



The Air Force Systems Command

COMPLETION of some major weapon and support systems, continuing progress in research and development, assignment of new tasks and extended management efforts in accomplishing its mission—these typified the Air Force Systems Command's fiscal '64 operations under the direction of Gen. B. A. Schriever.

Scientific research and development conducted by AFSC continued apace during FY '64. The command kept tackling one of the most challenging responsibilities in modern Air Force history. Mission: The research, development, testing, procurement, and production of all new USAF weapon systems from inception to delivery to operational commands.

AFSC R&D activities during the year ranged the scientific spectrum from in-house laboratory research and exploratory development to aircraft, missiles, and satellites. The period saw major progress in strengthening the deterrent force of the nation.

Major Programs Completed

In commemorating the nation's ten years of progress in aerospace achievements, USAF-AFSC credited the military-industry-scientific community for its team effort. The US today has a ready force of more than 1,000 ICBM and Polaris missiles in its arsenal.

On December 28, 1963, the entire Titan ICBM force became operational with the transfer by AFSC's Ballistic Systems Division (BSD) to the Strategic Air Command (SAC) of the sixth operational Titan II squadron, at Little Rock AFB, Ark.

On April 2, 1964, BSD turned over to SAC a third wing of Minuteman ICBMs, bringing the total to 450, and ended FY '64 with the turnover, June 30, of the fourth Minuteman wing of 150 solid-fuel ICBMs to SAC at Whiteman AFB, Mo. The turnover emphasized the fact that 600 solid-fuel ICBM missiles were in the nation's defense inventory.

One of the most significant studies of importance to the nation was Project Forecast, directed by the Secretary of the Air Force and the Chief of Staff and completed in May 1964. Forecast was a study of military

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.



technology and requirements during the time period from 1965 to 1975. Under direction of General Schriever, participants included representatives of all services, industry, NASA, other government agencies, nonprofit organizations, the AF Scientific Advisory Board, the National Academy of Sciences, and twenty-six universities and colleges. Areas examined by panel members included flight dynamics, propulsion, geophysics, weapon systems, navigation, and guidance.

Last September 26, the Semi-Automatic Ground Environment (SAGE) center located underground at North Bay, Ontario, Canada, became operational under the development management of AFSC's Electronic Systems Division (ESD). The center tied together a radar network developed to provide air-defense coverage for New England states, Northwest territories, Maritime provinces of Canada, Quebec, and most of Ontario. SAGE is designed for use against hostile aircraft and air-breathing missiles.

Also in September 1963 the last of the Ballistic Missile Early Warning System (BMEWS) sites was turned over to the British at Fylingdales, England. The other two sites—at Thule, Greenland, and Clear, Alaska—had earlier been turned over to the Air Defense Command by ESD.

The first flight during December of the swift, all-jet C-141 StarLifter cargo transport marked a major advance in the Air Force's airlift modernization program

(Continued on following page)

under development supervision of AFSC's Aeronautical Systems Division (ASD). Capable of spanning any ocean without refueling, the Lockheed StarLifter can carry a military cargo of 70,000 pounds over a range of 3,800 nautical miles. As a troop carrier, it can transport 154 combat troops or 127 fully equipped paratroopers. For medical evacuation roles, it is capable of moving eighty litter patients with eight attendants. The C-141 (*see front cover*) is the first military jet aircraft procured under joint Air Force-Federal Aviation Agency certification.

A new total materials-handling system—designated 463L—was demonstrated before world air-freight leaders at the Air Cargo Forum in Montreal, Canada. Developed by ASD, the system employed automated and mechanized equipment to handle and ship cargo the world over.

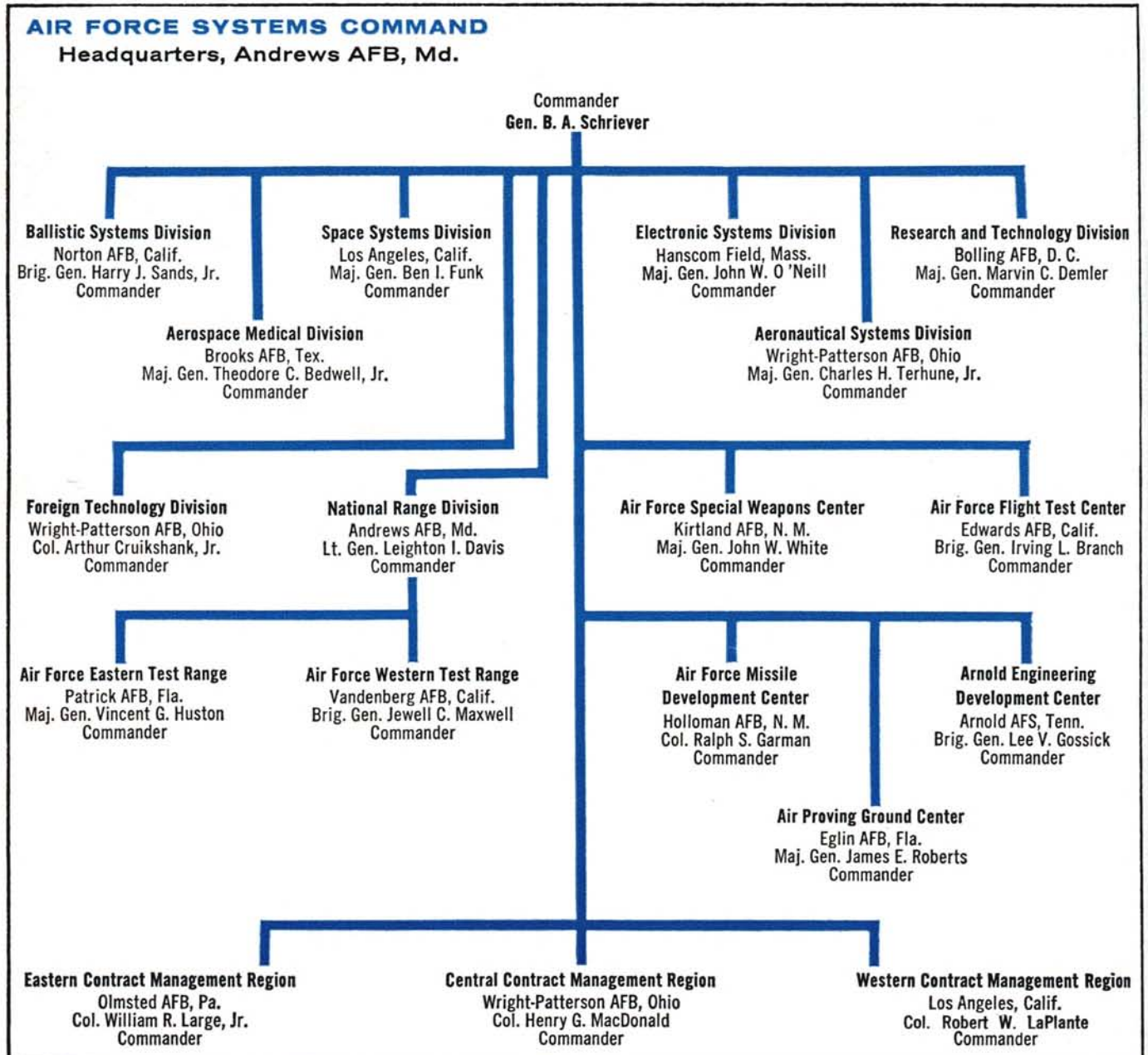
The world's largest high-altitude rocket test cell,

formally known as the Propulsion Engine Test Cell (J-4), went into operation at the Arnold Engineering Development Center (AEDC), Arnold AFS, Tenn., after dedication ceremonies on June 16.

On November 21, 1963, the day before his assassination, President John F. Kennedy dedicated six new buildings at the Aerospace Medical Division headquarters at Brooks AFB, Tex. At the dedication, the President officially recognized the work being done by the division and its component, the USAF School of Aerospace Medicine, in life sciences and bioastronautics.

The first of two XB-70s, an experimental, high-speed, deltawing aircraft built for the Air Force, rolled out of the Palmdale, Calif., North American Aviation plant on May 11. The craft is powered by six General Electric YJ93 turbojet engines, each producing

(Continued on page 117)





AFSC's famed X-15 rocket airplane, in cooperative efforts with NASA, has added enormous data to upper atmospheric flight knowledge. At left, improved No. 2 X-15, with two additional externally carried fuel tanks, is capable of Mach 8 speed.

approximately 30,000 pounds of thrust. It is designed primarily to investigate feasibility of long-range, high-speed flight, and to advance the aeronautical engineering state of the art in those flight regimes.

In the last quarter of FY '64, Air Force Missile Development Center (AFMDC) personnel at Holloman AFB, N. M., completed Category I tests on the off-the-shelf tactical F-4C. During the same period, thirty-one sled runs were completed. All runs were inertial-guidance tests and included Minuteman, Saturn, and Centaur tests.

The final launch of the air-to-ground Hound Dog test program at the Air Proving Ground Center (APGC), Eglin AFB, Fla., was accomplished in August 1963. After nineteen months of extensive flight tests, APGC terminated development testing of the AGM-28B Hound Dog's ability to penetrate enemy targets at low altitudes. Also completed at APGC on February 12, 1964, was the Target Radiation Measurement Program (TRUMP).

Refinement, Continuing Programs

An unprecedented cooperative triservice aircraft development program is being conducted in which the three military services are sharing equally in funding, support, and evaluation of the VTOL family, consisting of the X-19, XC-142A, and the X-22A experimental aircraft. The X-19 successfully completed several lift-offs June 26. A roll-out ceremony for the first XC-142 was held on June 17.

Currently AFSC's Space Systems Division, Los Angeles, Calif., is engaged in a broad program to standardize all space launch vehicles and spacecraft. A standard NASA-DoD Scout already is in use. It is designated SLV-1 (Standard Launch Vehicle). Two versions of the Air Force Thor SLV-2 are used with the Air Force Agena. The SLV-2 is the standard Thor with a single liquid-propellant rocket engine. The SLV-2A, or "thrust-augmented" Thor (TAT), combines the standard Thor with three solid-propellant rocket motors, almost doubling its liftoff thrust and significantly increasing its payload capability.

The SLV-4 is a modified Air Force Titan II ICBM, presently being developed by Space Systems Division (SSD) for use as the launch vehicle for the National

Aeronautics and Space Administration's Gemini manned spaceflight program.

The first NF-104A aerospace trainer was delivered to the Air Force Flight Test Center (AFFTC), Edwards AFB, Calif., October 1, 1963. This modified F-104 is equipped with a 6,000-pound-thrust rocket that should enable it to reach altitudes of 125,000 feet. Forty-five days after delivery, on November 15, AFFTC test pilot Maj. Robert W. Smith flew the rocket-assisted NF-104A to 118,860 feet for an unofficial world's altitude record.

The second X-15 was rolled out of a North American Aviation facility last February after undergoing repair and modification. The modified plane is capable of reaching speeds of Mach 8 (almost 6,800 statute miles per hour).

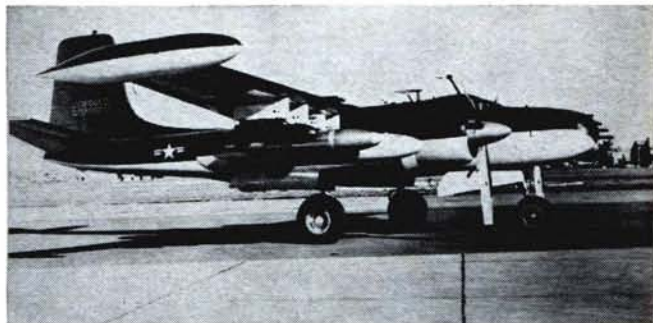
Use of a cost-plus-incentive-fee (CPIF) type of contract in the development of spacecraft has proved outstandingly successful. A prototype CPIF contract to develop spacecraft for detecting high-altitude nuclear detonations continues to motivate both contractor and program personnel toward high performance levels. The key to a CPIF contract is in the reward a contractor can reap, or the decrease in profit he can suffer, depending on his ability to meet Air Force schedules and performance goals.

While aerospace and satellite subjects caught and held world attention, an equally important phase of AFSC activities centered on management.

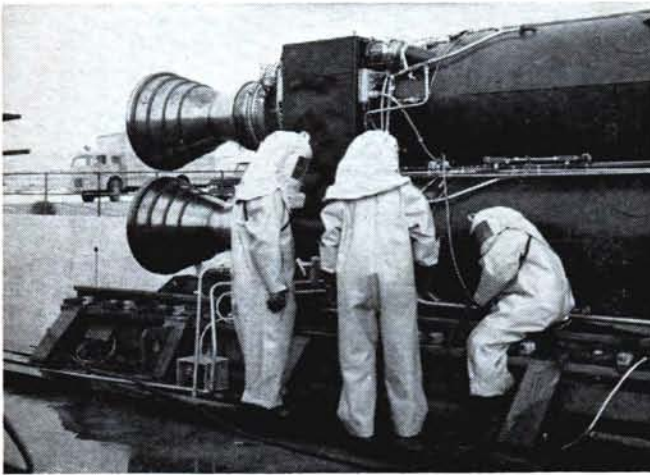
General Schriever, AFSC Commander, stressed effective management of funds and human resources—both civilian and military—and close cooperation with private industry and the scientific and engineering communities. Management efficiency in delivering the maximum in qualitatively superior weapon and support systems to the USAF at minimum cost was emphasized throughout the year.

Counterinsurgency

The Aeronautical Systems Division's Limited War Office supports counterinsurgency (COIN) and special air warfare operations. Aircraft testing takes place at the Air Force Flight Test Center (AFFTC) Edwards AFB, Calif. At the Tactical Air Warfare Center, *(Continued on following page)*



Systems Command's many development jobs include not only the search for systems for near-space and astronomical flight, but also for conventional and counterinsurgency airpower. Above, a modified B-26, designated B-26K, with strengthened wings, added firepower, for special warfare use.



Systems Command's Holloman AFB, N. M., is the site of aerospace research ranging from chimpanzee training to testing G-load training for astronauts. One of Holloman's most important facilities is its 35,000-foot captive missile test track, shown above during test of its 300,000-pound-thrust liquid-fueled engine. Testers are asbestos-clad.

Eglin AFB, Fla., commanders learn to face COIN problems in practice as well as in theory. Under the program, ASD personnel determine the suitability for COIN roles of many off-the-shelf or out-of-inventory aircraft and helicopters.

The T-37 twin-engine, jet primary trainer typifies aircraft being tested for possible COIN use. Designated YAT-37D, the trainer features new J85 jet engines and strengthened wings. It was flight-tested at AFFTC.

Also destined for COIN use are the YAT-28E, a modified T-28 single-engine aircraft equipped with a new turboprop engine; the short-takeoff U-10B liaison aircraft; the B-26K Invader; and various helicopters, some armed with .30-caliber machine guns.

New Tasks for AFSC

Last December, the Secretary of Defense assigned program responsibility to the Air Force for the development of a near-earth Manned Orbiting Laboratory (MOL). Assignment of MOL development to AFSC's SSD came just a year after USAF began active development of a new standard space-launch system—Titan III—capable of launching a wide variety of payloads ranging in weight from 5,000 to 25,000 pounds.

As presently planned, MOL will be a two-part tandem spacecraft including a Gemini ferry vehicle designated Gemini X and a cylindrical orbiting laboratory. In orbit, two or more astronauts will transfer from capsule to laboratory. Unencumbered by spacesuits, technicians will conduct various scientific experiments for as long as a month. They then will return to earth aboard the capsule.

Titan III is being produced in two versions. One is a three-stage, liquid-propellant booster designated Titan IIIA featuring an upper stage, called transtage (for transfer stage), with a multiple restart capability.

In the second version, the Titan IIIC, two 120-inch-diameter, five-segment, solid-propellant booster motors

are "strapped" on, giving the vehicle more than two million pounds of liftoff thrust.

Initial versions of MOL will be launched by the Titan IIIC.

Under development direction of AFSC's ASD, General Dynamics/Grumman are building a tactical, multipurpose fighter, the F-111, for both the Air Force and Navy. The Air Force version is being designed to reach speeds of Mach 2.5, two and a half times the speed of sound, with a ceiling above 60,000 feet, a transoceanic range, and capable of carrying both conventional and nuclear weapons. The seventy-foot-long plane will be powered by two Pratt & Whitney JTF-10A-20 turbofan engines. The two-man fighter has changeable wing positions, making it possible to carry out various missions at supersonic speeds—heretofore not possible with only one type of plane.

Flight testing is under way on the first production model Northrop F-5A Freedom Fighter which carries bombs, rockets, chemical stores, and pylon fuel tanks beneath the wings. Two 20-mm. cannon are mounted in its nose as added armament. Capable of supersonic speeds at an altitude of 50,000 feet, the fighter is suitable for a variety of missions.

Dissemination of Information

Increased emphasis over the years has been placed on the proper dissemination of scientific and technological information. Surveys and studies resulted in formation of a DoD Scientific and Technical Information (STINFO) program. Following a STINFO conference last fall at Dayton, Ohio, USAF issued a plan on February 10, 1964, to carry out the program. AFSC promptly geared its activities in support. STINFO offices under over-all supervision of AFSC's Research and Technology Division (RTD), now are located at all divisions, centers, and at major laboratories.

The purpose of STINFO is twofold. First, USAF must ensure that scientific and technical information
(Continued on page 121)



All-weather capability is increasingly essential in air operations, and Systems Command's mission includes equipment tests such as this extreme temperature study of the C-133 transport. This giant hangar at Eglin AFB, Fla., runs temperatures ranging from 65 degrees below zero Fahrenheit to 165 degrees above for its program of equipment testing.

makes the maximum impact on the development of technology. Second, USAF also must ensure that the scientific and technical information generated under Air Force R&D programs makes maximum contribution to the national community.

STINFO goals include identifying, acquiring, and making primary distribution of all useful scientific and technical information resulting from USAF RTD&E programs, developing and employing methods for effective exchange of information with other elements of the national STINFO program, and identifying scientific and technical information costs and benefits.

Expanding Responsibilities

A major management change was effected on January 2 with the creation of the National Range Division. Lt. Gen. Leighton I. Davis commands the division from headquarters at Andrews AFB, Md. Formation of NRD served to realign range management within the Department of Defense. Basically, DoD placed the Atlantic Missile Range and the ICBM and satellite-test portion of the Navy's Pacific Missile Range under a single management.

In a reorganization in May, the AF Missile Test Center at Patrick AFB, Fla., became the AF Eastern Test Range; and the AF Space Test Center (Provisional), Vandenberg AFB, Calif., became the AF Western Test Range. Both ranges are assigned to NRD to provide better control over and more effective use of range resources and permit more economy in overall range operations.

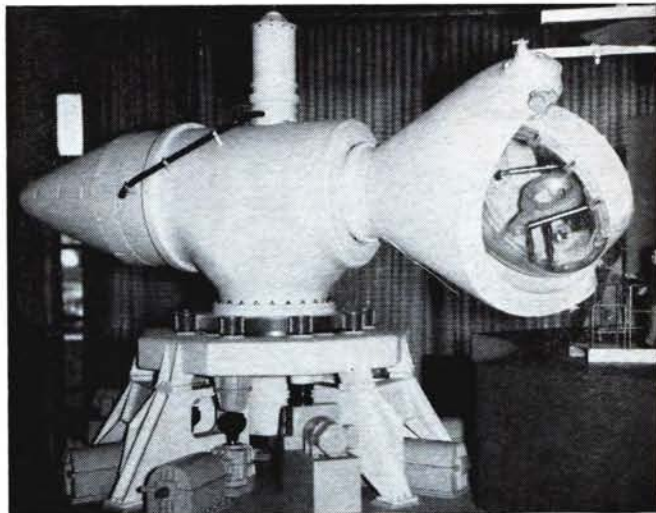
Scientific progress and management changes during the year highlighted activities of the Research and Technology Division, Bolling AFB, D.C.

Responsible for AFSC exploratory and advanced development programs, the division creates a broad base of research and technology which is speedily applied in the development of superior advanced aerospace systems. R&TD supervises seven Air Force laboratories. Widely scattered, four of them are located at Wright-Patterson AFB Ohio; one at Griffiss AFB, N. Y.; one at Kirtland AFB, N. M.; and the other at Edwards AFB, Calif.

A new Systems Design Laboratory at Hanscom Field, Mass., will be operated jointly by ESD and the MITRE Corporation. MITRE is a nonprofit company which serves as technical adviser to ESD and other development organizations. The heart and brains of the laboratory are an IBM 7030 (STRETCH) computer—one of the largest in the world—coupled with two command posts on the upper level of the building. The computer will supply information for displays in the command posts.

AFSC's Support Role

Air Force Systems Command has had a continuing commitment in support of National Aeronautics and Space Administration projects. Currently, AFSC works on more than a hundred tasks for NASA. SSD's 6555th Aerospace Test Wing, stationed at Patrick AFB, Fla.,



Maximum simulation of space conditions on earth is part of Systems Command's everyday job. Above, at Wright-Patterson AFB, Ohio, AFSC Aerospace Medical Research Laboratories, is a model of a research tool designed to produce simultaneous tumbling, spinning, vibration, high-Gs, while providing capability of observing subject reaction.

has launched all of the major NASA spacecraft. Various NASA programs (Mariner, Ranger, etc.) use the AF Thor, Atlas, and Scout space boosters.

An essential element in support of the National Space Program was the provision of tracking facilities of the Atlantic Missile Range (now Air Force Eastern Test Range). Extending some 10,000 miles from Cape Kennedy, Fla., off the coast of Africa, and into the Indian Ocean, it includes island or land-based stations plus instrumented ships and aircraft.

An Air Force Titan II booster contributed to the first flight of Gemini from Cape Kennedy last April. Air Force-NASA officials termed the flight successful.

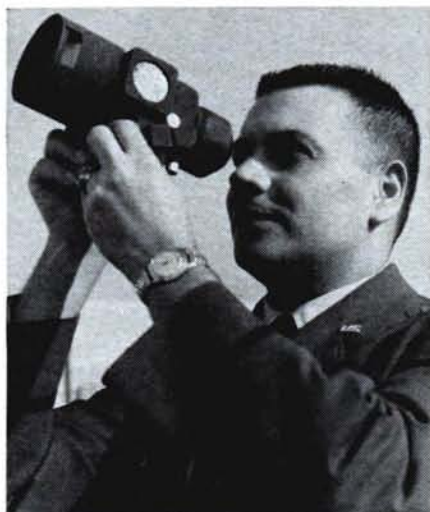
The Arnold Engineering Development Center (AEDC) serves as a vital resource for NASA. Among the tasks being conducted by AEDC are research-and-development tests on the Gemini retrorockets, capsule abort systems; ballute devices (deceleration devices, combining a balloon and a parachute) and other control systems; evaluation of the retrograde system for

(Continued on following page)

Another research effort by AFSC—a cordless headset for voice communications for aerospace crewmen in aircraft, space vehicles, or ground-maintenance communications. Device was development of AFSC's Avionics Laboratory for possible use in keeping crewmen from being tied to fixed-site equipment.



Another development by the Avionics Laboratory: the stadimeter. Its purpose is to provide space navigational data for orbiting astronauts, using a hand-held instrument. It does not require the assistance of a digital computer.



the Surveyor; and a range of test activities on Apollo.

The Aerospace Medical Division, Brooks AFB, Tex., performs biomedical research tasks in support of NASA. A sampling includes studies of the biological effects of radiation with high-energy protons, investigation of the mechanisms involved in the treatment of radiation sickness, and tests of the possible biophysical effects of prolonged oxygen inhalation.

In October 1963, two identical experimental nuclear-detection satellites were placed in orbit from a single launch. These research-and-development satellites provide data on the operation of nuclear-test-detection sensors in space and necessary information on the natural-radiation environment in which the sensors must function. This satellite program was a joint AEC/DoD effort.

Advanced Development

Electronic research and progress held high priority during the year.

Ballistic and spectral cameras and radiometers, mounted in KC-135, DC-4, and DC-6 aircraft, were successfully used in tracking ABRES (Advanced Ballistic Reentry System), Minuteman, Atlas, Titan, and Polaris development and reentry systems.

The Air Force Special Weapons Center (AFSWC), Kirtland AFB, N.M., proved that the airborne astrographic camera system can determine relative spatial positions of luminous reentry vehicles, meteors, and satellites to a high degree of accuracy. A prototype system, which uses two widely separated C-54 aircraft for the airborne camera platforms, was tested over White Sands Missile Range. This combination of tests confirmed that the camera portion of the system provided accuracy over a sufficient range to justify continued application.

ESD developed improved communications for SAC aircraft operating in the far northern regions early in 1964. Increased distance and reliability were added to continental ground stations with SAC aircraft flying missions in the far north and Arctic regions.

Studies of lightning were conducted intermittently under the direction of the Air Force Weapons Laboratory at Kirtland AFB, N. M. AFWL is a part of AFSC's

Research and Technology Division, Bolling AFB, D.C.

Experimental parachutes and balloons were deployed last November in flight tests up to ten times the speed of sound. The tests were conducted to determine their effectiveness as "brakes" and stabilizers for future aerospace craft entering the atmosphere.

Engineers at the Air Force Flight Dynamics Laboratory at Wright-Patterson late in 1963 investigated a "dust-wall" concept to shield future spacecraft, satellites, and other vehicles from meteorites encountered in space.

An electronic "eye" system which automatically and rapidly detects and reports nuclear bursts miles from a sensor was being developed by the Electronic Systems Division, L. G. Hanscom Field, Mass.

In April 1964, ESD was chosen to develop the Tactical Air Control Systems (TACS).

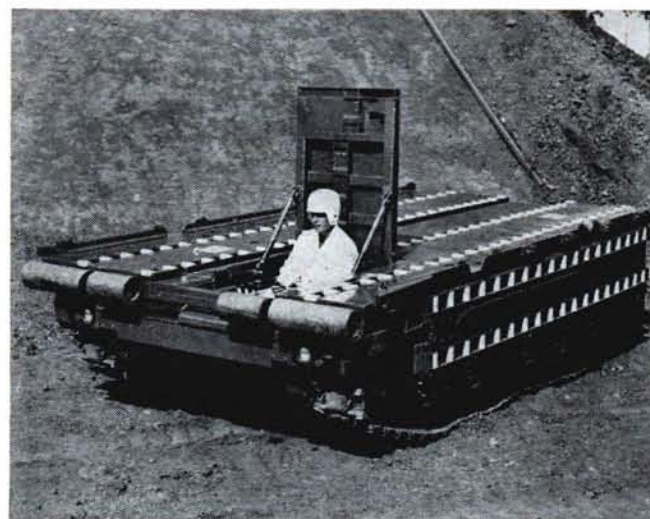
Summation

Indicative of the varied AFSC activities are some 60,000 contracts administered by the Eastern, Central, and Western Contract Management Regions of the command, with a total face value of about \$48 billion. For FY '65, the budget to support AFSC programs and installations totals more than \$7.5 billion.

More simply stated, the command has managerial responsibility for some forty percent of the AF budget, or about 8.2 cents of each federal dollar.

From headquarters at Andrews, AFB, Md., AFSC directs the operations of eight divisions, five development and test centers, two test ranges, and three contract management regions. Command personnel number about 29,000 officers and airmen and 37,000 civilian employees.

Summing up, future progress in the sciences and technologies bids fair to bring increasing problems for solution by the Air Force-industry-science team. This challenge has been met in the past. AFSC is confident it will continue to be met in the future.—END



No runway needed is the idea of this material-handling concept recently shown by Aeronautical Systems Division at an air-cargo forum. Built by FMC Corp., San Jose, Calif., and called rough-terrain loader, it's designed for forward areas to carry cargo to and from aircraft landed on rough terrain.