

# Prospects for navigable canals across the Canadian Arctic

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## Climate and Arctic shipping

Two conflicting theories offer to explain recent changes in weather patterns. Both theories allow for the emergence of a navigable commercial shipping route across the Arctic. Ships have successfully sailed through the Canadian Arctic passage that has now become navigable for a few weeks during the summer. The carbon dioxide theory of global warming suggests that the shipping route would remain navigable for longer periods of the year in future. The solar-cycle theory of global warming suggests that the sun releases thermal energy cyclically, in alternating periods of slightly more heat and slightly less heat. Proponents of this theory suggest the peak of sun's warmer period occurred some 2 to 10 years ago, with the North Atlantic drift having pushed heat from that period northward into storage under the Arctic ice, from where it melts Arctic ice.

While a trans-Arctic ocean route is presently navigable for a few weeks per year, Canada's geography offers two possible trans-Arctic canal options that may extend the trans-Arctic shipping navigable season from a few weeks per year to several months per year. The canal option is compatible with both theories of climate change as it could extend the operating season of trans-Arctic navigation.

## Prospective trans-Arctic canals

During the northern summer, Canada's Northern Transportation Company regularly sails the Beaufort Sea and through Simpson Strait to the outpost of Gjoa Haven at 96 degrees west and 67 degrees north. They also sail on Hudson Bay into Chesterfield Inlet and to the outpost of Baker Lake at 96 degrees west and 64 degrees north, located some 480 kilometres or 30 miles south of Gjoa Haven. Chantrey Inlet extends south to a point some 300 kilometres or 200 miles from Baker Lake. It appears possible to develop a navigable canal through the low lying area, lakes and riverbeds located between Baker Lake and the southern end of Chantrey Inlet or directly into the southeast corner of Queen Maud Gulf.

The Mackenzie River is navigable between the Beaufort Sea to Great Slave Lake, with prospects to extend the barge-navigable channel south along the Slave River into Northern Alberta and Lake Athabasca. It appears possible to extend a navigable canal

eastward through Black Lake and into Wollaston Lake, with potential to develop a canal across into Reindeer Lake that empties into the Churchill River that then flows into Hudson Bay at the Port of Churchill. This route passes through several mining regions and could serve their export needs, while also providing an east-west maritime passage across Canada.

## Ship technology

A canal built between Baker Lake and Chantrey Inlet could provide passage for shallow draft coupled barge trains that may be carried aboard larger ocean ships. Semi-submersible ships may carry such barges and/or hover-barges between Asian ports and a port on Chantrey Inlet, also between the port of Baker Lake and European ports. At port, the ships would moor in special locks and partially submerge to the lock floor, to allow barge trains and/or hover-barges to float onboard and off-ship. The carrier ship may be a diesel-electric oceanic ferry with engines located near the bow and feature stern-mounted doors.

Alternatively, a semi-submersible oceanic ferry barge with stern doors may be propelled and steered by a stern-coupled tug. A recent innovation called 'Seasnake' involves a scale model prototype of an oceanic train of coupled barges propelled by the combination of a coupled tractor and stern tug. An extreme extended length Seasnake ship could carry barge trains or hover-barges between Canadian Arctic ports and ports in Asia and Europe.

## Overland link

Venture capitalists may be reluctant to invest in a trans-Arctic canal due to uncertainty regarding future weather patterns, while the tundra and muskeg terrain between Chantrey Inlet or Queen Maud Gulf and Baker Lake is unable to support the weight of railway lines or roads for heavy trucks. An air cushion technology from Hovertrans Solutions of Singapore involves a concept hover-barge designed to carry up to 2,500 tonnes payload over muskeg and tundra terrain. Hover-barges may serve as the trans-Arctic intermodal link carrying bulk cargo and containers between ships that connect at Chantrey Inlet or Queen Maud Gulf and Baker Lake.



Port of Churchill, Manitoba

Image courtesy of Port of Churchill



Scale model of a Hoverbarge

Image courtesy of Hover-Trans

## Navigation locks

A trans-Arctic canal would include the water saving side reservoir system used on the European barge canal system and on the larger Panama Canal. To further ensure navigation in the northern climate, canal locks would include water pumps and water heaters. Natural gas and/or micro-nuclear power may provide the energy to operate the pumps and heaters, technology that could allow a canal built between Chantrey Inlet and Baker Lake to provide passage to larger and deeper draft ships. Barge trains would alternatively sail via the Mackenzie and Churchill Rivers, between the ports of Tuktoyaktuk and Churchill.

## Bulk/container ports

With a draft comparable to the Port of Montreal, the Port of Churchill on Hudson Bay processes bulk dry cargo and can be expanded to include barge-ship transfer of containers. The possible existence of extensive natural gas and an oil field near the Port of Tuktoyaktuk on the Beaufort Sea has prompted Canadian officials to consider upgrading that port for deep-sea service. Such an upgrade could include ship-barge transfer of bulk cargo and containers.

Trans-Arctic shipping that results from either a navigable canal or melting polar ice could increase traffic at the Port of Churchill, especially if a barge canal were to connect to Lake Winnipeg. It would require expansion, as it becomes a gateway into the north-central USA. Ships may sail into James Bay and to the Port of Moosonee that would require expansion and the railway line to Toronto would need upgraded. It may be possible to develop a barge canal between James Bay and Lake Superior.



Port of Churchill, (northwest view)

## Remote port operations

Modern telecommunications technology would allow for remote control of the Arctic cranes, with crane operators working from 'play stations' located elsewhere in Canada. Barges and ships would moor in parallel locks, with cranes straddling over both vessels and supported vertically on either side of the vessels. Future crane designs could carry multiple containers in each transfer, reducing ship time at port. Computer assisted crane operation would raise productivity further.

## Economic viability

The viability of a trans-Arctic canal depends on carrying massive tonnage from early May to late September or early October. By comparison, the St Lawrence Seaway upstream of Montreal operates from late March to late December and faces competition from railway lines that connect the ports of Montreal, Halifax, Boston, Newark, New Orleans and New York City to major ports around the Great Lakes. The Mississippi Barge Canal connects the



Hoverbarge in Northern Canada

Image courtesy of Hover-Tians

Port of New Orleans to Chicago where an interconnecting canal provides access to Lake Michigan and several Great Lakes ports.

The Canadian muskeg and tundra cannot support the weight of high-tonnage railway lines, leaving trans-Arctic inland canals free from competition and enhancing prospects for seasonal viability. That prospect could invite private venture capitalists to finance the shorter canal route to attract international traffic. Depending on the amount of tonnage that a southern canal could carry, a consortium of mining companies, food distribution companies and venture capitalists could develop the viable sections of that route.

## Political considerations

The Federal Government of Canada oversees some environmental matters and recently revised the environmental review process, reducing its duration from 36 to 12 months. There are precedents of rivers having been diverted in Quebec and in Ontario to build new hydroelectric power dams. These precedents combined with the new environmental review process enhance prospects of obtaining a favourable ruling to an application to build a navigable waterway through a very sparsely populated region.

## Conclusions

The maritime world seeks a shorter maritime passage between Western Europe and Eastern Asia. A trans-Arctic barge canal is one possible option. While such a canal may only operate for 5 to 6 months of the year, it could attract enough traffic to be viable. The ports of Churchill and Baker Lake operate seasonally and serve the mining and agricultural sectors, while an expanded port at Tuktoyaktuk would serve the energy industry. The shorter trans-Arctic canal would serve international shipping. The longer canal route would serve international shipping and connect Canada's mining, resources and agricultural sectors to international markets.

### ABOUT THE AUTHOR



**Harry Valentine** was born in Cape Town, South Africa and lives in Cornwall, Canada. He holds an engineering degree from Carleton University, where he pursued postgraduate studies in transportation and undertook extensive research at the University's Transportation Research Centre. He has research experience in the passenger and freight transportation sectors.

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