

Resolute Bay in the High Arctic. These flights are under the direction of the Department's Meteorological Branch and provide information on ice conditions in the sea lanes in all areas where the convoys operate. Helicopters, based aboard the icebreakers, are used for close-range reconnaissance. They carry trained observers provided by the Meteorological Branch and their ability to spot leads through the ice, which cannot be seen from the ship, has resulted in tremendous savings in time for the convoys. The helicopters are also extremely useful in ship-to-shore personnel movements and for carrying light freight.

As an indication of the growth of Arctic re-supply operations handled by the Canadian Coast Guard, the total tonnage in 1954 was approximately 8,000 and the annual figure is now in the vicinity of 100,000 tons.

**Aids to Navigation.**—Included under aids to navigation are the lighthouses and the whole system of marine danger signals on the East and West Coasts of Canada, on Hudson Bay and Strait, the St. Lawrence River and Gulf, the Mackenzie River and Arctic passages, and the inland rivers and lakes—a very extensive system designed to provide safe navigation in all Canadian waters. In addition, a pilotage service is maintained in waters where navigation is difficult; this service is described at p. 799. A further aid to safe navigation is found in the chains of radio signal and direction-finding stations described in the 1962 Year Book pp. 848-849. Lists of aids to navigation, with the exception of very minor ones, are published by the Department of Transport.

#### 15.—Marine Danger Signals Maintained in Canada, Years Ended Mar. 31, 1961 and 1962

NOTE.—In addition to the aids to navigation listed, approximately 10,400 unlighted buoys, balises, dolphins and beacons are maintained. Lists of marine danger signals maintained from 1929 are given in the corresponding table of previous Year Books beginning with the 1941 edition.

| Type of Signal               | 1961  | 1962  | Type of Signal   | 1961  | 1962  |
|------------------------------|-------|-------|--|-------|-------|
|                              | No.   | No.   |  | No.   | No.   |
| Lights.....                  | 3,054 | 3,196 | Mechanical bells and gongs.....                                  | 18    | 17    |
| Lightships.....              | 3     | 3     | Hand fog horns and bells.....                                    | 85    | 84    |
| Light-keepers.....           | 903   | 953   | Lighted and combination lighted<br>whistling and bell buoys..... | 1,324 | 1,384 |
| Fog whistles and sirens..... | 45    | 46    | Unlighted bell and whistling buoys...                            | 136   | 121   |
| Diaphones and tyfons.....    | 270   | 277   | Explosive signals.....   | 3     | 4     |

Navigable waters have been improved greatly by dredging in channels and harbours, by the removal of obstructions, and by the building of remedial works to maintain or control water levels. Incidental to these developments of navigable waters are works to guard shorelines and prevent erosion, and for the control of roads and bridges that cross navigable channels. Icebreaking operations are continuous throughout the winter.

*St. Lawrence Ship Channel.*—This channel extends from about 40 miles below Quebec City to the foot of the Lachine Canal at Montreal, a distance of 200 miles. About 130 miles of this distance is dredged channel.

Above Quebec the channel has a limiting depth of 35 feet at extreme low water and a minimum width of 550 feet, with additional width up to 1,500 feet at all curves and difficult points, and additional anchorage and turning areas. Widening of the channel to a minimum width of 800 feet, commenced in 1952, is about half completed. This section com-