News of Science

Explorer

The United States launched its first earth satellite, "Explorer," at 10:48 P.M. on 31 January, from Cape Canaveral, Florida. The 30.8-pound space vehicle, which circles the earth every 115 minutes, is a tube 6 feet, 8 inches long and 6 inches in diameter. It is traveling at approximately 18,000 miles an hour in an elliptical orbit that has an apogee of 1587 miles and a perigee of 219 miles. It is carrying instruments for measuring temperature, cosmic rays, and the frequency of meteorite particles. Information is received from the satellite over two radio transmitters that emit a sustained, though varying, high-pitched signal. The higher powered of the transmitters, which has an output of 0.06 watt, can be heard by anyone on a frequency of 108.03 megacycles and is expected to last for two or three weeks. The second transmitter operates with a power of 0.01 watt at 108 megacycles. It probably cannot be heard by amateurs; however, it should last two or three months because it consumes so little power.

Sputniks I and II. The American launching comes 4 months after the U.S.S.R. placed the first earth satellite, sputnik I, in orbit on 4 October 1957, and then sent sputnik II aloft about a month later. Sputnik I, which disintegrated on 4 January, was a 22-inch sphere that weighed 184 pounds, reached a maximum altitude of 560 miles, had an initial period of 96 minutes, and lasted 3 months. Sputnik II is rocketlike in shape, weighs 1120 pounds, reached a maximum altitude of 1056 miles, had an initial period of 103 minutes, and is expected to last for about 5 months. It contained a live dog when it was fired.

Launching vehicle. Explorer was launched with the Army's four-stage Jupiter-C rocket. This is a specially adapted version of the Army Redstone, an artillery weapon that is a descendant of the Nazi V-2 missile of World War II. Ordinarily the Redstone is fueled with oxygen and alcohol, but for the satellite firing liquid oxygen and a new propellant called "hydyne" were used. Hydyne is considered a major development in the field of high-power rocket fuels. It was produced by Rocketdyne, the California firm that built the Jupiter's motors. Wernher von Braun, chief of the Army Ballistic Missile Agency's development operations, and formerly rocket specialist for Germany, was primarily responsible for the successful launching. He described it as follows.

The first-stage Redstone, with its 78,000 pounds of thrust, lifted the 70-foot, 65,000-pound missile assembly to an altitude of 53 miles in 145 seconds. With its fuel exhausted, the first stage dropped off, leaving the three other stages, consisting of clusters of small solid-propellant rockets, to coast on up to an altitude of about 212 miles. For guidance, the last three stages were set spinning on take-off. As they coasted upward, the final three stages gradually arched over until they were moving parallel to the earth's surface. At this point, 405 seconds after take-off, a remote control button was pushed on the ground, firing the three stages in rapid succession and accelerating the satellite to the orbital speed of 18,000 miles an hour. The Explorer then went whirling off into space at a rate of about 700 revolutions a minute.

Explorer was sent up at an angle of 35 degrees to the equatorial plane so that the earth's rotation would give the launching rocket maximum assistance as it rose into space. The two sputniks were inclined to the equator at angles of about 65 degrees. The much shallower inclination of the Explorer's orbit, now calculated at 33 degrees at the equator, means that the American satellite probably will not pass over the Soviet Union.

Visual tracking. Because of its narrow silhouette, Explorer will be more difficult to see than the Soviet satellites. According to Fred L. Whipple, director of the Smithsonian Astrophysical Observatory and head of this country's visual tracking program, there is a 6-degree daily regression to the west in the orbit of Explorer. This will bring it low enough to be visible to the naked eye in the Northern Hemisphere in about 9 months. Whipple says that it will be visible without instruments in the Southern Hemisphere in the next 3 months. He reports that the principal visual tracking will be done with high-powered telescopes at four American stations and at two in South Africa. The stations are at Yuma, Ariz.; China Lake, Calif.; Albuquerque and Alamagordo, N.M.; and Bloemfontein and Capetown, Union of South Africa.

History. The plan for launching an artificial satellite with a multistage system of the Jupiter-C variety dates back to June of 1954. At that time a group of civilian and military scientists, including von Braun, met in Washington and agreed that a 5-pound vehicle could be sent aloft soon by using the Redstone for a first stage and clusters of Loki rockets for three other stages. The group laid plans for a joint venture, Project Orbiter, under which the Army was to provide the missiles, the Navy was to provide the satellite and instruments, and the Air Force was to help with logistics. However, it was never possible to muster enough support to put Project Orbiter into effect, partly perhaps because of interservice rivalries.

Help in stimulating Government interest in satellites came with the maturing of plans for the International Geophysical Year, to run from July 1957 through December 1958. In October 1954 a special IGY committee asked participating governments to consider launching satellites during the 18-month period. In the spring of 1955 the Administration responded, and a committee of nine scientists was created to study proposals put forward by the three services. The Presidential decision for the Navy's Project Vanguard, which was to be purely scientific, was announced in July 1955.

Largely overlooked at the time was the fact that 3 months earlier the Soviet Union had announced a similar satellite project. The United States and the U.S.S.R. have shown one particularly significant difference in the administration of their outer space research. In this country the satellite program has been entirely separate from the missile program, and of much lower priority. The Russians, on the other hand, developed their satellite launching vehicle as part of their military rocket program.

The first rocket firing connected with Project Vanguard, which has been badly hampered by lack of funds, took place in December 1956. The rocket was a Viking, and the test demonstrated that there was serious trouble with components intended for the Vanguard vehicle. As it became evident that Vanguard would be ready later than expected, pressure developed within the Administration to permit the Army to use a Jupiter-C to launch a satellite. When the Soviet Union put up sputnik I, the pressure grew more intense, and when sputnik II was announced the Administration gave in. Nevertheless, the Vanguard was to have first chance at a launching, and on

6 December an unsuccessful attempt was made at Cape Canaveral. Another test on 27 January had to be called off within 14 seconds of time zero because of trouble with the second stage.

The three-stage Vanguard rocket is 72 feet in over-all length, with a maximum diameter of 45 inches. It has an initial thrust of 27,000 pounds and its payload is a globular, 21-pound satellite. Von Braun said in a public statement recently that the Vanguard is superior to Jupiter-C, and that the Vanguard satellite will be pushed by a rocket needing only one-third of the thrust and take-off weight of the more cumbersome Jupiter-C. He commented that Vanguard is at a disadvantage because it is such an advanced rocket:

"It is so sophisticated that it is a little difficult to get it off. Ours is based on older and more proven components. . . . Ours is a little more obsolete."

Not long ago von Braun told the Senate Preparedness Subcommittee that it would take this country 5 years to catch up with the Russians in rocketry.

Bill to Establish AEC Outer Space Division

Proposals to give to the Atomic Energy Commission the job of building nuclear powered space vehicles are incorporated in a bill introduced in the Senate on 23 January by Sen. Clinton P. Anderson (D, N.M.). The bill would amend the Atomic Energy Act to permit the AEC to add to its current responsibilities responsibilities for the necessary research, construction, and operating facilities with which to achieve peaceful control of outer space and interplanetary travel. Anderson, who is vice chairman of the Joint Committee on Atomic Energy and chairman of its Subcommittee on Outer Space Propulsion, points out that by placing the project within the framework of the AEC, the principle of civilian control would be retained and emphasis on peaceful application of knowledge assured.

The bill would create a Special Outer Space Advisory Committee of seven members to be appointed from civilian life by the President, with the advice and consent of the Senate. The bill proposes to establish within the AEC a Division of Outer Space Development which would administer the AEC's activities in this field. The Commission would be required to use to the fullest practicable extent existing Government atomic laboratories and to retain full authority for the "planning, direction and overall budget control" for the program and its projects. To get underway, the bill would authorize the appropriation of $50 million "to finance initial operations and construction" to carry out provisions of the amendment. The bill would "authorize and direct" the AEC to accelerate research and development on outer space propulsion and to negotiate and execute with general policy guidance of the State Department, an agreement with cooperating nations for the establishment of and participation in an International Laboratory for Outer Space Propulsion.

Antarctic Ice Drilling

The deep drilling project at the IGY Byrd Station in Antarctica passed the 1000-foot mark on 26 January, according to a report by the IGY Committee of the National Academy of Sciences. Ice cores taken from this drill hole preserve in their annual layers clues to antarctic climate reaching back many centuries.

The deep drilling program is being conducted for the IGY by personnel from the Army Snow, Ice and Permafrost Research Establishment of the Corps of Engineers. Development of techniques and equipment for deep drilling to obtain undisturbed cores was inaugurated on the Greenland Icecap in 1956 and was continued and improved in 1957. Deep drilling at the Byrd Station was begun last December.

A modified Failing "1500" drill rig and specially-designed core barrels and bits are being used. Ice cuttings are removed from the drill hole by compressed air that has been specially cooled to the required temperature so that the core sample will not be melted. Extreme care must be taken to avoid shattering of the ice cores when they are removed from the great pressure which exists at depths over several hundred feet.

Equipment for the Byrd Station project was brought in by over-land traverse from Little America, 647 miles away. Some equipment was dropped by parachute.

Because of the relatively small annual accumulation of snow in Antarctica, ice at 1000 feet below the surface at Byrd Station is roughly equal in age to ice at the 2000-foot level in Greenland. However, the antarctic cores are more difficult to date. In Greenland, the annual layers of snow are generally marked by a thin crust of refrozen summer melt. The age of a core can then be read as one reads the age of a tree by its annual rings. In the Antarctic, the annual layers are thinner and more closely packed, and there is often little or no summer melt. Careful chemical analysis may be needed to date the deep-lying cores.

The Byrd Station cores will be broken into 3-inch units for density measurements, visual examination, and determination of yearly accumulation whenever possible. Microscopic examination and photography of thin sections of ice at different depths will permit studies of crystal structure and more accurate relation of age to depth. Selected portions of the cores are to be melted and filtered for study of the minute particles and primitive organisms that may have been trapped in the ice for hundreds of years.

Volcanic ash from the eruption of Katmai in 1912 has been found in cores taken from the Greenland ice, and it is expected that similar ash and other matter, perhaps from much earlier periods, will be found in the Byrd Station cores. A similar drilling project is planned for the Ross Ice Shelf in the latter part of this year.

Science Talent Search

Forty high school seniors were recently named winners in the 17th annual Science Talent Search, which this year attracted a total of 25,039 applicants, the largest number in the history of the competition. Each of the winners, 8 girls and 32 boys, has been awarded an all-expense trip to Washington, where they will compete for $34,250 in scholarships and awards during a 5-day Science Talent Institute beginning 27 February.

In this year's search, New York continued to lead all states in the number of winners produced—eight boys and one girl. Six of the nine come from New York City and vicinity. Illinois and California tied for second place with four each. Massachusetts placed third with three.

Begun in 1942, the Science Talent Search is conducted by Science Clubs of America through Science Service. The Westinghouse Educational Foundation, supported by the Westinghouse Electric Corporation, provides the awards and makes the Science Talent Search financially possible. Because of an expanded grant from the Westinghouse Educational Foundation, the total value of the scholarships and awards presented this year will amount to more than triple the $11,000 distributed each year in the past.

Underground Nuclear Test

The Atomic Energy Commission has reported that the yield of the deep underground nuclear test conducted at the AEC Nevada Test Site in September 1957 was 1.7 kilotons [*Science* **126**, 200 (2 Aug. 1957); **126**, 554 (20 Sept. 1957)]. Heretofore, data on such tests have been highly classified. Now the AEC has released full details for the benefit of seismologists, geophysicists, and geologists.

The shot was detonated at 09 hours,