

communications and electronics experience to transportation as a development engineer involved in vessel traffic management with the St. Lawrence Seaway Authority. In 1974 he joined the TDC as a project officer; he became Division Chief in 1977 and Executive Director in 1983. He is responsible for the planning, implementation and management of Transport Canada's central R&D program.

**Abstract:** The development of cold regions technology in Canada is reviewed, including a description of facilities and resources available in the country to undertake research, design and construction. While the development of northern region projects of the past forty to fifty years are described, the paper concentrates on those research and engineering developments of the past two decades initiated in response to the need to produce and transport oil and gas from the Arctic. The extension of this work into the Arctic Ocean and the cold oceans of the east coast is also described. An extensive infrastructure of human resources for research engineering design and construction has emerged in Canada as a result of these activities. A review of these is presented, as is an overview of the research facilities and engineering laboratories for cold regions research and design that have grown within the private sector, at universities and in government.

The extensive program of arctic marine research and development which has established Canada as a leader in many aspects of arctic marine technology is described, with particular attention to Transport Canada's R&D program. Mathematical model predictions and the results of scale model ice tank tests being systematically verified through a program of full scale data collection are described. Instrumentation projects carried out to measure ice forces acting on ship hulls are discussed, as is a procedure of instrumentation, mathematical modelling, scale model tests and full-scale data collection which has been applied to the ship propulsion train and steering gear. Canada's R&D capability as demonstrated in the MV Arctic and in the latest class of Canadian Coast Guard ice-breakers are described.

The role of naval architectural and marine engineering consulting firms, shipping operators, Canadian shipbuilders, and the academic community in the development of Canada's arctic marine technology is reviewed.