 1965, Bendix established reliable communication between a Pan Am jet in

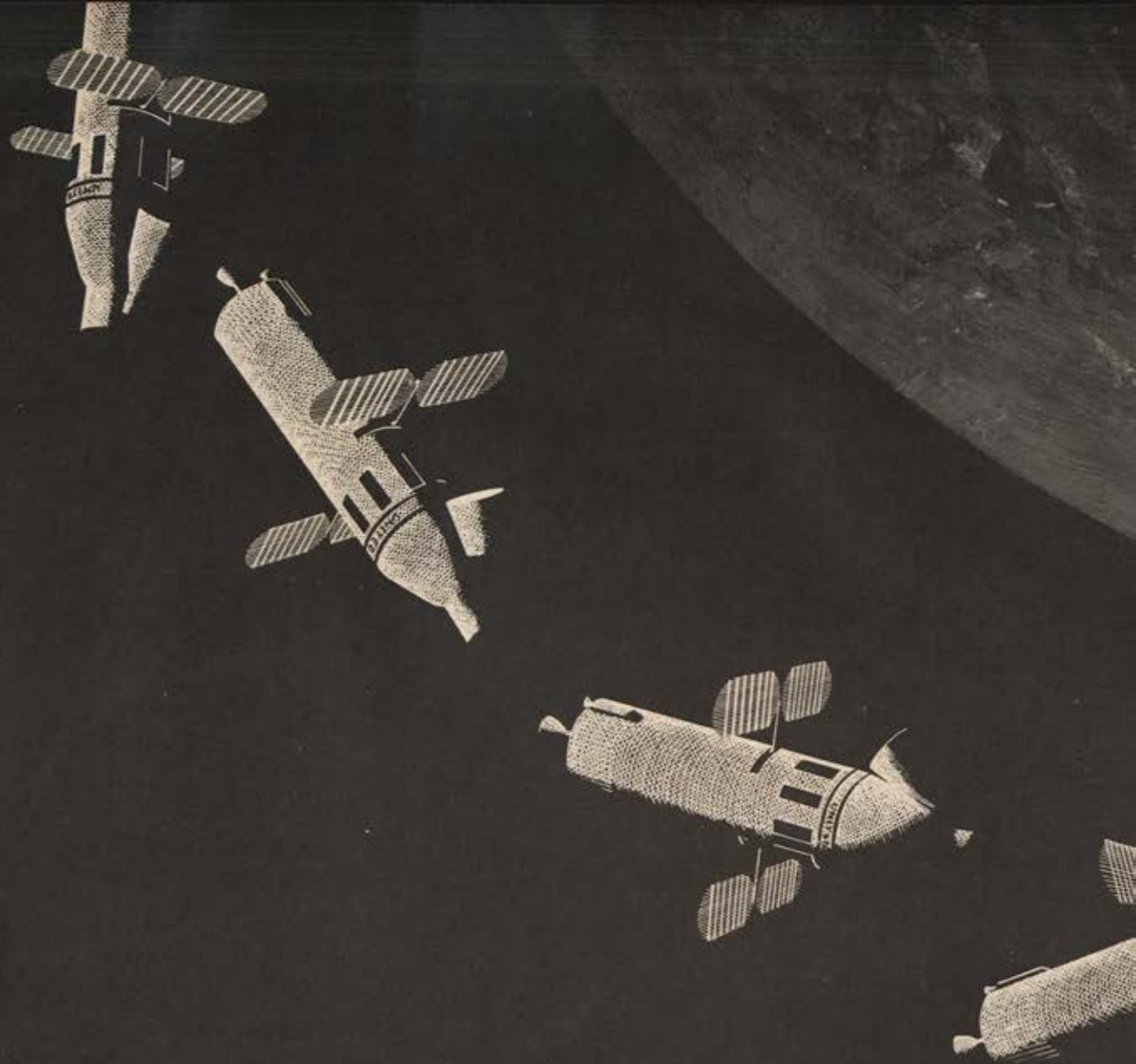
the vicinity of Hong Kong and a ground station in California via the Syncom III satellite. This demonstration marked a milestone in air/ground communications, proving conclusively that world-wide satellite communication for commercial aircraft is possible. Operational systems are now planned for late 1966.

VASR transoceanic communication for airlines is just one of the problems we're working on at Bendix Radio. We're also studying advanced airborne phased array systems for satellite communications, for example.

Whatever the communications problem, you can be sure Bendix Radio is working to solve it. The Bendix Corporation, Radio Division, Government Sales, Baltimore, Maryland 21204.

Bendix Radio Division





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We're developing an integrated control and stabilization system that will both stabilize a manned space laboratory and also allow its crew to maneuver it into any attitude to fulfill any mission.

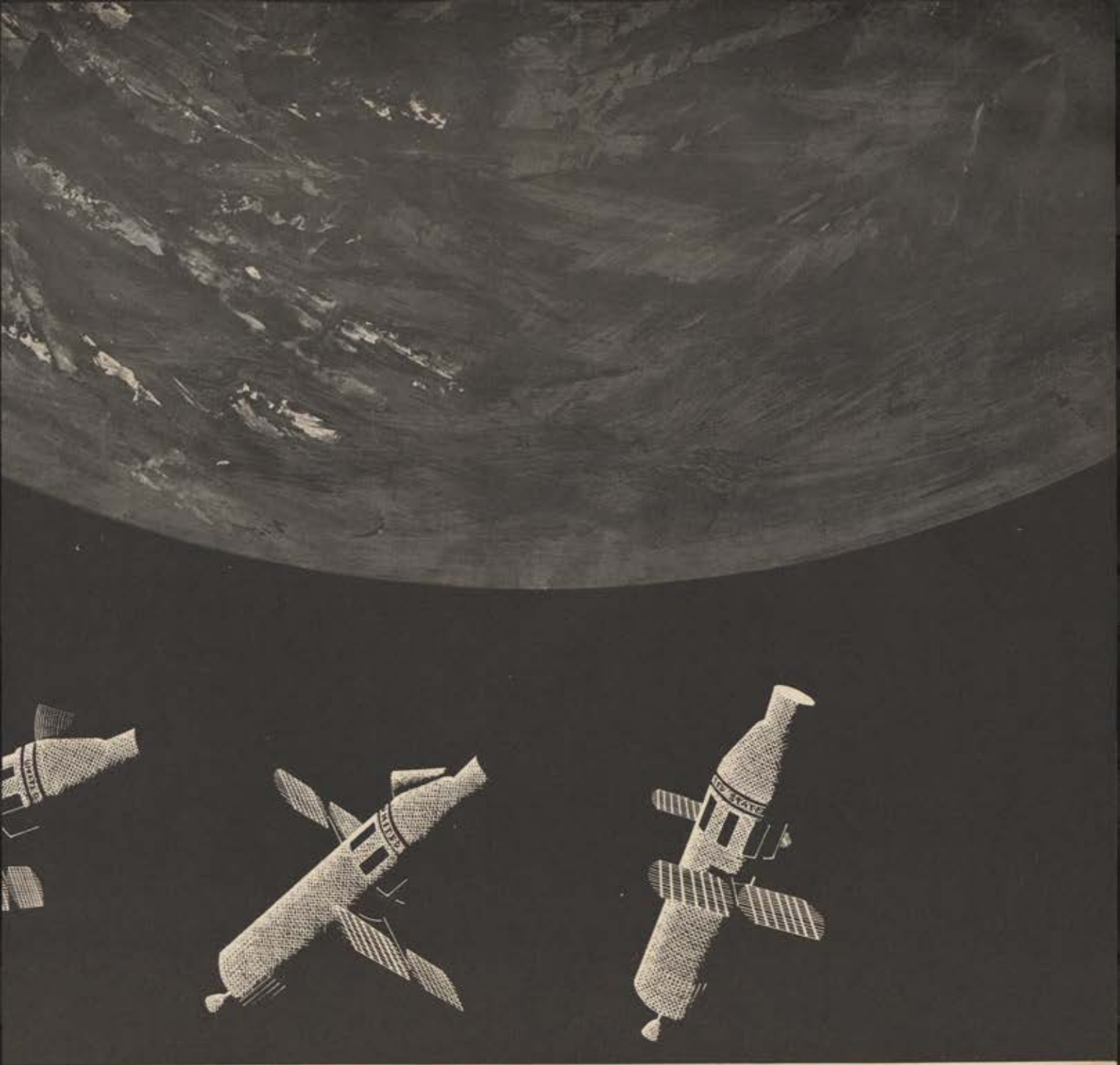
Our work includes flight simulation of a large manned orbiting vehicle with a mission to acquire and track a fixed earth target, to determine maneuvers the control system must accommodate and manual inputs that can be superimposed on the automatic system.

We are perfecting image motion computation techniques, solving pointing and tracking accuracy problems, maneuvering rates and trade-offs of propulsive versus momentum storage devices.

We are studying near-earth rendezvous and docking techniques.

And extending these studies into lunar and Mars orbit and fly-by missions.

We have a NASA/Douglas contract to study control and



on command and with precision?

stabilization systems for the Manned Orbiting Research Laboratory. And have extended this work for Manned Orbiting Laboratory application.

Our studies are in the areas of mission analysis and sub-system design and synthesis. Our hardware experience covers bi-propellant reaction controls, momentum storage devices, analog and digital electronic design, inertial guidance sensors, star trackers and sun sensing devices. If you're planning a manned space laboratory, we'd like

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reaction...**



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Quick reaction by Dynalelectron's AOD Division in retrofit/installation by fixed base or by field team, kit assembly to installation.

Top-qualification engineers

On hand in these three divisions are the industry's most highly qualified engineers, men of broad background and experience in ECM, engineers with proven records of accomplishment in ECM. These engineers welcome any ECM assignment, from the simplest installation to the most complex special-design job.

Complete facilities

Dynalelectron's three specialist divisions whose work is heavily ECM-oriented are the *Aerospace Operations Division*, Fort Worth, Texas; the *Cheyenne Division*, Airport Station, Cheyenne, Wyoming; and the *Pacific Division*, Gardena, California.

Fixed base or field team

Aerospace Operations Division is unequalled in quick reaction to problems of retrofit/installation by either fixed base or field team work . . . from kit assembly through installation and flight testing.



A Scimitar ECM antenna, one example of Pacific Division's wide ECM product line.

Products and prototypes

Cheyenne Division specializes in manufacture of ECM products and installation prototypes for all types of aircraft and production programs. It also is well known in the field for its facilities and its performance records.

Design, development, test

Pacific Division is composed of ECM engineering specialists in design, development, and testing of systems, components, and advanced modification programs. It boasts the finest ECM product line available anywhere in the free world . . . tops in microwave antennas, microwave connectors and adaptors, microwave transmission lines and systems.

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A Research and Technology Division technician performs experiments to discover methods of working in space at the space maintenance facility at Wright-Patterson AFB, Ohio.

Systems Command is developing two aircraft, the XC-142A and the X-19A, as part of a cooperative tri-service program to produce a new family of experimental vertical takeoff and landing (VTOL) aircraft. The XC-142A, first vertical short takeoff and landing (V/STOL) aircraft to be flown and also the largest, made its first hover flight in December. The aircraft then made its first conversion flight in January.

The Haystack Microwave Research Facility was placed in operation at Tyngsboro, Mass., last October. The facility is considered to be the forerunner of a new generation of radio communications, radar, and radio-astronomy antenna systems. With its first transmitter, the system could communicate with space probes 100,000,000 miles in space. As a radio-telescope, it will produce accurate "radio maps" of the universe, or, as a radar, track a target the size of a .22-caliber bullet 1,000 miles away.

Among the accomplishments of Research and Technology Division's laboratories was the first successful demonstration in late 1964 of internal thrust from a supersonic-combustion ramjet (SCRAMJET) engine. SCRAMJETs differ from conventional engines in having moving parts only in the fuel-feed system and producing thrust by burning fuel in a supersonic airstream. An 8,000-mph research airplane achieving orbital speeds could result from this study, AFSC's

Commander, General Schriever, pointed out in April.

Since superior aerospace systems are dependent on strong, technically competent laboratories, Systems Command continued to place major emphasis on further strengthening of its in-house laboratories. For example, the AF Aero Propulsion Laboratory acquired a high-vacuum test chamber that simulates space environment and altitudes up to 990,000 feet. It will be used to test liquid-metal system components such as space radiators and solar reflectors. The Aero Propulsion Laboratory has been testing a full-size, honeycomb, expandable structure for possible use in space.

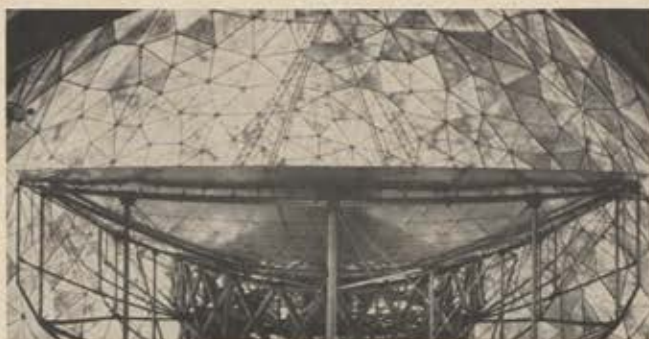
The Air Force will be able to study the adverse effects of space environment on rockets and associated equipment with a new facility at the AF Rocket Propulsion Laboratory. Initial tests were planned for this summer.

Among the management actions of the past twelve months was the formation of a new Air Force Contract Management Division in early 1965. The AFCMD is responsible for DoD contract management activities in plants assigned to the Air Force under the DoD National Plant Cognizance Program. During 1964, Systems Command administered 47,929 contracts with a face value of \$58.5 billion.

The first joint Air Force/Industry Subcontract Management Symposium was hosted last September by Systems Command.

A Program, Resources, and Objectives Management (PROM) activity was initiated at Systems Command Headquarters to provide the Air Force with procedures for conducting rigorous scientific analysis of new system proposals. PROM takes into account not only technical excellence, but also such factors as responsiveness to national defense policy and strategies, enhancement of military effectiveness, and reasonableness of cost. The PROM central workroom displays the dollar cost of currently approved programs and the intermediate and long-range plan for a fiscal period ten years into the future in the context of the total force structure.

Systems Command's goal continues to be the most effective use of defense resources in attaining superior aerospace strength. The highlights mentioned are representative of the command's efforts during the past year toward achieving that goal.—END



Above is an antenna at the Haystack microwave radio/radar research facility. The antenna, 120 feet in diameter, is the most precise large moving structure ever constructed. The facility is operated by MIT for AFSC and the USAF.



The Air Force Logistics Command

DURING the past year, the Air Force Logistics Command (AFLC) continued to pioneer management improvements while coping with emergency situations and meeting the challenges of the conflict in Vietnam.

The huge organization, which performs the mission of keeping all Air Force weapon systems at "go," is commanded by Gen. Kenneth B. Hobson.

Personnel of AFLC take pride in a tribute to the command's performance which was expressed in a speech made by Gen. John P. McConnell, USAF Chief of Staff.

"The Air Force has developed the tradition," General McConnell said, "of being the service that can get its people and equipment there 'fustest with the mostest.' It is one service that cannot be branded with the tag 'too little and too late.' And the responsibility for this belongs to the Air Force Logistics Command.

"When logistics support is as efficient as it is in the Air Force, it becomes an important instrument of national policy."

In the past several years there have been numerous crises, including Berlin, Laos, the Congo, Cuba, Vietnam, and the Dominican Republic. In each crisis, AFLC has demonstrated the flexibility and responsiveness required to ensure that every part, unit, and weapon is ready at the right place at the right time.

Priority for Southeast Asia

AFLC has been giving priority attention to the Air Force's readiness posture in Southeast Asia since early 1963. Its personnel are fully aware that the shooting war in Vietnam demands that the support to operating units there must be immediately responsive.

The logistics support to units in Southeast Asia continues to be satisfactory. The Not Operationally Ready, Supply (NORS) rates for USAF and Military Assistance Program aircraft compare favorably with those for units in the continental United States. Satisfaction has been expressed in messages from commanders in the area.

An example of this satisfaction is a message sent

Gen. Kenneth B. Hobson became AFLC Commander in August 1965. He was graduated from West Point in 1932.

Past assignments include tours as Commander of SAC's 92d Bomb Wing, Vice Commander of the Fifth Air Force in Japan, and Commander of AFLC's Ogden Air Materiel Area. He was Vice Commander of AFLC from 1961 to 1965.



last May to AFLC's Commander by Lt. Gen. J. H. Moore, Commander of the 2d Air Division in Vietnam.

"We have been receiving absolutely topnotch support from your command," General Moore stated. "This speaks especially well when you consider that we are just about as far away on the end of the pipeline as you can get."

STAR Procedures Praised

General Moore especially praised AFLC's STAR procedures. STAR—which stands for Speed Through Aerial Resupply—has been found to be the most effective method of supporting counterinsurgency operations. Under this system, the deployed activity has a single point of contact for its logistics requirements.

Referred to as a Weapon System Control Point, it receives requisitions, performs the necessary research, selects the proper source, follows up, and expedites the delivery of the materiel to the requesting activity.

As originally conceived, STAR was to be utilized in support of aircraft only. However, actual experience has dictated that this support be expanded to other areas, such as vehicles, ground generators, and ground communications and electronic equipment.

While the STAR procedures cost additional AFLC manpower, it is important to remember that the bases involved are 8,000 to 10,000 miles from home and must be relieved of as many logistics details as possible.

AFLC confidence in the system stems from the dramatic correction of many troublesome problems immediately after STAR was applied, and from the enthusiasm expressed for it by the using activities.

RAM Teams Improve Support

A significant improvement in support of Southeast Asia operations has resulted from the use of AFLC's Rapid Area Maintenance (RAM) teams in Vietnam, to expedite removal, recovery, and repair of crash- and battle-damaged aircraft for speedy return to operational status. This enables Pacific Air Forces (PACAF) maintenance personnel to concentrate on operational units.

Operations of RAM teams in the area are under the administrative control of the Air Procurement Region, Far East. This organization has been named winner of the Talbott Trophy for its outstanding record in recovery and repair of battle-damaged aircraft in South-

east Asia. The recognition, in the form of the highest Air Force award for procurement management efficiency, is for the period from October 1, 1964, through March 31, 1965.

The citation accompanying the award reads in part: "During this period, the Air Procurement Region, Far East, as a result of accelerated operations in Southeast Asia, was required to make recovery and repair of both USAF and Military Assistance Program crash- and/or battle-damaged aircraft in the shortest possible time, without benefit of depot-level maintenance and repair capability.

"Their ingenuity in procurement preplanning was evidenced by the introduction of a streamlined procedure, which they developed to accelerate the repair of aircraft in the shortest possible time."

In spite of the competence and exceptional maintenance performance of the tactical forces in Southeast Asia, AFLC recognizes that operations of this nature
(Continued on following page)

AIR FORCE LOGISTICS COMMAND

Headquarters, Wright-Patterson AFB, Ohio

Commander
Gen. Kenneth B. Hobson

Directorate of Operations
Brig. Gen. William G. Hipps
Director

Directorate of Procurement
and Production
Brig. Gen. Robert H. McCutcheon
Director

Directorate of Supply
Maj. Gen. Emmett M. Tally, Jr.
Director

Directorate of Maintenance
Engineering
Brig. Gen. Glen J. McClernon
Director

Directorate of Transportation
Col. William P. Thorington
Director

Directorate of Personnel and
Support Operations
Brig. Gen. Frederick J. Sutterlin
Director

Comptroller
Col. Frederick E. Morris, Jr.

Directorate of Plans and Programs
Brig. Gen. William G. Lee, Jr.
Director

AIR MATERIEL AREAS

Warner Robins AMA
Robins AFB, Ga.
Maj. Gen. Earl C. Hedlund

Rome AMA
Griffiss AFB, N. Y.
Col. George E. Harrington

Sacramento AMA
McClellan AFB, Calif.
Maj. Gen. Chester W. Cecil

San Bernardino AMA
Norton AFB, Calif.
Brig. Gen. Ralph C. Rockwood

San Antonio AMA
Kelly AFB, Tex.
Maj. Gen. Frank E. Rouse

Oklahoma City AMA
Tinker AFB, Okla.
Maj. Gen. Melvin F. McNickle

Ogden AMA
Hill AFB, Utah
Maj. Gen. T. Allen Bennett

Mobile AMA
Brookley AFB, Ala.
Maj. Gen. Charles B. Root

Middletown AMA
Olmsted AFB, Pa.
Maj. Gen. Frederic H. Miller

2802d Inertial Guidance
and Calibration Group
Newark AFS, Ohio
Col. Thomas O. Lawton, Jr.

The Military Aircraft Storage
and Disposition Center
Davis-Monthan AFB, Ariz.
Col. Charles L. Stafford

2750th Air Base Wing
Wright-Patterson AFB, Ohio
Col. Arthur E. Exon

Ground Electronics Engineering
Installation Agency
Griffiss AFB, N. Y.
Brig. Gen. Stephen D. McElroy

generate peak workloads beyond the capability of the operating forces. AFLC has responded and will continue to respond to these needs by providing special skills and extra effort in the maintenance area.

All Weapon Systems Supported

AFLC is charged with the responsibility for supporting all weapons for Air Force operating commands—the Tactical Air Command, the Air Defense Command, the Military Air Transport Service, the Strategic Air Command, the Pacific Air Forces, and the United States Air Forces in Europe. And AFLC also provides for the logistics requirements of all the other Air Force commands, including Air Training Command, Continental Air Command, and Air Force Communications Service.

The command's headquarters at Wright-Patterson AFB, delegates logistics management to its Air Materiel Areas (AMA), which are designated as system support managers for specific weapon systems.

Thus, the Oklahoma City AMA is the system support manager for the B-52, and the Ogden AMA is system support manager for the Minuteman ICBM. Other examples: The F-111 system support management team is at the Sacramento AMA, the B-58 is managed by the San Antonio AMA, and the C-141 by the Warner Robins AMA.

Regardless of its location or which weapon systems it supports, each Air Materiel Area is related to and dependent upon all the other AMAs. One of the principal reasons for this interdependence is the role of the inventory manager.

No matter what piece of standard Air Force equipment a system support manager may need, there is an inventory manager at one of the AMAs who can supply it. Inventory managers are important to logistics management. They prevent duplication of procurement and supply.

Specialized Activities

In addition to its Air Materiel Areas, the AFLC has a number of specialized activities. They include:

- The 2802d Inertial Guidance and Calibration Group at Newark AFS, Ohio. This facility has among its functions the test, repair, and calibration of the Minuteman inertial guidance and control system. Operating directly under Headquarters AFLC, the organization does the same kind of work on the Titan missile and on the navigational systems of the F-111 and F-4C aircraft.

- The Ground Electronics Engineering Installation Agency (GEEIA) at Griffiss AFB, N.Y. GEEIA is the Air Force's single-manager agency for the engineering, installation, and on-site depot-level maintenance of all communications-electronic systems worldwide. It is under the direct jurisdiction of Headquarters AFLC.

- The Military Aircraft Storage and Disposition Center at Davis-Monthan AFB, Ariz. Whenever a military aircraft becomes excess to active requirements, it goes to this installation. Under the executive

directorship of AFLC, the center provides a single point of disposition for all Department of Defense aircraft—Navy and Army as well as Air Force.

Manpower Resources

To perform its enormous and complex mission, AFLC has approximately 140,000 personnel. They process 17,000,000 requisitions a year and repair a million and a half items, components, and accessories. Their worldwide job entails support of defense organizations in eighty-six countries.

AFLC historians trace its antecedents back to July 14, 1921, when the Air Service set up the Office of Property, Maintenance, and Cost Compilation at Fairfield Air Depot near Dayton, Ohio. Mission of the new office was to control Air Service supply depots and be responsible for maintenance engineering and cost accounting.

The years since then have been marked by changes in name and specific functions and by increases in the size and complexity of the command's mission.

During the past year, AFLC continued to accomplish its objective of doing more with less resources. Improvements were effected and costs reduced despite a steady increase in the total number of aircraft and missiles and in the number of different types.

Workload More Complex

In 1962, the USAF aircraft-missile population was 14,500, representing 212 types. It now exceeds 17,500, and the number of different types has increased to 306. Absorbing this growth in the workload's size and complexity has been made possible by improvements in management techniques, the use of electronic data-processing equipment, increased airlift, and improved communications.

Four of the command's nine Air Materiel Areas are in process of being phased out. They are: Rome AMA in New York, Middletown AMA in Pennsylvania, Mobile AMA in Alabama, and San Bernardino AMA in California. The remaining Air Materiel Area installations—which will have increased workloads as a result of the phaseouts—are located at Warner Robins, Ga.; San Antonio, Tex.; Oklahoma City, Okla.; Ogden, Utah; and Sacramento, Calif.

This compression of logistics facilities will result in a considerable savings in overhead expenses. It is estimated that, after the phaseouts have been completed during the next four years, the overhead savings will amount to \$96 million annually; savings in personnel will total about 8,500.

The most significant barometer of the effectiveness of logistics support is the previously mentioned Not Operationally Ready, Supply rate, NORS. An aerospace vehicle is NORS when it cannot perform its mission due to lack of parts.

A marked improvement has been shown in aircraft NORS rates since 1957, when the average rate was a little more than thirteen percent. The figure now has dropped to about three percent. For ballistic missiles,

the average is less than one percent, compared with nearly four percent in 1961. Reduction in NORS rates is a constant objective of AFLC.

Improvements in Management

Another constant objective is described by General Hobson, AFLC's Commander, who says: "The most important job for an organization as large as AFLC, I am convinced, is to find ways to improve management. The command is always searching for better systems to turn over to its people for effective and economical management."

The search for improved systems includes constant state-of-the-art surveillance of new management techniques. Progress made anywhere in the military-industrial-research complex may have ingredients AFLC can adapt, or may open new avenues for in-house advances by AFLC. Two professional fields that are given a great deal of responsibility and top-level support are operations research and industrial engineering. Such tools as cost/effectiveness tradeoffs and simulation are playing an increasing role. The command has just established a small simulation center.

AFLC, additionally, is applying mathematical models to the Air Force's newest weapon systems. One of these models provides new techniques for setting stock levels which give promise of being dramatically more efficient than those used in the past.

An important example of management improvement is the new system for procurement of engineering data for Air Force weapon systems. This program for "Supply of Essential Engineering Data"—referred to as SEED—was designed by AFLC in cooperation with the Air Force Systems Command.

The new approach is being service-tested on the C-141 StarLifter transport, now in the production stage. Lockheed, the prime contractor on the StarLifter, maintains the engineering drawings and keeps them current.

Under SEED procedures, the Air Force no longer buys outmoded data. It is not necessary to buy all the changes which must be made by the contractor. In other words, the Air Force buys only needed data and only when it is needed. The program is proving so successful that it will be adopted for all aircraft entering the Air Force inventory.

Zero Defects Program

During the year the command launched an improvement drive known as the Zero Defects Program. Stated simply, the objective of this industry/Department of Defense program is to get the job done right the first time. As implemented by AFLC, the immediate purpose is to develop in each employee a feeling of pride in everything he does and thereby prevent mistakes before they happen.

All personnel have been asked to support this organized effort to improve the quality of work by centering attention on individual craftsmanship. The program has been implemented with a variety of motivational

materials, public information drives, and appropriate rewards for error-free performance.

A striking example of the effectiveness of the Zero Defects Program was reported in July by the Oklahoma City Air Materiel Area. Enthusiastic acceptance of the perfection concept by B-52 maintenance personnel has cut the flow-time and enabled OCAMA to return B-52s to the Strategic Air Command a full seven days ahead of schedule. The biggest factor in the accomplishment was the decrease in the number of rejected projects.

Cost Reduction Pushed

Management improvements are designed to obtain the most defense at the least possible cost. AFLC's implementation of the Defense Department's Cost Re-



Fourteen of the Air Force's biggest bombers, the eight-jet B-52 Stratofortresses, can be overhauled at once inside the huge aircraft maintenance hangar at San Antonio Air Materiel Area, Kelly AFB, Tex. SAAMA handles about half of the B-52s repaired and modified annually for SAC.

duction Program is called Gold Rush. The name serves to remind personnel of the importance of digging for the nuggets of savings.

During its first year, Gold Rush reported savings of \$1.27 billion, representing almost sixty percent of the total Air Force program. As a result, the Logistics Command won the first Air Force Cost Reduction management award last fall.

For the first three-quarters of Fiscal Year 1965, AFLC reported a cost reduction total of \$1.218 billion, compared with the goal for the entire year of \$1.205 billion.

General Hobson views cost reduction as a permanent way of life. He believes that economy is more important than ever because of the acceleration of operations in Vietnam. He insists, however, that money-saving efforts must never involve any sacrifice of reliability and safety.

"Even for a country as rich as ours," he declares, "it is necessary to make choices between what we can afford and what we cannot afford. Certainly, we can afford whatever is essential to preserve our security and freedom. But we cannot afford waste and inefficiency in defense."—END

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- **Built for rugged duty** and tested far in excess of required load factors, the Beechcraft TURBOPROP U-8 offers go-anytime reliability... longer service under the roughest usage... with a minimum of maintenance.

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The Air Training Command

AIR Training Command (ATC) is the world's largest training organization.

In the area of academic classroom instruction followed by graduation from a formalized course of study, more than 400,000 students, representing nearly half the numerical strength of the Air Force, are trained each year by the command, either at ATC schools or at operational units. This fact dramatizes the impact ATC has on the operation of USAF's aerospace forces. Without training there can be no operational capability.

ATC is highly responsive in its training functions to the needs of the other major air commands. Courses of study, changes in curriculum, student loads, and special training assignments are based on the requirements of the other major air commands for manning present and future weaponry and support equipment.

In this framework, ATC has built a flexible system, with complete training programs at a single base or with single-base management responsibility over a total training program.

An example of single-base operation is the undergraduate pilot training program (UPT). Eight bases are used for UPT. Each takes the new pilot trainee from the time of entry, gives him training in different types of aircraft, graduates him, and awards his wings, all at the same base. Flexibility in the training is a constant requirement. Four years ago, USAF's first supersonic trainer, the T-38 Talon, was introduced into pilot training alongside the twin-jet T-37 primary trainer. It was a radical change, propelling the student into the supersonic age before he won his wings. Yet, even before the T-38 had completely replaced the well-known T-33 T-Bird, a new entry into the program was taking place at the other end of the line. This was the T-41A, a Cessna-produced, 172 model, off-the-shelf light trainer. Its introduction into the pilot-training picture had as much impact as the T-38, although its purpose is entirely different.

T-41A training, which began in August 1965, is handled under civilian contract at an airport near each UPT base. Thirty hours of flight instruction are given. These thirty hours were pared from T-37 training. The present UPT program now calls for thirty hours in the

Lt. Gen. William W. Momyer became Commander of ATC, last month. He was a fighter group commander with 200 combat flying hours during World War II. He has been Deputy Chief of Staff for Plans, TAC; commander of a fighter-bomber wing in Korea; Director of Operational Requirements and Assistant DCS/Programs and Requirements at Hq. USAF.



T-41A, ninety hours in the T-37, and 120 hours in the T-38 or T-33. The T-38 is now operational at six of ATC's eight UPT bases.

The purpose of the T-41A program is to determine as early as possible which students will make the best pilots. The new program is expected to help attain an increased pilot production rate of 2,700 yearly by FY 1967.

Simultaneous lightplane and supersonic-aircraft training in a single program, and containment of that program on one base, resulting in increased production of pilots, is a prime example of management flexibility in the ATC structure.

Of equal significance are the changes taking place in the technical training areas. There has been a dramatic but quiet revolution in the schooling of technicians, brought about by ever-increasing complexity of equipment. Extended training periods have become the rule rather than the exception. More often than not, the technical specialist is the product of several years of study.

This situation has required a reapportionment of ATC academic resources. Basic courses have been established for students entering specialized courses of study requiring common background knowledge. New training methods have been developed to speed the learning process. Programmed learning and new electronic teaching aids, including closed-circuit television, are now commonplace in ATC resident schools.

At the five technical training centers located at Amarillo and Sheppard AFBs in Tex.; Chanute AFB, Ill.; Keesler AFB, Miss.; and Lowry AFB, Colo., a single-manager concept is employed. This means that all training related to a single weapon system is the responsibility of one training center, regardless of where training is conducted. Normally, most of the training for a given system will center at the base responsible, with lateral training being given by other training centers.

With the single-manager concept comes the oft-used word *concurrency*. Its relevance is as pronounced in training as it is in research and development. Personnel must be trained to operate a new weapon system as it is developed, or operational readiness cannot be achieved at an early date. Application of this principle is prevalent in ATC's involvement in such new systems as the F-4C, the F-111, the C-141, and the yet-to-be-developed C-5A.

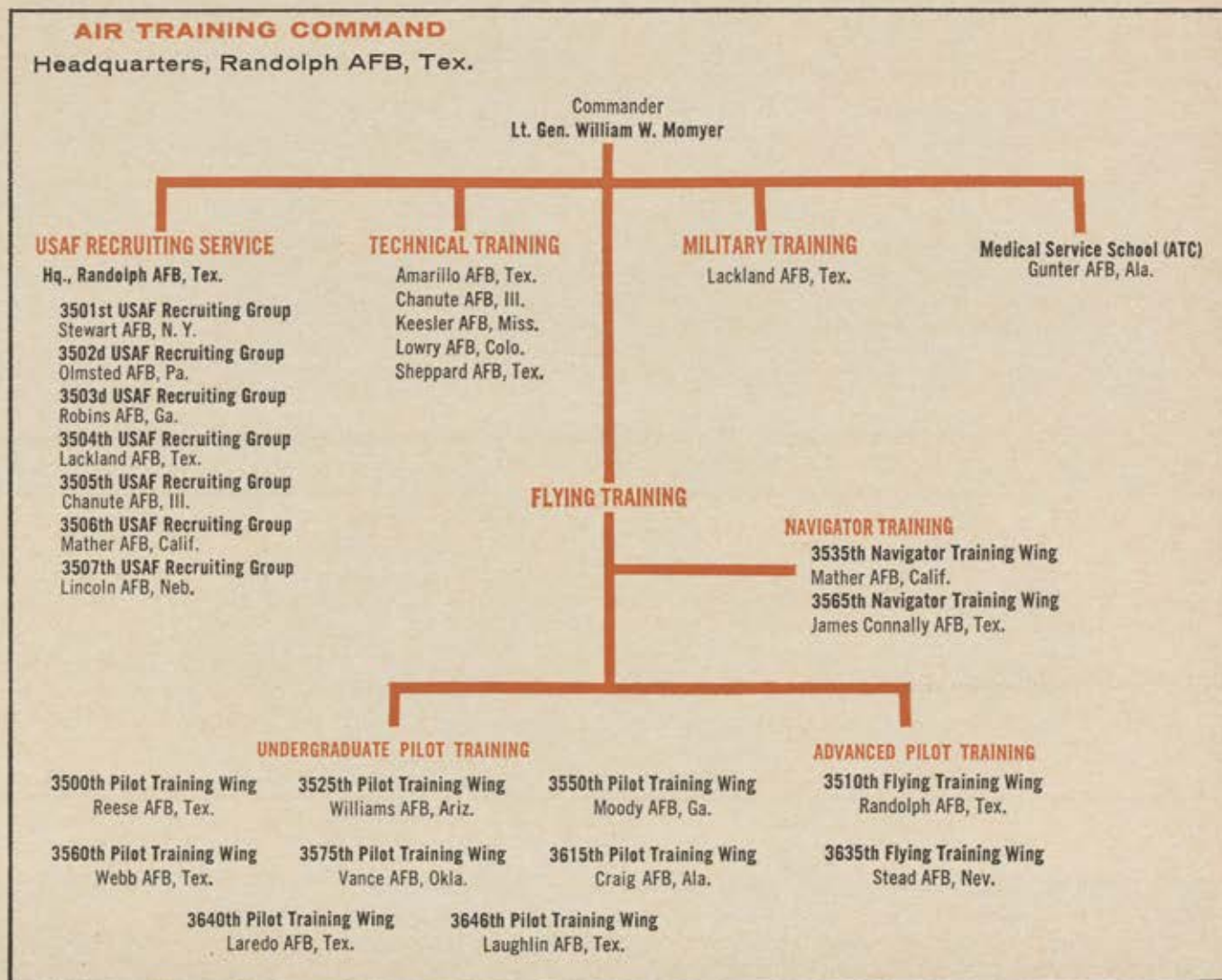
With the C-5A, ATC became involved in early 1964 during the Conceptual Phase of the system's development. At this time, training concepts, courses, numbers of people to be involved, and other basic planning for future training requirements were determined. The training element became part of the Air Force specifications given to the contract bidders. On January 1, 1965, the second phase (Project Definition) began.

ATC developed its plan to support the system and named Sheppard Technical Training Center as the base to manage the training program. With the second phase scheduled for completion in mid-summer of this year, ATC became involved in source-selection activity through evaluation of contractor training proposals. Evaluation by all interested major air commands was completed in June. When selection of contractors is made and DoD approves funds, award of the contract will follow. For ATC the training cycle then begins.

In the F-111 program, the training cycle has been reached. Approximately thirty training courses have been identified, and training in some courses is already complete. Key personnel from Hq. USAF, AFSC, AFLC, TAC, and ATC began attending staff management courses in September 1964. Some ATC instructor personnel have completed training. Additional instructor personnel entered training in August, and others will be entering training in September. The first major training program on the F-111 begins at Edwards AFB, Calif., this month, with the objective of training the technical personnel to support the Category II Test Program.

The F-111 training plan was completed and approved on June 14, 1965, based on known and anticipated trained personnel requirements during the develop-

(Continued on page 149)



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This year the conversion to the F-4C has been mounting at a rapid pace. Here, ATC instructor supervises as students bench-check components of an F-4C control amplifier.

mental period of aircraft design and construction. The validity of these requirements will be checked during the Category II Test Program at Edwards AFB. At this time the appropriate skill levels, including any requirements that might not have been foreseen during the early stages of design, will be identified and ATC will match its training program to the specific training needs.

Training management for any system must be dynamic since the weapon systems themselves are never static. Continuous configuration changes require continual adaptation of the training program.

Obviously the training of 400,000 annually cannot be done in the few existing permanent facilities. Classrooms and instructors just could not carry the load. Therefore, ATC takes the classroom to the student in the form of Field Training Detachments (FTD).

It is the FTDs and Mobile Training Detachments

(MTD) that give training to the greatest number of personnel. More than 370,000 individuals received training by these units during the past fiscal year, including several thousand in the conversion to new equipment.

In the past year, conversion to the F-4C has been mounting at a rapid pace. The first was at MacDill AFB, Fla., in May 1963, where the 836th Air Division received the first F-4Cs to enter the operational inventory. In the past year, an additional 5,860 personnel were trained at MacDill in one or more of the thirty-six major courses of instruction.

While F-4C training was initially concentrated at MacDill AFB, the program has now spread to many USAF tactical units. Other small FTD units, normally consisting of twenty-six instructors, began F-4C training at the 81st Tactical Fighter Wing (TFW), RAF Station Bentwaters, England; the 10th TFW, RAF Station Alconbury, England; 366th TFW, Holloman AFB, N. M.; 4453d Combat Crew Training Wing, Davis-Monthan AFB, Ariz.; 32d TFW, George AFB, Calif.; 33d and 3163d Tactical Reconnaissance Wings, Shaw AFB, S. C.; and the 33d TFW, Eglin AFB, Fla. In all, 16,296 personnel were trained during FY 1965 in all elements of F-4C maintenance and operation.

Equally important training was begun in the C-141 at three AF bases. Operating at Travis AFB, Calif.; Dover AFB, Del.; and Tinker AFB, Okla., members of ATC-operated FTD and MTD units taught twenty-four major courses to 1,968 personnel.

In ATC's global classroom environment of 2,000-plus courses, change is the pattern of existence. Everything is geared to the future as well as the present. Cancellation of programs is taken in stride, and transition into new course materials is routine. In the November 1964 base-closing actions announced by DoD, three ATC bases were included. One was the huge Amarillo Tech-

(Continued on following page)



Students at Keesler AFB, Miss., who are learning maintenance of the guidance system of the F-4C Phantom II, had a close look at the new supersonic, multipurpose fighter when one was flown into the Gulfport, Miss., airport. The F-4C is from MacDill AFB, Fla. Over 16,000 personnel received F-4C training during FY 1965.

nical Training Center. The planned transfer of training functions has already begun.

With the closing of the James Connally AFB, Tex., Undergraduate Navigator Training (UNT) School, slated for June 1966, Mather AFB, Calif., will assume the entire navigator training program. The first class at Mather entered training in August 1965. With the move came a major change in the UNT program, incorporating new low-level techniques, combined navigational aid use, and loran and celestial-navigation practice during twilight hours. With inclusion of new training, total training time was cut from forty-four to thirty-eight weeks.

It is a combination of the amazing latitude in academic and flying training skills and a soundly based management team that has allowed ATC to define and successfully solve the seemingly endless maze of training problems that face our aerospace forces. Yet, while living with the problem, there is room for improvement in existing programs.

One such change this past year was the introduction of a new helicopter training program. In the past, helicopter training was an advanced flying training program, which meant that students must already have graduated from pilot training (UPT). Starting in July 1965, students now enter directly into a separate training program using the T-28 for fixed-wing experience. A total of 120 flying hours are given in the T-28 at Randolph AFB, Tex., before students proceed to Stead AFB, Nev., for helicopter training in the H-19 and H-43 or the new CH-3C.

The same result has been achieved in basic training of airmen at Lackland AFB, Tex., where some 82,000 recruits made their debut into the Air Force in the past year. Starting in October 1964, basic training was cut from eight to six weeks. The tremendous manpower savings of this action can readily be seen, but manpower saving at the basic airman level is the least important element. Saving two weeks' time in basic training places the young airman in a technical training situation that much earlier and eventually in an



The workings of the complete elevator, stabilizer, and rudder control and trim systems are being studied by these students of the basic jet aircraft course at the Sheppard AFB, Tex., Department of Aircraft Maintenance Training. Mockup is used to show students working parts of systems.

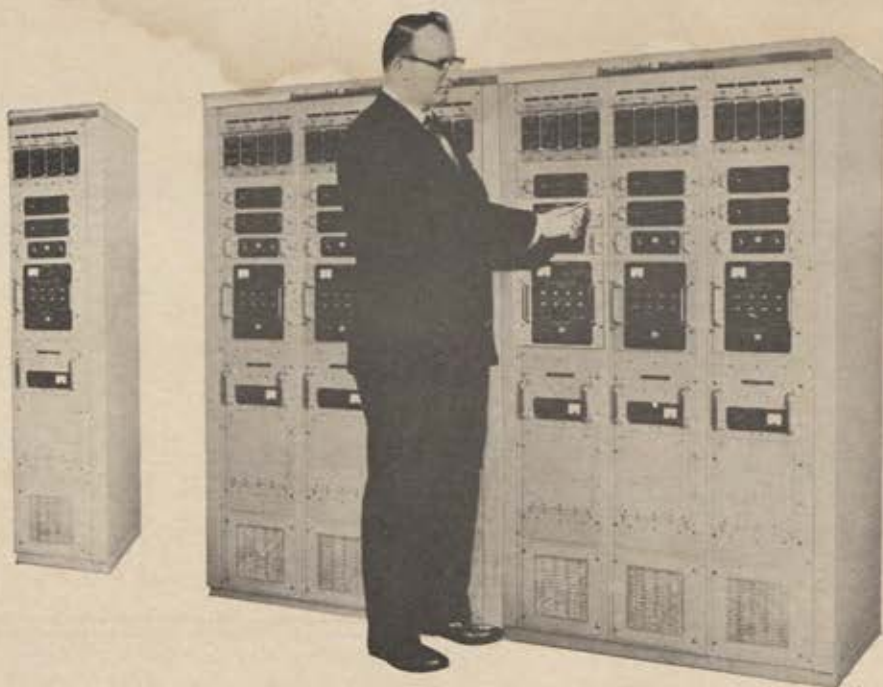
operational unit far ahead of his previously projected schedule. Savings become more significant with each step, perhaps the most important being the 6,560,000 man-hours of highly skilled technical experience saved in the operational unit as a result.

In some instances, the value of a given training program is difficult to calculate. An example of this is Military Assistance Program (MAP) training. The fact that so many friendly nations are able to attribute, in no small measure, their continued and strengthened sovereignty to the program is dramatic evidence of its worth.

Managing ATC is a complex business. On the surface, there appears a single product—trained people. In the process of creating this product, there is an intricately woven association with every facet of Air Force operations and aerospace industry. All have a vested interest in seeing that ATC does an efficient job.—END

Students who are taking the Aircraft Control and Warning (AC&W) Operator Course at Keesler AFB, Miss., plot positions of textbook "aircraft" on a huge plexiglass board under the supervision of their ATC instructor. In the foreground, students operate search radar consoles and practice relaying information to the plotters.





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Photo shows six Type 214A transmitters combined to generate 1200 watts on each of six different channels. These six transmitters could also be combined to generate 7200 watts of output power on one channel. 84 Type 214A transmitters could be combined into a single unit generating 100 kw of output power.

The Type 214A is adaptable to navigational systems such as Decca, Consol, Loran-D and Omega, and to communication systems employing CW, FSK, AM or FM. Overall size: 66 inches high, 14 inches wide, 20 inches deep; weight, 160 lbs.

Yet, the Type 214A is just one result of Continental's solid state transmitter capability which currently covers the frequency range from 10 kc to 10 mc.

For a brochure on the Type 214A, or additional information on other solid state transmitters, write to: Military Marketing Manager, Continental Electronics Mfg. Co.; Box 17040; Dallas, Texas 75217.

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The Alaskan Air Command

ALASKA is the "Air Crossroads of the World" in more ways than one. It not only lies astride the polar air route between Europe and the Far East, but stands as a potential roadblock on the shortest air route from Eastern Siberia to the industrial heart of the United States. For these reasons the Alaskan Air Command (AAC) represents both a capability and a potential of great importance to the United States.

Though it supports units from every major Air Force command in the US in a variety of missions, AAC has as its primary task the first-line aerial defense of the more than a half-million square miles that go to make up Alaska, as well as providing warning of attack to the rest of North America.

The Bering Strait, a narrow fifty-mile-wide strip of water, separates Alaska's Seward Peninsula from the USSR's Chukotsk Peninsula, and slightly more than a mile separates the US's Little Diomed Island from the USSR's Big Diomed Island.

A network of aircraft control and warning, communications, and radar surveillance sites are operated and supported by AAC for the North American Air Defense Command (NORAD) and the Air Defense Command (ADC). The mission aircraft used by AAC to fulfill its obligation of guarding the "Top of the World" are the F-102 Delta Dagger and the F-106 Delta Dart. Scheduled to become a part of AAC's aerial defense force is the multipurpose Mach 2 F-4C Phantom II, which will be assigned to Alaska on a rotational basis, providing some tactical air-support training for US Army units as well.

As for the support mission of AAC, every US-based major Air Force command supports or is supported by AAC.

There are also many civilian organizations of the federal government receiving AAC support. In addition, the US Army at nearby Ft. Richardson receives considerable support from AAC in the form of the AAC medical facility at Elmendorf AFB, aerial shipment facilities and aerial resupply missions, aerial supply and transport on field exercises, and many other support facilities of the command.

Maj. Gen. James C. Jensen became Commander, AAC, in 1963. A native of California, he won his wings in 1932. During World War II, he served with Air Transport Command and after the war in various operational and staff posts, including NORAD assignments. Before his present assignment he served as DCS/Operations, Hq. ADC.



The magnitude of AAC's support role may be better understood through the following statistics: Tenant organizations constitute thirty-two percent of the total work force, sponsor thirty-four percent of the military dependents, occupy thirty-two percent of the family quarters, twenty-eight percent of the bachelor units, and twenty-eight percent of all other inside space. They use seventy-eight percent of the aviation fuels, own thirty-eight percent of the aircraft on AAC stations, consume forty percent of all supplies, and use forty percent of the motor vehicles.

About one-fifth of the command's population is stationed on remote sites throughout the state, which are operated by AAC in support of the NORAD and ADC mission, which is the protection of the North American continent. These men and the equipment they operate must be supported, either completely or in part, by AAC aircraft, transportation, and supply activities.

AAC operates Shemya Air Force Station (near the end of the Aleutian Chain) for the sole benefit of tenants. Elements of ADC, the Army, Navy, and other governmental agencies are stationed there due to its location.

Point Barrow AFS, the northernmost military installation on the North American continent, is operated primarily for the benefit of the Navy-sponsored Arctic Research Laboratory and the ADC distant early warning (DEW) station there.



C-130s of Alaskan Air Command's 17th Troop Carrier Squadron comprise principal resupply pipeline, especially during winter months, for the one-fifth of AAC's personnel stationed at remote arctic sites. Dogsled teams meet incoming planes.

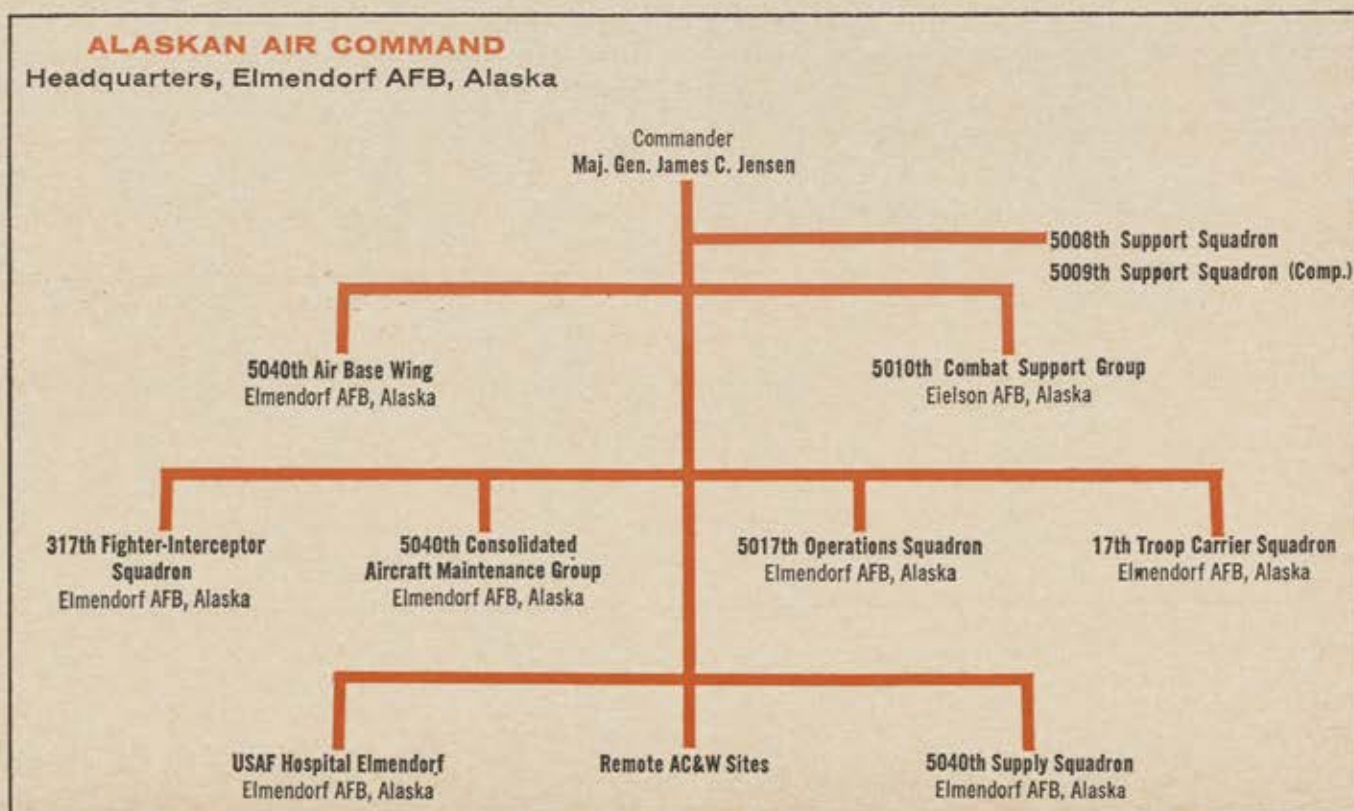
Eielson AFB, second largest Air Force installation in Alaska, is also operated primarily for the benefit of tenant organizations, such as the Strategic Air Command and the Military Air Transport Service's Air Weather Service. The base also supports the Air Force Systems Command's Arctic Aeromedical Laboratory at nearby Ft. Wainwright.

Another support mission AAC points to with pride is the support of two DEW sites on the Greenland ice cap by rotational detachments of AAC's 17th Troop

Carrier Squadron. Operating huge, ski-equipped C-130 Hercules aircraft, the 17th Squadron supplies every ounce of fuel, every stick of lumber, every ration of food, and, in fact, everything else that is used by the ice-locked sites in their mission.

AAC's 5040th Consolidated Aircraft Maintenance Group also keeps maintenance men and equipment at the Sondrestrom Air Base, Greenland, detachment to support the C-130s.

(Continued on following page)





Photographer trekked through snow in early Alaskan morning to take this striking picture, "Dawn at Tatalina," depicting the air-conditioned splendor of remote-site life.



In addition to flying resupply missions, C-123s of 5017th Operations Squadron, shown here taxiing on Elmendorf AFB ramp, work with Army forces in combat-readiness exercises.

In the past twelve months, AAC has participated in numerous exercises, including Polar Strike and Northern Hills, which were the largest of their kind to be held in Alaska.

Cpts. William A. Kuschel, Jr., and Robert W. Hawes of AAC's 5017th Operations Squadron set an Air Force record for total flying time in H-21 helicopters, logging 3,000 hours last October 2.

In October, AAC's newest squadron, the 17th Troop Carrier Squadron, conducted its first significant training exercise in conjunction with US Army Alaska troops, with a mass paratroop over the Claxton Drop Zone. And during October, AAC was the winner of the first annual Air Force Cost Reduction Award for Category II commands.



Ground crewman doffs gloves to perform maintenance chore on F-102 interceptor. Flight-line duties go on, regardless of weather, for planes and crews on constant alert.

Also in October, AAC participated in King Crab, an exercise that also involved active and Reserve Air Force outfits from California and Washington and US Army Alaska personnel.

Governor William A. Egan proclaimed Arctic Airlift Week in Alaska, October 25-30, and AAC was host to many arctic aviation pioneers, such as Col. Bernt Balchen, USAF (Ret.), as well as many US newsmen. The five days were packed with briefings, demonstrations, and travel in AAC aircraft to various remote sites within the state, and a deployment via the Polar Route to Greenland in AAC's C-130 aircraft.

Eighteen AAC units were honored last December for the part they played in the disaster relief and recovery program caused by the gigantic Alaskan earthquake of March 27, 1964. The units were awarded Air Force Outstanding Unit Awards.

Winding up 1964 activities of the Alaskan Air Command was "Operation Santa Claus," sponsored by the Air Force Sergeants Association. AAC aircraft and personnel visited nine remote sites in Alaska, and delivered toys and gifts to 2,000 Eskimo children.

During the past twelve months, AAC has conducted numerous air-defense exercises, and has proved itself capable of responding well and quickly adapting to any situation it has been confronted with, whether it be air defense or aerial resupply of ground forces.

Recognition of Alaska's strategic value as a military base of operations is increasing, and its worth in other areas due to its geographical location and proximity to so many of the world's capitals, make it even more valuable. The job of protecting it is one that could only be accomplished through the use of a well-trained air strike and theater counterair force capable of meeting an enemy over a vast rugged expanse of wilderness, where temperature extremes range from 70° F below zero to 90° F above, and the walk to the nearest help could cost you your life without special training. The Alaskan Air Command has these capabilities.—END

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CLIFTON STEPPER MOTORS

SIZE	8	8	10	10	11	11	8	8	8	11
LENGTH (M.F.)	0.770	0.770	0.770	0.770	1.215	1.215	1.062	1.112	0.770	1.215
WEIGHT (OZ.)	1.0	1.0	1.6	1.6	3.2	3.2	1.5	1.5	1.0	3.2
INERTIA (GM-CM ²)	0.19	0.19	0.19	0.19	0.77	0.37	0.18	0.45	0.19	0.77
INDEX ANGLE	90° ±3°	90° ±3°	90° ±3°	90° ±3°	90° ±3°	15° ±1°	90° ±3°	90° ±3°	45° ±2°	45° ±2°
TYPE	PM 2Ø	PM 2Ø	PM 2Ø	PM 2Ø	PM 2Ø	VR 3Ø	PM 2Ø	PM 2Ø	PM 2Ø	PM 2Ø
RATED D.C. VOLT.	28V	28V	28V	28V	28V	28V	28V	28V	28V	28V
RESISTANCE (OHMS/PHASE)	460	300	300	300	300	150	300	300	135 per PHASE	130 per PHASE
NO LOAD RESPONSE RATE PULSE/SEC	250	320	350	330	220	600	360	280	600	440
NO LOAD SLEW RATE PULSE/SEC	510	930	700	610	265	1600	375	650	2700	1200
HOLDING TORQUE OZ-IN ONE PHASE	0.37	0.35	0.50	0.53	1.1	0.60	0.80	0.58	0.60	1.5
DETENT, OZ-IN ZERO INPUT	0.12	0.05	0.05	0.13	0.24	—	0.17	0.10	0.05	0.12
TYPE NUMBER	MSA-8-A-1	MSA-8-A-2	MSA-10-A-1	MSA-10-A-2	MSA-11-A-1	MSA-11-A-1	MSM-8-A-1	MSL-8-A-1	MSA-8-A-3	MSA-11-A-2

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The Air Force Communications Service

MEETING increased demands for support of US operations in Southeast Asia and at the same time maintaining a global operation keyed activities of the Air Force Communications Service (AFCS) during the past year.

AFCS, the Air Force's most widely dispersed command, has upward of 50,000 people operating at more than 500 locations around the world, in forty-five of the fifty states and in thirty-six foreign countries, territories, and island mandates. Its mission is to provide communications, air traffic control, and air navigation services to the Air Force and other government and civilian agencies worldwide. Headquarters for the command are located at Scott AFB, Ill.

AFCS technicians are providing the full spectrum of its services in Southeast Asia. In addition, AFCS personnel were among the first deployed to the Dominican Republic in May, setting up communications and navigational-aid facilities to support the massive movement of US troops and equipment to the troubled area. They continue to operate there.

An AFCS "Talking Bird" communications package, transported in a Tactical Air Command C-130, served for three days as the initial command post for US operations in the Dominican Republic. AFCS also sent personnel and equipment from three of its mobile communications groups. These men provided mobile navigational aids and air traffic control service for the huge airlift operation and also local and long-range communications.

In addition, AFCS technicians worked with representatives of the Bendix Corporation to install a tropospheric-scatter communications link between Ramey AFB, Puerto Rico, and the Dominican Republic.

AFCS, which was established on July 1, 1961, provides five principal services:

- On-base communications that contribute to the efficient functioning of an air base. These include base telephone, intercom, fire and crash alarm, air police and security alerting systems, and on-base closed-circuit television.

- Long-line communications consisting of global

Maj. Gen. J. Francis Taylor, Jr., succeeded Maj. Gen. Kenneth P. Bergquist as Commander of AFCS in July 1965. Prior to the AFCS post, he had been Director of Command Control and Communications for Hq. USAF since 1962. In 1956, he commanded the Continental Airways and Air Communications Service (AACS) Area.



radio, teletype, and telephone networks that link Air Force activities around the world; special networks that provide communications for aircraft and missile early-warning systems; and, as a part of the Defense Communications System, the Automatic Digital Network (AUTODIN) and the Automatic Voice Network (AUTOVON).

- Air navigational aids, including radio ranges, direction finders, homing beacons, radar beacons, marker beacons, instrument landing systems, and tactical navigational aids.

- Air traffic control services, including the operation and maintenance of point-to-point and ground-to-air radio stations, airdrome control towers, and precision radar approach control services that permit aircraft operations under all weather conditions.

- Emergency mission support, an operation whereby the command deploys mobile communications, air traffic control, and air navigation facilities anywhere in the world.

To do its job, AFCS uses primarily two types of highly skilled Air Force technicians, informally called communicators and air traffic controllers.

Three Facility Checking Flights constantly perform service evaluation of the command's 1,500 air traffic control facilities and electronic aids to air navigation.

AFCS's command structure is functionally aligned to be responsive to Air Force needs. It includes two

subordinate headquarters called "communications areas"—comparable in size and mission to numbered air forces—with each having subordinate dependent regions, and five "communications regions"—similar to air divisions—which are considered independent in that they report directly to Hq. AFCS. The "areas" are European-African-Middle Eastern (EAME) Communications Area with headquarters at Lindsey AS, Germany, and commanded by Brig. Gen. Robert W. Paulson; and the Pacific Communications Area, headquartered at Wheeler Field, Hawaii, and commanded by Brig. Gen. Anthony T. Shtogren.

EAME subordinate regions are the United Kingdom, Central European, the Mediterranean, and Spanish Regions. In the Pacific, they are the Far East and Southeast Asia Regions.

Independent regions which report directly to Hq. AFCS are:

- TAC Communications Region at Langley AFB, Va., commanded by Col. Sam L. Huey.

- Alaskan Communications Region at Elmendorf AFB, Alaska, commanded by Col. Elmo A. Elliott.

- Eastern Communications Region at Westover AFB, Mass., commanded by Col. Robert W. Dickerson.

- Central Communications Region at Tinker AFB, Okla., commanded by Col. Harold L. Hughes.

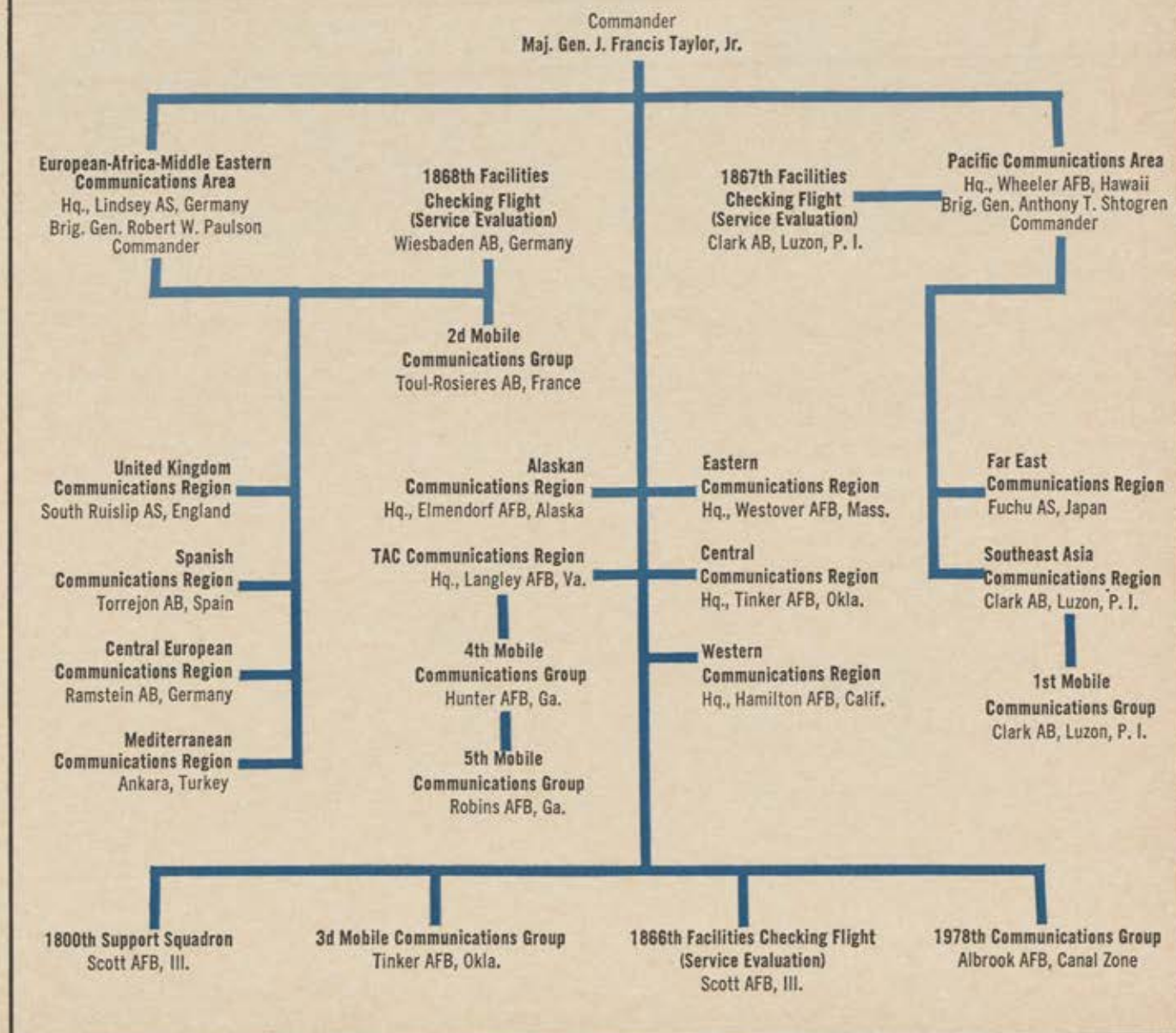
- Western Communications Region at Hamilton AFB, Calif., commanded by Col. Charles U. Brombach.

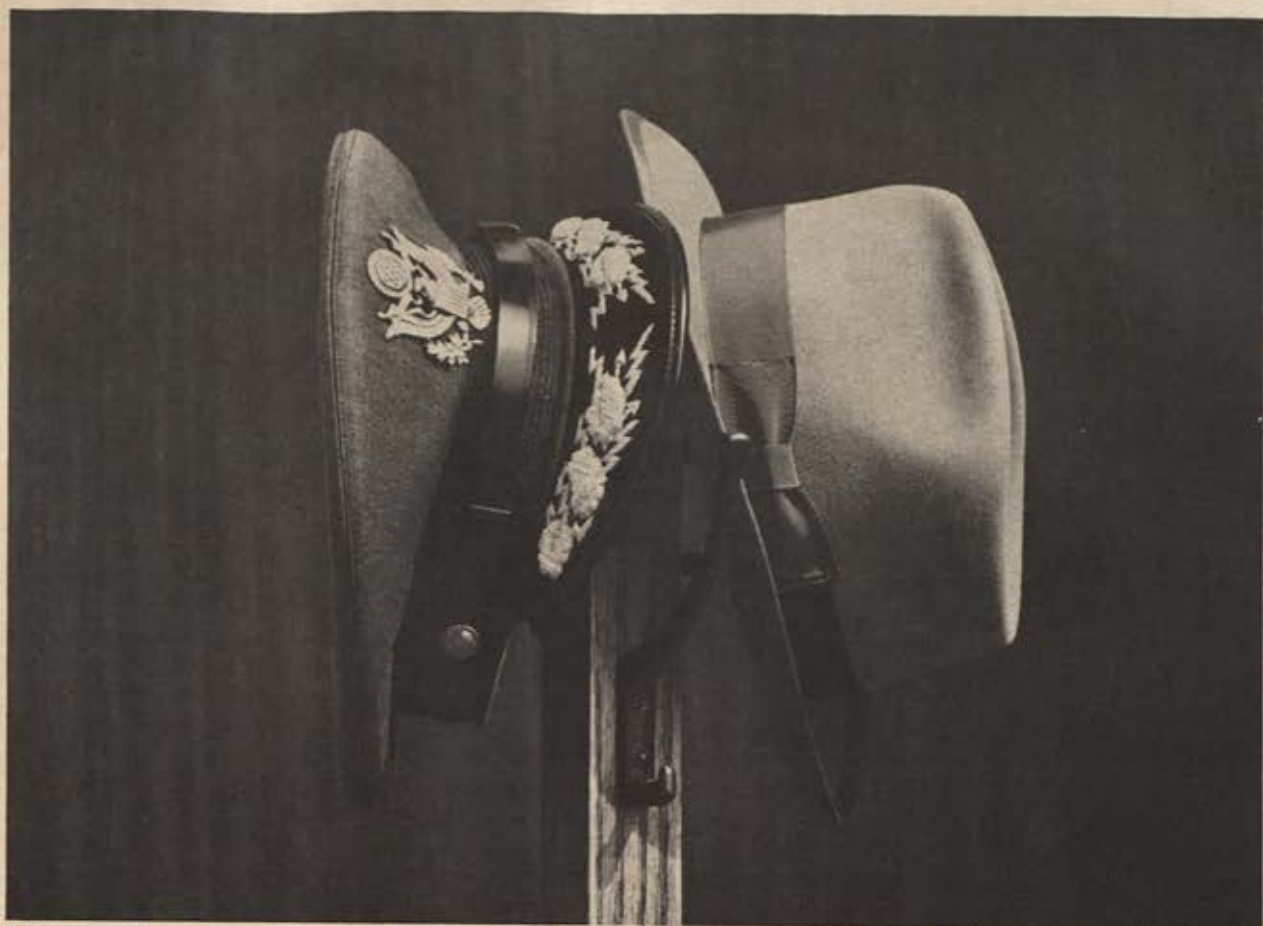
Commanders of the areas and Alaskan and TAC Communications Regions, as well as commanders of most other globally dispersed AFCS units, handle dual responsibilities—the performance of communications-electronics staff functions, and the direction of communications and air traffic control operations and maintenance. At each level, AFCS commanders are primarily responsible to the commanders to whom their units provide service. This "dual-hat" role is unique within the Air Force.

(Continued on page 159)

AIR FORCE COMMUNICATIONS SERVICE

Headquarters, Scott AFB, Ill.





When it comes to plug-in valves, the owners of these hats have a lot in common: they specify General Controls

There are compelling reasons for the growing use of modular plug-in valves in aircraft fuel, hydraulic and pneumatic systems.

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cost plus life maintenance costs ...finds that plug-in valves are often the optimum choice.

And there are compelling reasons for specifying plug-in valves from General Controls. For example, Douglas Aircraft Company, which specified "only the most reliable components" for its DC-9, selected General Controls valves.

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From stations at Clark Air Base in the Philippines and Wiesbaden AB, Germany, AFCS flies specially equipped C-140A JetStar aircraft to analyze the performance of electronic aids to navigation and evaluate air traffic control facilities.

AFCS regards its Reserve Forces personnel as a vital part of the command's total mission resource. There are 7,600 Air National Guard and Air Force Reserve personnel over which AFCS would be gaining command should these components be mobilized. These Guard and Reserve components are trained in the operation of fixed and mobile communications, air traffic control facilities, and air navigation aids. In addition, there are 125 M-day assignees to augment AFCS personnel in key positions throughout all levels of the command.

AFCS's ability to carry out its "service" role was effectively demonstrated in many areas during the past year.

AFCS technicians supported every major Air Force exercise during the year and many joint exercises. These included Gold Fire I, a joint Army-Air Force operation held in Missouri, October 29-November 13; Operation Ayacucho, a large combined-training defense exercise held in Latin America last December; Exercise Polar Strike, a joint (Air Force-Army) combined (US-Canada) training exercise held last February 4-17 at Big Delta, Alaska; Quick Kick VII, held March 22-April 15 on Vieques Island off the south-



Technician in AFCS channel and technical control facility on island of Guam checks circuit status indicator boards to ensure that lines are open for users of Defense Communications System between the US and bases in Far East.

eastern coast of Puerto Rico in the Caribbean; and Exercise Silver Hand, a joint Air Force-Army exercise held in Texas, May 1-15. Several theater exercises in overseas areas were also supported.

In the area of special support, AFCS mobile communicators and air traffic control technicians were deployed in December to the West Coast to aid in rescue operations in the Northern California flood disaster area. These men worked hand in hand with the Federal Aviation Agency to control both civilian and military aircraft in the disaster area.

Command personnel also supported the two manned Gemini flights, providing communications for emergency voice circuits and other communications needed in recovery operations.

AFCS, as a system manager, played a prominent role during the year in expansion plans for the Automatic Digital Network (AUTODIN). The system, which consists of five major CONUS switching centers, is being expanded to a nine-switching-center complex, and is scheduled to become the total common user communications network for the Department of Defense. AUTODIN is the world's most advanced digital

(Continued on following page)



Mobile communications vans, like one being loaded aboard C-124 transport, are kept in readiness for immediate deployment to support unified command operations anywhere.



This mobile tropospheric-scatter unit was set up in Puerto Rico in May by AFCS and Bendix technicians to provide communications link with US forces sent to Santo Domingo.

Men assigned to AFCS learn to adapt to jobs in widely varying climates. Some members of this team assigned to a site at Cimoni, Italy, carry skis to speed them home after work.



Roman-built sentry tower contrasts with tropospheric-scatter communications antennas of this AFCS site at Humosa, Spain. Three-fifths of AFCS personnel are stationed overseas.

data system. First of the new centers, at Hancock Field, N. Y., will be activated this fall.

In June of 1964, AFCS's Tinker AFB, Okla., Weather Relay Facility threw the switch that started operation to overseas points. The date marked the transfer of military weather communications relay from Travis AFB, Calif., to the central consolidated facility at Tinker, which now has direct contact over long-haul circuits to Alaska, Hawaii, and Japan. Air Weather Service, one of the subcommands of MATS, is one of AFCS's biggest customers.

In the area of operational effectiveness, AFCS was credited with validated savings of \$12.2 million during the FY '64 Cost Reduction Program against assigned goals of \$8.015 million. In addition, AFCS efforts on behalf of "host" installations resulted in validated savings of \$5,454,096.

AFCS made "big money" in its air traffic control-navigation aid operation. The command's air traffic

controllers, operating at bases around the world, were credited with saving 113 military and civilian aircraft during 1964. Of that total, ninety-nine were military aircraft valued at \$89,807,562. There were 371 persons, either passengers or crew members, on board the saved aircraft.

Saves are accredited by an Aircraft Save Review Board in cases where the assistance of the air traffic controller was paramount to successful recovery of the aircraft. Nearly 500 saves have been recorded in the brief four-year history of AFCS.

One unit, the 1936th Communications Squadron at Lajes Field, Azores, drew special praise during the year from Air Force Secretary Eugene M. Zuckert after personnel of the squadron successfully guided twenty Navy aircraft to safe landings under critical emergency conditions. All of the aircraft—from the US Navy attack carrier *Roosevelt*—were critically low on fuel and were diverted to Lajes because of adverse weather conditions.

All of the past year's activities point out once again the significance and importance of communications toward the accomplishment of Air Force missions worldwide. AFCS is proud of its role in operating aerospace communications, and the command will continue to have as its paramount purpose the full support of Air Force operations to assure maximum combat effectiveness. It seeks primarily to live up to the command motto—"Providing the Reins of Command."—END



Guiding aircraft to safe landing, whatever the weather, is the job of this RAPCON (radar approach control) technician, another of varied functions performed by AFCS.



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...or how great the dollar savings its extended life will produce

At Thiokol, we build rocket motors to last well beyond normal military requirements. Propulsion systems for Minuteman, Pershing, Sergeant, the Nike and Bullpup series and other major weapons, by Thiokol, now boast an average shelf life of about eight years. Life expectancy is still going up, and ultimate cost is coming down. Consider Minuteman first stage. Orig-

inally built for an in-service duration of three years, its life has been extended to five—and ten is predicted. Through the increased longevity of this single motor, the Air Force realized a savings of over 100 million dollars in 1964-65 alone.

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uting important economies to the Military and to the taxpayer, while maintaining high levels of reliable defensive power.

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The Air University

"BRAINPOWER for aerospace power" aptly defines the significant contribution made to national security by Air University (AU), professional educational center of the Air Force. This major air command, headquartered at Maxwell AFB, Ala., constantly builds its programs on changing technologies and anticipated needs of the future.

AU has occupied a distinctive position in the nation's defense structure for almost two decades. Its responsibilities have increased, its programs have broadened, but its far-reaching mission has remained basically unchanged. AU provides professional education for AF officers. It also operates as an AF doctrinal and research command in designated fields.

Lt. Gen. John W. Carpenter, III, assumed command of AU in August 1965.

The past year was a productive and meaningful period in AU's history. Two of its schools received the USAF Outstanding Unit Award. The Squadron Officer School (SOS), first organization of AU to win this recognition, was cited for its meritorious service in support of professional military education during January 1, 1962-December 31, 1963. The AF Institute of Technology (AFIT) at Wright-Patterson AFB, Ohio, was accorded the award for its high-quality, dynamic programs in 1964.

AFIT added other milestones to its educational accomplishments. School of Engineering highlights included occupying its new modern academic facility, successful operation of the Minuteman Educational Program for Launch Control Officers at Malmstrom AFB, Mont., and graduation of both the largest masters' class in its history (111 students) and its first masters' class in Systems Management. The School of Systems and Logistics and the Civilian Institutions Program paced their programs to meet increased DoD requirements successfully.

Passage of the ROTC Vitalization Act last October resulted in a streamlined on-campus AFROTC program. Participating institutions gained the option of selecting any one or all of three different programs: (1) the traditional four-year program, (2) a new two-year program, and (3) a financial assistance grant program for selected juniors in the four-year pro-

Lt. Gen. John W. Carpenter, III, assumed command of AU in August 1965. He came to the post from duty as Assistant DCS/Plans and Operations for JCS Matters. A 1939 graduate of West Point and a bomber pilot in the Pacific in World War II, he has spent most of his career in R&D. He formerly commanded the AF Flight Test Center.



gram. Full implementation of the new AFROTC system is expected during the coming year. In consonance with the space age, head officers at AFROTC detachments acquired new designations. Former professors of air science became professors of aerospace studies.

Warfare Systems School (WSS) conducted several classes in its five different courses with a total graduate output of 1,200. Pilot class of its new six-week Personnel Management Course, designed to cover the whole spectrum of the senior personnel officer's needs, was scheduled for November. AU's Aerospace Presentation Team, a WSS component, received the Air Force Association's Hoyt S. Vandenberg Trophy for distinguished service to the nation in the field of aerospace education. The team's outstanding 1964-65 academic year record included 274 live-audience presentations and seventy radio and television programs in 139 cities in thirty-eight states, with a total audience of approximately 10,000,000.

The Academic Instructor and Allied Officer School conducted three instructor classes with a total of 545 graduates. Fifty-one students, representing sixteen free-world nations, completed two Allied Officer Familiarization Courses (AOFC). Two Nigerian officers, the first representatives of the Republic of Nigeria in the AU system, were members of AOFC Class 65-A.

SOS conducted three classes, with a total graduate roll of 2,300. In Class 65-A, programmed instruction was initiated as a teaching technique for the Staff

Study Report. Use of this modern teaching method provided Air University savings through reduced instructor and curriculum time.

Air Command and Staff College (ACSC) Class of 1965, with a student body of 618, was graduated in June. Rapid rise in the educational level of ACSC students and their lack of combat experience necessitated several new educational techniques. Programmed learning entered the remedial program, field-trip exercises increased, and enrichment courses augmented the regular curriculum.

The 281-member Air War College Class of 1965 was the largest in the school's history. Programming for the class of 1966, which began in July, calls for the replacement of the student thesis program with a professional studies program. The college's Associate Programs continued to grow; 817 students were enrolled in the Correspondence Program, and sixty groups at selected bases participated in the Seminar Program.

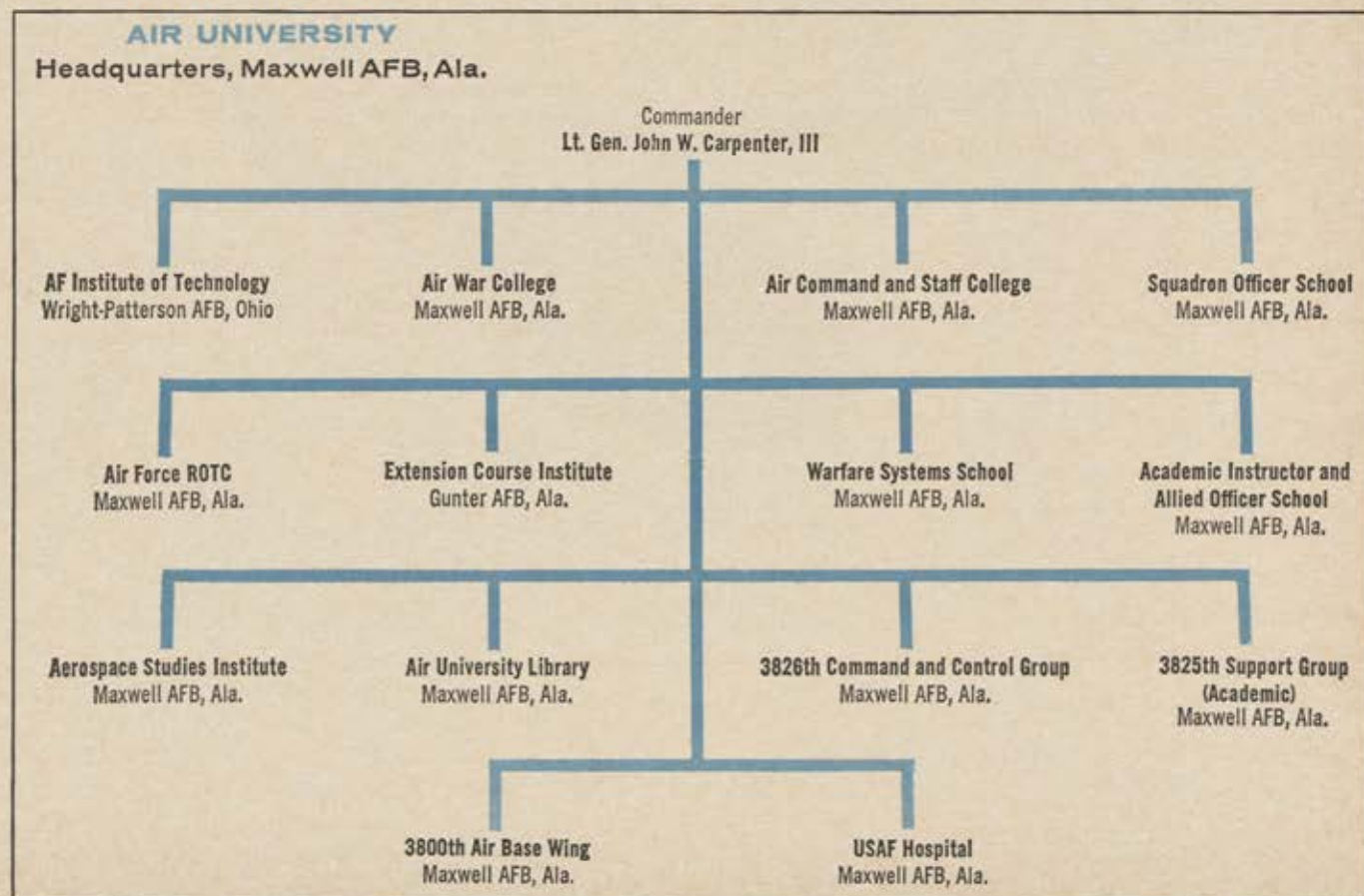
The Extension Course Institute adopted a new concept. A requirement that Career Development Courses be offered to prepare airmen for Specialty Knowledge Tests brought revolutionary changes in texts, mailing system, and evaluation techniques. And a speedy automation device, "the scanner," took over test grading.

AU played a major role in the development of the world's first multilingual astronomical dictionary, scheduled for publication in late 1965. Dr. Woodford A. Heflin, Aerospace Studies Institute, served as a coeditor and adviser for this international project. The lexicon will define in seven different languages space terms used in articles, digests, and schemata.



Air University "exports" information on new USAF concepts and philosophies through two traveling briefing teams. Above are, from left, Maj. George T. James, Jr., Lt. Col. Francis J. Sweeney, Jr., and Maj. Lester R. Hewitt, who tour US giving illustrated lectures on US space programs.

As AU rounds out its first twenty years of operation, its contributions to national defense become more and more evident. Only through its vital educational programs can the Air Force meet its ever-present need for top-quality officers in its chain of command. —END



From World War II to Gemini... Sikorsky is proud to be on the U.S. Air Force team.

The R-4, earliest of these six Sikorsky helicopters built for the nation's air arm, dates back to 1942. It performed utility and rescue work for the Army Air Corps during World War II. The latest U.S.A.F. helicopter, the amphibious CH-3C, is giving increased operational effectiveness to the Tactical Air Command.

The Air Rescue Service's version, the HH-3C, is backing up Project Gemini in recovery duties. Spanning 23 years, these products of Air Force-Sikorsky cooperation are a source of pride to us at Sikorsky.

We look forward to making even greater contributions to tomorrow's Air Force.



- A. **R-4** joined the Army Air Corps in 1942.
- B. **R-6** with advanced performance, followed in 1944.
- C. **H-5** joined inventory when the Air Force was born: 1947.
- D. **YH-18** joined the Air Force in 1951.
- E. **H-19** with combat capability, joined in 1952.
- F. **HH-3C** being used in Gemini, joined in 1964.



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The Continental Air Command

RESPONSIBLE for guidance and training of thousands of the nation's Air Force Reserve personnel—the men and women who fill the dual role of citizen-airmen—the Continental Air Command (CONAC) is one of the Air Force's largest major air commands.

Commanded by Lt. Gen. Cecil H. Childre, CONAC is divided into six geographic regions. Immediately subordinate to the regions are sixteen Air Force Reserve Sectors which administer the Air Reserve units in their particular areas. Flying units of the command—Reserve troop-carrier wings and air-rescue squadrons—mobile communications units, and medical units are directly under Reserve Region headquarters for administrative supervision. Supervision of their training and inspection is the responsibility of the major air commands to which they are assigned in the event of a call-up in a national emergency.

There are fifteen Air Force Reserve troop-carrier

Lt. Gen. Cecil H. Childre, who became Commander of CONAC in August 1965, was Commander of the 315th Air Division in Japan during the Korean War and served as TAC's Deputy for Operations in 1960. He was Assistant Deputy Chief of Staff for Plans and Programs and later, Personnel, at Hq. USAF.



wings within CONAC. Twelve are equipped with C-119 Flying Boxcars, two with C-124 Globemasters, and one with the C-123 Provider assault-type aircraft. TAC is the gaining organization for the C-119 and C-123 units. The two C-124 wings would become part of MATS if called to active duty. There are Reserve troop-carrier units in twenty-five of the forty-eight continental states.

In addition, five air-rescue squadrons, whose gaining command is MATS, are stationed throughout the nation. Though comparatively small in size, these rescue units fly many search-and-rescue missions. Each rescue unit has about 100 officers and airmen and four HU-16B Albatross aircraft. Two of the five units are programmed to receive HC-97 aircraft next year.

During the past year CONAC's Air Force Reserve flying units and their supporting elements have repeatedly demonstrated their "Ready-Now" capability.

Volunteer aircrews of Reservists have airlifted cargo over 16,000,000 ton-miles and flown some 4,000,000 passenger-miles in direct support of the Air Force in the last twelve months.

While flying overwater training missions to such destinations as South Vietnam, Japan, Thailand, and the Philippines, C-124 Globemaster crews completed some 150 flights over MATS routes, airlifting cargo 11,750,607 ton-miles.

During the crisis in the Dominican Republic, Reservists flew some 1,800 missions totaling more



US Army airborne troops are regular customers of C-119 crews of the Air Force Reserve. Of the Reserve's fifteen transport groups, twelve are equipped with C-119s. In the past year, aircrews flew 4,000,000 passenger-miles and 16,000,000 cargo ton-miles on CONAC-directed missions.

than 16,000 hours in direct support of TAC and MATS, airlifting cargo more than 4,865,355 ton-miles and flying over 4,427,900 passenger-miles.

C-119 Flying Boxcars were used to haul the bulk of the cargo and passengers with C-123 Provider and C-124 Globemaster units also involved in the operation.

Many humanitarian missions were recorded during this period. During the flood disaster in Colorado early this summer, Air Force Reserve aircraft airlifted 60,000 pounds of emergency supplies into the stricken area. Other mercy missions were recorded last winter when weather extremes created desperate situations in Montana and states west of the Rocky Mountains.

In Montana, subzero weather and heavy snow isolated hundreds of ranches. Reservists flew many missions and dropped food for about 100,000 starving cattle.

In late December, rains brought floods to five West Coast states. The day after Christmas, Northern California received the brunt of the flood damage. Again Air Force Reservists mounted a full-scale effort and responded to the disaster. About 170 troop-carrier aircraft funneled more than 965 tons of relief supplies into the area.

Another significant achievement was registered by the 433d Troop Carrier Wing, Kelly AFB, Tex., when the Reservists developed the "Alamo Slingshot," a new improved method of airdropping heavy cargo. The development of the new method earned the wing the first Air Force Outstanding Unit Award ever presented to an Air Force Reserve organization.

Region and Sector headquarters are manned jointly by members of the Regular Air Force and of the Air Force Reserve. Units below Region and Sector are



Space vehicle model, on display in New York City during Air Force Reserve medical symposium last spring, is examined by Maj. Anne Stubbs and 1st Lt. Patricia McGuire, AFRes nurses, who were among more than 400 members of CONAC's 132 medical-service units attending the session.

manned by Reservists, with a small active-duty advisory staff.

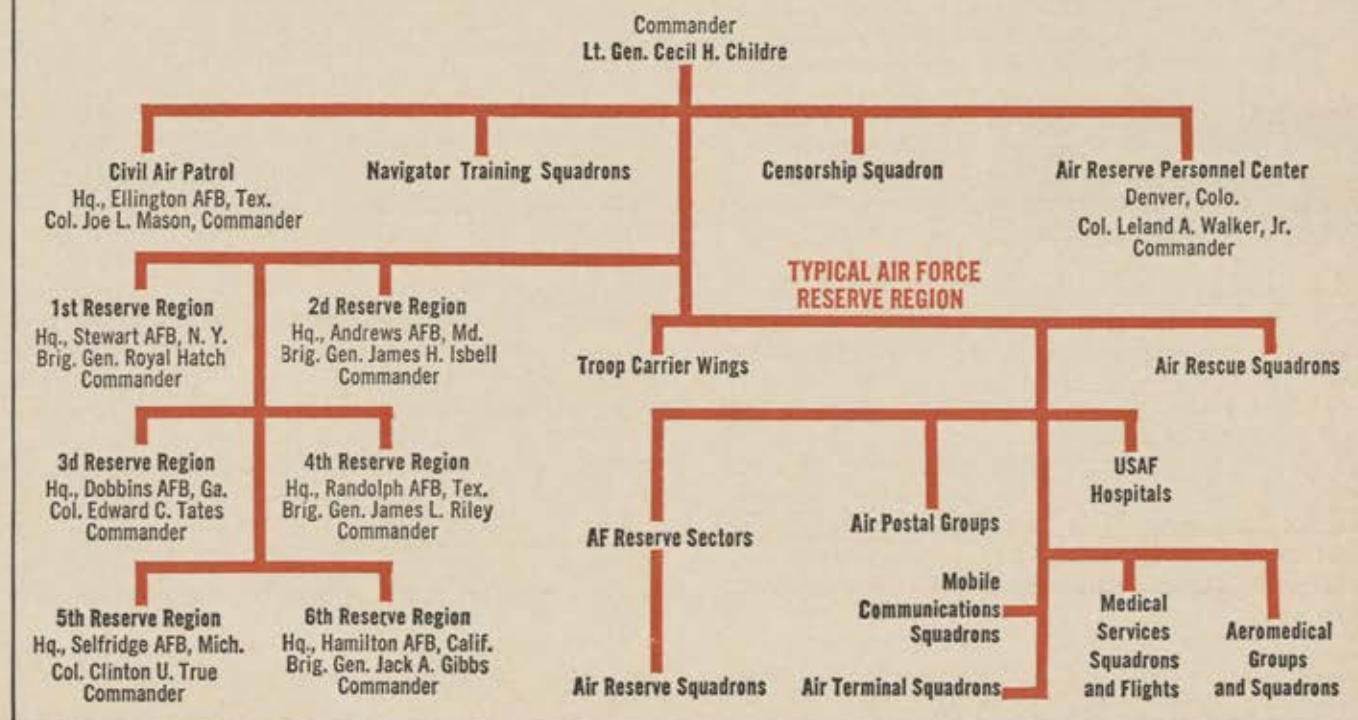
The Air Reserve Personnel Center (ARPC), formerly the Air Reserve Records Center, located at Denver, Colo., is a major component of CONAC. ARPC holds the personnel records of more than 350,000 Reservists. All changes and actions affecting this mountainous volume of records are the responsibility of ARPC personnel.

In addition to Reserve flying and administrative units, CONAC supervises numerous support-type organizations including medical, mobile communications, and air terminal units.

(Continued on following page)

CONTINENTAL AIR COMMAND

Headquarters, Robins AFB, Ga.





Crewmen of Reserve's 442d Troop Carrier Wing, Richards-Gebaur AFB, Mo., preflight their C-124 Globemaster for a cargo mission to Saigon. Air Force Reserve's two C-124-equipped wings airlifted almost twelve million cargo ton-miles in the past year in 152 overwater flights for MATS.

Flight engineer Howard N. Rakestraw monitors instrument panel in his C-124 en route to Saigon.



Capt. Richard G. McMahon, C-124 aircraft commander in 442d Wing at Richards-Gebaur AFB, has logged more than 4,300 hours as military pilot, plus 1,500 hours in civilian aircraft.

The Civil Air Patrol (CAP) operates under CONAC guidance. Organized in 1941 by air-minded civilians, CAP is a federally chartered, nonprofit corporation and an auxiliary of the Air Force. It is governed by a national board of senior members and fifty-two wing commanders. Its mission is to sponsor educational and training programs for adults and youths; to participate in USAF-authorized search-and-rescue missions; to assist government agencies in domestic emergencies and disasters, nationally and locally; and to cooperate with civil defense organizations and the Air Force Reserve.

CAP is composed of more than 86,000 members, including more than 52,000 teen-age (cadet) members. There are 9,285 FAA-licensed pilots in CAP and 14,900 radio stations—fixed, mobile, and airborne.



A2C Joe B. Stone, loadmaster of a Reserve C-124 based at Robins AFB, Ga., checks cargo his crew will deliver to USAF detachment in Thailand.

South Vietnamese mechanic adjusts an engine at Saigon under direction of Maj. Judson H. Whitlinger, pilot of Reserve C-124 crew from Richards-Gebaur AFB, Mo.



Their equipment boasts an inventory of 4,304 aircraft and 4,500 vehicles. Civil Air Patrol pilots flew 9,247 sorties in the US for a total of 18,607 hours in 1964 in support of USAF-authorized search-and-rescue missions. CAP was credited with nearly sixty-nine percent of all flying hours expended in the search-and-rescue effort coordinated by Air Rescue Service, Orlando AFB, Fla., during 1964.

The primary responsibilities of CONAC are command; operational control; and budgetary, administrative, and personnel support of all Air Force Reserve units and individual trainees. Special missions include supervision and liaison responsibilities for CAP, coordination of Air Force plans in domestic and civil emergencies, Air Force representation on civil defense boards, cooperation with the Army and Navy in basic plans for defense other than air defense, Air Force representation on state Reserve facilities boards, liaison with Selective Service, supervision and implementation of the Air Force program of cooperation with the Boy Scouts of America, and certain added responsibilities delegated in USAF war plans.

The dedication of the individual Air Force Reservist and the training he receives are the mainstays of the "Ready-Now" Air Force Reserve. Training programs are revised frequently to assure the gaining commands that the Air Force Reservists who may some day be stepping into their ranks are truly "Ready"—whether it be today, tomorrow, or years from now.—END

Reeves



For Radar/Electronic Systems...

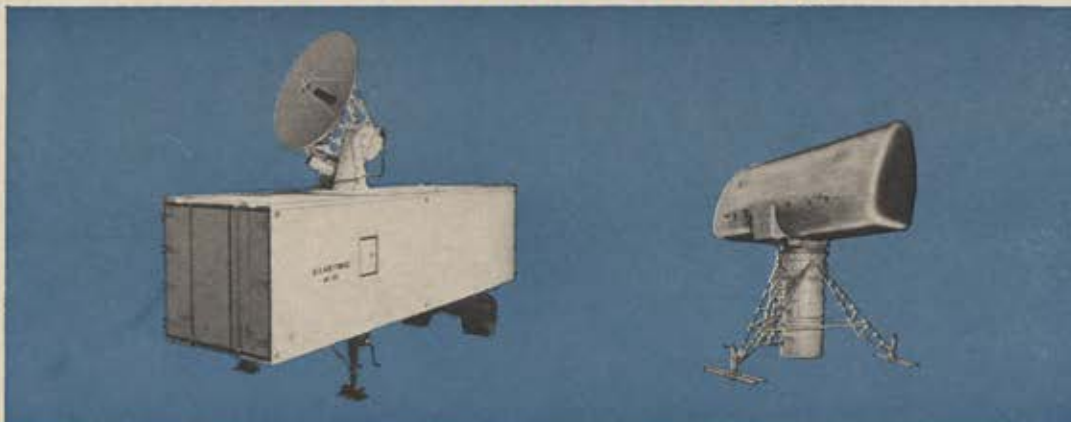
Reeves Instrument Company, a total capability organization in the field of RADAR/ELECTRONICS — providing design, development, production of — Range Instrumentation — Tactical Radars—Satellite & Spacecraft Tracking Radars—Analog Computers — Aerospace Components.

Reeves facility at Garden City, nearly half million square feet, includes a modern antenna testing range; radar testing facilities; and modern precision machine shop; complete system production capabilities; and advanced materials and environmental testing laboratories. With over

1100 staff personnel, Reeves engineering, production, testing, quality assurance and estimating groups provide one of the most effective RADAR/ELECTRONICS operations in the country.

Proof?—Every major government agency, aerospace company, and research institution involved with RADAR/ELECTRONICS has turned to Reeves for the design and production of advanced systems. Among them: U.S. Air Force, U.S. Navy, NASA, FAA, AEC, Grumman, Boeing, Ling-Temco-Vought, M.I.T., Bell Aircraft, and others.

ALL WEATHER WEAPON DELIVERY SYSTEM REEVES AN/MSQ-35(A)



The Reeves AN/MSQ-35(A) is the most modern automatic tracking radar and computer facility now available. This tactical system can provide precision automatic control and armament release of airborne weapons from all type military aircraft. The system is mobile and air transportable and designed to increase the accuracy of the U.S.A.F.'s All Weather Weapon Delivery capability. All aircraft missions such as navigation, surveillance, reconnaissance, etc. can be guided and/or controlled and monitored from this advanced ground radar command post.

The AN/MSQ-35(A) features:

- An S-Band search and acquisition radar including IFF — SIF and MTI
- A precision X-Band tracking radar with the new low level cartesian tracking system
- A completely automatic guidance and weapon delivery computer
- VHF ground-air communications

Complete AN/MSQ-35 All Weather Weapon Delivery Systems can be delivered to the U.S. Air Force six (6) months after receipt of order.

Reeves

REEVES INSTRUMENT COMPANY
Garden City, New York
Division of Dynamics Corporation of America

DCA

8 steps to acquiring a better memory...



* Disc mass memory, that is.

For "time-sharing" and other applications where various computer systems must draw upon one large-capacity, central memory file designed for continuous and virtually instantaneous information processing, the LIBRAFILE 4800 mass memory produced by Librascope Group of General Precision, Inc., offers many remarkable new features. Consider the following before you buy or specify:

Step 1. Consider Capacity:

Where an extremely large amount of data must be stored, the memory element of the LIBRAFILE 4800 has an initial capacity of 400 million bits of information with expansion capability to 6.4 billion bits on a single trunk line.

Step 2. Inquire About Access and "Time Sharing":

The technique of information retrieval used by the random-access 4800 is either fixed-address or record-content search, depending on the master-control electronics used. Average access time is 35 milliseconds. Search by record-content is an exclusive technique that permits any desired field to be used as the access key so that where the data is stored need not be known; only what information is needed. Costly flagging and table look-up are

eliminated and simultaneous off-line search is permitted. The 4800 can be easily incorporated into time-sharing computer networks.

Step 3. Consider Flexibility:

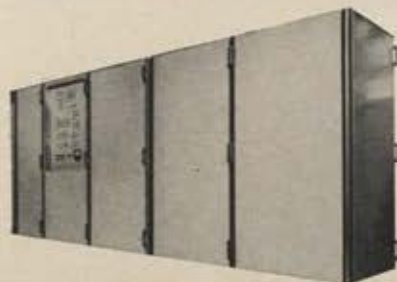
The LIBRAFILE 4800 mass memory can be used with any data processing system, whether already in use or scheduled to be installed in the future to provide faster, more accurate, more reliable operation with greater storage capacity.

Step 4. Inquire About High Transfer Rates:

The Series 4800 disc files can be organized to transfer data at rates from 1 million up to 160 million bits per second. This is accomplished through multiple-head read/write operations. (The 4800 discs have one head for every data track.) Through adaptation of special electronics, data rates approaching 1 billion bits per second are possible for special applications.

Step 5. Ask About The Manufacturer's Experience:

Behind the LIBRAFILE 4800 mass memory is the extensive background and 28-year history of Librascope Group of General Precision, Inc., in computer equipment and components.



Step 6. Check The Equipment's Performance Record:

LIBRAFILE 4800 mass memories are a key part of a General Precision/Librascope data processing system in Headquarters USAF's 473L command-and-control system in the Air Force Command Post at the Pentagon. More than a million headbar hours have been logged without a single head-bar failure. And, a scheduled installation for a scientific laboratory will provide a common data base for eight powerful computers, enabling many scientists and engineers to "share" the system on virtually a simultaneous basis. The 4800, in this instance, will help replace magnetic-tape equipment twelve times more costly and which must now be manually monitored to provide the data base.

Step 7. Request Detailed Information:

Write today for our brochure showing applications, typical configurations, and complete specifications.

Step 8. Call or Write Us:

The quickest and surest way to acquire a better memory (a LIBRAFILE 4800 mass memory) is to contact our Marketing Department. The address is shown below.

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'Ready' Partner to Several Major Air Commands . . .



The Air National Guard

IF CREDENCE can be attached to the Cervantes adage, "The proof of the pudding is in the eating," the active Air Force must have certainly relished its diet of operational accomplishments catered by the Air National Guard during the past year.

It has been a year of action for the Air Guard: action—in reaching a state of readiness never before believed possible of a reserve force, and action—in lending a significant assist to the Air Force during periods of heightened world tension, while still remaining on inactive status.

Although it was just a few years ago that Air National Guard aircraft were limited to overflying US territory, it is now not at all unusual to see Air Guard planes in such unlikely spots as South Vietnam, Turkey, Korea, Greenland, Libya, France, and other far-flung locations. Air Guard tactical fighter and reconnaissance squadrons, supported by their own refueling aircraft, range to European and Alaskan bases in training exercises.

Air transports of the Guard last year averaged more



After nine years at the helm of the Air National Guard, Maj. Gen. Winston P. Wilson, in September 1963, was named Chief of the National Guard Bureau, first Air Guardsman in that post, where he reports to Secretaries of both Army and Air Force in administering 400,000-strong Army Guard and 75,000-man Air Guard.

Brig. Gen. I. G. Brown succeeded General Wilson as Assistant Chief, National Guard Bureau, for Air National Guard. A wartime transport pilot, he was Air Guard liaison at Air Defense Command and Executive Secretary, Air Reserve Forces Policy Committee, before assuming his present post.



Hawaii Air National Guard, armed with F-102 interceptors, maintains around-the-clock alert as primary air defense force for the fiftieth state and its military and naval bases. In background is dormant Koko volcano, an estimated million years old, but youngest crater on Oahu.

than 100 overwater flights a month outside the continental US, delivering vitally needed supplies and equipment to our forces and friends overseas. Air Guard air commando and tactical control units are sent out of the country to orient and acclimate themselves to alien situations and to test deployment readiness. Aeromedical teams assist their Air Force counterparts in evacuating Americans to Stateside hospitals.

Meanwhile, at home, twenty-one ANG fighter-interceptor squadrons and six aircraft-control-and-warning units maintain crews and aircraft on alert twenty-four hours a day for the Air Defense Command. In the state of Hawaii, the entire Air Force air defense system is operated by Air Guardsmen. Elec-

(Continued on following page)

Members of an Air Guard communications construction unit splice an underground telephone cable during field training at an active Air Force base. By helping to maintain USAF's communications network, Air Guard training dollars pay double dividends.



On training tour in Panama, medics of West Virginia commando unit help USAF doctor treat a patient.

tronics and communications construction squadrons of the Guard lend support to the Air Force's vital communications network.

Whether internal or international in scope, the Air National Guard is ready to, and actually does, assist the Air Force in a great many of its undertakings.

The Air Guard is made up of 75,000 officers and airmen based in every state, plus Puerto Rico and the District of Columbia. Its command structure is unique. In peacetime, units are under command of the governor of each state, but when mobilized become part of the regular Air Force establishment. Operations and training are supervised by the Air Force and the major air commands to which units would be assigned upon mobilization orders of the President.

Acting as intermediary between the federal and state roles of the Guard is the National Guard Bureau in the Pentagon, which oversees the organization and equipping of both the Army and Air National Guard. Air Force Maj. Gen. Winston P. Wilson is the Bureau Chief. Brig. Gen. I. G. Brown is General Wilson's assistant for the Air National Guard.

If any one aspect of Air Guard operations can be highlighted over the others during the past year, it would probably be the tremendous effort exhibited by the air transport units. Upon the completion of Guardlift I, which saw the air transport units airlift more than 10,500 Army Guardsmen to 1964 summer field training, a request for assistance came from the Military Air Transport Service. Heavily engaged in operations in Southeast Asia, MATS asked the Air Guard to augment its worldwide airlift mission. In addition to making actual flights into some of the trouble spots around the globe, Guard air transport units took up

the chore of flying many regular MATS scheduled runs. This assist was given in cases where regular Air Force aircraft were diverted from their scheduled flights to respond to emergency situations. Santo Domingo upheavals further committed MATS, and the Air Guard kept right on the job throughout the year.

As a result of this assistance, air transport units of the Guard shattered just about every previous Guard record in airlift operations. They flew more than 1,350 overwater flights outside the US and during one three-month stretch airlifted nearly 4,500 tons of cargo. Gen. Howell M. Estes, Jr., MATS Commander, personally commended the Guard effort.

In early May, the Oklahoma Air National Guard's "Talking Bird" deployed to the Caribbean to support US forces landing in the Dominican Republic. Packed with electronics equipment, this flying command post can go almost anywhere in the world to provide communications for contingency or emergency situations. Operating from Ramey AFB, Puerto Rico, the Bird alternated with a similar aircraft from Tactical Air Command, providing the Commander in Chief, Atlantic, over-all commander of the operation, with a vital communications link to the US.

Air Guard and ADC fighter-interceptors are once again actively firing weapon systems during annual deployments to Tyndall AFB, Fla. Halted over a year ago by Air Force directive, the program was begun anew to realistically ensure that weapon systems are fully reliable and operational.

A second air refueling wing, the 136th ARW, was organized in February. Actually no new units were created, but a realignment of established units resulted. The move came about to accommodate additional refueling requirements of increased global assignment capabilities of Air Guard tactical aircraft.

Guardlift II began early in 1965 and is the largest air mobility exercise ever undertaken by a Reserve component. Slated to end in September, the exercise will see Guard transports airlift more than 24,000 military personnel.

In addition to these federal actions, the Air Guard has been almost continually committed to state activities. Flood-ravaged communities in California and the Midwest received rescue and relief aid from Air National Guardsmen. Vice President Humphrey surveyed flood damage from a Guard aircraft. Reconnaissance units in Alabama have been involved in a photomapping project encompassing soil erosion and a defense highway system. An Air Guard transport, working with the Federal Aviation Agency, guided a disabled civilian airliner with forty-five passengers aboard to a safe landing. And the achievements go on.

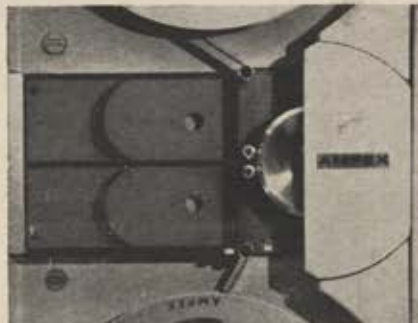
Establishing proof of their prowess, Air National Guard units have maintained an average passing rate of ninety-seven percent for federal inspections and ninety-four percent in operational readiness inspections during the past three years. Of 132 ORIs which the Air Force requires for combat-ready certification, Air Guard units have passed 124.

In essence, the Air National Guard is truly our readiest Ready Reserve Force.—END

Announcing a new generation of instrumentation products. The "first family" in magnetic recorders.

New Ampex 1600 series: a matched family of 2 Mc recorders—the first recorders designed to work together to improve overall systems performance. The 1600 lab-type, portable and airborne recorders feature full 2 Mc record/reproduce capability with near-absolute time base accuracy. This makes it possible to gather and re-create with great precision more usable data on any recorder in the family.

All 1600 recorders feature an important design innovation: a new, fast-response servo that gives a Time Base Error of ± 0.5 microsecond at 120 ips when reproduced on the lab recorder; a TBE of ± 2.0 microseconds when reproduced on the airborne and portable units. All offer direct and wideband FM recording. Envelope delay is uniform over the pass band.



FR-1600 Lab-Type Recorder

Unique vacuum drive system insures stable tape motion; reduces ITDE, TBE; minimizes flutter to less than 0.2%. Reels up to 16 inch for 33% more playing time. Up to 14 channels of record and reproduce in one cabinet.



AR-1600 Airborne Recorder

Operates up to 70,000 feet. A rugged, compact 14 channel recorder and reproducer with coaxial 14 inch reels. Flutter: less than 0.3%. Aircraft environment and power.



PR-1600 Portable Recorder

For field, van, shipboard and submarine use with performance same as AR-1600. 60 cps, 400 cps or 28 v.d.c. power.



**Also Ampex FR-1800:
a new 1.5 Mc recorder.**

The FR-1800 is a virtually fail-proof recorder featuring full compatibility with 1.5 Mc, 300 Kc Direct—Wideband 400 Kc FM—Standard band 20 Kc FM, Frequency Shift Modulation and Pulse Duration Modulation. The transport eliminates 60% of the parts found in comparable recorders. Result: new reliability, reduced maintenance and parts inventory. Excellent time base accuracy and low flutter substantially improve system performance. A fast-response, servo-controlled zero loop capstan gives a TBE of less than ± 4.0 microseconds at 120 ips. ITDE: ± 0.3 microsecond at 120 ips. Flutter: 0.25% from 0.2 cps to 10 Kc. For complete details on the FR-1600 series and the FR-1800 recorder, write Ampex, Redwood City, California.

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We thought our light metals were flying pretty high 20 years ago.

Since World War II, our light metals have come a long way. But even then they were essential for military use. At that time, magnesium was declared the nation's top strategic metal. And Dow, as its largest and oldest domestic producer, was looked to as a major source of technical information and material. Magnesium's light weight and relatively high strength made it ideal for castings for aircraft wheels and engine parts. Wrought magnesium was utilized in wings, fuselages and accessories.

But even the sky's no limit now.

Now we are involved in the Gemini program. The adapter module of the recent 4-day orbiting Gemini 4 was 85% magnesium. Made of special magnesium alloys developed by Dow for use at elevated temperatures, it performed perfectly through the entire orbital flight.

Obviously, light metals have a great future ahead of them. And wherever they go, we'll be a part of it. Government Affairs Department, The Dow Chemical Company, Midland, Michigan.





The United States Air Forces Southern Command

THE US Air Forces Southern Command (USAFSO), with headquarters at Albrook AFB, Canal Zone, is the representative of USAF for operations throughout Latin America and the air component of the unified US Southern Command (USSOUTHCOM).

USAFSO efforts increased during the past year as the result of growing unrest and activity throughout the area. Highlighting the command's growing operational efforts during the year was the airlift of more than 400,000 pounds of supplies and equipment to earthquake-torn El Salvador and the airlift of troops and equipment to the Dominican Republic from Brazil, Honduras, Nicaragua, Paraguay, and Costa Rica as part of the Organization of American States Inter-American Armed Forces.

The over-all mission of USAFSO, under the command of Maj. Gen. Robert A. Breitweiser, centers on conducting planning and operations as directed by

Maj. Gen. Robert A. Breitweiser assumed command of USAFSO September 30, 1963. A native of Missouri and a 1938 graduate of West Point, he won his wings in 1939. He saw combat in China-Burma-India theater during World War II, served in staff and operational posts, and became Assistant Chief of Staff, Intelligence, at Hq. USAF in 1961.



the unified commander, and assisting in developing Latin American air forces.

The command's area of responsibility is approximately 2½ times the size of the continental US—extending from the southern border of Mexico to the southern tip of South America.

USAFSO exercises command over US Military Groups in Argentina, Chile, Colombia, Paraguay, Peru, and Uruguay and advises and assists in the development and implementation of military assistance plans and programs (MAP) in Latin America as well as providing air defense for the Canal Zone and airlift support for US Southern Command activities.

In December of last year, USAFSO played an important role in Operation Ayacucho, a Latin American defense exercise which employed forces from six Latin American countries and the US. More than 7,000 military personnel from the participating nations took part in the large-scale maneuvers held in Peru.

The 5700th Air Base Wing, with headquarters at Albrook, is unique in that it also operates Howard AFB, twenty minutes away on the west side of the Canal. The wing provides logistic support for the command throughout Latin America and has achieved a three-year accident-free flying record.

A most important program undertaken by the command is that of Special Air Operations Planning and Training. Training is not limited to the counterguer-

(Continued on following page)



NASA Astronaut David R. Scott, an Air Force pilot, stirs the fire in his lean-to in the dense Panama jungle as he prepares his evening meal while undergoing survival training at USAFSO's Tropic Survival School, Albrook AFB, C. Z. All US astronauts are graduates of the week-long course.



Technical adviser of USAF mission to Bolivia instructs crewmen in engine repair. Working alongside their local counterparts, US airmen help improve hemisphere defense.



When real emergency arose during preventive medicine trip to Panamanian village, students in USAF School for Latin America carried victim to airstrip for flight to hospital.



Nicaraguan troops board USAF C-130 to be flown to Dominican Republic as part of the inter-American force assembled under leadership of the Organization of American States.



Responding to call from revolution-torn Dominican government, Nicaraguan troops prepare to board transports. USAFSO coordinated OAS airlift of all Latin American forces.

rilla phase, but also includes civic action activities. It is conducted by the 605th Air Commando Squadron, located at Howard AFB, which sends out Special Air Operations Mobile Training Teams into Central and South American countries that have requested training assistance.

USAFSO places considerable emphasis on strong civic-action programs by providing training, equipment, technical assistance, and encouragement to Latin American air forces to help them expand and continue their own civic action programs.

One of the most effective ways of introducing USAF standards of technical competence to Latin American air forces is through the USAF School for Latin America, operated by USAFSO at Albrook AFB. The school has the capability to provide training in thirty-one different subjects to approximately 500 Latin American students a year, both officers and airmen.

Another training program at the school is the Preventive Medicine Training Program under which five-man teams receive six months training and, provided with medical equipment and supplies, go home to function in dispensaries in underdeveloped areas.

Tropic survival training is conducted at the USAFSO Tropic Survival School located at Albrook AFB. All USAFSO flying personnel receive this training. The school trains pilots of the Army, Navy, Marine Corps, Latin American air forces, and other federal agencies.

USAFSO is responsible, through its Rescue Coordination Center, for providing search-and-rescue (SAR) services, both sea and air, in the USSOUTHCOM area. More than 100 SAR missions were conducted in the Panama area during the past year. Latin American air force personnel are also being trained in rescue techniques.

USAFSO continued expanding to meet its increasing responsibilities in turbulent Latin America. A major feature of this expansion has been the buildup of the Air Commando personnel and aircraft. Another significant step was the return of Howard AFB from the Army and the subsequent modernization and expansion of facilities, which are still under way.

USAFSO faces a unique challenge in the imposing task that lies ahead—one requiring the most efficient employment of those USAF resources that can be made available to the theater and demanding the energetic and direct application of the full efforts of the command.—END

CAE



CONTINENTAL POWER

world's first twin turboshaft power package

The Continental Model 217A-2 (Military designation XT67-T-1) twinned powerplant is being flight-tested in a modified Bell Iroquois helicopter. This powerplant consists of two 770 horsepower free turbine engines joined to a common output shaft through an integral power sharing controlled combining gearbox.

The powerplant is designed to deliver any combination of engine output from either or both engines without impairing the system transient performance. Thus, an individual engine shutdown or start can be accomplished automatically, and with no compromise of the delivered horsepower or speed up to the maximum capability of the other engine. Unlike conventional twin engine installations, the Model 217A incorporates an automatic power sharing system that permits the pilot to operate his helicopter just as though it were a single engine vehicle.

This twinned powerplant is another aviation first for Continental, where research and development is focused on one objective . . . to produce the ultimate in dependable, high performance powerplants.



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High-speed Automatic Data Recorders shown monitoring performance of U. S. Air Force development engine during test.

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where high thrust-to-weight ratio developments are paving the way for advanced propulsion systems.



WRIGHT AERONAUTICAL DIVISION • CURTISS-WRIGHT CORPORATION



Headquarters Command

NO OTHER command has as varied a mission as USAF's Headquarters Command, "HEDCOM." Serving as the official USAF representative in the nation's capital, it also supports Hq. USAF and special activities and field extensions in more than 600 locations around the world. Air Force personnel in such diverse activities as FAA, DSA, NASA, MAAGs, NATO, and other unified commands and organizations are all assigned to HEDCOM.

The command's two bases in the Washington area are Andrews AFB, one of our nation's busiest airports and home base for the Presidential aircraft; and forty-seven-year-old Bolling AFB, the scene of some of the most memorable events in aviation history and now a busy administrative base.

The command had responsibility for all Air Force participation in the last Presidential Inauguration. Starting nearly two months before the ceremony, officers and airmen from Headquarters Command began work on many details. These included transportation, protocol, housing, press relations, security, and every other support requirement. Squadrons from both bases, plus the Air Force Band, joined other Air Force units to swell the total to a grand total of more than 2,200 Air Force men.

Less than ten days after the Inauguration, another event of major significance took place, on February 1, when Gen. Curtis E. LeMay retired as fifth Chief of Staff of the USAF. Again, for this event, the command provided personnel and facilities for the formal farewell ceremonies for General LeMay and welcoming ceremonies for the new Chief of Staff, Gen. John P. McConnell.

A great deal of the command's glamour is reflected in two of its units: the world-renowned, twenty-three-year-old Air Force Band and the USAF Ceremonial Unit. Both frequently blend their music and precision drills with other command personnel in a variety of ceremonies that salute national and international dignitaries. During the past year, these have included the Secretary General of NATO, the Chancellor of West Germany, the Prime Ministers of Japan and Malaysia,

Maj. Gen. Brooke E. Allen has been Commander of HEDCOM since 1959. Commissioned in 1934, he was at Hickam Field during the December 7, 1941, attack and flew the war's first heavy-bomber combat mission that day. He served in the Pacific during the war and afterward held a number of operational and staff posts.



the Presidents of Korea and the Philippines, and innumerable other leaders. Andrews AFB averages 196 VIP flights a month.

The USAF Hospital at Andrews is one of the nation's leading military medical centers. Named in honor of the Air Force's first Surgeon General, the Malcolm Grow Medical Center provides medical support for thousands of personnel and dependents. In addition, it has been acclaimed for its pioneering work with wireless cardiac monitoring systems. No other hospital in the world has a system whereby ambulatory patients have their heart action continually monitored and recorded. Wounded personnel are airlifted to Andrews from Vietnam in four days, and the hospital serves as the major East Coast center for air-evac reception and distribution. During the conflict this year in the Dominican Republic, the wounded reached Andrews AFB in as little as four hours.

While Andrews gets the bulk of international visitors, Bolling AFB has also welcomed more than 400 Allied military personnel during the past year. The command headquarters are at Bolling, together with units of USAF Headquarters, SAC, OAR, AFSC, and AFCS. All flying activities, except helicopters, moved to Andrews in 1962. The 1001st Helicopter Squadron, based at Bolling, observed nine years of accident-free operation (a total of 27,000 hours) in February 1965. The
(Continued on following page)

1100th Support Group, at Bolling, furnishes accounting and finance support to all USAF units in the Washington area. It has pioneered many new finance and accounting procedures and regularly tests new ones.

While the command is daily involved with present-day, worldwide, history-making events, it has also gained acclaim from both the Secretary of the Air Force and the Chief of Staff for the command's Retired Officer and NCO programs. An outstanding example was the Retired Officers' Luncheon last September that hailed the fortieth anniversary of the Air Service's First World Flight. Guests at the luncheon included three of the original crew: Maj. Gen. Leigh Wade, USAF (Ret.); Col. Alva Harvey, USAF (Ret.); and Henry H. Ogden. Lowell Thomas, flight "historian"; Maj. Gen. Clayton Bissell, USAF (Ret.), one of the flight planners; and Linton Wells, newsman "stowaway," also

were honored guests. The more than 350 retired officers in the audience applauded their reminiscences and the old newsreel footage that was shown. Through the courtesy of the National Air Museum, one of the original aircraft, *The Chicago*, was displayed outside the Bolling AFB Officers' Club during the luncheon.

Maj. Gen. Brooke E. Allen is Commander, Headquarters Command, and Col. Maurice R. Lemon is Vice Commander. On September 1, Brig. Gen. Clair L. Wood retired as the Commander of Andrews AFB and Brig. Gen. James W. Chapman, Jr., relieved him. Col. Frank E. Marek is Commander of Bolling AFB. Brig. Gen. Archie A. Hoffman commands the USAF Hospital at Andrews AFB, and the 1100th Support Group, Bolling AFB, is commanded by Col. Richard D. Vitek. Maj. Arnauld D. Gabriel is the Commander of the USAF Band.—END

An Air Force Major Air Command . . .



The United States Air Force Security Service

THE US Air Force Security Service (USAFSS) monitors all United States Air Force communications to ensure compliance with established communications security practices and procedures. USAFSS units occasionally conduct research in communications phenomena in support of various elements of the US government.

Major Subordinate Units

The Air Force Special Communications Center (AFSCC), located at Kelly AFB, Tex., provides technical assistance to all operating elements of USAFSS.

The 6940th Technical Training Wing, located at Goodfellow AFB, Tex., trains officers and airmen in the many skills used solely by USAFSS.

The European Security Region, located at Frankfurt, Germany, exercises command and administrative control over USAFSS units deployed in the European theater.

The Pacific Security Region, located at Wheeler AFB, Hawaii, exercises command and administrative

Maj. Gen. Richard P. Klocko has commanded USAF Security Service since 1962.

Prior to that he was Deputy Commander. A 1937 West Point graduate, he commanded a fighter group during World War II until taken prisoner on a special mission over enemy lines. He joined the Security Service in 1954, advancing through several posts to Commander.



control over USAFSS units deployed in the Pacific theater.

The 6981st Radio Group Mobile, located at Elmendorf AFB, Alaska, exercises command and administrative control over USAFSS units deployed in Alaska.

The USAF Cryptologic Depot, located at Kelly AFB, Tex., provides communications equipment and devices for all US Air Force organizations.—END

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The United States Air Force Academy

SINCE April 1, 1954, when President Eisenhower signed the act creating the United States Air Force Academy, the basic mission of this newest of the service academies has remained unchanged. It is to provide instruction, experience, and motivation to each Cadet so that he will graduate with the knowledge, character, and qualities needed for leadership that are essential to his progressive development as a career officer in the US Air Force.

The Academy accomplishes its mission through a four-year curriculum composed of academic courses, leadership and military training, physical education, and athletics. Completion of the curriculum entitles the Cadet to graduate with a Bachelor of Science degree and a Regular commission as a second lieutenant.

On July 1, 1965, Lt. Gen. Thomas S. Moorman became the Academy's fifth Superintendent. He and his staff and faculty are constantly seeking new methods and procedures to ensure the high motivation, education, and training Academy graduates will need to meet the ever-changing challenges faced by a dynamic and progressive Air Force.

In 1962, the Cadet Wing reached the 2,500-man strength authorized by the initial Academy legislation. In 1964, congressional action permitted a seventy-five percent increase over the next several years to 4,417 Cadets. This legislation equalizes student strength at the Air Force, Military, and Naval Academies. In addition to its US students, the Academy is authorized to provide instruction to as many as twenty young men from the Latin American republics and four from the Republic of the Philippines.

The framework of the curriculum is based on standardized or prescribed courses which prepare the Cadet for a broad scope of activity as an Air Force officer. In order to graduate from the Academy, a Cadet must complete forty-nine credit and three noncredit academic courses, ten military-training courses, and fifteen physical-education courses. Thirty-three of the credit academic courses and the three noncredit academic courses are prescribed for all Cadets, as are ten military-training and fifteen physical-education courses.

Lt. Gen. Thomas S. Moorman was named Superintendent of the Air Force Academy in July 1965. Twenty years of his career were spent with the Air Weather Service, culminating in a tour as Commander in 1954. He has also commanded the Thirtieth Air Force in the Philippines, and has been Vice Commander in Chief of PACAF.



The academic program under the Dean of the Faculty is designed to give each Cadet the basic education that he needs for a career of service, together with a degree of specialization in an area related to an Air Force career field. All graduates complete the requirements for a major. Under cooperative arrangements with certain universities, selected students may earn a master's degree within seven months after graduation from the Academy. The subject areas are: Astronautics; International Affairs, specializing in either Economics or Political Science; Management; and Mathematics.

The Frank J. Seiler Research Laboratory, one of three basic research laboratories operated by the Office of Aerospace Research, is located on the Academy grounds. The mission of the laboratory is to conduct research in chemistry and in the applications of mathematics to the solution of aerospace and astronautics problems. It also provides a means for supporting faculty and Cadet research and disseminating the results to other Air Force agencies and the scientific community.

The faculty research program is designed to keep faculty members current in their special fields and to provide an opportunity for research to a limited number of Cadets in the enrichment and graduate programs. During summer months, the professional
(Continued on following page)



"Gentlemen, you are dismissed," ends graduation ceremonies at US Air Force Academy, immediately followed by a blizzard of dress caps flung into air by new USAF second lieutenants. Most graduates move on to aircrew training, but one out of six is selected to pursue advanced degree.

capabilities and special skills of the all-military faculty are utilized in a consultant program for other Air Force commands.

The Leadership and Military Training program under the Commandant of Cadets encompasses three essential areas: professional knowledge, character development, and leadership qualities. In this program, the Cadet is provided with a basic knowledge of his profession on which to build his professional competence; he is exposed to a set of values on which to develop his character to the point that is expected of an officer; and he is provided the maximum opportunity for observing and practicing leadership. In all three areas, the degree of competence is nurtured progressively over the four-year program.

The Cadet athletic program is premised on the fact that outstanding leadership and athletic participation go hand in hand. The program is designed to develop leadership characteristics, physical ability, and skills in a variety of sports. The three principal athletic programs—intercollegiate sports, physical education, and intramurals—are leadership-oriented and are specifically tailored to accomplish carefully programmed body development, endurance, agility, and coordination. A wholesome attitude toward competition and physical fitness, fostered by their training, encourages the young men to pursue a high physical-fitness standard as professional officers.

The Class of 1965 had 517 graduates, the largest class to date. The assignments of the new graduates included: pilot training—317; navigation—29; technical training—53; direct duty assignment—24; Regular AFIT—10; Special Masters—41 (Purdue, Astronautics—14, Georgetown, International Relations—14, UCLA, Management—13); Surgeon General (4) and JAG (1) Programs—5; Scholarships—26 (1 Rhodes, 4



Cadet works on chemistry problem in one of forty-five laboratories in Fairchild Hall, named for Gen. Muir S. Fairchild, first Commander of Air University. The six-story academic building also contains 168 classrooms, five lecture halls, the Academy library, and offices for faculty.

National Science Foundation, 10 Atomic Energy Commission, 4 Fulbright, 3 East-West, 1 Woodrow Wilson School at Princeton, 1 Gerard Swope, 1 University of Virginia, and 1 National Collegiate Athletic Association); other services (Marine Corps)—2; not physically qualified—7; and late commissions (physical reasons)—3.

As Fiscal Year 1965 came to an end, the Academy looked back on a very successful Cost Reduction Program. The year began with a final tabulation of FY 1964 savings of \$767,000 against a dollar goal of only \$155,000. For exceeding the assigned goal by more than 390 percent, the Academy was officially recognized by Headquarters USAF for outstanding program administration among all separate operating agencies of the Air Force.

In further recognition of the Academy's cost reduction efforts, FY 1965 dollar goals were increased by more than 700 percent to a total of \$1,153,000.

The increase in Cadet strength necessitates an expansion of the physical facilities. This includes a new dormitory, a field house, and additions to the Academic Building, Dining Hall, Physical Education Building, and Social Center. The first new building will be the Cadet Quarters. Site preparation was completed in June, and actual construction on the quarters will begin before the end of the year. The new construction will follow the general architecture of the original construction. The Air Force Academy is rapidly becoming the main tourist attraction in the Pikes Peak region. The impact of millions of tourists annually has been considered in the siting and construction of the new facilities.

The Academy will graduate more than 900 Cadets per year at the completion of the expansion program. —END

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The Air Force Accounting and Finance Center

QUILL-pen bookkeeping served its purpose in the days of the musket, the sailing ship, and the horse-drawn supply wagon. The desk calculator of World War I and even the electric accounting machine of World War II were able to keep up with the comparatively slow-paced requirements of the times.

Today, the startling strides in science and technology demand an accounting and finance system that will keep ahead of aerospace-age needs. Creative financial management, dependent on intelligent and instantly responsive accounting, provides a sound basis for many day-to-day Air Force management decisions.

USAF looks to the Air Force Accounting and Finance Center (AFAFC) in Denver, Colo., for leadership in fiscal operations and, equally important, for continual improvement of the Air Force fiscal system.

Due to the global nature of today's Air Force, operating units are located in practically every country throughout the free world. And wherever the Air Force

Brig. Gen. Thomas P. Corwin was named Commander, AFAFC, in 1963 after a year as Vice Commander. A graduate of the University of Maryland, he also holds a bachelor of laws degree from Georgetown University. He served in World War II and was recalled to duty during the Korean War to aid in organization of AFAFC at Denver, Colo.



is located, it must pay its bills. This calls for prompt and accurate accounting for expenditures.

More than 300 accounting and finance field offices throughout the world send fiscal information to the Center. This maze of data is audited, balanced, analyzed, and consolidated to give a more meaningful financial picture to Air Force top management.

It is here that essential systems are continually streamlined in an effort to further reduce reaction time. And it is here that many of the ideas for better fiscal management originate.

While the gathering of fiscal data and analyzing it for use by top management is the primary mission, AFAFC has another major responsibility, which has considerable military, economic, and social significance. That is the monthly issuance of over 440,000 allotment, retired pay, and Reserve pay checks. It also issues the US Savings Bonds purchased by Air Force members—more than 2,000,000 per year.

In getting the fiscal management job done, AFAFC's personnel is its most important asset. An active and responsive training program continues to broaden the base of knowledge, experience, and professionalism of its employees. As a result, its people recognize and respond to the role of the Air Force Accounting and Finance Center—finding and carrying out better ways to do the creative accounting and financial management job required for today's fluid and mobile aerospace Air Force.



Purchaser of five-millionth US savings bond to be issued by Accounting and Finance Center, 1st Lt. John T. York, right, of Stewart AFB, N. Y., receives memento from Brig. Gen. Thomas P. Corwin, Center Commander, and Walter K. Koch, head of Rocky Mountain Industrial Savings Committee.

Last year significant steps were taken in AFAFC's research-and-development projects.

- In 1964, the Air Force Accrued Military Pay System (AMPS) became fully operational. This automated system, using desk-size computers, signaled the beginning of military pay accounting control that had been sought for many years.

- The "Legal Information Thru Electronics" (LITE) program to modernize legal research in financial management was completed and placed in operation.

- Payment and accounting responsibility for AF Reservists was centralized at AFAFC in late 1964.

- A new system to replace present check- and bond-writing equipment has been developed and will become operational late in 1965. The new system will replace most of the Center's punch-card accounting machines. The equipment permits the validation of figures before processing.

- Another program called RITE (Retired Information Thru Electronics) is being developed for implementation in the near future. It is a program for improvement in Retired Pay Administration and a program to cope with the expansion of retired-pay accounts expected for the next few years.

- DATE (Data for Allotments Transmitted Electronically) is another future development, a program to expeditiously handle 150,000 changes each month to AFAFC's 1,500,000 allotment accounts.



Col. Ben Blair, Director of Data Automation, demonstrates the use of a carbon address strip used in the Air Force allotment program to the Hon. Leonard Marks, Jr., Assistant Secretary of the Air Force for Financial Management, on recent visit to the AF Accounting and Finance Center.

These are some of the highlights of present operations and future plans at the Air Force Accounting and Finance Center. The mission is a vital one. And AFAFC expects to carry it out in a responsive manner. That is its constant goal.—END

An Air Force Separate Operating Agency . . .



The Aeronautical Chart and Information Center

WHEREVER in this world (or out of it) America's airmen, astronauts, and missilemen plan a mission—to explore this and other planets, find downed and lost comrades, or counter a foe—they need aeronautical charts and other flight publications to guide them.

Providing those varied and vital charts and aids—in the exact type, time, place, and number needed—is the mission of the USAF separate operating agency known as the USAF Aeronautical Chart and Information Center (ACIC), headquartered in St. Louis, Mo.

ACIC's products, like fuel and other basic products
(Continued on following page)

Col. John G. Eriksen was named Commander, ACIC, in 1963. A 1937 West Point graduate, he is a native of Wisconsin. He won his wings in 1938. During World War II he trained B-29 crews. He has served as Air Attaché in Warsaw, in Intelligence at the Pentagon, and was Commander, European Security Region, prior to his ACIC command.





An ACIC cartographer scans moon photographs through a comparator, measuring the length of shadows cast by lunar surfaces. The information he logs, using digitizer at his right and a card punch output writer, is later processed by computers in compilation of USAF Lunar Chart series.

visions, are so much a part of every mission that they might almost be taken for granted. But the average air or space venture would rise about as far above base or pad without fuel as it would without the Chart Center's publications.

Among the items ACIC produces for the Air Force are aeronautical charts, air target materials, flight information publications, geodetic missile data, astronomical and geophysical charts, and reference materials. These Air Force cartographic products also are used by other military organizations in the Department of Defense and civilian aviation and space agencies.

All ACIC publications evolve side by side with the development of the hardware stage of a weapon system or a support system. Concurrently, ACIC maintains close liaison with operational commands to assure that the ACIC cartographic support items are available when a system becomes operational in the field.

Most of the major sciences and about sixty-five special skills are involved in the ACIC cartographic processes; from simple arithmetic to complicated mathematics, from fundamental camera procedures to sophisticated photographic techniques, and from sciences required for charting the earth to sciences required for the development of space reference systems.

Within the ACIC mission there are four major program areas of production and related services: Air Target Materials, Air Navigation and Planning Charts, Flight Information Publications, and Services.

Tactical Situation Display Indicators are miniaturized cartographic items in the form of 35-mm. film strips and electronic data-computer tapes produced to support the F-106. Aeronautical video mapping plates for ground control of flights are among the many miniaturized items produced to support new weapon systems.

ACIC supports NASA's Project Gemini with test, training, orbit, and recovery charts.

A Lunar Atlas and two Lunar Reference Mosaics

have been published at scales of 1:5,000,000 and 1:10,000,000, and twenty-five of the 144 Lunar Aeronautical Charts required to cover the moon have been published at the 1:1,000,000 scale.

The 1:35,000,000-scale prototype chart of the planet Mars, published by ACIC, was widely used by space planners and news media representatives during the Mariner-4 probe of the red planet.

About 100,000,000 copies of the 38,000 separate items ACIC publishes were distributed this past year to users all over the world. A few more than 3,800 military and civilian personnel produced and distributed these publications. They operated on a budget of slightly more than \$40 million in Fiscal Year 1965.

Although the headquarters and production plant in St. Louis are the focal point of ACIC activities, ACIC squadrons and detachments are located all over the world, wherever needed to provide the most effective support for the major users of ACIC products.

In Washington, D. C., the ACIC office provides liaison with other intelligence and mapping agencies located there. It also maintains the USAF Historical, Pictorial, and Documentary Library for the Air Staff and provides photographic services for the Department of Defense.

Lunar observers use the facilities of Lowell Observatory at Flagstaff, Ariz., to study the moon for topographic details that are incorporated in ACIC's Lunar Chart Series.

Through the years, ACIC has had to stay "ahead of the game" as men have flown faster and higher in increasingly complex machines. The Center's technicians continue to chart vital aerial paths around the globe—even while probing new dimensions to stretch out guidelines for astronauts whose missions extend further and further into space.—END



Cartographers check the relief portrayal of a section of pilotage charts. The three-dimensional maps, from which navigation charts are prepared, are painstakingly developed by technicians who press underside of plastic sheets with pointed tools to create exact topographic features.

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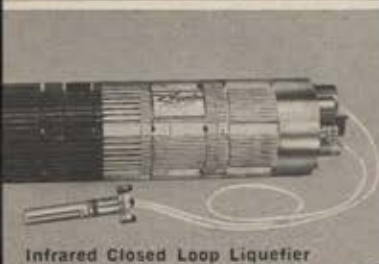
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practically limitless. In addition to the ones pictured here, it's in use for: refrigeration of liquefied gases, spot cooling of airborne and satellite components, cooling of densely packed electronic units for space systems, and cryosurgery. Many of these units have been operated in the field for over 1,000 hours; a life of over 10,000 hours is projected with only minor maintenance.

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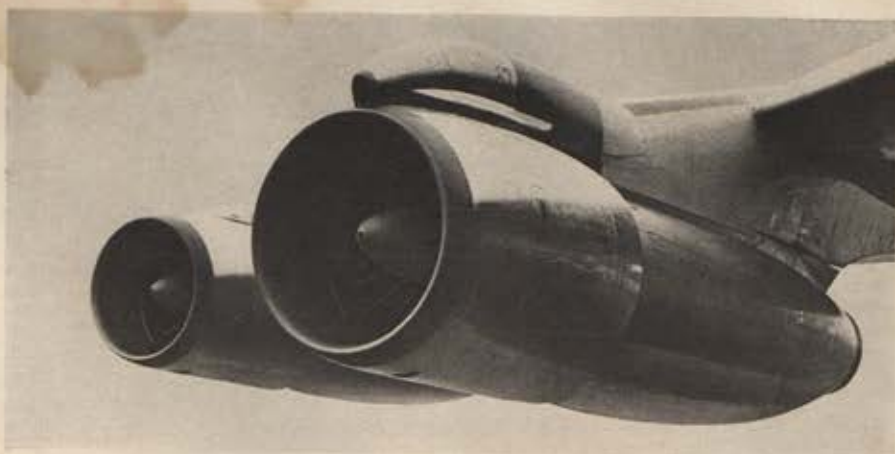
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A fighter aircraft engine was experiencing high EGT (exhaust gas temperature) excursions, but

none lasted as long as three seconds, the period for mandatory squawks. The Garrett system, designed to trigger and analyze all high EGT, quickly predicted a fast deterioration in the hot section. Teardown revealed inner lining and nozzle cracks, and major damage to the engine or aircraft was prevented.

The same concept can, and is, being applied to major systems, such as avionics and autopilot, hydraulic, and secondary power.

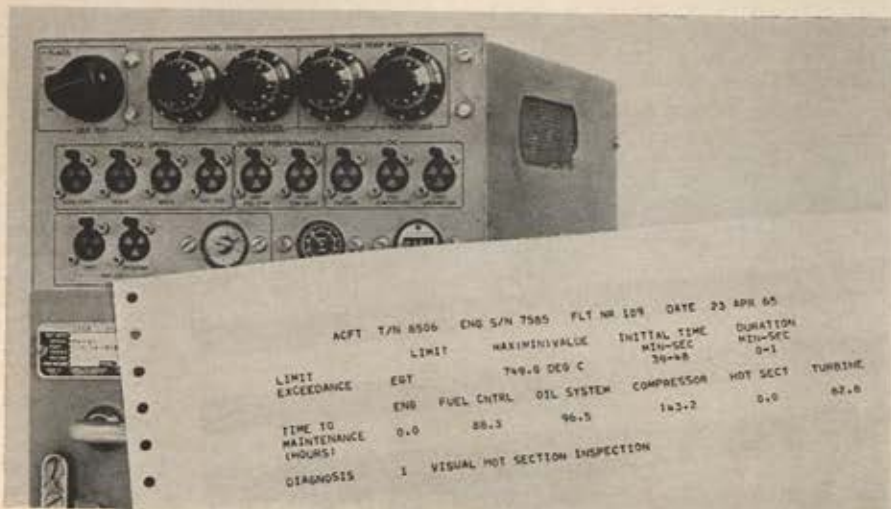
There are a lot of other ways to save money with this kind of system.

Overhaul schedules can be extended because they are based on actual "wear out" conditions. And the optimum maintenance schedule can be derived for any military or airline operator.

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is experience



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The Office of Aerospace Research

NOW IN its fifth year as a separate operating agency with the procedural functions and responsibilities of a major air command, the Office of Aerospace Research (OAR) is continuing its diversified efforts to provide scientific knowledge in all areas of interest to the US Air Force. Through its eleven subordinate elements, OAR conducts in-house and extramural (contracts and grants) research which has produced, during the past year, many scientific discoveries of interest to the general scientific community as well as of importance to the Air Force.

OAR was established in April 1961, and since September 1962 has been under the command of Maj. Gen. Don R. Ostrander. Its facilities are located in various parts of the United States and in three foreign countries.

At Laurence G. Hanscom Field, Bedford, Mass., the Air Force Cambridge Research Laboratories (AFCRL) employ about half of the assigned OAR manpower, with its scientists specializing in electronic and geophysical research. One of AFCRL highlights of FY 1965 was a scientific feat which represents a significant step forward in the refinement of satellite geodesy technique. In January 1965, AFCRL scientists bounced a laser beam off the orbiting Explorer 22 satellite and photographed the reflection. This technique will enable scientists to determine with greater precision the distances between two or more widely separated points on the earth's surface. This first successful laser experiment in satellite geodesy is being further developed into an operational system.

Through its research balloon-launch facilities at Holloman AFB, N. M., and Chico, Calif., AFCRL scientists carry on a continuing study of upper-atmosphere conditions that might affect man and the earth. In flights soaring up to twenty-seven miles high, AFCRL scientists proved the suitability of new lightweight balloon material designed to lift the heaviest possible payloads to the highest possible altitudes.

AFCRL is also responsible for the Sacramento Peak Observatory in New Mexico, which conducts research in solar physics, such as the prediction of proton showers and other sun-induced disturbances in space

OAR's Commander is Maj. Gen. Don R. Ostrander.

A 1937 graduate of West Point, he served with the Eighth Air Force in World War II. He has specialized in R&D for the past eighteen years and has held various important posts in what is now Systems Command as well as assignments in launch development with NASA.



that affect aerospace operations (including manned spaceflight).

A second major in-house laboratory complex, the Aerospace Research Laboratories (ARL) at Wright-Patterson AFB, Ohio, concentrates on basic research in the physical and engineering sciences. Among its areas of continuing investigations are those involved in radar engineering, hypersonic wind-tunnel techniques, crystal growing, and mathematics.

One such investigation has to do with the detection of aerial targets. It is concerned with the effectiveness of back-and-forth patrols, using circular radar coverage. This, in turn, has led to a mathematical formulation of moving-target-by-moving-patrol detection whereby the patrol employs repetitious pattern movements. A conjecture to be verified is that this back-and-forth pattern, besides being the simplest, is generally the most effective with respect to detection probability.

Scientists at ARL also are engaged in nuclear-structure research to obtain detailed information about the excited states of selected nuclei. Such data can be used to provide a significant test of present and future nuclear models.

The third major component of OAR is the Air Force Office of Scientific Research (AFOSR) in Washington, D.C., which supports research, through contracts and grants, to provide new knowledge and understanding

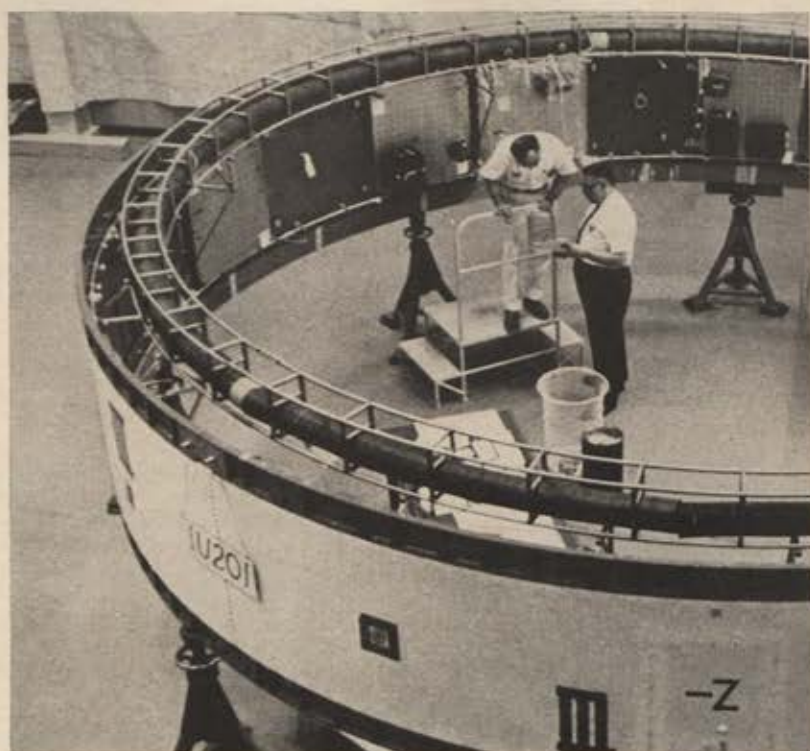
(Continued on page 194)

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- ☐ Steer Titan III launch vehicles from pad to orbit
- ☐ Build a nerve center for Saturn launch vehicles
- ☐ Solve down-to-earth problems from space
- ☐ Memorize all the Gemini-V flight plan alternatives



Steering Titan III launch vehicles from pad to orbit. ☐ This is the job for a compact, rugged IBM computer, a key element of the Titan III guidance system. It's from a line of IBM ASC-15 guidance computers that have flown more than 50 successful missions aboard Saturn I, Titan II and Titan III-A. ☐ Before a mission, IBM's computer checks instruments and controls. During flight, the rugged computer generates signals to correct roll, pitch and yaw to keep the vehicle on course. ☐ This IBM computer withstands the thrust of rocket blast-off and temperature extremes. And its record in the testing arena of outer space proves that it's tough, reliable and accurate.



Building a nerve center for Saturn launch vehicles. ☐ Since April, 1964, IBM has been lead contractor for this part of NASA's Saturn launch vehicle program. This is a management assignment to construct Instrument Units for Saturn IB and Saturn V which are being developed under the direction of the Marshall Space Flight Center. ☐ The Instrument Unit is Saturn's control center. Located between the Apollo spacecraft and the upper stage of a Saturn vehicle, it controls and guides Saturn's first, second and third stages before releasing Apollo for its lunar flight. ☐ IBM's job includes designing and manufacturing data adapters and computers for the Instrument Unit, plus total systems integration and checkout of the more than 50 electronic units that make up the Saturn launch vehicle.

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- ☐ System support and field operations.

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Or call
Mr. G. B. Gerrish,
Manager, Field Marketing,
301 GA 4-6700.

in those sciences which offer the greatest potential for improving the Air Force's present and future operational capability. As the major USAF contractual activity for sponsoring fundamental research in the sciences, AFOSR plans, directs, and carries out its research programs with more than 200 colleges, universities, and private research organizations in the US and abroad.

One of the outstanding programs supported for the Air Force through AFOSR is the National Magnet Laboratory at the Massachusetts Institute of Technology, Cambridge, Mass. By utilizing a giant water-cooled magnet this laboratory has produced the strongest continuous magnetic field ever generated by man: 255,000 gauss, more than 100,000 gauss higher than ever recorded before. In comparison, the earth's magnetic field is about one-half gauss in strength. This magnet opens a new era of high-magnetic field research in a variety of physical science areas, including the magnetic, optical, electronic, nuclear, and other properties of matter.

One of the many fine university laboratories conducting research under the AFOSR program is the University of Chicago. A new accelerator, which may do for chemical research what the cyclotron did for physics, is being developed there. The device will be capable of firing a whole molecule at an atomic target. The accelerator may enable chemists to learn the secrets of molecular collisions, which are the basis of all chemical reactions.

Other OAR installations include the Frank J. Seiler Research Laboratory at the Air Force Academy, where OAR laboratory scientists conduct in-house research in the fields of mathematics, chemistry, and aerospace mechanics. In addition, research is performed by Academy faculty members and selected outstanding Cadets. The Office of Research Analyses at Holloman AFB, N. M., furnishes managerial and technical advice in operations research and related disciplines.

Overseas, the European Office of Aerospace Research, in Brussels, Belgium, is responsible for the procurement and administration of R&D contracts and grants in Europe, the Near East, and Africa for all Air



Specially designed Aerobee rocket nose, nicknamed the Venus Flytrap, will be used to collect micrometeorites and noctilucent cloud particles over Canada in upcoming international scientific experiment.

Force agencies. The Latin American Office of Aerospace Research in Rio de Janeiro, Brazil, with operations on a smaller scale, seeks out research proposals for the Air Force in South America.

At Fort Churchill, Manitoba, Canada, OAR manages the Churchill Research Range where aerospace environmental data at high latitudes is collected by the Air Force, NASA, and the National Research Council of Canada through year-round rocket firings. In recognition of its proficiency, the Churchill Range and its personnel have been awarded the Air Force Outstanding Unit Award.

OAR also manages the joint OAR-AFSC Aerospace Research Support Program (ARSP). This program supports Air Force scientific experimenters in their investigations of the aerospace environment and its effects. Support provided these scientists consists of rockets, satellites, and related services required to put the experiments into the space environment and to collect desired data. Three OAR field offices (one in Los Angeles, Calif., one at the Air Force Eastern Test Range in Florida, and the other at the Western Test Range in California) assist OAR in its management of the ARSP. These offices serve as the central point of contact, at the working level, for the scientists, the ranges, and the AF contractors involved in the program.

However, research conducted for and by the Air Force is not OAR's only contribution to the development of superior aerospace systems and the continued technological growth of the Air Force. A very significant contribution is the creation and maintenance of a team of scientists (military and civilian) who know the needs of the Air Force and can communicate with the scientific community of the world, evaluate new ideas as they are reported, and pass them on to the applied research-and-development agencies of the Air Force Systems Command.—END



This Lockheed U-2 played an important part in OAR's Project Stormy Spring. Assigned to Cambridge Research Laboratories for meteorological research, the plane was used to measure temperatures, wind distributions, and radiometric data, and photographed clouds over the US Northeast.

*"Who is to bell the cat?
It is easy to propose
impossible remedies."*

Aesop

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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
MAJOR COMMAND HEADQUARTERS LOCATED OVERSEAS

ALTUS AFB, Okla., 3 mi. NE of Altus. Phone: (405) HUDson 2-8100. Heavy bomber and tanker base, 2d AF, SAC. Named for city.

AMARILLO AFB, Tex., 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 and tanker base, 2d AF, SAC. Named for nearby city. Base closes by June 1968.

ANDREWS AFB, Md., 11 mi. SE of Washington, D. C. Phone: (301) 981-9111. Headquarters Command; Hq. AFSC; Hq. 2d Reserve Region, CONAC; Naval Air Reserve Training Unit. Formerly Camp Springs AAB, renamed for Lt. Gen. Frank M. Andrews, airpower pioneer, CG, European Theater of Operations, killed in aircraft accident, Iceland, May 3, 1943.

ARNOLD ENGINEERING DEVELOPMENT CENTER, Tenn., at Arnold AFS, 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., 3 mi. N of Columbus. Phone: (812) 372-2501. Reserve training, CONAC. Formerly Atterbury AFB, renamed for Lt. John E. Bakalar, WW II fighter pilot, killed in France, September 1944.

BARKSDALE AFB, La., 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., 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., 7 mi. SE of Austin. Phone: (512) EVERgreen 5-4100. Heavy bomber and tanker base, 2d AF, SAC. Formerly Del Valle AAB, renamed for Capt. John A. E. Bergstrom of Austin, killed at Clark Field, P. I., December 1941, during Japanese bombardment.

BIGGS AFB, Tex., 6 mi. NE of El Paso. Phone: (915) LOGan 6-6711. Heavy bomber base, 15th AF, SAC. Named for Lt. James B. Biggs, WW I fighter pilot killed in an accident in France, October 1918.

BLYTHEVILLE AFB, Ark., 3 mi. SE of Blytheville. Phone: (501) LEhigh 2-5667. Heavy bomber and tanker base, 2d AF, SAC. Named for city.

BOLLING AFB, 3 mi. S of Washington, D. C. Phone: (202) JOHnson 2-9000. Headquarters Command, USAF. Rotary-wing flying activities only. Named for Col. Raynal C. Bolling, Assistant Chief of Air Service, died saving life of a 19-year-old private near Amiens, France, March 26, 1918.

BROOKLEY AFB, Ala., 3 mi. SW of Mobile. Phone: (205) HEMlock 8-6011. 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., 7 mi. SE of San Antonio. Phone: (512) LEhigh 2-8811. Second oldest AFB in the US. Formerly Gosport Field; renamed in honor of Lt. Sidney J.

Brooks, Jr., a native of San Antonio, who lost his life in final flight on eve of his graduation from pilot training in 1917. Home of USAF Aerospace Medical Division (AFSC), which manages bioastronautics research and development programs; personnel system research programs; clinical and aerospace medicine requirements; and, as directed, specialized education programs and postgraduate professional education in medicine, dentistry, and aerospace medical subjects.

BUNKER HILL AFB, Ind., 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., 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., 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, killed in China, October 1944.

CASTLE AFB, Calif., 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., 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., 10 mi. N of Charleston. Phone: (803) SHERwood 7-4111. Air transport base, EASTAF, MATS; fighter-interceptor base, ADC. Named for city.

CLINTON CO. AFB, Ohio, 2 mi. SE of Wilmington. Phone: (513) 382-3811. Reserve training, CONAC. Named geographically.

CLINTON-SHERMAN AFB, Okla., 1 mi. W of Burns Flat. Phone: (405) Burns Flat, LOGan 2-3121. Heavy bomber and tanker base, 8th AF, SAC. Formerly Clinton NAS.

COLUMBUS AFB, Miss., 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., 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., 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. 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., 2 mi. SE of Marietta. Phone: (404) 428-4461. Reserve training, troop carrier, Hq. 3d Reserve Region, CONAC; CONAC-ADC, joint use. Formerly Marietta AFB, renamed for Capt. Charles M. Dobbins, killed while transporting paratroops over Sicily in June 1943.

DOVER AFB, Del., 3 mi. SE of Dover. Phone: (302) 734-8211. Air transport base, EASTAF, MATS; fighter-interceptor base, ADC. Named for city.

DOW AFB, Me., 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. Base closes by June 1968.

DULUTH MUNICIPAL AP, Minn., 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., 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., 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."

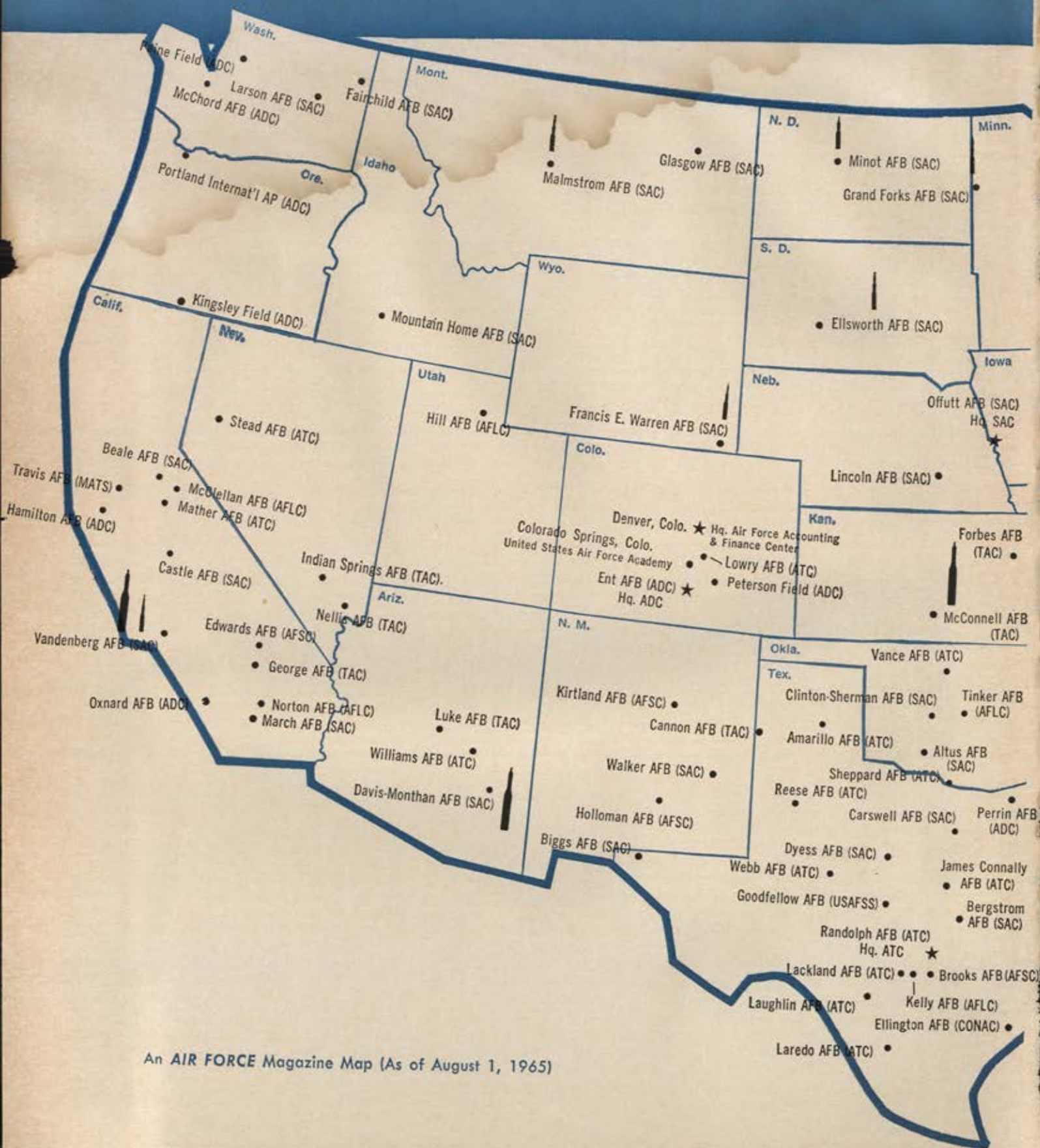
EGLIN AF AUXILIARY FIELD #9. (See *Hurlburt Field*.)
EGLIN AFB, Fla., 2 mi. SW of Valparaiso. Phone: (904) 881-6668. Hq. Air Proving Ground Center, AFSC; Tactical Air Warfare Center; tactical fighter base. Named for Lt. Col. Frederick I. Eglin, killed in an aircraft accident in 1937.

(Continued on following page)

Glossary of Terms Used in Guide to AFBs

AAB	Army Air Base
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
CBI	China-Burma-India Theater
CG	Commanding General
CMH	Congressional Medal of Honor
CO	Commanding Officer
CONAC	Continental Air Command
DFC	Distinguished Flying Cross
DSC	Distinguished Service Cross
EASTAF	Eastern Transport Air Force
ETO	European Theater of Operations
GEEIA	Ground Electronics Engineering Installation Agency
HEDCOM	Headquarters Command
ICBM	Intercontinental Ballistic Missile
MATS	Military Air Transport Service
NAS	Naval Air Station
NORAD	North American Air Defense Command
OCS	Officer Candidate School
SAC	Strategic Air Command
SAGE	Semi-Automatic Ground Environment
TAC	Tactical Air Command
USAF	United States Air Force
USAFSS	USAF Security Service
WESTAF	Western Transport Air Force
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, 1965)

the Continental United States



GUIDE TO AIR FORCE BASES

ELLINGTON AFB, Tex., 16 mi. SE of Houston. Phone: (713) HUDson 7-1400. Air Reserve, CONAC. Named for 2d Lt. Eric L. Ellington, killed during training flight near San Diego, Calif., in 1913.

ELLSWORTH AFB, S. D., 8 mi. NE of Rapid City. Phone: (605) Fillmore 2-2400. Heavy bomber, tanker, and Minuteman ICBM support base, 15th AF, SAC. Formerly Rapid City AFB, renamed for Brig. Gen. Richard E. Ellsworth, killed in B-36 crash in Newfoundland, March 18, 1953.

ENGLAND AFB, La., 6 mi. NNW of Alexandria. Phone: (318) HI. 3-4561. Tactical fighter base, 12th AF, TAC. 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., Colorado Springs. Phone: (303) 635-8911. Hq. North American Air Defense Command (NORAD); Hq. ADC. Named for Maj. Gen. Uzal G. Ent, CG, 2d AF, recipient of DSC, died in 1948.

FAIRCHILD AFB, Wash., 11 mi. WSW of Spokane. Phone: (509) CHestnut 7-1212. Heavy bomber and tanker base, 15th AF, SAC. 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., 7 mi. S of Topeka. Phone: (913) UNION 2-1234. Troop carrier base, TAC; reconnaissance base, 2d AF, SAC. 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., 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., 6 mi. NW of Victorville. Phone: (714) CHapel 6-8611. Tactical fighter base, 12th AF, TAC; fighter-interceptor base, ADC (tenant). 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., 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 by June 1968.

GOODFELLOW AFB, Tex., 2 mi. SE of San Angelo. Phone: (915) San Angelo 653-2471. USAF Security Service base. Named for Lt. John J. Goodfellow, Jr., of San Angelo, killed in fighter combat in France, 1918.

GRAND FORKS AFB, N. D., 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 II ICBM site under construction.

GRIFFISS AFB, N. Y., 2 mi. NE of Rome. Phone: (315) Rome 336-3200. Rome Air Materiel Area, AFLC; Hq. GEEIA, AFLC; Hq. Rome Air Development Center, AFSC; 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. AMA closes by June 1967.

GUNTER AFB, Ala., 5 mi. NE of Montgomery. Phone: (205) 272-1210. Extension Course Institute, USAF, AU; training base for USAF Medical Service School, ATC; 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., 6 mi. NNE of San Rafael. Phone: (415) TUCKer 3-7711. Fighter-interceptor base, ADC; Hq. 6th Reserve Region, CONAC; SAGE combat center. Formerly Marin Meadows, renamed for 1st Lt. Lloyd A. Hamilton, recipient of DSC, killed in fighter combat, France, August 1918.

HANCOCK FIELD, N. Y., 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, 6 mi. S of Ogden. Phone: (801) TAYlor 5-5215, east area; TAYlor 5-9711, west area. Hq. Air Materiel Area, AFLC; air transport base, MATS. Named for Maj. Ployer P. Hill, killed near Wright Field while testing one of the first B-17s, October 1935.

HOLLOMAN AFB, N. M., 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., 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.

HUNTER AFB, Ga., 3 mi. SW of Savannah. Phone: (912) ADams 4-4461. Troop carrier base, EASTAF, MATS. Named for Maj. Gen. Frank O'D. Hunter, WW I ace, recipient of DSC, four clusters, past AFA Director. Base closes by June 1967.

HURLBURT FIELD (*Eglin AF Auxiliary Field #9*), Fla., 6 mi. W of Fort Walton Beach. Phone: (305) 946-9680. TAC base. Home of USAF Special Air Warfare Center (1st Air Commandos), USAF Air Ground Operations School. On Eglin AFB reservation.

INDIAN SPRINGS AFB, Nev., 1 mi. NW of Indian Springs. Phone: (702) Indian Springs 20. Bombing and gunnery range support base, TAC. Named for city.

JAMES CONNALLY AFB, Tex., 7 mi. NNE of Waco. Phone: (817) SWift 9-3611. Navigator training, ATC. 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 closes by June 1966.

KEESLER AFB, Miss., 2 mi. WNW of 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., 6 mi. WSW of San Antonio. Phone: (512) WALnut 3-5411. Hq. Air Materiel Area, AFLC; Hq. USAF Security Service. Named for Lt. George E. M. Kelly, pioneer Army pilot, killed in an airplane crash in San Antonio, 1911.

KINCHELOE AFB, Mich., 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.

KINGSLEY FIELD, Ore., 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., 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; died in 1941.

K. I. SAWYER AFB, Mich., 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., 7 mi. WSW of San Antonio. Phone: (512) OR. 4-3211. Military Training Center, WAF training, USAF Recruiting School, USAF Chaplain 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., 3 mi. N of Hampton. Phone: (703) 764-9990. Hq. TAC; troop carrier base, TAC; fighter-interceptor and air defense missile base, ADC. Named for Samuel P. Langley, pioneer aeronautical scientist, who died in 1906.

LAREDO AFB, Tex., 3 mi. NE of Laredo. Phone: (512) RANdolph 3-9121. Undergraduate pilot training, ATC. Named for city.

LARSON AFB, Wash., 5 mi. N of Moses Lake. Phone: (509) 769-1212. Heavy bomber and tanker base, 15th AF, SAC. Formerly Moses Lake AAB, renamed for Maj. Donald A. Larson, native of Yakima, Wash., WW II ace, killed on fighter mission over Ulzen, Germany, August 1944. Base closes by June 1966.

LAUGHLIN AFB, Tex., 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., 1 mi. SSW of Bedford. Phone: (617) 274-6100. Hq. USAF Electronic Systems Div. and Office of Aerospace Research for USAF Cambridge Research Laboratories, AFSC. Formerly Bedford Airport, renamed for Laurence G. Hanscom, Boston and Worcester newspaperman, Army Reserve pilot, killed near base, 1941.

LINCOLN AFB, Neb., 5 mi. NW of Lincoln. Phone: (402) GROver 7-6011. Medium bomber base, 2d AF, SAC. Named for city. Base closes by June 1966.

LITTLE ROCK AFB, Ark., 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, 11 mi. SSE of Columbus. Phone: (614) TEMple 3-8211. Troop carrier base, TAC; fighter-interceptor base, ADC. Named for nearby city.

LORING AFB, Me., 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., 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., 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., 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., 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., 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., 12 mi. SE of Sacramento. Phone: (916) EMpire 3-3161. Advanced 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., 1 mi. WNW of Montgomery. Phone: (205) 265-5621. Hq. Air University; Air War College; Air Command and Staff College; Hq. AFROTC Aerospace Studies Institute; Squadron Officer 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., 8 mi. S of Tacoma. Phone: (206) JUNiper 8-2121. Fighter-interceptor base, ADC; SAGE direction center, ADC; air transport base, WESTAF, MATS. Named for Col. William C. McChord, killed in US, 1937.

McCLELLAN AFB, Calif., 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., 5 mi. SE of Wichita. Phone: (316) MURray 5-1151. Tactical fighter 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., 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., 18 mi. SE of Trenton. Phone: (609) RAYmond 4-2100. Hq. EASTAF, MATS; air transport base; MATS; fighter-interceptor and 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.

(Continued on following page)

GUIDE TO AIR FORCE BASES

MINOT AFB, N. D., 13 mi. N of Minot. Phone: (701) TEmp 7-1161. Heavy bomber and tanker base, Minuteman ICBM support base, 20th AF, SAC; fighter-interceptor base, ADC. Named for city.

MOODY AFB, Ga., 10 mi. NNE of Valdosta. 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, 11 mi. WSW of Mountain Home. Phone: (208) 828-2111. Medium bomber and tanker base, 15th AF, SAC. Named for city.

MYRTLE BEACH AFB, S. C., 3 mi. SW of Myrtle Beach. Phone: (803) Myrtle Beach 448-3131. Tactical fighter base, 9th AF, TAC. Named for city.

NELLIS AFB, Nev., 8 mi. NE of Las Vegas. Phone: (702) 382-1800. Tactical fighter crew training, fighter weapons, 12th AF, TAC. 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., 4 mi. E of Niagara Falls. Phone: (716) 297-4100. Air defense missile base, ADC. Named for city.

NORTON AFB, Calif., in San Bernardino. Phone: (805) TUrner 9-4411. Hq. Air Materiel Area, AFLC; Hq. Ballistic Systems Division, AFSC; Deputy, The Inspector General; SAGE direction center, ADC. Formerly San Bernardino Air Depot, renamed for Capt. Leland F. Norton, bomber pilot, killed in an aircraft accident near Amiens, France, May 1944. AMA closes by June 1969.

OFFUTT AFB, Neb., 9 mi. S of Omaha. Phone: (402) 291-2100. Hq. SAC; air refueling base; Atlas ICBM support base. 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., 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 June 1969.

ORLANDO AFB, Fla., 2 mi. E of Orlando. Phone: (305) 241-2401. Hq. Air Photographic and Charting Service; Hq. Air Rescue Service, MATS; USAF Tactical Missile School, TAC. Named for city. AF withdraws and base transfers to Navy by June 1967.

OTIS AFB, Mass., 5 mi. NNE of Falmouth. Phone: (617) LOcust 3-5511. Fighter-interceptor and air defense missile base, ADC; airborne early warning and control, ADC; air refueling base, SAC. Named for Lt. Frank J. Otis, killed in an air crash in the Illinois River on January 11, 1937.

OXNARD AFB, Calif., 5 mi. E of Oxnard. Phone: (805) 486-1631. Fighter-interceptor base, ADC. Named for city.

PAINE FIELD, Wash., 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, who was killed while mapping airmail routes, 1922.

PATRICK AFB, Fla., 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, who died in the US in January 1942.

PEASE AFB, N. H., 3 mi. W of Portsmouth. Phone: (603) GENEva 6-0100. Medium bomber and tanker base, 8th AF, SAC. 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., 6 mi. NNW of Sherman. Phone: (214) STillwell 7-2971. Pilot interceptor training (Adv.), ADC. Named for Lt. Col. Elmer D. Perrin of Boerne, Tex., killed testing a B-26 near Baltimore, Md., June 1941.

PETERSON FIELD, Colo., 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., 1 mi. SW of Plattsburgh. Phone: (518) JORDan 3-4500. Medium bomber and tanker base, 8th AF, SAC. Named for city.

POPE AFB, N. C., 12 mi. NW of Fayetteville. Phone: (919) 396-4111. Troop carrier base, 9th AF, TAC. Named

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

CONNECTICUT

Bradley Field, Windsor Locks

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

MICHIGAN

Selfridge AFB, Mount Clemens

MINNESOTA

Minneapolis-St. Paul International Airport,
Minneapolis

MISSOURI

Richards-Gebaur AFB, Kansas City

NEW HAMPSHIRE

Grenier Field, Manchester

NEW JERSEY

McClellan AFB, Trenton

NEW YORK

Niagara Falls Municipal AP, Niagara Falls
Stewart AFB, Newburgh

OHIO

Clinton County AFB, Wilmington
Youngstown Municipal Airport, Youngstown

OKLAHOMA

Davis Field, Muskogee
Tinker AFB, Oklahoma City

OREGON

Portland International Airport, Portland

PENNSYLVANIA

Greater Pittsburgh Airport, Pittsburgh
Willow Grove NAS, Willow Grove

TENNESSEE

Memphis Municipal Airport, Memphis

TEXAS

Carswell AFB, Fort Worth
Ellington AFB, Houston
Kelly AFB, San Antonio

UTAH

Hill AFB, Ogden

WASHINGTON

Paine Field, Everett
(Relocates to McChord AFB, Wash.,
December 1965)

WISCONSIN

General Mitchell Field, Milwaukee

for 1st Lt. Harley H. Pope, killed making a forced landing in a Jenny in North Carolina, January 1919.

PORTLAND INTERNAT'L AP, Ore., 7 mi. NE of Portland. Phone: (503) ATlantic 8-5611. Fighter-interceptor base, ADC. Named for city.

RANDOLPH AFB, Tex., 15 mi. ENE of San Antonio. Phone: (512) OLive 8-5311. Hq. ATC; USAF Military Personnel Center; Hq. 4th Reserve Region, CONAC; pilot instructor training. Named for Capt. William M. Randolph of Austin, fighter pilot, killed in a training-flight accident in Texas, 1928.

REESE AFB, Tex., 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., 16 mi. S of Kansas City. Phone: (816) DICKens 5-4400. Fighter-interceptor base, ADC; 29th Air Division Hq., SAGE. 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., killed over North Korea in 1952.

ROBINS AFB, Ga., 14 mi. SSE of Macon. Phone: (912) 926-1100. Hq. Air Materiel Area, AFLC; Hq. CONAC; heavy bomber and tanker base, 8th AF, SAC. Named for Brig. Gen. Augustine Warner Robins, Chief of Materiel

(Continued on following page)

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, Wilmington

DISTRICT OF COLUMBIA

Andrews AFB

FLORIDA

Imeson Airport, Jacksonville

GEORGIA

Dobbins AFB, Marietta
Travis Airport, Savannah

HAWAII

Hickam AFB, Honolulu

IDAHO

Boise Air Terminal, Boise

ILLINOIS

Capital 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

Hutchinson Air National Guard Base,
Hutchinson
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 Wayne Municipal Airport, Detroit
Kellogg Airport, Battle Creek

MINNESOTA

Duluth Municipal Airport, Duluth
Minneapolis-St. Paul International Airport,
Minneapolis

MISSISSIPPI

Jackson Airport, 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

Grenier Field, Manchester

NEW JERSEY

Atlantic City Airport, Atlantic City
McGuire AFB, Trenton

NEW MEXICO

Kirtland AFB, Albuquerque

NEW YORK

Hancock Field, 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 Municipal Airport,
Providence

SOUTH CAROLINA

McEntire Air National Guard Base, Columbia

SOUTH DAKOTA

Joe Foss Field, Sioux Falls

TENNESSEE

Berry Field, 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

Division, Air Corps, who devised system of cataloging in the 1920s still used; died in 1940.

SAWYER AFB. (See *K. I. Sawyer AFB.*)

SCOTT AFB, Ill., 6 mi. ENE of Belleville. Phone: (618) ADams 4-4000. Hq. MATS; 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.

SELFIDGE AFB, Mich., 3 mi. E of Mount Clemens. Phone: (313) 465-1241. Fighter-interceptor base, ADC; Hq. 5th Reserve Region, CONAC; air refueling base, 2d AF, SAC. Formerly Joy Aviation Field, renamed for Lt. Thomas E. Selfridge, killed in 1908 while on flight with Orville Wright to demonstrate Wright plane.

SEWART AFB, Tenn., 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, November 1942.

SEYMOUR JOHNSON AFB, N. C., 2 mi. SSE of Goldsboro. Phone: (919) REpublic 5-1121. Tactical fighter base, 9th AF, TAC; Hq. 19th AF, TAC; fighter-interceptor base, ADC; heavy bomber and tanker base, 8th AF, SAC. Named for Lt. Seymour A. Johnson, Navy pilot from Goldsboro, killed in 1942.

SHAW AFB, S. C., 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., 5 mi. N of Wichita Falls. Phone: (817) 851-2511. Technical Training Center, ATC; heavy bomber and tanker base, 2d AF, SAC. Named for Morris E. Sheppard, US Senator from Texas, chairman of Senate Military Affairs Committee, who died in 1941.

SHERMAN AFB. (See *Clinton-Sherman AFB.*)

STEAD AFB, Nev., 10 mi. NW of Reno. Phone: (702) FIreside 9-0711. Helicopter pilot training school; survival training, ATC; SAGE direction center, ADC. Formerly Reno AAB, renamed for Lt. Croston Stead, Nevada ANG pilot killed in a crash at the base. Base closes by June 1966.

STEWART AFB, N. Y., 4 mi. W of Newburgh. Phone: (914) JOhn 2-1300. Hq. 26th Air Division, ADC. Named for Lachlan Stewart, sea captain whose son provided land for the base.

SUFFOLK CO. AFB, N. Y., 3 mi. N of Westhampton Beach, L. I. Phone: (516) WEsthampton 4-1900. Fighter-interceptor base, ADC.

TINKER AFB, Okla., 8 mi. ESE of Oklahoma City. Phone: (405) PErsching 2-7321. Hq. Air Materiel Area, AFLC. 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., 6 mi. ENE of Fairfield and Suisun. Phone: (707) IDlewood 7-2211. Hq. WESTAF, MATS; heavy bomber and tanker base, 15th AF, SAC; air transport base, MATS; fighter-interceptor base, ADC. 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., 1 mi. E of Madison. Phone: (608) 249-5311. Fighter-interceptor base, ADC; SAGE direction center, ADC; Hq. 30th NORAD Region; Hq. Chicago NORAD Sector. Named for 1st Lt. Thomas L. Truax of Madison, pilot, killed in training flight in US, November 1941. Base closes by June 1968.

TURNER AFB, Ga., 4 mi. ENE of Albany. Phone: (912) HEMlock 5-3411. Heavy bomber and tanker base, 8th AF, SAC; photo mapping and charting wing, MATS. Named for Lt. Sullins Preston Turner of Oxford, Ga., killed in an aircraft accident at Langley AFB, Va., May 1940.

TYNDALL AFB, Fla., 8 mi. E of Panama City. Phone: (305) ATLantic 6-2111. Combat crew training schools for F-101 and F-106 pilots, ADC. 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., 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., 10 mi. NW of Lompoc. Phone: (805) 866-1611. Hq. 1st Strategic Aerospace Division, SAC; Air Force ICBM launch and missile combat 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, Air Force Chief of Staff from 1948 to 1953, who died April 2, 1954.

WALKER AFB, N. M., 6 mi. S of Roswell. Phone: (505) 348-0011. Heavy bomber and tanker base, 15th AF, SAC. Formerly Roswell AAB, renamed for Brig. Gen. Kenneth N. Walker, a native of New Mexico, CG, 5th Bomber Command, WW II recipient of CMH, killed in Southwest Pacific while leading a bomber attack, 1943.

WARREN AFB. (See *Francis E. Warren AFB.*)

WEBB AFB, Tex., 1.8 mi. SW of Big Spring. Phone: (915) AMherst 4-2511. Undergraduate pilot training, ATC; fighter-interceptor base, ADC. Formerly Big Spring AFB, renamed for 1st Lt. James L. Webb, Jr., F-51 pilot, killed off Japanese coast, 1949.

WESTOVER AFB, Mass., 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., 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., 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, 5 mi. ENE of Dayton. Phone: (513) 253-7111. 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., 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

UNITED STATES AIR FORCE MAJOR COMMAND HEADQUARTERS 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
Shemya AF Station

AZORES

Lajes Field

BERMUDA

Kindley AFB

CANADA

Ernest Harmon AFB, Newfoundland
Goose AB, Labrador

CANAL ZONE

Albrook AFB
Howard AFB

CRETE

Iraklion Air Station

FRANCE

Camp Des Loges
Chambley AB
Chateauroux Air Station
Chaumont AB
Dreux AB
Etain AB
Evreux-Fauville AB
Laon AB
Phalsbourg AB
Toul-Rosieres AB

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

Søndrestrom 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
Yokota AB

JOHNSTON ISLAND

Johnston Island AB

KOREA

Kimpo AB
Kunsan AB
Osan AB

LIBYA

Wheeler AB

NETHERLANDS, THE

Camp New Amsterdam AB

NORWAY

Oslo

OKINAWA

Kadena AB
Naha AB

PAKISTAN

Peshawar Air Station

PHILIPPINE ISLANDS

Clark AB

PUERTO RICO

Ramey AFB

SPAIN

Moran AB
Torrejon AB
Zaragoza AB

TAIWAN (FORMOSA)

Tainan AB
Taiping Air Station

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
South Ruislip Air Station
Upper Heyford RAF Station
Wethersfield RAF Station
Woodbridge RAF Station

The Air Force Bombers



B-26K



RB-47E



B-52 with Hound Dogs

B-26K COUNTER-INVADER — latest version of Douglas veteran of World War II and Korea, and only one scheduled for operational inventory since earlier models were grounded; "K" designation applies to 40 B-26s extensively modified by On Mark Engineering Co., Van Nuys, Calif. Firepower has been enhanced, wings strengthened. Hard nose, with 8 .50-caliber guns, can readily be replaced with glass nose accommodating photo equipment for reconnaissance missions. JATO equipment can be added. **Contractor:** Douglas Aircraft Co.; 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:** 4,000-lb. capacity in bomb

bay; 6,000 lb. mounted on 8 wing pylons, including rocket-launcher pods, gun pods, bombs, incendiary, or fuel tanks; 8 .50-caliber guns in nose. **Crew:** 3; 4 in glass-nose configuration. **Maximum gross takeoff weight:** 41,000 lb. **Primary using command:** TAC (Air Commando Wing).

B-47 STRATOJET — medium-jet bomber, employed in SAC since late 1940s. Phaseout of last B-47 bombers will be completed by June 1966 but a few will continue in service as RB-47s for photo and electronic reconnaissance, and WB-47s for Air Weather Service. **Contractor:** Boeing Co. **Powerplant:** 6 General Electric J47 turbojets, 6,000 lb. thrust each engine (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. **Bomb load/armament:** more than 20,000 lb.; 2 20-mm. cannon in tail turret. **Crew:** 3—pilot, copilot, navigator-

bombardier; 6 in RB-47H; 4 in WB-47. **Maximum gross takeoff weight:** 230,000 lb. **Primary using commands:** SAC, MATS.

KB-50J, K SUPERFORTRESS — originally a replacement for B-29 bombers, later used as tanker or in photo or weather reconnaissance versions, all B-50s have now been retired from the USAF inventory.

B-52 STRATOFORTRESS — strategic heavy bomber; mainstay of USAF manned-bomber deterrent strength. Prototype flew in April 1952. Total of 744 B-52s produced from A through H models; production ended October 1962. B-52As and Bs have been scrapped; C through F series are scheduled to be retired not later than 1970. G and H series will remain operational into 1970s. G and H models, equipped with AGM-28 Hound Dog missiles, are distinguishable from early types by shorter vertical tail, redesigned wing incorporating integral fuel



RB-57D



B-57



B-58

tank. H model has turbofan engines, yielding 12 percent better fuel consumption while eliminating water injection. **Contractor:** Boeing Co. **Powerplant:** 8 Pratt & Whitney J57-P-19W turbojets, C through E models; J57-P-43, F and G models, up to 13,750 lb. thrust each engine; H model, 8 Pratt & Whitney TF33-3s, 17,000 lb. thrust. Hound Dog engines of 7,500 lb. thrust can be used on takeoff. **Dimensions:** models C-F, span 185 ft., length 156 ft., height 48 ft.; models G-H, span 185 ft., length 157 ft., height 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:** more than 20,000 lb.; 4 .50-caliber machine guns in tail, 2 AGM-28 Hound Dog missiles under wings. **Crew:** 6. **Maximum gross takeoff weight:** ranges from 450,000 lb. in C model to 488,000 lb. in H model. **Primary using command:** SAC.

B-57B; RB-57 D, F CANBERRA—light bomber, once retired from active inventory but now embarked on new combat career in Vietnam. First US model, based on British Canberra, flew in July 1953; production ended in 1959 with total of 403 built in A through E models. Some B-57s were converted by Air National Guard to RB-57 reconnaissance configurations, but are now being restored to bomber role for use in Southeast Asia. Two reconnaissance versions flown by USAF are RB-57F, extensively re-

worked from earlier types, featuring much greater wingspan and high-thrust turbofan engines, for high-altitude, long-range reconnaissance; and RB-57D, initially built for long-range electronic recon missions, now being extensively modified by Martin Co. **Contractor:** Martin Co.; 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 gross takeoff weight:** more than 60,000 lb. **Primary using commands:** PACAF, SAC, MATS.

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." Two SAC wings fly B-58s—

43d of Little Rock AFB, Ark., and 305th, Bunker Hill AFB, Ind. B-58 crew of 305th Wing claimed international supersonic speed 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-71E3 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.

RB-66 DESTROYER—USAF version of Navy A-3A, used in USAF for photo and reconnaissance in RB-66A, B, and C, versions. Bomber versions B-66B and D have been retired along with WB-66 weather plane. RF-4Cs have begun replacing RB-66s. **Contractor:** Douglas Aircraft Co. **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/cameras:** 2 20-mm. cannon in tail; RB-66B, C, full range of camera

(Continued on following page)



XB-70



RB-66



SR-71

equipment for day or night photography; WB-66D, special weather reconnaissance gear. Crew: 3; 4 in RB-66C. Maximum gross takeoff weight: 70,000 lb. or more. Primary using commands: TAC, USAFE.

XB-70 VALKYRIE—Mach 3 intercontinental bomber, conceived in 1954 as follow-on to B-52, but now limited to 2 experimental prototypes. First XB-70 was expected to achieve test goal of Mach 3 flight at 70,000 ft. in mid-August. Second XB-70 has begun flight-test program. XB-70 incorporates numerous significant advances in state of the art, many of which are employed in YF-12A and SR-71 and in US supersonic transport design studies. Several proposals have been made to extend XB-70 test program beyond next year, including employing it as SST testbed, and as mother plane for X-15, which, launched from 70,000 ft. at Mach 3 and with auxiliary ramjet engine, might be able to achieve orbital velocity. **Contractor:** North American Aviation, Inc. **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:** 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 command: AFSC.

SR-71—Mach 3 long-range advanced strategic reconnaissance aircraft. Capable of both preattack and postattack strategic reconnaissance missions, SR-71 carries wide variety of advanced observation equipment. Flying at 2,000 mph at 80,000 feet, it can survey 60,000 square miles of land or ocean per hour. Development program was initiated in February 1963. Less than two years later, in December 1964, SR-71 made first flight at Palmdale, Calif. It is scheduled to enter operational service at Beale AFB, Calif., later this year. Like the YF-12A interceptor, SR-71 grew out of Lockheed's secret A-11 development program; it is substantially heavier than YF-12A and has longer range. **Contractor:** Lockheed Aircraft Corp. **Powerplant:** 2 Pratt & Whitney J58 engines, with thrust estimated in excess of 30,000 lb. each with afterburner. **Dimensions:** approximately same as those of YF-12A, about 55-ft. wingspan, 100-ft. length. **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 battle-

field 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 system officer. Maximum gross takeoff weight: estimated at 175,000 lb. or more. Primary using command: SAC.

AMSA—Advanced Manned Strategic Aircraft, in preliminary study phase. USAF has been pressing for go-ahead on development, had hoped it would be available as replacement for B-52C-F, scheduled to be retired by 1970. Now unlikely that it could be ready by that date. Four engine manufacturers — Allison, Curtiss-Wright, General Electric, Pratt & Whitney — are competing on design of propulsion system. Avionics components also under early development. AMSA capabilities were indirectly indicated by Gen. J. P. McConnell, USAF Chief of Staff, in testimony before a congressional committee.

Referring to the possibility of employing a "stretched" F-111 to replace earlier B-52s, General McConnell said it doesn't have the range "to do the job which we have in mind for the AMSA. It can't carry the same amount of ordnance. It would require overseas bases for recovery."

The Air Force Fighters



A-1E



F-86

A-1E—counterinsurgency fighter, employed in South Vietnam by USAF. Two-man crew seated side by side. Originally built for US Navy, designated AD-5. A-1H single-seat version is flown by South Vietnam AF. **Contractor:** Douglas Aircraft Co. **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:** above 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.

F-84F THUNDERSTREAK—temporarily restored to USAF inventory to equip additional TAC wings activated in 1962-63, F-84F is being returned to Air National Guard as it is replaced by F-4C. Reconnaissance version, RF-84F, is used extensively in ANG. It differs from fighter version mainly in that air intakes are in wing roots rather than nose, which is elongated to carry cameras. **Contractor:** Republic Aviation Corp. **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. of conventional or nuclear bombs, incendiary, or rockets. **Armament:** 6 .50-caliber machine guns. **Crew:** 1. **Maximum gross takeoff weight:** 26,000 lb. **Primary using commands:** TAC, USAF, ANG.

F-86 SABREJET—famed conqueror of the MIG-15 in Korea, the Sabrejet has virtually disappeared from the active Air Force but is widely 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, Inc. 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:** be-



F-89



RF-84F

yond 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—no longer in active USAF inventory, the Scorpion is being flown by Air National Guard interceptor units in US northern perimeter states. First flown in August 1948, it has gone through numerous model changes to the H; the J model used in the Guard is actually an earlier model factory-modified to incorporate changes up to the H. **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.

(Continued on following page)



F-100C



F-102



RF-101



F-104B

F-100 SUPERSABRE—first USAF fighter to exceed the speed of sound in level flight, Supersabre is extremely versatile, and with air-to-air refueling can fly long distances nonstop. Flight of three flew from England to Los Angeles in 14 hr. 5 min. Equipped for buddy-system refueling from one F-100 to another. F-100D is capable of being zero-launched. 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, Inc. **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, USAF, PACAF, ANG, NATO, Chinese Nationalist Air Force.

F-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. 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. **Contractor:** McDonnell Aircraft 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. All electronic equipment, armament, and fuel carried internally. Radar locks onto target and at right instant electronic fire-control system automatically prepares and fires its weapons. 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. **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. **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, ANG.

F-104 STARFIGHTER—the most widely used fighter in free-world air forces. Capable of Mach 2 speeds, it functions in both interceptor and tactical roles operating as close-support fighter in Vietnam. Production for USAF has been completed, but F-104G is being built under the Military Assistance Program in US, Canada, Germany, Belgium, the Netherlands, and Italy, and the F-104J in Japan. 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 future astronauts. **Contractor:** Lockheed Aircraft Corp.



F-105D



F-106A



F-4C

Licensees include Canadair, Mitsubishi, and numerous consortiums in Europe. **Powerplant:** General Electric J79-3, -7 or -11, 15,800 lb. thrust with afterburner; NF-104A 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. **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, 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. F-105B day fighter-bombers have been withdrawn from USAF and assigned to Air National Guard. F-105 bomb bay is longer than that of B-17. In one test, it 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 Corp. **Powerplant:** 1 Pratt & Whitney J75-19W turbojet, 26,500 lb. thrust with after-

burner. **Dimensions:** span 34 ft. 11 in., length 64 ft. 3 in., height 19 ft. 8 in. **Speed:** Mach 2.25 at 38,000 ft., 1.25 on deck. **Ceiling:** 52,000 ft. **Range:** over 2,000 mi. without refueling. **Bomb load:** 8,000 lb. of nuclear or conventional weapons in bomb bay, plus 4,000 lb. of bombs, incendiary, 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, USAF, 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. **Contractor:** General Dynamics/Convair. **Powerplant:** A, Pratt & Whitney J57-9 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. **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 PHANTOM II—world's fastest tactical fighter in production, USAF's principal tactical weapon system in period before F-111A becomes available. Britain is acquiring Phantom IIs for Royal Navy and RAF (F-4K, M). USAF will equip 10 or more of Tactical Air Command's 21 fighter wings with 2-man F-4C. Reconnaissance version, RF-4C, now replacing USAF RB-66s. F-4D and E series will be equipped with improved radar and close-support weapons. Unusual features of F-4C include variable-geometry air inlets, blowing boundary-layer control on both leading- and trailing-edge flaps. Capable of carrying twice the weapons payload of the World War II B-17, it employs a wide variety of armament from air-to-air missiles to multiple rocket-launching pods, incendiary, or nuclear ground-strike weapons. Uses probe-and-drogue refueling, with provisions for buddy refueling from one F-4C to another. **Contractor:** McDonnell Aircraft Corp. **Powerplant:** 2 General Electric J79-15s, generating 17,000 lb. thrust each with afterburner. **Dimensions:** span 38 ft. 5 in., length 58 ft. 3 in., height 16 ft. 3 in. **Speed:** over Mach 2.5. **Ceil-**

(Continued on following page)



YF-12A



F-5As



F-111A

ing: above 66,000 ft.; has reached 98,000 ft. in 6 min. 11 sec. Range: more than 2,000 mi. without refueling. Bomb load: more than 12,000 lb. Armament: Bullpup, Sidewinder, Sparrow III missiles, rockets, incendiary. Crew: 2. Maximum gross takeoff weight: over 40,000 lb. Primary using command: TAC.

F-5A FREEDOM FIGHTER—tactical fighter similar to USAF T-38 supersonic trainer. Though F-5A has not been ordered by USAF, it is being produced for air forces of 9 allied nations, including Canada, and under consideration by several others. USAF is reported assembling 1 squadron of F-5As for combat test in South Vietnam and, if results are favorable, may order substantial number for TAC to supplement F-4C. F-5A is single-seater; F-5B accommodates 2-man crew, for training or combat missions. It carries up to 5,000-lb. external stores—armament or fuel—and can take off or land from sod field. Contractor: Northrop Corp., Norair Div. Powerplant: 2 General Electric J85-13 turbojets, 4,000 lb. thrust with afterburner. Dimensions: span 26 ft. 5 in., length 43 ft. 11 in., height 13 ft. Speed: 900 mph. Ceiling: over 55,000 ft. Range: 2,100 mi. with external tanks. Armament: 2 M39 20-mm. cannon in nose. Can carry Sidewinder missiles or 2,000-lb. bomb, or rockets in combinations. Crew: F-5A, 1; F-5B, 2. Maximum gross takeoff weight: 19,000 lb. Primary using agencies: NATO allies.

F-111A—versatile fighter, with variable-sweep wings making possible

range of speeds from 100 mph to 1,850 mph, thus permitting its use in roles from close support to high-altitude intercept. Now in environmental test at Edwards AFB, Calif. First flight Dec. 24, 1964, at Ft. Worth, Tex. Orders have been placed for 431 F-111s, of which 24 are Navy F-111Bs, but eventual quantity is expected to reach 1,500 or more. Total cost earmarked for F-111 program to date is \$7.65 billion, of which USAF will spend \$963 million for research and development, \$4.5 billion for production. Initial order of 431 will be delivered by mid-1968. Subsequent planes will be designated Mark 2 model, with improved navigation platform, digital computer for navigation and weapons delivery, infrared search and detection subsystem, terrain-following radar, improved communications, and advanced missile. Australia has ordered 24 F-111s for RAAF; British have option to buy, with decision to be made by end of 1965. "Stretched" version of F-111A under consideration as interim replacement for B-52C through F. Contractor: General Dynamics/Ft. Worth (Grumman is building Navy F-111B). Powerplant: 2 Pratt & Whitney TF30 turbofans, over 20,000 lb. thrust each. Dimensions: wingspan 32 ft. swept, 63 ft. fully extended, length 72 ft. 2 in., height 17 ft. 1 in. Speed: 1,850 mph. Ceiling: above 60,000 ft. Range: transoceanic. Armament: conventional and nuclear weapons, including air-to-surface tactical missiles and rockets. Crew: 2. Maximum gross takeoff

weight: over 70,000 lb. Primary using command: TAC.

YF-12A—advanced interceptor in development test stage; 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; for speed over closed-circuit courses with varying payloads, and for horizontal flight at 80,000 ft. Employs ASG-18 pulse doppler fire-control system and AIM-47A long-range guided missile initially developed by Hughes Aircraft Co. for F-108 interceptor program and continued after F-108 was canceled. Current interceptors require accurate control from ground radars which direct them to proper altitude, speed, and heading for intercept. YF-12A's ASG-18/AIM-47 systems enable it to operate relatively independently 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: estimated at about 100 ft. long, 55-ft. wingspan. Speed: more than 2,000 mph. Ceiling: above 70,000 ft. Range: 1,500 mi. or more. Armament: Hughes ASG-18 fire control, AIM-47A missile; carries 4 or more missiles. Crew: 2. Maximum gross takeoff weight: estimated at 150,000 lb. Primary using commands: AFSC, ADC.



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The Air Force Cargo Aircraft



C-5A



C-46



C-47



C-97 with auxiliary turbojets



C-118A

C-5A—(formerly CX-HLS)—heavy logistics transport; winner of design competition between Boeing, Douglas, and Lockheed was to be decided by late summer. C-5A will be world's biggest aircraft, with maximum takeoff weight of about 725,000 lb., able to carry biggest equipment of an Army combat division, including M-60 tanks, helicopters, missiles. If present development schedule is maintained, it should be operational by 1969. Plans call for initial procurement of about 58 planes to equip 3 squadrons. Estimated cost per ton-mile is 30 to 40% less than for C-141. With landing gear of 20 wheels or more, it will be able to operate from low-strength runways as short as 4,000 ft., providing "home base to foxhole" service. **Contractor:** Boeing, Douglas, or Lockheed. **Powerplant:** DoD has continued development funding for GE 1/6 high bypass turbofan engine of about 40,000 lb. thrust, indicating its selection over Pratt & Whitney design. Four GE 1/6s would power C-5A. **Dimensions:** length expected to be about 215 ft., span 240 ft., fuselage diameter about 18 ft. **Speed:** 550 mph. **Range:** 7,000 mi. **Payload:** 250,000 lb., or 600 troops. **Maximum gross takeoff weight:** 725,000 lb. **Primary using command:** MATS.

C-46 COMMANDO — cargo-troop carrier used extensively in World War

II, returned to USAF inventory for use in counterinsurgency operations. More than 3,000 C-46s were built in World War II. Still in civilian use as freighters in many parts of the world. **Contractor:** Curtiss-Wright Corp. **Powerplant:** 2 Pratt & Whitney R2800-51 or -75 radial engines, 2,000 hp each. **Dimensions:** span 108 ft., length 76 ft. 4 in., height 21 ft. 9 in. **Speed:** 250 mph. **Ceiling:** over 20,000 ft. **Range:** 1,800 mi. **Payload:** 16,000 lb. or 50 troops. **Crew:** 4. **Maximum gross takeoff weight:** 55,000 lb. **Primary using command:** TAC.

C-47 SKYTRAIN — the "Gooney Bird," first flown in 1935, is still a valued workhorse in USAF, other services, other lands. Current inventory of US military aircraft lists 25 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:** Douglas Aircraft Co. **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., 28 troops. **Crew:** 3. **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 trans-

port for Air Force and Navy. Used extensively as an administrative command aircraft. Several versions employed in air-evac role. HC-54 used by Air Rescue Service. **Contractor:** Douglas Aircraft Co. **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:** MATS, 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 MATS cargo on training missions to Europe and Far East as well as within ZI. **Contractor:** Boeing Co. **Powerplant:** 4 Pratt & Whitney R4360-59 Wasp Majors, 2,650 hp each (3,500 hp on takeoff); KC-97s being modified to add 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



C-119



EC-121



C-123



C-54E



C-124

equipment, or more than 65,000 lb. Crew: 5. Maximum gross takeoff weight: 175,000 lb. Primary using command: ANG.

C-118 LIFTMASTER—cargo-troop carrier; military version of civil airlines' DC-6A; made first flight Sept. 1949; initially designed as cargo carrier to meet requirements for swift and economical transportation of air freight; being phased out of MATS except for aeromed-evac role. Contractor: Douglas Aircraft Co. 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: MATS.

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. 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 command: TAC (AFRes).

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-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; C-121C, G flown by the ANG as air transport, 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, ANG.

C-123 PROVIDER—capable performer in Vietnam, operating from short, unprepared fields to land and evacuate troops and supplies. High tail assembly and squat landing gear permits tail-ramp loading of combat equipment. H model has wider land-

ing gear to improve crosswind landing stability. Contractor: Fairchild Hiller Corp. Powerplant: 2 Pratt & Whitney R2800-99W piston engines, 2,500 hp 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, AFRes.

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 from ground to cargo sections, which can be converted to double-deck cabin for troops. Last C-124 delivered to USAF in May 1955. Contractor: Douglas Aircraft Co. 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. load. Payload: 200 fully equipped troops or 127 litters or 74.

(Continued on following page)



KC-135A refueling KC-135B



C-131E



C-130



C-133A

000 lb. of cargo. Crew: 5, plus doctors and nurses with litter patients. Maximum gross takeoff weight: 194,500 lb. Primary using commands: MATS, AFLC, SAC, AFRes.

C-130 HERCULES — versatile transport, performing a variety of missions around the world. C-130E is kingpin of US Strike Command paratroop and paradrop operations, indispensable element of TAC Composite Air Strike Force deployments. RC-130As have performed photomapping mission, in South America, Ethiopia, and elsewhere. HC-130Hs operating from Hawaii have compiled a high average in fielding capsules released from Discoverer satellites. 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. **Contractor:** Lockheed Aircraft Corp. **Powerplant:** 4 Allison T56-7 turboprop engines, 4,050 shp each. **Dimensions:** span 132 ft. 7 in., length 97 ft. 9 in., height 38 ft. 4 in. **Speed:** 365 mph maximum, 311 mph normal. **Ceiling:** above 30,000 ft. **Range:**

4,300 mi. with 25,000 lb.; 3,500 mi. with 35,000 lb. load. **Payload:** 35,000 lb., 92 troops, 64 paratroopers, or 74 litters. **Crew:** 5. **Maximum gross takeoff weight:** 155,000 lb. **Primary using commands:** TAC, MATS, 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 bombardier, navigator, and radar operators. VC-131 is executive transport. **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. 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:** MATS, ATC, SAC, TAC, PACAF, USAFE.

C-133 CARGOMASTER — giant turboprop transport, largest in USAF operational inventory, whose 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. C-133s were reworked in spring and summer of 1965 after series of accidents from uncertain causes. **Contractor:** Douglas Aircraft Co. **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:** MATS.

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 drogues 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



C-140



C-141



VC-137C



XC-142A

post were put out of action. At least one is airborne at all times. In 1961 USAF ordered C-135 transports for MATS, developed from KC-135. Fifteen C-135As and 30 C-135Bs were delivered. With entry of C-141 transport, however, C-135s are being shifted to other missions, including radar and weather reconnaissance (RC-135, WC-135). A dozen KC-135s with Pratt & Whitney TF33-5 engines have been 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; KC-135B, C-135B, 4 Pratt & Whitney TF39-9 turbofans; J57-59W 13,750 lb. thrust; TF33-9 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, MATS.

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 & Whit-

ney 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:** MATS.

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 MATS'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, MATS.

C-141 STARLIFTER—first pure-jet aircraft developed from start as cargo plane; now entering operational service with MATS, which is scheduled to equip 13 groups with C-141A. Cargo capacity exceeded only by C-133. Cubic capacity limitations, however, limit C-141 to about 55% of weight capacity, except when carrying high-density cargo such as am-

munition. C-5A being rushed into production to complement C-141, permitting optimum mix of heavy and bulky cargo and troops between 2 types. Linked with USAF's 463L cargo-handling 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 160.7 ft., length 145 ft. **Speed:** 550 mph. **Range/Payload:** 4,600 mi. with 60,000 lb.; 5,800 mi. with 30,000 lb.; ferry range, 7,250 mi. **Crew:** 8—2 alternate 4-man crews. **Maximum gross takeoff weight:** 330,000 lb. **Primary using command:** MATS.

XC-142A VTOL, STOL TRANSPORT—a triservice operational research vehicle, the XC-142A is being 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 '65. **Contractor:** LTV/Hiller/Ryan. **Powerplant:** 4 General Electric T64 turbo-prop engines, linked by an interconnecting shaft, 2,850 shp each. Normally cruises on two engines. **Dimensions:** span 67 ft. 6 in., length 58 ft., height 26 ft. **Speed:** cruise at 285 mph, maximum speed 430 mph. **Ceiling:** 25,000 ft. **Range:** 3,000 mi. ferry range, 460 mi. with maximum payload. **Payload:** 12,000 lb., or 32 fully equipped troops, STOL; 8,000 lb., VTOL. **Crew:** 3. **Maximum gross takeoff weight:** STOL, 41,500 lb.; VTOL, 37,500 lb. **Primary using command:** AFSC.

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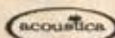


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GALLERY OF USAF WEAPONS

The Air Force Trainers



T-28D



T-29B

T-28D NOMAD; YAT-28E—counterinsurgency fighter, withdrawn from combat use in South Vietnam but employed by Air Commandos as trainer and light tactical aircraft. 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 provision 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 three-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



T-33

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. 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—student and instructor in tandem. **Maximum gross takeoff weight:** 16,000 lb. **Primary using commands:** most of the major air commands.

T-37B, YAT-37D—T-37B is highly successful primary jet trainer, with more than 600 in use for pilot training. May find new role in counter-insurgency work. Cessna has developed a pair of YAT-37Ds which were tested by Air Commandos. Changes include beefing up wing structure to carry 3,000 lb. of weapons and increasing power to reduce takeoff roll. Two General Electric J85s of 2,400 lb. thrust each replace T-37B powerplants. General purpose or incendiary bombs, gun pods, or rocket pods are slung from six points under wings
(Continued on following page)

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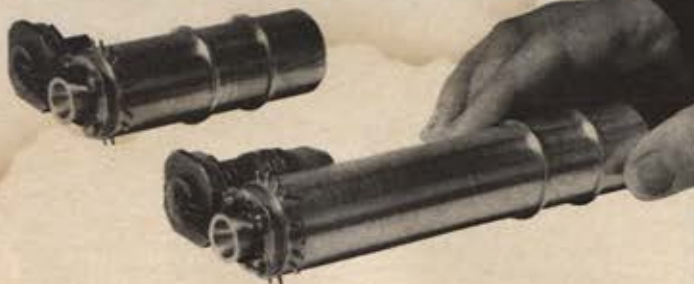
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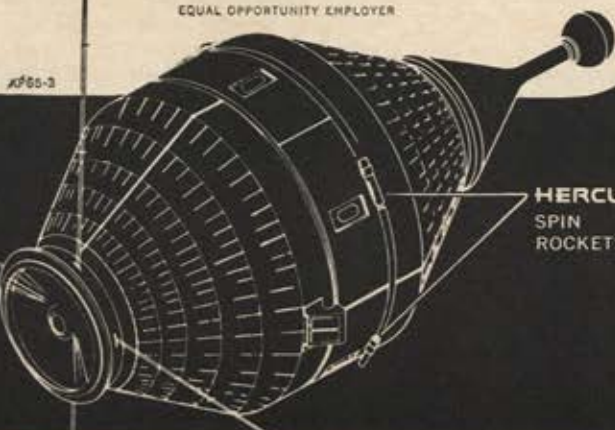
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T-38s

and a General Electric 6,000-rpm Gatling gun of 7.62 caliber is installed in nose. Following data is for T-37B trainer. **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. **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. Similar to 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:** beyond 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



T-37



T-41A



T-39A

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-39A is basic utility trainer and light, fast transport; T-39B fitted with all-weather search-and-range radar (NA-SARR) and Doppler navigation system for training F-105 pilots. **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:** 8 passengers. **Crew:** 2. **Maximum gross takeoff weight:** 17,760 lb. **Primary using commands:** ATC, TAC, SAC, MATS, USAFE.

T-41A—new 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. **Contractor:** Cessna Aircraft Co. **Powerplant:** Continental 0300-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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UH-1F



UH-13



CH-3C

UH-1F IROQUOIS—employed for ICBM site support. Other versions used by Army, Marines. **Contractor:** Bell Helicopter Co. **Powerplant:** 1 General Electric T58-8B, 1,250 shp. **Dimensions:** rotor span 48 ft., length 44 ft. 7 in., height 14 ft. 4 in. **Speed:** 130 mph. **Ceiling:** 12,500 ft. **Range:** with 800-lb. load, 250 mi. **Payload:** 10 passengers or 2,000 lb. **Crew:** 1. **Maximum gross takeoff weight:** 8,500 lb. **Primary using command:** SAC.

CH-3B, C—high-speed twin-turbine cargo or personnel helicopter, replacing HH-19 and HH-21. **CH-3C** features hydraulically operated rear ramp for straight-in loading of vehicles, 2,000-lb. winch for internal cargo handling, can operate from land or water. **Contractor:** Sikorsky Aircraft Div., United Aircraft Corp. **Powerplant:** 2 General Electric T58 shaft-turbine engines, 1,250 shp each. **Dimensions:** rotor span 62 ft., length 58 ft. 11 in., height 15 ft. 4 in. **Speed:** 150 mph. **Ceiling:** 6,700 ft. **Range:** 800 mi. with 2,400-lb. load. **Payload:** 5,000 lb. or 25 passengers. **Crew:** 3. **Maximum gross takeoff weight:** 18,000 lb. **Primary using commands:** SAC, MATS, TAC.

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-evacuation helicopter; in extensive USAF use and in 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. **Maximum gross takeoff weight:** 7,500 lb. **Primary using commands:** Most major commands.

HH-21B, CH-21B, C WORKHORSE—rescue and troop carrier helicopter; first flight April 1952; features well-known "banana" fuselage. Cockpit has



HH-21



HH-19B



HH-43B

side-by-side seating with the pilot on the right. 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 take-off weight: 15,000 lb. Primary using commands: TAC, MATS, 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, is powered by Lycoming T53-11, increasing rating to 1,000 hp. 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, 800 hp. 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 of the USAF commands.



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U-2D



U-3A



U-4A

The Utility and Experimental Aircraft

U-2A, D—high-altitude weather and photo-reconnaissance aircraft. Used primarily in high-altitude sampling program (HASP) for Defense Atomic Support Agency, operating in various parts of the world. Earlier models 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 & Whitney J57C or J75-13; J57C, 11,000 lb. thrust; 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. (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 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. **Contractor:** Aero Commander. **Powerplant:** 2 Lycoming IGO540 6-cylinder air-cooled engines, 350 hp. **Dimensions:** span 49 ft. 6½ in., length 35 ft. 2 in., height 14 ft. 6 in. **Speed:** 250 mph. **Ceiling:** 21,900 ft. **Range:** 1,700 mi. **Crew:** 2. **Maximum gross takeoff weight:** 7,500 lb. **Primary using command:** HEDCOM.

U-6A BEAVER—liaison-administration, high-wing lightplane produced in limited quantities for Air Force and Army since 1947. SAC had acquired U-6As for missile site support, but is replacing them with Bell UH-1F helicopters. **Contractor:** de Havilland Aircraft Co. **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 command:** SAC.

U-10A, B, C COURIER—4- 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:** Helio Aircraft Corp. **Powerplant:** A, B, Lycoming GO480, 295 hp; C, IGSO540, 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, ANG.

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 Air Rescue 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. **Contractor:** Grumman Aircraft Engineering Corp. **Powerplant:** 2 Wright R1820-76A or B piston engines,



U-10A



X-15A-2



U-6A



HU-16



Tripartite XV-6A (with Hawker Hunter)



X-21A



X-19A

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:** MATS, ANG.

XV-6A—VTOL tactical fighter. USAF is participating with US Army and Navy and RAF and West German AF in tripartite squadron based in England to field-test 9 XV-6A prototypes, built in England as P.1127. **Contractor:** Hawker Siddeley Aviation, Ltd.; Northrop is US licensee. **Powerplant:** Bristol Siddeley BS.53 Pegasus, 18,400 lb. thrust. **Dimensions:** span 24 ft. 4 in., length 41 ft. 2 in., height 10 ft. 3 in. **Armament:** carried on pylons under wings. **Crew:** 1. **Maximum gross takeoff weight:** 12,000 lb. **Primary using command:** AFSC.

X-15A—high-speed, high-altitude research vehicle conducting experiments jointly for USAF and NASA. Three X-15As have been built. X-15 No. 2 has resumed flight operations after extensive rework, including addition of two 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 ft. Three firms—Garrett Corp., General Electric, and Marquardt—have received preliminary design contracts for hypersonic ramjet engine to be tested on X-15 No. 2. X-15 holds unofficial speed record of 4,104 mph and altitude record of 354,200 ft., both piloted by NASA Chief Test Pilot Joe Walker. 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., length Nos. 1 & 3, 50 ft. (No. 2, 52 ft. 5 in.), height 13 ft. 6 in. **Speed:** Mach 8. **Ceiling:** 400,000 ft. or more. **Crew:** 1. **Maximum gross takeoff weight:** No. 2, 50,000 lb.; others, 34,000 lb. **Primary using commands:** AFSC, NASA.

X-19A—twin-engine, high-tandem-wing VTOL aircraft; triservice project, directed by USAF. Four propellers, 1 on each wingtip fore and aft, are tilted vertically for takeoff and landing, swing through 90 degrees in climb, are in normal horizontal position for cruise. Cross-shafting and overrunning clutches connect propellers to engines so that either engine can drive all 4 propellers continuously. Can perform entire mission on 1 engine. **Contractor:** Curtiss-Wright Corp. **Powerplant:** 2

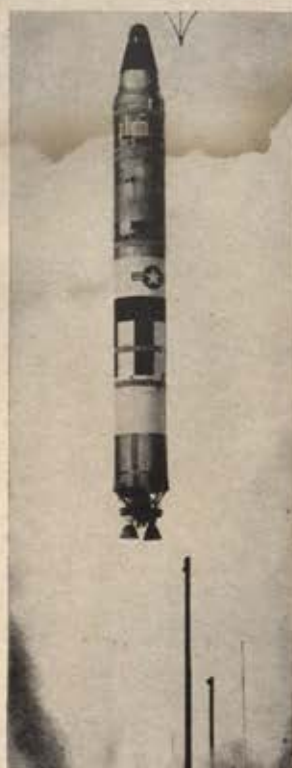
Lycoming T55-5 propjet engines located in aft fuselage, 1,850 shp each. **Dimensions:** span 34 ft. 6 in., length 43 ft., height 17 ft. **Speed:** 0 to 460 mph. **Ceiling:** 25,000 ft. **Range:** 345 mi. **Payload:** 1,000 lb. or 6 passengers. **Crew:** 3. **Maximum gross takeoff weight:** 13,000 lb. **Primary using command:** AFSC.

X-21A—designed to explore laminar-flow control which can, in theory, double an aircraft's range and/or payload. Two prototypes built using Douglas WB-66D airframes. Flight tests at Edwards AFB, Calif., have not yet achieved design specifications. Wing leading edge is being modified. X-21A wings have 25 percent greater span, almost twice the area of WB-66. Allison J71 turbojet engines used in WB-66 have been removed, with nacelles being used to house pumps drawing air from wing surfaces through lengthwise slots. General Electric J79-13 turbojet engines have been installed in pods along rear of fuselage. **Contractor:** Northrop Corp. **Powerplant:** 2 General Electric J79-13 turbojets, 10,000 lb. thrust each. **Dimensions:** span 93 ft. 6 in., length 75 ft. 6 in., height 23 ft. 7 in. **Speed:** over 600 mph. **Crew:** 5. **Maximum gross takeoff weight:** 83,000 lb. **Primary using commands:** AFSC, Federal Aviation Agency.

The Air Force Missiles



ATLAS-AGENA
launching Mariner-4
to Mars



TITAN II



MACE

CGM-13C MACE—tactical, air-breathing, surface-to-surface missile launched from fixed, hardened sites; earlier model, MGM-13B, fired from mobile launcher, is being retired in favor of Army's Pershing missile. **Contractor:** Martin Co. **Powerplant:** Allison J33-41 engine, 5,200 lb. thrust, plus Thiokol rocket booster of 100,000 lb. thrust for zero launch. **Dimensions:** span 22 ft. 11 in., length 44 ft., diameter 4 ft. 6 in. **Speed:** 650 mph. **Ceiling:** 40,000 ft. **Range:** 1,200 mi. **Warhead:** conventional or nuclear. **Guidance:** inertial, AC Spark Plug Div., GMC, General Mills. **Launch weight:** 18,000 lb. **Primary using commands:** USAF, PACAF.

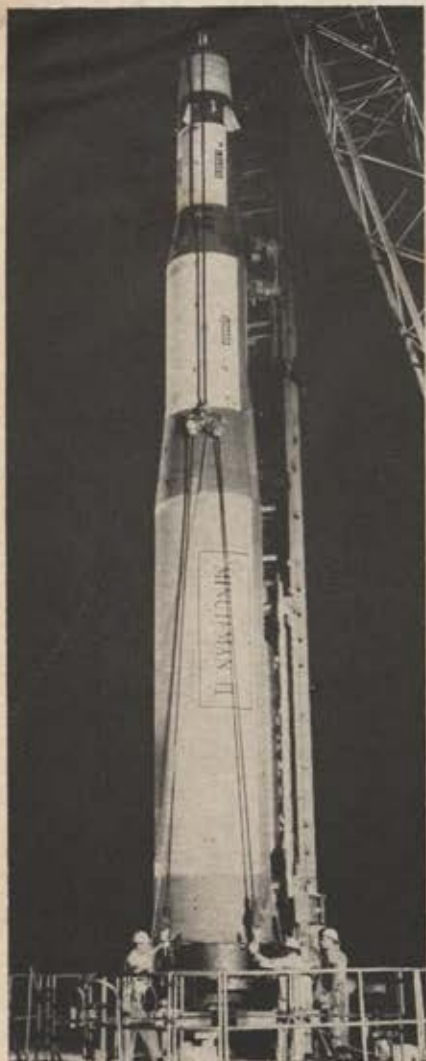
CGM-16D, E; HGM-16F ATLAS—all Atlas intercontinental ballistic missiles have been phased out of USAF inventory. Atlas continues in service as first-stage booster on USAF and NASA space shots. It served as booster on all US Mercury manned orbital flights, as well as Ranger moon probes and Mariner spacecraft to Venus and Mars. **Contractor:** General Dynamics/

Astronautics; technical assistance, Space Technology Labs. **Powerplant:** Rocketdyne 1½-stage liquid-rocket engine developing 389,000 lb. thrust. Acoustica Associates, Inc., propellant-utilization system. **Dimensions:** length 82 ft., diameter 10 ft. **Speed:** over 16,000 mph. **Range:** -16F, 9,000 mi. **Guidance:** D, radio-inertial by General Electric, Burroughs; E, F, all-inertial by Arma. **Launch weight:** 269,000 lb. **Primary using commands:** AFSC, NASA.

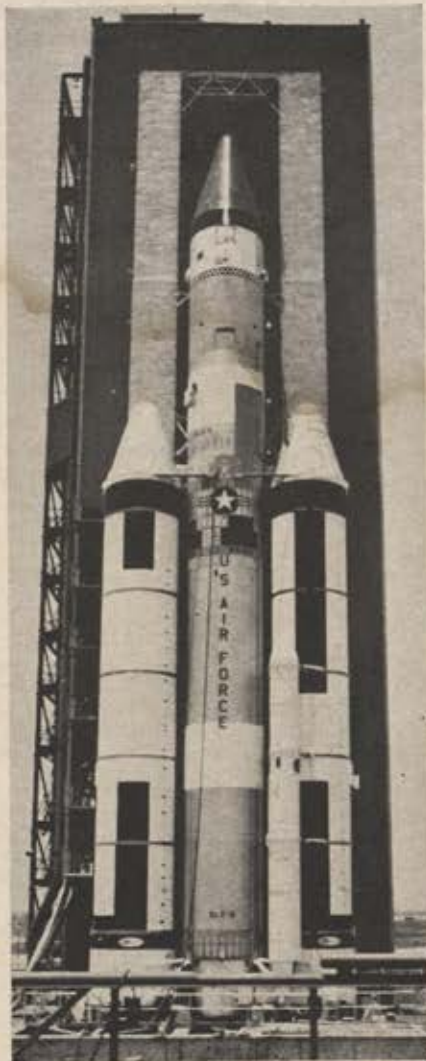
HGM-25A TITAN I; LGM-25C TITAN II—2-stage, liquid-propellant ICBM. Man-rated Titan II is launch vehicle for NASA-DoD Gemini program and serves as core for Titan III (see below). Titan I has been retired from USAF missile inventory. Titan II, employing storable propellants, is silo-launched in less than a minute, has thrust, range, and payload greater than any other US ICBM. Pairs of Titan II squadrons, 9 missiles each, at McConnell AFB, Kan.; Davis-Monthan AFB, Ariz., and Little Rock AFB, Ark. **Contractor:** Martin/Denver; tech-

nical direction, Space Technology Labs. **Powerplant:** Aerojet-General liquid-propellant rockets; first stage 430,000 lb., second stage 100,000 lb. **Dimensions:** length 103 ft., diameter 10 ft. **Speed:** over 15,000 mph. **Range:** over 9,000 mi. **Warhead:** nuclear; re-entry vehicle by General Electric. **Guidance:** AC Spark Plug Div., GMC, all-inertial. **Launch weight:** 330,000 lb. **Primary using commands:** SAC; Titan II in booster role, NASA, AFSC.

LGM-30A, B, F MINUTEMAN—solid-propellant ICBM, principal US deterrent missile weapon system with 800 now operational in SAC, building toward goal of 1,000. LGM-30A (Minuteman A) and LGM-30B (Minuteman B) differ only in that second-stage motor chamber is made of steel in -30A and titanium in -30B. LGM-30F (Minuteman II) features larger and more powerful second-stage motor with single nozzle instead of four nozzles in earlier series, providing longer range, heavier payload, or both; greater thrust plus improved guidance system affords more flexible targeting.



MINUTEMAN II



TITAN III



Thrust-Augmented THOR

Wing I, equipped with A model, at Malmstrom AFB, Mont.; Wings II-V, employing B model, at Ellsworth AFB, S. D.; Minot AFB, N. D.; Whiteman AFB, Mo.; and F. E. Warren AFB, Wyo., respectively; Wing VI, to be equipped with Minuteman IIs, at Grand Forks, N. D. Wing V (Warren AFB) has 200 missiles; Wing I (Malmstrom) now has 150 missiles, will get 50 more; all others, 150 missiles each. As soon as Minuteman II development tests are completed this fall, force modernization program will get under way to replace LGM-30As and Bs with LGM-30Fs. **Contractors:** Boeing Co. assembly and test; systems engineering and technical direction, Space Technology Labs. **Powerplant:** Thiokol first stage, 170,000 lb. thrust; Aerojet-General second stage, 65,000 lb. thrust in A and B models; Hercules third stage, 35,000 lb. thrust. **Dimensions:** A, length 54 ft.; B, 56 ft.; F, 60 ft.; diameter of each, 71 in. **Speed:** over 15,000 mph. **Range:** A, B, over 6,300 mi.; F, over 7,000 mi. **Warhead:** nuclear; Avco, General Electric, reen-

try vehicle. **Guidance:** North American Autonetics, all-inertial; F model ground electronics system by Sylvania. **Launch weight:** I, 65,000 lb.; II, 70,000 lb. **Primary using command:** SAC.

MMRB—development of this mobile medium-range ballistic missile has been canceled.

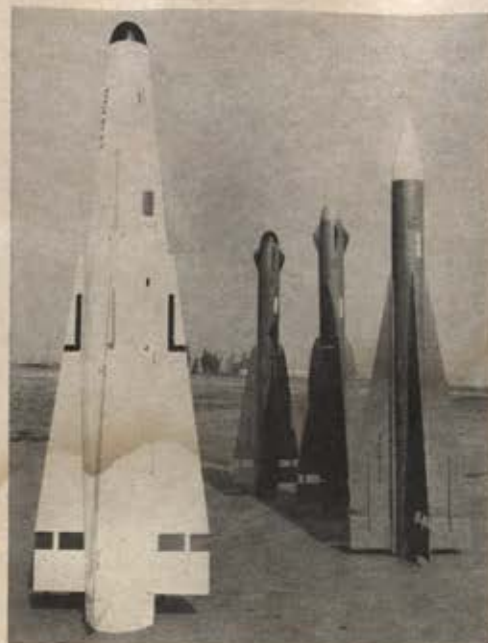
TITAN IIIA, C—standardized space launch system for variety of manned and unmanned booster missions, including USAF's Manned Orbiting Laboratory. Designed for use in either of two configurations: IIIA consists of modified Titan II core with new upper stage and control module, IIIC a complete Titan II plus two strap-on motors of more than a million pounds thrust each. Titan III employs "integrate-transfer-launch" (ITL) complex built by Ralph M. Parsons Co., permitting booster to be completed, assembled, and checked out in assembly area, then moved intact to simplified launch pad, reducing time on pad and number of pads required. **Integrating contractor:** Martin/Denver; technical assistance, Aerospace Corp. **Power-**

plant: same as Titan II, plus two United Technology Center strap-on boosters in Titan IIIC, bringing total thrust to nearly three million pounds. **Dimensions:** height 120 ft., diameter IIIA, 10 ft.; IIIC, 30 ft. **Speed:** over 15,000 mph. **Range:** orbital. **Guidance:** AC Spark Plug Div., GMC, all-inertial. **Payload:** IIIA, 5,000 lb. in earth orbit; IIIC, 25,000 lb. in low orbit, 2,100 lb. in high orbit or interplanetary probe. **Launch weight:** IIIA, 345,000 lb.; IIIC, more than 600 tons. **Primary using command:** AFSC.

PGM-17A THOR—retired from its original role as an intermediate-range ballistic missile, Thor in two configurations continues in service as space booster alone or in combination with various second-stage vehicles; NASA Delta booster employs Thor as first stage. Thrust-Augmented-Thor (TAT) and -Delta (TAD) employ three Thiokol solid-propellant strap-on motors to augment thrust to more than 300,000 lb., increasing versatility as boost vehicle. **Contractor:** Douglas Aircraft
(Continued on following page)



BLUE SCOUT



AIM-26A, AIM-4A, AIM-4C, AIM-4E



BOMARC B



GENIE

Co. Powerplant: Rocketdyne liquid-propellant rocket of 165,000 lb. thrust; TAT and TAD add 3 strap-on rockets, 54,000 lb. thrust each. Dimensions: length 65 ft., diameter 10 ft. Speed: Mach 10 to 15. Range: beyond 1,750 mi. Guidance: AC Spark Plug Div., GMC; Bell Telephone Labs, all-inertial. Payload: 1,500 lb. in 100-mi. orbit (TAT, TAD). Launch weight: over 110,000 lb. Primary using commands: AFSC, NASA.

BLUE SCOUT—space-probe and satellite-launch vehicle; not a combat weapon system. USAF modification of NASA Scout booster. Three versions in USAF use—Blue Scout Junior and Blue Scout I and II. Contractor: Ford Aeronutronic; frame by Ling-Temco-Vought. Powerplant: Junior and II are four-stage, produced variously by Aerojet-General, Thiokol, Allegany Ballistic Labs, United Technology Center, and Hercules; Blue Scout I is three-stage. Length: Junior, 40 ft. 3 in.; I, 71 ft.; II, 74 ft. Speed: hypersonic. Range/payload: capable of putting 250 lb. in 300-mi. orbit. Guidance: Honey-

well, inertial. Launch weight: Junior, 12,750 lb.; I, II, about 37,000 lb. Primary using command: AFSC.

CIM-10B BOMARC B—surface-to-air winged area-defense missile. Total of 188 missiles deployed at 6 USAF sites—Duluth, Minn.; Kincheloe AFB, Mich.; Langley AFB, Va.; McGuire AFB, N. J.; Niagara Falls Municipal AP, N. Y.; and Otis AFB, Mass.—and two RCAF sites in Canada. Contractor: Boeing Co. Powerplant: Thiokol booster, 50,000 lb. thrust; two Marquardt ramjet cruise engines, 12,000 lb. thrust each. Dimensions: span 18 ft. 2 in., length 45 ft., diameter 35 in. Speed: 2,500 mph. Ceiling: 100,000 ft. Range: 440 mi. Warhead: nuclear, Bendix fuze. Guidance: Westinghouse, General Precision SAGE-linked homing radar. Launch weight: 16,000 lb. Primary using commands: ADC, RCAF.

AIR-2A GENIE—air-to-air rocket, operational on F-89J, F-101B, F-106. Contractor: Douglas Aircraft Co. Powerplant: Aerojet-General solid-propellant rocket engine, 36,000 lb. thrust.

Dimensions: span 2 ft., length 9 ft. 7 in., diameter 17 in. Speed: Mach 3. Range: 6 mi. Warhead: nuclear. Guidance: none. Launch weight: 800 lb. Primary using commands: ADC, ANG.

AIM-4A to G; AIM-26A, B; AIM-47A FALCON—air-to-air guided missile of which ten configurations are in use, production, or development. AIM-47A is designated as primary weapon for YF-12A interceptor with ASC-18 fire-control system; launched from aircraft at 70,000 to 80,000 feet, and traveling at Mach 6, it can strike targets from ground to about 95,000 feet at range of 100 miles or more; no size or weight details available. AIM-4C and -26B being produced for Swedish AF under license by SAAB. Contractor: Hughes Aircraft Co. Powerplant: AIM-47A, Lockheed single-stage solid-propellant; AIM-4F, G, two-stage Thiokol solid-propellant; all others Thiokol single-stage. Engine casings by Norris Thermador. Dimensions: AIM-4F, length 7 ft. 2 in.; -4C, 6 ft. 9 in.; -26A, 7 ft.; others, 6 ft. 6 in. (Continued on page 232)

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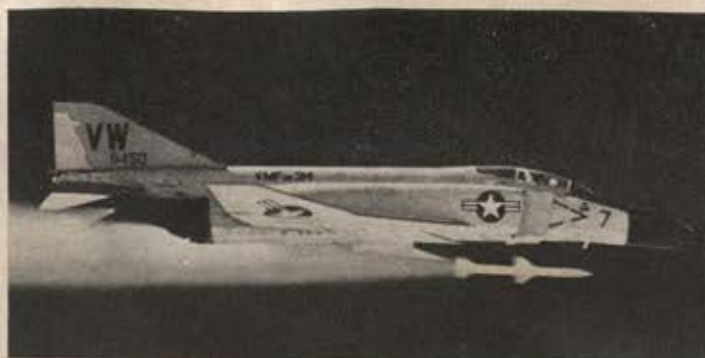
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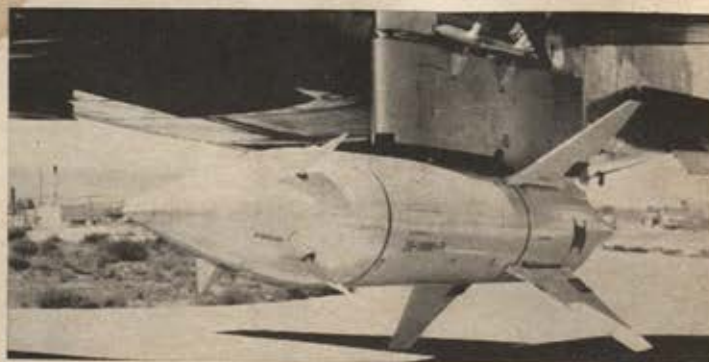
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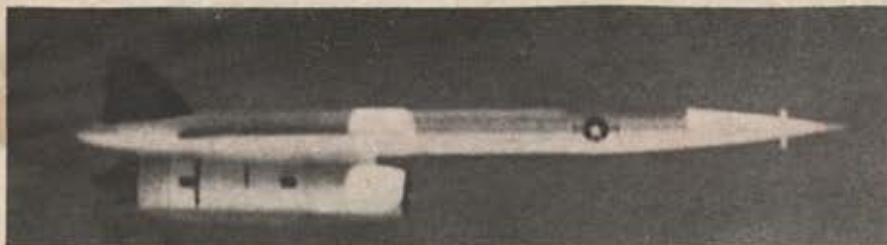
in.; diameter AIM-26A, 11 in.; others, 6.5 in. **Speed:** AIM-47A, Mach 6; AIM-4F, G, Mach 3; others, Mach 2. **Range:** AIM-47A, 100 mi.; AIM-4F, G, 7 mi.; others, 5 mi. **Warhead:** AIM-26A, -47A, nuclear; others, conventional; fuze and arming by General Sintering, Philco. **Guidance:** AIM-4B, C, D, G, Hughes infrared homing; others, Hughes semiactive radar homing. **Launch weight:** AIM-26A, 203 lb.; others, from 120 to 150 lb. **Primary using command:** ADC.

AIM-7E SPARROW IIIB—air-to-air guided missile with 360-degree attack capability, developed under the direction of US Navy, employed on USAF F-4C fighter. **Contractor:** Raytheon Co. **Powerplant:** Aerojet-General solid propellant. **Dimensions:** length 12 ft., diameter 8 in. **Speed:** Mach 3. **Range:** 13 mi. **Warhead:** conventional. **Guidance:** Raytheon semiactive radar homing. **Launch weight:** 400 lb. **Primary using command:** TAC.

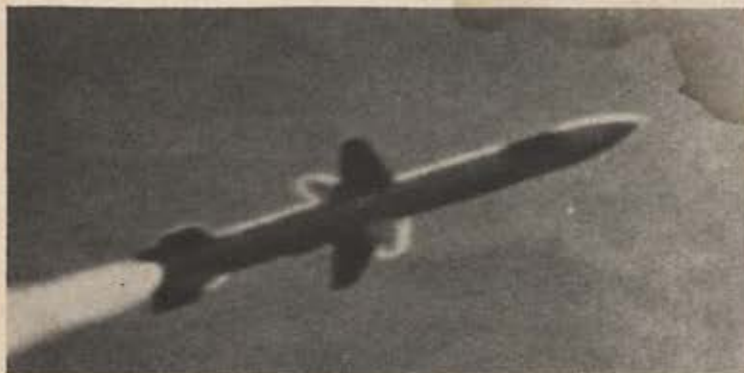
AIM-9D SIDEWINDER—air-to-air missile, originally developed by US Naval Ordnance Test Station, used on USAF F-100, F-101, F-104, F-105, and F-4C. Various versions of AIM-9

have been produced under license overseas and are employed in air forces of a dozen or more US allies. **Contractor:** Philco Corp. **Powerplant:** Rocketdyne solid propellant. **Dimensions:** length 9 ft. 4 in., diameter 5 in. **Speed:** Mach 2.5. **Ceiling:** above 50,000 ft. **Range:** 2 mi. **Warhead:** ACF Industries, conventional; fuzes by Honeywell, Eastman Kodak, Baldwin Piano. **Guidance:** Philco infrared homing. **Launch weight:** 155 lb. **Primary using commands:** TAC, ADC, over-seas commands, US allies.

AGM-12B, D BULLPUP—air-to-surface guided missile developed by US Navy, carried on USAF F-100 and F-105 tactical fighters. AGM-12B being produced in Europe for NATO air forces. **Contractors:** Martin Co., Maxson Electronics Co. **Powerplant:** Thiokol storable liquid-propellant engine. **Dimensions:** length 10 ft. 6 in., diameter 1 ft. **Speed:** Mach 1.8. **Range:** 6 mi. **Warhead:** B, conventional; D, nuclear or conventional. **Guidance:** Martin/Maxson command, radio signal from pilot. **Launch weight:** 571 lb. **Primary using commands:** TAC, over-seas commands.



HOUD DOG



SHRIKE



QUAIL

AGM-28B HOUND DOG—air-to-ground air-breathing defense-suppression missile, with canard airplane configuration. Can be launched and flown at low altitudes. Two carried under wings of B-52 bomber. **Contractor:** North American Aviation. **Powerplant:** Pratt & Whitney J52 turbojet, 7,500 lb. thrust. Can be used on takeoff to shorten B-52 takeoff roll. **Dimensions:** span 12 ft. 2 in., length 42 ft. 6 in., height 9 ft. 3 in. **Speed:** Mach 2. **Ceiling:** over 52,000 ft. **Range:** 700 mi. **Warhead:** nuclear. **Guidance:** North American Autonetics inertial, Kollsman Instrument Corp. astro-tracker. **Launch weight:** 9,600 lb. **Primary using command:** SAC.

AGM-45A SHRIKE — Navy-developed air-to-surface missile, designed to attack and home on enemy radar sites. **Contractor:** Texas Instruments. **Powerplant:** Rocketdyne solid propellant. **Dimensions:** length 10 ft., diameter 8 in. **Warhead:** conventional. **Guidance:** Texas Instruments electro-magnetic. **Launch weight:** 390 lb. **Primary using command:** TAC.

ADM-20B, CQUAIL—air-launched, air-breathing bomber decoy missile,

carried aboard B-52 bombers and released over enemy territory. Because it produces the same radar image as a B-52, it multiplies enemy defense problems. **Contractor:** McDonnell Aircraft Co. **Powerplant:** General Electric J85-7 turbojet, 2,450 lb. thrust. **Dimensions:** span 5 ft. 4 in., length 12 ft. 10 in., height 3 ft. 4 in. **Speed:** 650 mph. **Ceiling:** over 50,000 ft. **Range:** -20C, 400 mi.; -20B, 250 mi. **Warhead:** none. **Guidance:** McDonnell, Summers Gyroscope, autopilot; countermeasures gear by TRW. **Launch weight:** 1,200 lb. **Primary using command:** SAC.

XAGM-69a SRAM—short-range attack missile in design proposal phase; defense-suppression weapon designed to be carried on B-52, F-111, and possibly on B-58 and F-4C; original conception envisioned the use of such a missile on the Advanced Manned Strategic Aircraft; primary purpose is to attack ground targets over short ranges. B-52s would carry several SRAMs in contrast to present limit of 2 Hound Dog missiles. SRAM will supplement Hound Dog missile for certain missions.—END



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The right insurance program can keep a family from financial trouble when death or disability strikes. It can keep a family together, provide a comfortable home, pay for children's education . . . even provide a few luxuries in addition to the necessities of life.

To help its members provide proper insurance protection

for their families, AFA has made a variety of group insurance plans available at the lowest possible cost. Each one is specifically tailored to meet the known needs of military families. Complete descriptions of any or all of these plans are available without cost or obligation. Use the coupon on the facing page.

MILITARY GROUP LIFE INSURANCE

(with New, **BIGGER** Benefits at the Same, Low Cost)

Substantial new benefits have been added to AFA Military Group Life Insurance at *no increase in premium*.

Equal coverage, up to \$20,000, is now provided for both flying and nonflying personnel. This eliminates the penalty of lower coverage for the man on flying status whose death is caused by illness or ordinary accident.

The accidental death benefit has been increased to \$12,500—a substantial increase in this benefit for every age group.

The only exception to these new provisions is that a flat sum of \$15,000, regardless of age, will be paid for death caused by aviation accident *while the insured is serving as pilot or crew member of the aircraft involved*.

Policyholders may also keep their insurance in force at the low group rate after they leave the service, and until age 65—provided their coverage has been in effect for at

least a twelve-month period prior to their date of separation.

Net cost of insurance has now been reduced by dividend payments for three consecutive years. Dividends amounting to 20% of the annual premium were paid to 1964 policyholders . . . in addition to the major benefit increases made in the policy.

Other benefits include guaranteed conversion privilege, waiver of premium for disability, choice of settlement options, and a choice of convenient payment plans, including payment by allotment for those on active duty.

All military personnel on active duty, in the National Guard, and in the Ready Reserve are eligible for AFA Military Group Life Insurance.

More than 13,000 participants carrying over \$225,000,000 life insurance in force have selected this unique program—truly the best protection for all service families.

CIVILIAN GROUP LIFE INSURANCE

This new program offers AFA's nonmilitary members \$10,000 of needed insurance protection at the lowest cost we know of for any group term policy which offers equal benefits:

Double Indemnity is a unique feature of this plan, covering almost all accidental deaths, including death caused by aviation accident unless the insured is acting as pilot or crew member of the aircraft at the time of accident.

Coverage may be continued at low group rates to age 65, when it may be converted to any permanent plan of insurance then being offered by the Underwriter,

United of Omaha, regardless of the health of the insured person at that time. Conversion prior to age 65 is also guaranteed, at the option of the insured.

The plan also provides many other benefits—waiver of premium for disability, a choice of settlement options, and a choice of convenient payment plans to fit most family budgets.

Any member of AFA, man or woman, who is not on active duty or in the National Guard or Ready Reserve, and who is between 20 and 60, is eligible, except for members who have left military status but still retain AFA Military Group Life Insurance at Group rates.

AFA's Low-Cost Insurance Programs

• CIVILIAN GROUP LIFE INSURANCE (with Double Indemnity)

• COMPREHENSIVE ACCIDENT INSURANCE

There Is No Cost! No Obligation!

COMPREHENSIVE ACCIDENT INSURANCE

This unique accident policy, available to *all* AFA members, offers worldwide full-time protection against all accidents except those involving crew members in aircraft accidents.

It is available in units of \$5,000, to a maximum of \$50,000, and may be purchased for individual protection, or for complete family protection under the popular Family Plan—both at remarkably low rates.

The Family Plan provides insurance for each member of the family under one convenient policy. The wife of the policyholder is insured for 50% of his coverage.

Each child, regardless of the number of children in the family, is insured for 10% of the AFA member's coverage.

Insurance is also provided for nonreimbursed medical expenses of over \$50, up to a maximum of \$500. Under the Family Plan, *every* family member receives this valuable extra coverage.

In addition, policyholders receive an automatic 5% increase in the face value of their policies *each year* for the first five years their insurance is in force. There is no extra premium cost for this increase.

FLIGHT PAY INSURANCE

AFA *guaranteed* Flight Pay Protection is available to rated personnel on active duty. Protection is guaranteed even against preexisting illnesses after a policy has been in force for twelve consecutive months. This insurance protects active-duty members on flying status against loss of their flight-pay income because of injury or illness.

Grounded policyholders receive payments equal to 80% of their flight pay (tax free) for periods up to two

years if grounding is caused by aviation accident and for periods up to one year for groundings caused by illness. Because they are tax free, these payments are essentially the equivalent of full government flight pay, which is taxable income.

This plan assures members of no loss of income if they are returned to flying status within the benefit period. If grounding is permanent, they have sufficient time to adjust to a lower-income level.

**FOR COMPLETE INFORMATION
ON ANY OR ALL OF THESE
AFA INSURANCE PLANS,
RETURN THIS COUPON.**

AIR FORCE ASSOCIATION Insurance Division

1750 Pennsylvania Ave., N. W.
Washington, D. C. 20006

Gentlemen:

Without obligation please send me complete information about the AFA Insurance Program(s) checked at right.

Name _____

☐ Military Group Life Insurance

Rank or Title _____

☐ Civilian Group Life Insurance

Address _____

☐ All-Accident Insurance

City _____

☐ Flight Pay Insurance

State _____ Zip Code _____

9-65

MODERN AERIAL RECONNAISSANCE IS A COMPLEX (AND VITAL) BUSINESS



Cuba, 1962.

All of this equipment simply to take an aerial photograph? It may seem overdone at first glance, but a knowledgeable analysis of present requirements reveals that aerial photographic reconnaissance is indeed a highly complex business. Unique cameras. Self-thinking electronic scanners. Associated components. Ground support equipment. These components combine to provide precision automatic control necessary for high resolution aerial photography. It all adds up to the

"modern" aerial reconnaissance system.

Considering a reconnaissance vehicle almost hugging the landscape at supersonic speeds, it immediately becomes apparent that the pilot must devote his effort to aircraft control—leaving the camera system to perform its own automatic "thinking" and picture taking. Designing superior automatic photographic reconnaissance systems is the specialty of Chicago Aerial Industries and has been for 41 years.



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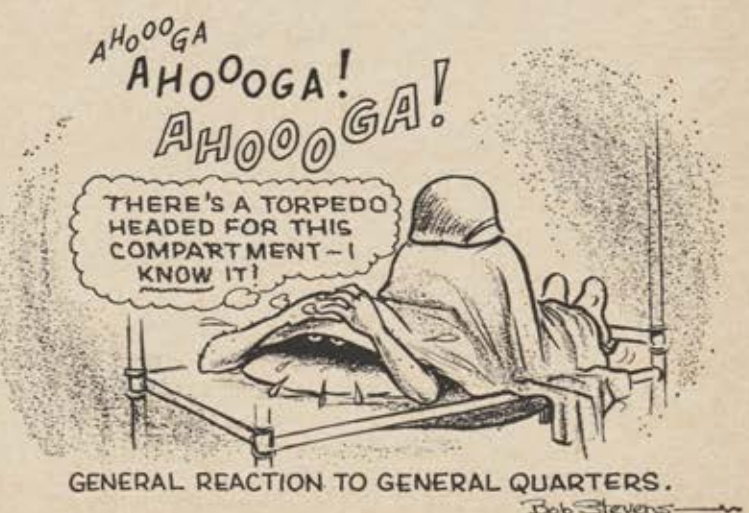
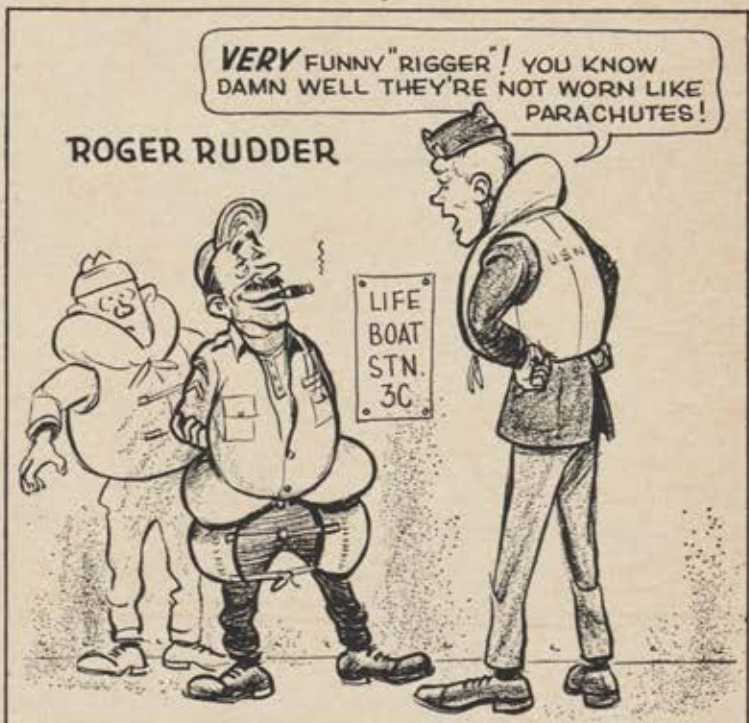
Pacific Optical Corporation, Inglewood, California



Bob Stevens'

"There I Was..."

During the second unpleasantness, the lucky ones flew over the big ponds, but the majority of the troops bound for exotic overseas stations sweated it out at eight to eighteen knots aboard one of Uncle's luxury liners.



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.

Objectives

- To assist in obtaining and maintaining adequate airpower for national security and world peace • To keep AFA members and the public abreast of developments in the field of aviation.
- To preserve and foster the spirit of fellowship among former and present personnel of the United States Air Force.

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—\$6 per year. **Service Members** (non-voting, non-officeholding): US citizens on extended active duty with any branch of the United States armed forces—\$6 per year.

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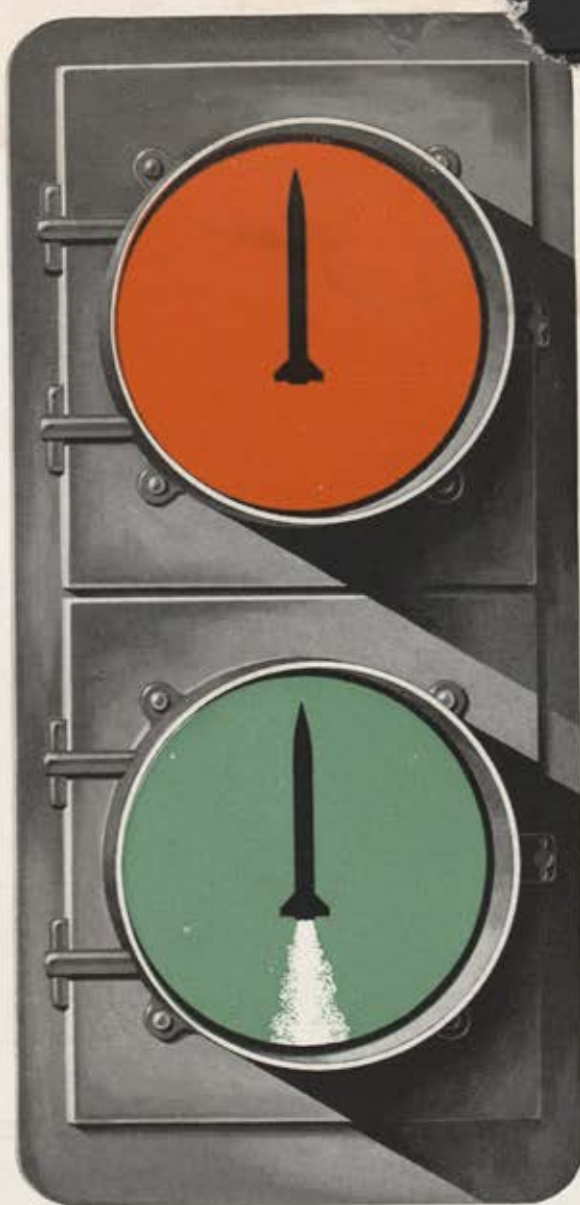
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