

The need for accurate information from the upper atmosphere calls for direct measurements, and this can only be done by sending instruments into the region that is being explored. Rockets and satellites are devices that permit man to send his instruments into the high regions of the atmosphere.

USE OF ROCKETS

The development of rockets during and after World War II has resulted in a variety of devices useful for atmospheric research at high altitudes. Altitudes of about 60 miles can be reached by balloon-launched rockets, called rockoons. These small rockets are fired from balloons once the latter have reached their maximum height. Larger, ground-launched rockets are available that can attain greater altitudes. The Aerobees, which are to be used in the United States program, can travel to a height of approximately 200 miles above the earth's surface. Somewhat similar rockets have been or are being developed by other nations and are to be used in the IGY program.

Rockets have already been successfully used, particularly by scientists in the Department of Defense, to study the outer atmosphere. Certain solar radiations, for example, which are absorbed by the atmosphere and hence never reach the earth's surface, have been investigated. A rocket measurement led to the discovery of solar X-rays in one of the ionospheric layers. Measurements of ultraviolet radiation have established the variation with height of the ozone in the atmosphere up to an altitude of 42 miles. What are believed to be auroral particles have been detected by rocket-borne geiger counters, and the density of charged particles in the ionosphere has been measured directly.

The importance of rocket measurements is threefold: first, it provides direct measurements of events in the high atmosphere; second, these direct measurements permit us to upgrade the indirect data collected more economically from many ground stations, greatly increasing its values; and, third, new discoveries are possible—like the discovery of X-rays in the ionosphere.

UNITED STATES ROCKET PROGRAM

A variety of studies will be undertaken in the United States rocket program. Investigation of the structure of the atmosphere will include measurements of pressure, temperature, density, and winds. Special instruments will be used to measure the chemical and ionic composition of the atmosphere. Particles and radiations from the sun will be observed and measured, including the nature of auroral particles. Variations in the nature of the ionosphere will provide information on the electrical currents flowing in the lower ionosphere.

Some 600 rockets will be launched, including Aerobees that reach an altitude of about 200 miles and rockoons that travel some 60 miles above the earth. Most of the Aerobees will be fired from Fort Churchill in cooperation with Canada, and some from White Sands and Alamogordo, N. Mex. Rockoons will be launched from shipboard in many areas, including waters off the Antarctic coastline, off the west coast of North America, in equatorial regions, and in Arctic waters. This basic program will be supplemented by launchings of small rockets assembled as two-stage combinations, Nike-Dencons,