

technique and use rockets to carry their instruments into the ionosphere and aurora. The rockets involved in doing so are not too large or difficult for Canadian manufacture. A 17-inch rocket now being made in Canada will carry about 150 lb. of pay load to a height of about 150 miles and a series of rockets known as *Black Brant I, II, III* and *IV* is being developed by Canadian industry jointly with government branches.

The United States led the way in this field and about the time the International Geophysical Year (1957-58) was being planned rockets of the above type, developed primarily with military objectives, became common for scientific purposes. Several types are now available in many countries, besides those being developed in Canada, which have no military significance but will be used solely for scientific purposes. In preparing for the International Geophysical Year the United States established a rocket-launching range at Churchill. This was used jointly after the IGY until fire put it out of action in February 1961.

The first practical applications of space technology in the fields of meteorology and communications are almost within reach. Meteorological satellites that can televise cloud formation and ice formation are being proven to be of immense value in advancing this science. Though meteorology satellites have as yet been launched only by the United States, the project is essentially an international one and co-operative receiving stations in various parts of the world are important to their success. It has also been shown recently that synoptic measurements all over the world are desirable up to heights of about 50 miles and these can be made with relatively small rockets. In world-wide communications the use of satellites will expand available channels by a large factor. The Canadian Department of Transport, which holds the nation's responsibility in both meteorology and communications matters, is undertaking studies which will permit Canadian use of the techniques as they emerge from research to serviceable application.

One of the largest current research projects in Canada is the construction of the *Topside Sounder* satellite being designed and built in the Defence Research Board laboratories with considerable assistance from industry. The satellite will be launched in the United States in late 1962 and will circle the earth in an almost north-south orbit. It will contain a number of experimental packages mainly to study the upper part of the ionosphere which can be examined at present in no other way. Secondary experiments carried in the satellite are comprehensive cosmic ray measuring instruments being built by the National Research Council and radio receivers for listening to cosmic radio waves. The *Topside Sounder* got its name from the fact that it will probe the upper side of the ionosphere from above (about 600 miles up) by the same sounding technique that is used on the ground to probe the under side, that is, by studying the reflection of radio waves of varying frequency. For this and other United States satellites, special satellite data recovery stations will be established in Northern Canada.

Section 4.—Other Scientific and Industrial Research Facilities

Aside from the research facilities and activities covered in Sections 1, 2 and 3, Canadian research is carried on by various federal agencies, provincial organizations, universities and industries. Several provinces in Canada have established provincial Research Councils to stimulate and support research on problems having special provincial significance. The universities, of course, form an extremely important part of the Canadian pattern of research. Much of their work is along fundamental lines but practical problems are not neglected, especially those of regional interest.

All three types of institutions—federal, provincial and university organizations—have an interest in problems of industrial significance; this is part of the current Canadian pattern of research. Though many Canadian industries now possess research facilities—some of them quite extensive—the major part of industrial research to date has been done under government auspices.