

they provide one feasible method. For the east coast and European markets, however, tankers, if they prove able to make the long haul through the Northwest Passage, will have a decided economic edge on pipeline transportation.

The voyage of the *Manhattan* is an awesome undertaking, in which the giant vessel will sail from the Atlantic seaboard to Alaska, approximately 4,500 miles, to test the question of whether the currently-exploited shipping season of three months in the ice-infested waters of Canada's Arctic archipelago can be extended, by means of super-powered, ice-breaking tankers, to nine or even 12 months.

The Canadian and United States Governments are co-operating in the project, which is being carried out by Humble Oil on behalf of a consortium that also includes Atlantic Richfield and British Petroleum, with the assistance and support of the Canadian Department of Transport and the U.S. Coast Guard.

CANADA'S ROLE

Canada found the grand conception of opening up the Arctic in this manner a challenging one, especially in view of the country's vast Arctic resources. Transport, designated the department of primary interest by the Government, held a lengthy series of consultations and exchanges of information with the U.S. Coast Guard and Humble Oil.

In addition to the expert advice of its Marine Operations Branch and experienced senior officers, the Department has provided an officer to work full-time on the project. He is Captain T.C. Pullen, an Arctic expert of wide experience. Captain Pullen, who made organizational plans for the Canadian part of the undertaking, is aboard the *Manhattan* as Canada's official representative, where his knowledge in Arctic operations will be available to the master of the tanker, Captain Roger Steward.

The icebreaker attached by the Department of Transport to the expedition is the largest Canadian Coast Guard ship now in general service. CCGS *Louis S. St. Laurent*, which is larger, was received by the Department this month and is now undergoing sea trials.

CCGS *John A. Macdonald* was built in 1959 by Davie Shipbuilding at Lauzon, Quebec. Based at Dartmouth, she measures 6,186 gross tons and is capable of travelling 20,000 miles without refuelling or revictualling. She is a triple-screw vessel with diesel-electric propulsion machinery generating 15,000 shaft horsepower at peak operation.

The vessel has spent much time in the high Arctic, gaining information on bottom topography, ice conditions and, similar to other Canadian Coast Guard icebreakers, carrying hydrographers to chart the waters. The information thus gained was of incalculable aid to those who planned the *Manhattan* voyage.

Under her veteran master, Captain Paul Fournier, the *John A. Macdonald* earned special note during

Canada's centennial year by steaming through the Northwest Passage into the polar ice of the Beaufort Sea to assist the United States Coast Guard Icebreaker *Northwind*, which was crippled and trapped in heavy ice.

Another contribution to the tests by the Government of Canada is the services of a Department of Transport-leased DC-4 aircraft recently fitted with special remote-sensing equipment for mapping and assessing ice conditions. This equipment includes a laser profiler, an infra-red thermal mapper, and a panoramic camera with associated recording equipment. The aircraft is also fitted with facsimile equipment used to send ice maps by radio to ships. Other special equipment installed on this "flying laboratory" includes closed circuit TV, synchronous astro compass, Doppler radar, a precision gyro compass and Omega navigation equipment. Records and film will be free-dropped to the *Manhattan* for processing. The aircraft, with a range of more than 2,500 miles, normally is part of the regular operations of the Meteorological Branch's ice reporting system to aid winter shipping. Ice observers will maintain constant surveys ahead of the convoy. Their reports, combined with the information obtained on short helicopter flights from the decks of the vessels, will keep the ships' navigators well informed as to ice conditions.

Also available throughout the voyage are the services of Canadian Government meteorological and telecommunications bases established in strategic places across the Canadian Arctic.

To transform the huge tanker into the type of strong icebreaker they had in mind, Humble Oil executives had to have her cut into four parts, allotting each piece to a different shipyard in order to get the job done as quickly as possible. The gigantic sections, transformed into temporary barges, were towed by tugs to their separate shipyards. A specially-designed icebreaking bow was built, replacing the ship's conventional one.

The results of this historic voyage are no foregone conclusion, but they obviously will have widespread impact on the international economy. It presents an exciting example of what governments and large industries can accomplish together.

HISTORY OF ARCTIC NAVIGATION

Navigation in the Canadian Arctic, which began in the sixteenth century as part of the general exploration of the Western Hemisphere, was usually motivated by the desire to find a route to the Far East. Martin Frobisher made three voyages (1576-78) to Frobisher Bay on the southeastern tip of Baffin Island. He believed the bay to be a strait leading to the Orient. John Davis also made three voyages (1585-87) skirting the southwest coast of Greenland, the southeast coast of Baffin Island and the coast of Labrador. Henry Hudson discovered Hudson Strait and Hudson Bay (1610), the most important discoveries thus far. He, too, was instructed to search