

some 1,500 men are sent into the field to make surveys and to carry out research, the results of which are ultimately published in the form of maps, charts and reports.

The Department's branches engaged in technical surveys are the Surveys and Mapping Branch, which carries out geodetic and topographic surveys and produces base maps, electoral and other special maps and aeronautical charts; the Marine Sciences Branch, which produces hydrographic charts of Canada's sea coasts and inland waters; the Geological Survey of Canada, which maps geological features; the Observatories Branch, which produces geophysical maps; and the Geographical Branch, which produces a number of special maps.

The surveys and maps produced by the Department are the result partly of long-range plans based on general national needs and partly of requests from private enterprise and other government agencies. To avoid duplication, the Department co-ordinates its work with provincial and private mapping organizations. Hydrographic and aeronautical charts, however, are produced exclusively by the Department.

The methods and techniques used by the surveyors and map-makers must frequently be adapted to the peculiarities of the Canadian geography, which are, above all, great distance and, over most of the country, a harsh climate. Of inestimable help in overcoming these difficulties have been the aeroplane, the helicopter and electronic distance-measuring devices such as the geodimeter, the tellurometer and the aerodist. Together with photogrammetry (i.e., plotting of maps from air photographs) these techniques make it possible for field parties to map relatively large areas accurately without ever setting foot in them. In a trial project in 1963, for example, a topographical party in northwestern Ontario, using the aerodist, established survey control for 37,000 sq. miles of territory on a scale of 1:50,000 in seven and a half days. By conventional methods, such a project would have taken several years to complete in this difficult terrain.

Small fixed-wing aeroplanes and helicopters play a large role in transporting survey parties from point to point in areas where no other means of transportation exists, so that most of the time formerly lost in slow and laborious progress by pack-horse or canoe can now be used for actual survey work, be it topographical, geological or geophysical. The helicopter is also used to advantage in hydrographic surveying. The two largest ships of the Marine Sciences Branch have helicopters based on them, and depth-sounding in the ice-infested waters of the Arctic has been made easier by the use of echo-sounders towed by helicopters.

In geological mapping, older reconnaissance methods have been supplemented by such novel investigations as geochemistry and biogeochemistry, in which minute quantities of minerals found in the surface soil, in creeks and in vegetation are analysed to map out major mineral deposits. In geophysics, the airborne magnetometer, the various adaptations of the gravimeter for measurements at sea and on the ice, the study of palaeomagnetism and similar advances have helped to speed up and to make more accurate the mapping of features below the earth's surface and have also brought new areas and new depths within the range of knowledge.

In the drafting and printing of the maps, highly advanced techniques for the automatic transfer of terrain features from air photos to drafting sheets and precise lithographing have been combined to assure speedy processing of field data and the production of colourful, easily understood and relatively inexpensive maps for every type of user, from vacationer to town planner and from prospector to pilot. The large modern printing plant of the Surveys and Mapping Branch also prints maps compiled by the other Branches of the Department as well as maps of other government departments and agencies. The Branch has a stock of almost 12,000,000 maps available, from which it distributes over 1,000,000 annually. Each year the Geological Survey distributes about 350,000 maps and reports, the Marine Sciences Branch distributes about 250,000 charts, and other Branches distribute large numbers of their own maps and charts.