

ICE FORECASTING

BY

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Ice forecasting in Canada is a relatively new activity but the concept of an ice warning service dates back to the early days of World War II. This initial service, begun in 1940 by the Marine Branch of the Department of Transport, was concerned only with the opening of navigation to Montreal and Quebec for the ice in the Gulf was then thought to be unnavigable throughout the winter. Indeed, the old Gulf of St. Lawrence Pilot spoke of an 'ice bridge' from Cape Breton to Newfoundland nearly every winter. This patrol was conducted in April and May from Prince Edward Island and bulletins were prepared which described ice conditions in general terms.

In 1953 the starting date of the patrol was advanced to early March and a winter study of the ice was begun in 1956 by the Department of Mines and Technical Surveys both being part of an effort to lengthen the shipping season. The responsibility for operational ice reconnaissance and forecasting had been delegated to the Meteorological Branch in the mid fifties and we assumed full reconnaissance duties in this area in 1958. Ice forecasting began at the same time although for the first year Ice Central itself was a naval office. 1958 happened to be the warmest year on record in the Gulf and there was in fact very little ice to predict that season. The following winter was the coldest in the previous 25 years so we quickly made up for the first easy season.

You might wonder how ice prediction became a function of meteorologists for at first glance it appears that since ice is frozen water it should properly be a function of oceanographers. There are two main factors which make the present assignment reasonable. Ice floating in the sea is exposed to wind and air temperatures which vary appreciably but can be forecast. It is also carried along by water currents but these are less well known and, even though they are considerably less variable, operational techniques for forecasting them are not available. In addition to this the Meteorological Service is accustomed to moving large amounts of data rapidly, analysing it and preparing a forecast of conditions in a limited time. We all know that forecasts are not always accurate but they are always available. An oceanographer would be the first one to admit that their science, is not geared to this time scale for research results of oceanographic cruises are often years in preparation and the concept of reaching the best possible answer based on limited data is foreign to their approach.

The essence of this whole question is that a meteorologist can quite easily learn the portion of oceanography he needs to predict ice. An oceanographer would need to learn large amount of meteorology, disregard part of his own training and change his whole approach to science to become a day-to-day ice forecaster. The number of willing candidates would obviously be very small.

With these comments as a background let us look next at the organization and operation of the Canadian ice program. We have, first of all, 20 trained ice observers based in Toronto, Met Headquarters. They are assigned in teams to an aircraft or individually to an ice breaker. A normal seniority structure is allowed for in the form of senior observer, field supervisor etc.

The policy for aircraft operation has always been to support the air carriers by charting aircraft for several months at a time and as a result there have been many changes over the years. The old Canso has been used in Hudson Bay but the most common platform has been the DC 3 and the C 46. In recent years as the amount of airborne equipment required continued to grow, the repeated installation charges became unreasonably high and 2 DC 4 aircraft were chartered for a five year period. We are now in the final year of the contract and the aircraft are rather tired. Besides a special observers position above the pilots, they are equipped with Decca Navigators, Doppler radar, closed circuit TV cameras, an advanced gyro compass for Arctic operations and an airborne

facsimile transmitter besides all the usual radar and electronic equipment in aircrafts. When long range tanks are added, the space available for passengers has nearly reached the vanishing point. The charter is for 2400 total hours per year and in fact most of this flying is done in the ten months from January to October.

The aircraft and observing teams are moved into the field at the request of Ice Central and are then directed entirely from Halifax. In the Atlantic Provinces the principal bases used are Moncton and Gander but Sydney and Goose are sometimes used as alternates. After a flight, the observers ice chart is transmitted by facsimile equipment to Halifax using telephone or broad-band circuits. While airborne they will contact ice breakers in the area and transmit directly to them a chart of ice conditions ahead of the ship. Special requests from the ship captain can then be passed to the aircraft and there is also a communications channel which can be used for special requests for coverage in advance of need.

In addition to the aircraft reports, certain coastal radio stations, weather offices and lighthouses pass a daily report to us, and every ice breaker sends a daily message of the conditions they encounter. These are the routine additions to the aerial reports but besides that, satellite pictures are available and can be used operationally. At present the satellite station in Halifax is of marginal value because of the format of their pictures but routine access to the output of an improved station is planned. The resolution of present satellite pictures is only about 2 miles and consequently thin or dispersed ice usually not discernible. All the same the technology has come a long way in 10 years and future satellites may be significantly better. At present the primary use is for broad-scale surveillance in remote areas and as an aid to planning the detailed manned reconnaissance.

With all this material, the ice forecaster is able to prepare charts indicating where the ice is located, how much is present, what types are included and the proportions of each as well as such additional features as extent of ridges, puddles etc. These charts are broadcast twice daily by radio facsimile from CFH Halifax and are received as far away as Alaska and England. Ice breakers and any commercial vessels in the area can receive them to assist their operation.

An ice forecast of conditions until midnight the following day is also prepared by combining the ice conditions with currents and forecast winds and temperatures. These are broadcast by marine radio stations and include a description of present ice conditions for the benefit of those vessels without facsimile gear. The forecast includes an outlook for the third day ahead.

All the foregoing is intended to assist captains of ships at sea who are in the ice, intend to enter it or merely want to avoid it. The office output also included a 30 day ice forecast, a weekly mailed ice chart and a seasonal outlook indicating the severity of the coming ice season. The maps are useful for shipping agents, marine work planners shipyards, ferry operators etc. The long range forecasts have many uses for they can give guidance in planning many land based activities.

To complete the picture I should add that once the St Lawrence and Newfoundland area is clear of ice, our operations merely move northward to Hudson Bay and the Arctic resupply operations. The observers and ice forecasters are if anything busier in summer than in the winter for the area to be covered is very much greater even though the amount of shipping is less. In the last two years a third aircraft has been added to supplement the reconnaissance along the Arctic continental coast.

We have a free and complete exchange of data with the Americans where the ice programs are mostly military and with the Danes in Greenland. All countries use the same terminology and a numerical code is available for exchange of operational data but so far methods of charting are of national design. In size, the Canadian program is second only to that of the Soviet Union where ice navigation is almost the normal condition in Siberian waters at least. The trend towards resource development in the Arctic and the possibility of year round navigation seems to indicate that continued expansion of the program is necessary with more sophisticated aircraft and instrumentation capable of observing the ice through cloud and in darkness.