

1 inch to 1 mile) from its own surveys, and shared with provincial governments in the production, by contract, of 437 sheets. The amount of information, of value to all persons studying the geology and mineral deposits in the areas covered, that has been made available to the public is very great. Studies of magnetic effects in the ionosphere and space have become increasingly important in Canada. The *Alouette* satellite, launched in 1962, continued to provide a very great amount of useful information on the ionosphere. The *Alouette*, or 'topside sounder' of the ionosphere, transmitted to earth 2,060 hours of data from measurements made by the instruments it carried. The rocket-launching range at Churchill, Man., was used by a number of groups to send instrument-carrying rockets aloft, including one prepared by the University of Saskatchewan. Research on ionospheric conditions as related to radio communication problems was continued by the Defence Research Board. McGill University scientists investigated the use of missiles launched from guns to send instruments into the upper atmosphere.

Oceanographic measurements were extended in both the Atlantic and Pacific Oceans, and similar work was carried out in the Great Lakes by the Great Lakes Institute, University of Toronto. Work in the oceans was conducted by the Bedford Institute of Oceanography, Department of Mines and Technical Surveys, and by Oceanographic Institutes at Dalhousie University and the University of Toronto. The measurements made by these groups include not only water depth, temperature, salinity and currents, but also geophysical studies of the crust beneath the oceans, by seismological, gravimetric and magnetic methods. The ship resources for Canadian oceanography were greatly strengthened by the construction during 1963 of the CSS *Hudson*, a modern research vessel. In addition, the Minister of Mines and Technical Surveys announced that twelve survey and research ships would be built during the next five years. These ships, operated by the Canadian Coast Guard, must operate at times under the most difficult conditions. The CCGS *Labrador*, for example, encountered the worst ice conditions on record when, in 1963, she pushed into Kennedy Channel between Ellesmere Island and Greenland.

The use of geophysical methods in the exploration for petroleum and minerals showed an increase during the year, and there was an increased demand for students with degrees in the subject. Teaching and research in geophysics was started in additional universities, so that virtually all Canadian universities now have some activity in the field. The activity of this country in geophysics was recognized when the Geophysics Laboratory of the University of Toronto was accepted as the principal office and headquarters of the International Union of Geodesy and Geophysics.

Section 2.—Astronomy

There has been in Canada, as elsewhere in the world, an upsurge of popular interest in astronomy, due no doubt to the achievements in space science. This subject was last covered in detail in the 1956 Year Book, pp. 49-55; the following special article indicates the advances made since that time in astronomical research and educational facilities in Canada.

ASTRONOMY IN CANADA*

Astronomy in Canada is currently an expanding science pursued with vigour at various institutions devoted to astronomical research and education. Its early history is closely related to the demand for accurate positions on the earth, for the problem of establishing longitudes in Canada was once acute because of the difficulty in transporting accurate time across the Atlantic Ocean. The early Jesuits in Quebec were interested in solar eclipse observations as an aid to longitude determination and records exist showing that they observed partial solar eclipses as early as 1670. Their records also describe observations of several bright comets observed from Quebec City.

* Prepared from material supplied by the various institutions and edited by Dr. Ian Halliday of the Dominion Observatory, Ottawa.