

earth's magnetic field. It is this interaction that makes space research in Canada so important, because the axis of the earth's magnetic field is tilted with respect to the earth's axis in such a way that the northern region where the magnetic lines of force are nearly vertical is in Northern Canada. This interaction with the magnetic field causes the ionosphere disturbances that are responsible for blackouts in radio communication as well as the well-known aurora.

Canada's interest in space research is, therefore, mainly in this region at heights from about 30 to 200 miles. This is the region where rockets serve better than satellites as the instrument-carrying vehicle. Such interest is by no means new. Studies of the ionosphere using the technique of reflected radio waves have been conducted for years, and also studies of the aurora both by spectroscopy of the light it emits and by the reflection of radio waves from the auroral discharges. Scientific research groups in the University of Saskatchewan, the Defence Research Laboratories and the National Research Council have made important contributions.

The importance of direct measurements at high geomagnetic latitudes led the United States in 1956 to establish a comprehensive rocket-launching facility at Fort Churchill in Manitoba as part of their International Geophysical Year program. This was a purely scientific effort even though the operation of the rocket range was by the United States Army and it was established at a Canadian Army Base under Canadian Army supervision.

The United States groups using the range were very generous in making the facilities available to Canadian scientists and in treating it as a joint undertaking. The Canadian contribution during the IGY, though small compared to the total operations at Churchill, was appreciable in that the operation would have been very difficult and much more expensive had it not been for the existence of the Army Base and the Defence Research Board's Northern Laboratory. Meteorological assistance was also given by the Department of Transport. During the IGY, scientists of the Canadian Armament Research and Development Establishment built experiments in two rockets launched at Churchill designed to study certain visible and infrared radiations produced in the upper atmosphere.

After the close of the IGY (Dec. 31, 1958) a limited program was continued as a joint operation. The United States continued to operate the rocket-launching facility but several Canadian projects have been undertaken. It was a natural development that Canada's record of research in the ionosphere should lead to suggestions to extend measurements using satellites and rockets. The invitation of the American Space Science Board of the National Academy led the Defence Research Board's Telecommunications Establishment to suggest an experiment to be carried in a satellite wherein the ionosphere was observed from above rather than from below. One common technique on the ground is to observe echoes of short radio pulses directed upward and reflected downward from the ionosphere. This is known as vertical sounding. The same technique from a satellite was suggested but with the radio pulse transmitted from above and reflected upward. The project has been called the "Topside Sounder" and the instruments designed and built by Canadian scientists will be launched in 1961.

During 1959 two Aerobee rockets given to Canada by the United States were used for Canadian experiments. Experiments designed to measure electron density in the ionosphere and the intensity of low energy cosmic rays were carried out successfully. The Canadian Armament Research and Development Establishment had been working for some time on a solid fuel propellant for large rockets. Their results reached a stage during 1959 where a propellant test vehicle could be launched at Churchill and four such rockets were launched late in 1959. While the development of propellants is obviously a military objective this particular investigation can result in the construction of a very good rocket for scientific purposes which will carry 150 lb. of instruments up to nearly 200 miles. Experiments planned for 1960 and 1961 will use a rocket of Canadian design and manufacture.