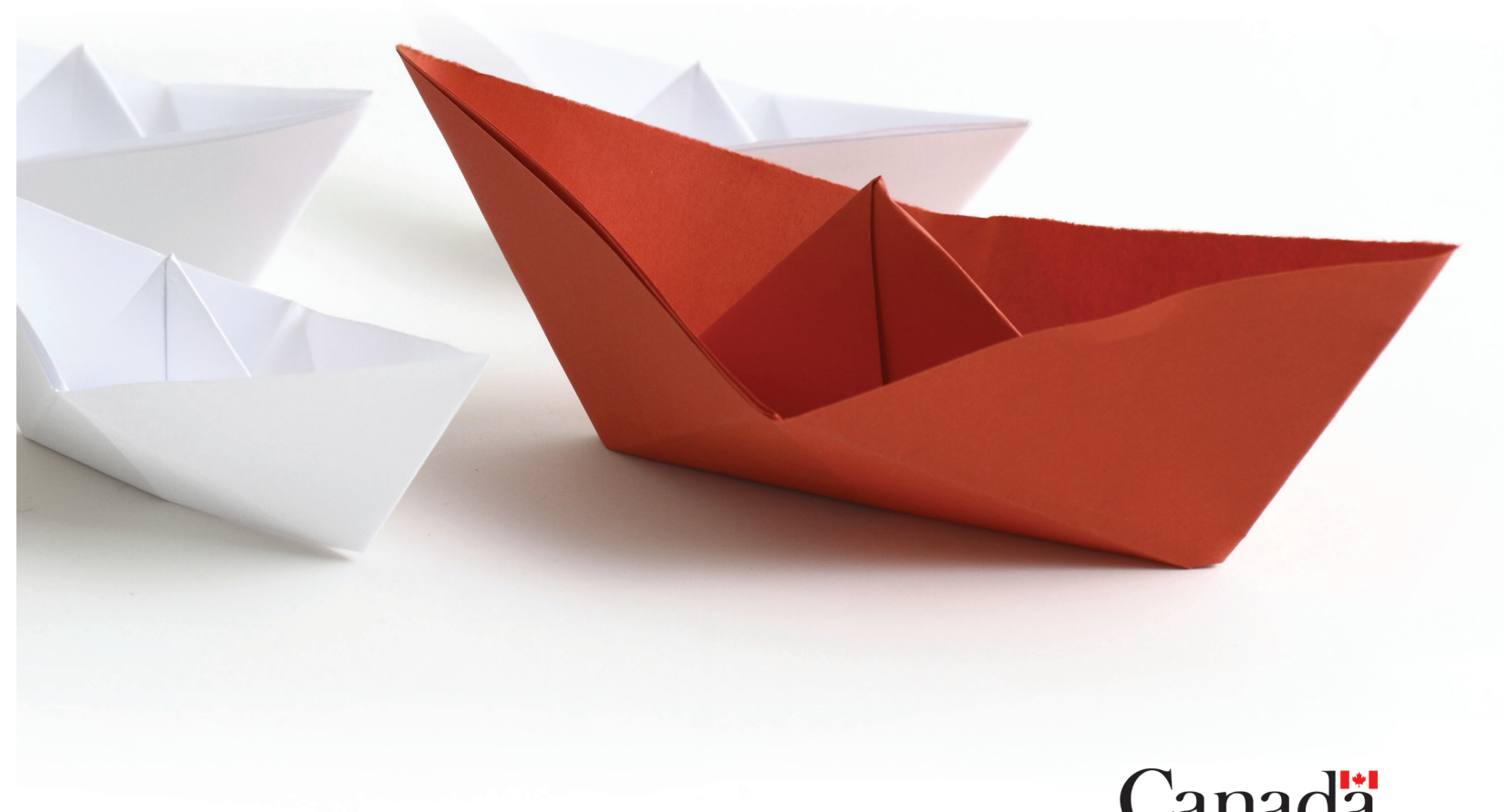




# Pathways: Connecting Canada's Transportation System to the World

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Volume 1



Canada 

# Chapter 4: The North

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Canadians recognize our shared heritage and destiny as a northern nation, yet most of us have never travelled north of 60° to experience the harsh beauty of the landscape, along with the unique challenges of living in and travelling to and from that environment. In his introduction to The Globe and Mail's 2014 series of articles on "unprecedented changes to the climate, culture and politics of Canada's last frontier," former editor-in-chief John Stackhouse alludes to the complexity that will inevitably attend further development of the North:<sup>1</sup>

We're a southern people, for the most part, huddled along and near the U.S. border, oblivious to the Far North and its quiet magnetic pull on the Canadian soul. And yet, our great northern span, through the territories and Arctic, is in the midst of an epochal shift.

Climatically, economically, socially and culturally – our North is being redefined in ways that will shape Canada for the century ahead.

Our energy ambitions and resulting carbon emissions are disrupting the northern landscape, its very foundation. Our neighbours are showing territorial interests that seek to alter our sovereignty. Our investments in mines, oil fields, roads and ports are changing the northern economy, for good and bad. Even the North Pole is in question.

The Government of Canada has a continuing obligation to support northern development and facilitate the region's continued participation in the Canadian federation. Federal leadership is required to ensure that, as the resource potential of the North is further unlocked, development occurs in such a way as to respect and benefit Northerners, while minimizing environmental impacts. Transportation will continue to be a major development catalyst, and because many of the decisions that affect northern transportation systems are made in the South, it is of utmost importance that these decisions be informed by northern realities and made in partnership with Northerners.

Canada's diverse northern territories, home to just 0.3 percent of Canadians, comprise the Northwest Territories (NWT), Nunavut, and Yukon. Together, they cover 3.5 million square km, or 40 percent of Canada's landmass. Because the population is so small, transportation routes are neither as heavily used nor as developed as those in the South, but the traffic is critically important to the quality of life of Northerners as well as the economic future of the territories.

While our focus is on Canada's northern territories, the northern parts of provinces experience many of the same challenges in respect of the establishment of transportation routes considered in this chapter. These routes are essential to enabling contact with remote communities and resource deposits and developmental projects.

The terms of reference for the Review ask "how to address rapid changes in the North and associated challenges for the continued safety, security, and sustainability of the northern transportation system, and specifically, the federal role in supporting the northern transportation system."

In this Chapter, we address the most significant transportation-related challenges for northern Canada. To gain a better grasp of the issues, CTA Review Advisors and members of the Secretariat travelled to the three territories on a number of occasions to meet with stakeholders and territorial government officials; they also visited various transportation infrastructure sites. Our recommendations are informed by these visits, and by the representations made to us in writing and in person. They focus on delivering significant improvements in northern infrastructure for multimodal corridors and the aviation and marine modes; they also aim to strengthen transportation policy and regulatory frameworks.

## **History: Setting the Stage for Canada's Northern Destiny**

Historically, Northerners have been highly dependent on transportation to move goods and people across huge distances and harsh environments. However, the Canadian government had no development strategy or strategic transportation vision for Canada's North until the second half of the 20<sup>th</sup> Century. That said, transportation in the period since then has been of critical importance to northern society and to the economy of the North, providing a vital lifeline to remote communities. And there have been some significant successes in the development of Canada's northern transportation networks, particularly when they have been planned and built through partnership, in line with a shared vision.

For the most part, however, northern infrastructure projects have been built on an ad hoc basis without a long-term cohesive plan or links to trade and travel corridors (see Volume Two, Appendix D for more information on northern infrastructure projects). With the creation of more permanent settlements and the migration of outsiders to the North during the 19<sup>th</sup> and first half of the 20<sup>th</sup> century, the limited transportation systems then in existence grew incrementally. Significant development occurred during World War II and in the decades that followed, as health and other social services were introduced to communities and infrastructure was put in place for resource development and defense purposes. By the 1970s, progress on major infrastructure projects had slowed and, until recently, there has been relatively little activity.

In the last few decades, the federal government has devolved authority to the territories for education, health care, and social services. Responsibility for lands and resource management was devolved to the Yukon in 2003 and to the NWT in 2014; negotiations with Nunavut are currently underway. Numerous comprehensive land claims have been negotiated, and self-government agreements have enabled a higher degree of involvement of northern Indigenous communities in resource exploration.

Interest in the North has intensified due to the potential for resource development, geopolitical developments, and the opening of new transportation routes. The federal government's 2009 Northern Strategy, 2013 Arctic Foreign Policy, and other initiatives illustrate this renewed interest, with the latter policy recognizing the urgent need for infrastructure. The lack of infrastructure, including transportation infrastructure to enable economic development and assert Canada's sovereignty, has historically been a major challenge.

The initial transportation routes in the development of the North were shipping routes that supported the fur trade (Hudson’s Bay Company ships served the eastern Arctic and smaller vessels plied the western Arctic).<sup>2</sup> Rail technology followed and had a more limited, albeit important impact on northern development. Highways and road access in the North have developed somewhat haphazardly, with some of the highways following the ancient routes of dog sled and other trails. The advent of air travel in the early 20<sup>th</sup> century brought important advances in terms of accessing remote communities and shortening travel time in the North. As transportation-related technologies have advanced through the years, businesses, communities, and governments have adapted to take advantage of safer, more efficient methods.

## Where we are today: The largely untapped North gaining in importance

Notwithstanding devolution of certain powers, the federal government retains important responsibilities and ultimate accountability for development in the North. While many of the historical and geographical challenges remain, new and emerging issues present further challenges and opportunities in relation to transportation. Most traffic and corresponding transportation routes and corridors are North-South, as is the typical flow of goods and people. There continues to be more travel to and from the North than within it.

The northern transportation network is patchy. Aviation is heavily relied upon to move people and goods, as well as to address medical needs, especially in remote communities. Rail is currently limited to the lines that reach Hay River in the Northwest Territories; to a number of lines in the northern regions of provinces that move goods and connect to natural resource projects; and the isolated line between Skagway, Alaska and the Yukon. In terms of road travel, all-weather roads are essential for year-round access. However, only the Yukon is well served in this regard; the Northwest Territories is only partially connected by all-weather roads and Nunavut has no highways. Both the northern part of the Northwest Territories and all of Nunavut rely primarily on marine transport and aviation. Figure 1 below displays data on the total movement of inbound and outbound freight from 2009.

Total Freight in 2009 in Tonnes (estimated)				
Transportation System	Community Resupply General Freight	Resource Projects General Freight	Bulk Fuel Supply	Total Inbound
Eastern Sealift	54,500	39,100	139,900	233,500
Western Sealift	3,750	3,850	58,900	66,500
Hudson Bay	4,300	27,300	38,500	70,100
Mackenzie River	8,900	3,900	26,000	39,000
Inside Passage *	59,400	24,100	64,000	147,500
Mackenzie Rail *	8,500	1,700	201,300	211,500
NWT Highways	163,000	48,000	300,000	511,000
Yukon Highways	371,000	143,900	121,900	636,800

**FIGURE 1 — FREIGHT FLOWS IN THE NORTH**

<b>Total Inbound *</b>	<b>605,350</b>	<b>266,050</b>	<b>685,400</b>	<b>1,556,900</b>
Air Freight				20,000
Mineral Exports				54,000
<b>Total</b>				<b>1,630,000</b>

\* Mackenzie Rail and Inside Passage Tonnes included in Highway and River Tonnes, and excluded from Total Tonnes.<sup>3</sup>

### Infrastructure Gaps

Infrastructure needs in the North, of which transportation is only one component, are varied and widespread. The Yukon government states that it “ . . . appreciates the fiscal reality that all public governments need to deal with and recognizes that transportation is not the only sector that places demands on limited budgets.”<sup>4</sup> The *New Building Canada Fund*, a 10-year federal infrastructure investment program launched in 2014, provides allocations to each territory (\$250 million base funding plus a per-capita adjustment) and eligibility to submit proposals for nationally significant projects under an un-allocated National Infrastructure Component. In the context of current funding mechanisms, the federal government will contribute up to 75 percent of project costs, while territories are expected to cover the remaining 25 percent. In addition to these mechanisms, projects can sometimes benefit from other targeted contributions, such as the funding set aside for the construction of the Inuvik to Tuktoyaktuk Highway in the 2011 federal budget.

There are innumerable challenges inherent in planning and building transportation infrastructure in the North. For one thing, it takes a very long time due to the challenging climatic conditions and thus relies on infrastructure funding mechanisms that remain in place over a long period. For another, there are competing priorities, such as water, waste water, solid waste, and energy, all of which require infrastructure to respond to current and future needs.<sup>5</sup> Long-term transportation projects may be less likely to receive funding than projects addressing immediate needs relating to health, safety and education.

Cost is another major challenge. Operating and infrastructure construction costs in the North and remote areas are higher than elsewhere in the country. Two resource development sectors combined— mining and quarrying, and oil and gas extraction—represent about 40 percent of the North’s GDP.<sup>6</sup> Long-standing advocacy efforts by the mining industry, particularly focusing on infrastructure, seek to lower the cost of doing business in the North. The Mining Association of Canada states that there is a “ . . . cost premium for both exploration and mining linked to the transportation infrastructure deficit in remote and northern Canada.”<sup>7</sup>

## Transportation of Food

Currently, almost all food and consumer goods are transported to the North from the South. This translates into exceedingly high prices for everyday items that are readily accessible to southern Canadians and, in particular, sky-high food prices. The Review heard about the challenges associated with the federal government's Nutrition North Canada program, which offers full or partial subsidies to assist residents in isolated communities to purchase perishable nutritious food and traditional or country food. It also heard from a small business owner frustrated by discrepancies in shipping costs: large companies with high volumes receive lower prices from airlines, whereas small companies bear the full cost burden.

In comparison with other Arctic countries, Canada's northern infrastructure is much more limited. For example, Russia is advancing economic development by subsidizing resource projects and investing in military and other infrastructure, such as deep-water sea ports along the Northern Sea Route.<sup>8</sup> More information on northern infrastructure in other Arctic countries is included in Appendix D.

### Strengths

In spite of the challenges, there are significant successes and strengths upon which to build:

- Yukon's well developed road network, which consists of 4,820 km of highway, with access points to British Columbia, international border crossings with Alaska, and the only all-season highway to cross the Arctic Circle.<sup>9</sup>
- Transport Canada's Northern Transportation Adaptation Initiative, an \$11-million program whose objective is to support the design, development and adoption of new technologies, enhance knowledge of the effects of climate change on the northern transportation system, and make northern transportation infrastructure and operations more resilient and adaptable to climate change.<sup>10</sup> A recently conducted evaluation of the Initiative affirms, "support for northern transportation adaptation continues to address an ongoing need, as all modes of the northern transportation system require adaptive measures in the face of climate change, and knowledge of effective adaptive practices remains limited."<sup>11</sup> The Yukon Government has requested the program's extension beyond the appointed termination date of March 2016.
- The 137 km Inuvik–Tuktoyaktuk component of the Mackenzie Valley and Dempster corridors built under the most challenging winter conditions and designed to tackle permafrost. It will be the first Canadian highway to connect with the Arctic Ocean and is a strong enabler for local communities with respect to employment, training, and resource development.<sup>12</sup>

### **Indigenous Partnerships**

Indigenous land claims and self-government agreements are crucial to development in the North, including the development of transportation systems. Indigenous people and communities have been in northern Canada for millennia and are playing a progressively greater role in its development. Increasingly, they are the owners, operators, and decision-makers for marine, air, and surface transportation companies and projects, though capacity limitations are still a concern. For example, a recent news article describes how an Inuit-owned entity, the Nunavut Resource Corporation, is working with Transition Metals Corporation and has been successful in exploring and finding gold and base metal deposits in the Izok Corridor, between Izok Lake and the Coronation Gulf.<sup>13</sup>

### **Climate Change**

The effects of climate change are more visible and dramatic in the North than in the rest of Canada. Global warming and fluctuating climatic conditions are causing the premature deterioration of transportation infrastructure.<sup>14</sup> For example, more pronounced freeze-thaw cycles are causing airport tarmacs to buckle and dip. Permafrost degradation due to warming temperatures poses challenges for road construction and maintenance, since it is increasingly difficult to ensure stability. Melting ice and the resulting mobile ice are having a significant impact on marine transportation and related infrastructure planning. Warming temperatures also encourage a longer navigation season for commercial ships. In this context, the aforementioned Transport Canada Northern Transportation Adaptation Initiative is sponsoring important research and development.

### **Technological Innovation**

Satellite technology is playing an important role in facilitating transportation and other economic activities in the North, as well as maintaining safety and security. The October 6, 2011 loss of satellite services and the resulting disruption to communications and air travel demonstrated just how reliant Northerners have become on this technology. The Canadian Space Agency's submission to the Review outlined how space-based satellite technology currently supports transportation in the North through communications, weather reporting, navigation, surveillance, and search and rescue activities.<sup>15</sup> Its importance to northern transportation and the economy of the North is undeniable.

### **Marine**

Recent developments in northern marine transportation include increases in marine traffic, and those vessels that are traversing Canada's Northwest Passage. The increased traffic reflects the important demand for goods and freight as well as increasing tourism and small craft traffic. These developments have led stakeholders to call for improved infrastructure and updated policies and regulations to meet the challenges.



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**“Lack of marine infrastructure in the Canadian Arctic is an acute social challenge as many small communities rely for the most part on seasonal marine transportation. Deficient marine infrastructure also seriously limits important economic activities such as resource project development, fishing and tourism, activities which could contribute greatly to the development of a prosperous Canadian Arctic and Canada as a whole. Lack of adequately equipped ports, places of refuge and refueling facilities as well as oil spill prevention and mitigation equipment limits significantly the ability to protect the fragile Arctic environment and address potential resource extraction, shipping or other polluting accidents in a timely and effective manner.”**

— John Higginbotham

Canadian Arctic Marine Transportation: Long-Term Challenges and Opportunities, Unlocking Economic and Natural Resource Development  
March 31, 2015

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Port operations in the eastern Arctic are characterized by rudimentary methods of bringing goods onto shore. Even Iqaluit, the largest community served by sealift vessels, lacks basic infrastructure to enable safe and efficient sealift operations. Infrastructure improvements for ports and harbours in the North would improve the fluidity of sealift activities, as well as the safety of the operations. The federal government formerly funded the maintenance and good repair of Northern landings, docks, and harbours, but in recent years has played a diminished role. The Government of Nunavut notes that, in March 2013, the Department of Fisheries and Oceans discontinued its program for sealift and resupply support (that covered items such as boulder removal and shore infrastructure); the program previously provided some \$500,000 a year under the terms of an annual memorandum of understanding.<sup>16</sup> Similarly, the federal government formerly provided dredging services, including for areas of the North, such as on the Hay River, which is a key hub for the transportation of goods into the high Arctic. Instead of operating with water drafts of metres, operators on the Hay River are dealing with centimetres. Understandably, this has a negative effect on the fluidity of goods movement, adding to their cost. While aboard a small vessel, representatives of the Review experienced firsthand the extremely shallow water on the Hay River—an additional example of the need for federal leadership to improve northern transportation networks.

Canada’s regulatory oversight and cooperation efforts have a significant impact on safe marine transportation in the North. While melting sea ice is lengthening shipping seasons in the Arctic, there is a greater danger to ships, their crews, and the marine environment from mobile, multi-year ice—ice that contains more brine and is stiffer and more difficult to navigate.

The vast majority of marine shipping companies operating in the North are doing so in a safe and responsible manner. However, the increased activity and vessel traffic means that there are likely to be new and inexperienced operators that could pose challenges. The increased numbers of small craft operating in northern waters is concerning, because they are not required to report to the Canadian Coast Guard as part of the Northern Canada

Vessel Traffic Services Zone (NORDREG regulations apply to vessels of 300 gross tonnage or more, as well as vessels carrying a pollutant or dangerous goods).<sup>17</sup> The Review heard that many operators of these types of small craft may be adventurers and tourists that might be inadequately prepared for the hazards of operating in an Arctic environment.

There are no authorities for pilotage in the Arctic, as there are in the South. Concerns have been expressed about the lack of marine ice pilots with adequate experience in Canadian Arctic shipping. This is a serious safety and efficiency issue. Some private sector experts claim that Canadian ice pilotage standards are lower than Russian standards, for example. In Russia, ice navigators have to have at least three years of navigating experience in ice waters. In Canada the requirement is 30 days, as set out in the Arctic Ice Regime Shipping System.<sup>18</sup>

In the fall of 2014, the Commissioner of the Environment and Sustainable Development found that there are many “higher-risk” areas in the Canadian Arctic that are inadequately surveyed and charted and that the capacity for such work is limited. Further, hydrographic coverage is about 30 percent in the Arctic marine corridors used for marine shipping and other kinds of vessels. The Commissioner also found that the Canadian Coast Guard’s icebreaking presence is decreasing, while vessel traffic is increasing. The Canadian Coast Guard, Transport Canada, and the Canadian Hydrographic Service are currently advancing the Northern Marine Transportation Corridors Initiative to enhance marine navigation safety and as a guide for future Arctic investments. The 2014 Tanker Safety Expert Panel Phase II Report on the Arctic recommended that, as a matter of priority, hydrographers be stationed aboard vessels in the Arctic to accelerate data collection. The Report also noted the inadequate coverage of charting.<sup>19</sup>

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**“The primary impediments to northern and remote aviation in Canada are currently infrastructure-related. There are issues with runway lengths and surfaces. Too many short runways and too many gravel runways limit aircraft choices for operators. A lack of 24-hour weather information in many locations creates delays and cancellations. Older instrument approach procedures and lack of approach lighting keep limits high and cause missed approaches and cancellations. Inadequate fuel supply in some locations limits loads and drives up cost. Virtually all of these issues are beyond the financial capability of the smaller communities to deal with . . . What is needed is a program to foster the improvement of these northern and remote locations, not limit them to an outdated status quo.”**

— Northern Air Transport Association Submission to the CTA Review  
December 30, 2014

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## Aviation

The Northern Air Transport Association highlighted to the CTA Review that there are significant physical and service-related infrastructure challenges faced by northern air operators, northern communities, and customers. Of particular concern, fleets capable of serving short-gravel runways are aging and increasingly costly to operate, and the “gravel kits” for the commonly used jet aircraft have not been manufactured for close to thirty years. The Review has heard that newer and more efficient jet aircraft will require paved runways and aprons.<sup>20</sup> The heightened risk that attends the use of unpaved, short runways in northern and remote aviation could mean that services are lost, or that there are a higher number of accidents.

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**“Many of Nunavut’s airports could benefit from the installation of GPS systems to reduce flight cancellations or missed approaches that have significant cost impacts to both passengers and airlines.”**

— *Department of Economic Development and Transportation Government of Nunavut Presentation to the CTA Review June 23, 2015*

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**“The reality of 10 years of airline deregulation in Canada’s North are the foremost challenges currently facing Canada’s major northern air carriers. The larger southern based airlines are competing aggressively on major trunk routes to southern gateway airports with no obligation to provide regional or local service beyond northern gateways.”**

— *RP Erickson & Associates*

Comparison of Approaches for Supporting, Protecting & Encouraging Remote Air Services  
*June 2015*

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By not subsidizing such services, Canada has taken a less interventionist approach to northern and remote aviation than countries such as the U.S., member states of the European Union, and Australia, where northern and remote communities benefit from reliable and robust passenger air services year-round.<sup>21</sup> The Canadian experience has seen some successes, particularly in the northern hubs that are well served by multiple carriers. For example, Yellowknife, a city of approximately 21,000, is well served by five airlines connecting to three southern Canadian cities.<sup>22</sup> Nevertheless, northern airlines face difficult operating environments, low traffic, and competition from southern airlines on their busiest routes.

The federal government is a significant user of air services to most remote and northern communities. However, public servants may have difficulty purchasing tickets on northern carriers. The research report on northern aviation and CTA Review consultations found that the northern air carriers are frustrated with the federal Government’s travel-booking platform, in that the system does not adequately display their inventory and prices.<sup>23</sup> These difficulties may be due to the high costs of participation and unfavourable display algorithms, both of which relate to the corporate travel policy set out by Public Works and Government Services Canada.

In general, aviation regulations apply equally across the country. For example, smaller and remote airports, such as the Erik Nielsen Whitehorse International Airport, have to comply with the same requirements as large airports, such as the Toronto Pearson International Airport, regardless of their difference in size. This one-size-fits-all approach may not be appropriate or realistic for the smaller airports of the North because the risks that the regulations seek to address are different in the North, as are the operating realities.<sup>24</sup>

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**“Unlocking the potential of the North will not happen overnight. It will take decades of concerted effort and continued revisiting of strategies to make it happen. This will require long-term commitments and partnerships to ensure success.”**

— *Government of Yukon Submission to the CTA Review*  
April 2015

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## Canada’s North in the next 20 to 30 years

The current approach to federal infrastructure funding and northern marine and air transportation policies are not sufficient in scope, or proceeding at a sufficiently rapid pace, to enable Canada to grasp the opportunities that the North offers. The time has come for Canada to enable the development of vast potential of the northern economy. Mineral resources in particular require the transportation systems to channel them to export markets. The corridor efforts currently underway, the existing infrastructure funding mechanisms, and the current northern transportation systems are good bases upon which to build more robust transportation networks.

To overcome the impediments associated with insufficient transportation systems to bring resources to tidewater for export, Canada requires a number of long-term (20–30) projects to ramp up northern transportation networks. Long lead times reflect the high cost of planning and building new corridors and their associated infrastructure, the challenge of working in a northern climate, and the preconditions for consultation and collaboration with Indigenous and other communities. To address these challenges, the federal government and its partners need to develop a long-term vision for planning and constructing transportation infrastructure to catalyze economic development.

Efforts are currently underway within the federal government and in other jurisdictions to advance the development of northern transportation and multi-modal corridors. The Canadian Northern Economic Development Agency (CanNor) is developing a conceptual framework entitled the Infrastructure Corridor System (ICS) as a basis to assess infrastructure components that support economic development in the North. Some provinces have developed plans for developing northern and resource-rich areas: Quebec’s Plan Nord and the Government of Ontario’s *Growth Plan for Northern Ontario* are cases in point. There have also been discussions among participants (state, territorial, and provincial governments,

private sector stakeholders, and others) in the Pacific Northwest Economic Region to advance corridor development efforts. The University of Calgary's School of Public Policy and the Montréal-based Centre for Interuniversity Research and Analysis of Organizations (CIRANO), are undertaking a project to investigate the feasibility of building a multi-modal corridor north of the existing main routes.<sup>25</sup>

### **How transportation can help fulfill Canada's northern destiny**

The Review received many submissions related to northern transportation and met with a broad range of stakeholders. Our recommendations draw from this rich input, augmented by analysis and advice on infrastructure funding and construction, as well as policy and regulations. We believe these are all areas in which the federal government must play a leadership role to expand and improve northern transportation.

Nation-building initiatives, both immediate and long-term, should be put in place to attract investment and resource development, as well as to reinforce Canada's sovereignty over its northern territory. Through job creation and the provision of more fluid transportation routes, such initiatives will help to improve the quality of life for Northerners. Improved infrastructure and improved transportation, policies, and regulatory frameworks will contribute to a stronger economy, a cleaner environment, and a safer, more prosperous North.

Climate change is having a magnified effect on the North. Ecosystems are extremely vulnerable as are the continuing social and economic conditions of Indigenous and other communities of the region. Development will require a great deal of sensitivity to these conditions.

Research prepared for the Review indicates that there are six main northern Canadian transportation corridors that hold promise for improved infrastructure and development:

- Cassiar-Campbell, connecting southeast Yukon mining areas with the port of Stewart, BC.
- Klondike Dempster, which runs through central Yukon, between the Alaskan port of Skagway and NWT town of Tuktoyaktuk.
- Mackenzie Valley Corridor, which follows the Mackenzie River from Tuktoyaktuk to Yellowknife and Hay River.
- Coronation Yellowknife, which stretches northeast from Yellowknife, through Slave Geological Province to Grays Bay in Nunavut.
- Hudson Bay, connecting the Kivalliq Region of Nunavut to Montréal via sealift and to Winnipeg via multiple modes.
- Arctic Sealift, which encompasses the coastline of Nunavut and the NWT.

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**“Northern Corridor development needs to move beyond the economics of an individual resource project, which is often what precludes both. For multimodal planning and coordination within a potential corridor, all prospective linear infrastructure should be vetted to:**

- **Build on what is already working;**
- **Seek synergies and avoid duplication;**
- **Promote sharing of risks, financing and permitting;**
- **Continually monitor changing risks and opportunities;**
- **Introduce Infrastructure Best Practices (e.g. franchising, P3s).”**

— *PROLOG Canada Inc.*

A Preview of Northern Resource Corridor Development: Prospects for Arctic and Northern Surface and Marine Corridors  
August 2015

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New dedicated funding approaches are needed to support the development of transportation infrastructure in the three northern territories. To confront the challenges involved in traversing vast distances and enabling the territories to address their many transportation needs, significant federal funding should be committed to stimulate economic activity, which in turn will attract private financing for resource development projects.

Infrastructure needs in the North are so significant that the most practical approach would be to focus on two or three long-term, nation-building projects that would serve to attract more investment in resource development projects in proximity to the infrastructure. Additionally, immediate projects should be developed to attract further private sector capital and to address immediate needs. Government investment in transportation infrastructure would yield significant long-term revenue and economic benefits for all of Canada. Investments in corridors could bring about additional local benefits that would effectively multiply the impact of investments several times over.

The Review assessed which of the six corridors would be of greatest benefit, and selected three priorities for infrastructure investment (see the Figure 2 below). The Cassiar-Campbell Corridor is an all-Canadian route that is predicted to result in development expenditures that exceed the government’s investment by an estimated multiplication factor of 32. Increased infrastructure investment should be committed to this corridor, as significant improvements are needed to enable increased resource development activities, including the reconstruction of the Nahanni Range Road that over the long-term could improve rail connections. The Mackenzie Valley Corridor is favoured due to the levels of infrastructure already in place, as well as the anticipated very high rate of return on investment. Finally, development of the Coronation Yellowknife Corridor is recommended, as it would tie together a number of mining projects and provide a deep-water port in the central Arctic. The Arctic Sealift Corridor and related infrastructure considerations are covered in the analysis regarding Arctic marine transportation infrastructure. It is acknowledged that the costs of planning and constructing such large-scale infrastructure are significant, but the current relatively low interest and lending rates are incentives to undertake this work as expeditiously as possible.

The Review considered whether the federal government could help to advance infrastructure projects by developing financing mechanisms, such as royalties or tolls, which would enable cost recovery over a long period of time. Such projects could include public-private partnerships in which the private sector and other contributors, such as Indigenous communities, would provide much of the upfront capital; in return, the federal government would guarantee a rate of return for investors. However, there would be significant challenges in attracting private sector investment and in introducing revenue mechanisms such as tolls.

<b>Resource Development Expenditures as a Multiple of Corridor Infrastructure Investment</b>			
	Prospective Corridor Infrastructure Investment	Potential Resource Development Expenditures	Leverage Factor (Expenditures ÷ Prospective Investment)
<b>Cassiar-Campbell Corridor</b>	\$463,500,000	\$14,878,000,000	32
<b>Klondike Dempster Corridor</b>	\$438,000,000	\$19,880,550,000	45
<b>Mackenzie Valley Corridor</b>	\$2,270,490,000	\$182,350,000,000	80
<b>Coronation Yellowknife Corridor</b>	\$1,890,000,000	\$39,496,672,000	21
<b>Hudson Bay Corridor</b>	\$3,503,000,000	\$8,556,981,000	2.4
<b>Arctic Sealift Corridor</b>	\$558,000,000	\$11,600,661,000	21
<b>Total</b>	<b>\$9,122,990,000</b>	<b>\$276,762,864,000</b>	<b>30</b>

**FIGURE 2 — COST-BENEFIT ESTIMATES FOR INVESTMENTS IN NORTHERN RESOURCE CORRIDORS<sup>26</sup>**

Infrastructure also relates to technological improvements, such as satellite and space-based technology, to better realize the potential that the North holds for Canadians. It is anticipated that these technologies, and possibly airships, will continue to play an important role in growing the northern economy in terms of facilitating more fluid and safer transportation systems.

The federal government would be well advised to reverse the decline in funding for marine infrastructure in the North. Increased investments are needed to ensure the fluidity of goods and the safety of this mode of transportation in northern waters. With respect to operations on the water, increased investments for navigational assistance are needed and should focus on surveying and charting, ice breaking services, and other means to enhance navigational fluidity. To meet the charting needs of the increased vessel traffic in the Arctic, it will also be necessary to add capacity to the Canadian Hydrographic Service.

The most significant challenges to northern and remote aviation relate to infrastructure. It is beyond the ability of the territories and smaller communities to finance necessary projects, just as it is beyond the means of existing federal infrastructure programs to fund

them due to the high estimated cost. It would go against basic fairness to expect a territorial government to dedicate half or more of its ten-year federal infrastructure funding envelope to runway improvements for modern jet service in just one or two communities, given the known gaps in all forms of infrastructure across all communities in the North. We expect that collaborative relationships between the provinces and the federal government would include consideration of the unique circumstances of northern and remote areas of Canada.

The lack of paved runways and the difficulties in obtaining essential weather information pose serious threats to safety. An entirely new approach is needed to ensure the safety and development of northern and remote aviation.

**1. The Review recommends that the Government of Canada develop and implement an infrastructure strategy for all modes of transportation in the North by:**

- a. increasing the base level of funding in the federal government's infrastructure fund for the territories, and adapting funding initiatives and programs to take account of such northern realities as higher costs and longer time frames for planning and constructing infrastructure.
- b. focusing federal corridor development efforts on transformative nation-building projects, based on territorial and CanNor recommendations, including immediate support for the following projects:
  - i. the Cassiar-Campbell Corridor, improving tidewater access from resource development areas in the Yukon and western Northwest Territories, with preference given to the port of Stewart, British Columbia;
  - ii. the Mackenzie Valley Corridor, from the Tuktoyaktuk Peninsula South to Yellowknife along the Mackenzie River, including immediate infrastructure investment in an all-season road from Yellowknife to Whati;
  - iii. the Coronation Yellowknife Corridor, connecting resource development projects in the Slave Geological Province to the Arctic coast in the North and Yellowknife in the South; the intention is to facilitate the development of a central Arctic transportation corridor for both Nunavut and the Northwest Territories, beginning with funding for the Grays Bay Road and Port Project;
  - iv. Immediate paving and improvements to a few key northern airports that would set the groundwork for other economic and resource development.
- c. Renewing responsibility for and increasing investment in navigational assistance and sealift infrastructure to facilitate fluid, safe, and environmentally sustainable marine transportation in Canada's North. This renewed commitment would include federal funds to support dredging in Hay River and marine infrastructure (i.e. harbours, docks and landings) on the Mackenzie River, Northwest Territories Arctic coast, and in Nunavut. In addition, increased resources should be made available to support the Canadian Hydrographic Service to significantly increase charting and surveying, including securing opportunities on private vessels and those of partner organizations. For hydrographic surveying, the procurement and construction of government-owned vessels should address the need to have surveying technologies integrated into the designs.



- d. Providing targeted financial support for runway extensions and surfacing (e.g. paving), as well as for 24-hour automated weather systems and modern landing and approach systems in applicable communities in the territories. To facilitate these improvements, an investment of \$50 million per year over ten years is recommended to address the most significant infrastructure gaps, either by augmenting the Airports Capital Assistance Program, or by creating a new “Northern Airports Capital Assistance Program.”

### **Marine Policy and Regulatory Improvements**

The increase in vessel traffic due to melting sea ice in the Arctic calls for a new vision and regulatory regime for marine transport in the North.

As the Tanker Safety Expert Panel reported in 2014, stronger measures are needed to address the environmental and safety risks associated with gaps in Canadian domain awareness and management in northern waters. Such improvements would help to realize the economic potential of resource development in the North.

Due to increased vessel traffic and the possibility that even more foreign vessels will operate in Arctic waters, it would be beneficial to establish a dialogue with pilots, private sector marine companies, and federal departments on whether operators should be required to contract the service of pilots in certain regions. It will be a challenge to recruit and train the required number of ice pilots and strategies will have to be developed to execute this initiative.

The establishment of an Arctic Port authority would enable the ports to work in a complementary fashion and avoid duplication in the planning and construction of facilities.

Establishing a program that enables Northerners to undertake hydrographic surveying work will improve Arctic marine charts, with the added benefit of providing needed employment opportunities.

Implementing these measures will also serve to demonstrate that Canada is exerting control and sovereignty over its waters, consistent with meeting the safety and security challenges in Canada’s Arctic.

## **2. The Review recommends that the Government of Canada develop a new federal policy vision and regulatory regime to strengthen the safety and reliability of marine transport in the Arctic that includes:**

- a. stricter regulations requiring vessel operators in the Canadian Arctic to have more experience than is currently required;
- b. consultations on whether and how a coastal pilot requirement should be established in the North;
- c. compulsory reporting to NORDREG for all vessels and small crafts, regardless of size or purpose;

- d. establishment of an Arctic-wide governance model for port development, including an appropriate timetable for a Port authority to be established and in consideration of the Marine recommendation on port governance (see recommendation 3 in Chapter 10: Marine Transport);
- e. support for the Canadian Hydrographic Service, in consultation with government and Indigenous partners, to develop a program to engage, educate, and enable Northerners to undertake hydrographic surveying work in northern waters.

### **Northern Aviation Policy and Regulatory Improvements**

Proposed policy and regulatory reforms to support northern aviation are based on the goal of maintaining and increasing the viability of northern operations. Successfully encouraging cooperative arrangements among airlines would give northern carriers access to the networks of the southern carriers and would enable them to compete on price and level of service. Other options include mandating improved cooperation on schedules, baggage handling, and access to frequent flyer programs.

By enabling northern carriers to compete for federal public service travel, the federal government would recognize the important role these carriers play in the economic development of the North.

Overall, the federal government should ensure that aviation regulations take into account the unique challenges of delivering air transport services in the North, including the high cost of maintaining and modifying northern aviation infrastructure, labour costs, and the limited financial capacity of the territories. (Refer to Chapter 9, Recommendation 11).

### **3. The Review recommends that the Government of Canada act to maintain and improve access to air transportation for communities and for the economic well-being of the North by:**

- a. strengthening cooperation between southern- and northern-based airlines by seeking commitments from southern carriers or, in the absence of such commitments, the Government should consider monitoring, reporting and other mechanisms to encourage such cooperation. The purpose of a more collaborative system would be to ensure that customers are able to access global networks by paying a single fare, on a single itinerary or ticket, from place of origin to final destination. Other enhancements could include improved cooperation on schedules, baggage handling, and access to frequent flyer programs.
- b. adjusting policies for federal public service procurement of northern air transportation:
  - i. upon renewal of the federal travel directive travel agency services contract, including as a requirement that northern carriers be considered for government travel to the north and be displayed by the travel provider on an equal basis, on the understanding that final travel decisions will continue to be based on price.
  - ii. using the federal government's purchasing power to give northern carriers equal opportunities to compete for government travel.
- c. adequately and consistently considering the unique needs and challenges of the North in respect of all regulatory changes. The federal government should ensure that its regulations are reasonable for northern circumstances and should compensate the territories for mandated safety and security measures.

## Notes

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- <sup>1</sup> John Stackhouse, "How Canada's North has become a test of nation-building for us all," *The Globe and Mail*, (January 16, 2014), accessed on November 23, 2015, online: <http://www.theglobeandmail.com/news/national/the-north/letter-from-the-editor-how-canadas-north-has-become-a-test-of-nation-building-for-us-all/article16378312/>.
- <sup>2</sup> Robert Bothwell, "Transportation in the North," *Historica Canada*, accessed on November 8, 2015, online: <http://www.thecanadianencyclopedia.ca/en/article/transportation-in-the-north/>.
- <sup>3</sup> PROLOG Canada Inc., EBA Engineering Consultants Ltd., *Northern Transport Systems Assessment: Phase 1 Report, Northern Transportation Demand Assessment*, (June, 2010), at 7.
- <sup>4</sup> Yukon Government's submission to the CTA Review, April 17, 2015, at 33.
- <sup>5</sup> *Ibid.* at 13.
- <sup>6</sup> Canadian Northern Economic Development Agency (CanNor), *Northern Economic Diversification Index*, accessed on November 8, 2015, online: <http://www.cannor.gc.ca/eng/1388762115125/1388762170542>.
- <sup>7</sup> Mining Association of Canada, *Levelling the Playing Field: Supporting Mineral Exploration and Mining in Remote and Northern Canada*, (April 2015), accessed November 8, 2015, online: [http://mining.ca/sites/default/files/documents/Levelling\\_the\\_Playing\\_Field.pdf](http://mining.ca/sites/default/files/documents/Levelling_the_Playing_Field.pdf).
- <sup>8</sup> Higginbotham, at 7 and 15.
- <sup>9</sup> Yukon Government's submission to the CTA Review, at 6.
- <sup>10</sup> Transport Canada, *Transport Canada's Northern Transportation Adaptation Initiative*, accessed on November 8, 2015, online: <http://www.vanhorne.info/files/vanhorne/transport-canada.pdf>.
- <sup>11</sup> Transport Canada, *Evaluation of the Northern Transportation Adaptation Initiative: Final Report*, (Ottawa: March 2015), accessed on November 8, 2015, online: [https://www.tc.gc.ca/media/documents/corporate-services/EVALUATION\\_NORTHERN\\_TRANSPORTATION.pdf](https://www.tc.gc.ca/media/documents/corporate-services/EVALUATION_NORTHERN_TRANSPORTATION.pdf).
- <sup>12</sup> Some interesting statistics are available at [http://ith.dot.gov.nt.ca/sites/default/files/ith\\_by\\_the\\_numbers\\_15-02-12.pdf](http://ith.dot.gov.nt.ca/sites/default/files/ith_by_the_numbers_15-02-12.pdf)
- <sup>13</sup> Nunatsiaq Online, *Inuit-owned firm explores for minerals in western Nunavut*, (October 15, 2015), accessed on November 23, 2015, online: [http://www.nunatsiaqonline.ca/stories/article/65674inuit-owned\\_firm\\_explores\\_for\\_minerals\\_in\\_western\\_nunavut/](http://www.nunatsiaqonline.ca/stories/article/65674inuit-owned_firm_explores_for_minerals_in_western_nunavut/).
- <sup>14</sup> Government of Northwest Territories, *Connecting Us: Northwest Territories Transportation Strategy 2015–2040*, accessed on November 8, 2015, online: <http://www.assembly.gov.nt.ca/sites/default/files/td267-175.pdf>.

- <sup>15</sup> Refer to Volume Two, Appendix D for an excerpt of the Canadian Space Agency's submission regarding satellites.
- <sup>16</sup> Nunavut Government presentation to the CTA Review, June 23, 2015.
- <sup>17</sup> NORDREG data (of voluntary reporting operators) shows an increase in small craft reporting: 11 in 2010, 20 in 2011, and 26 in 2012. Margaret Johnston et al. (Aug. 2013), *Strategies for Managing Arctic Pleasure Craft Tourism: A Scoping Study: Report to Transport Canada*, at 9, accessed on November 23, 2015 online: [http://www.espg.ca/wp-content/uploads/2013/04/8-C-TAC\\_Scoping-Study.pdf](http://www.espg.ca/wp-content/uploads/2013/04/8-C-TAC_Scoping-Study.pdf).
- <sup>18</sup> To read about the Arctic Ice Regime Shipping System, go to <https://www.tc.gc.ca/eng/marinesafety/debs-arctic-shipping-operations-ice-navigators-1708.htm>.
- <sup>19</sup> Transport Canada, *A Review of Canada's Ship-source Spill Preparedness and Response: Setting the Course for the Future, Phase II – Requirements for the Arctic and for Hazardous and Noxious Substances Nationally: Report of the Tanker Safety Expert Panel*, (Ottawa: Her Majesty the Queen in Right of Canada, represented by the Minister of Transport, 2014), accessed on November 8, 2015, online: <https://www.tc.gc.ca/media/documents/mosprr/TC-Tanker-E-P2.pdf>.
- <sup>20</sup> Nunavut Government Presentation to the CTA Review, June 23, 2015.
- <sup>21</sup> Refer to Volume Two, Appendix D for more details on the support for remote aviation provided by other states.
- <sup>22</sup> RP Erickson & Associates, *Comparison of Approaches for Supporting, Protecting & Encouraging Remote Air Services*, prepared for the CTA Review, (June 2015).
- <sup>23</sup> *Ibid.*
- <sup>24</sup> See Chapter 9, Recommendation 10, for addressing the one-size-fits-all approach of federal aviation regulations.
- <sup>25</sup> The impetus for the research project is that the southern Canadian transportation system is built to trade with the United States and that it will take a new national vision to get exports to and market access in growing economies in Asia, Africa, and Latin America.
- <sup>26</sup> PROLOG Canada Inc., *A Preview of Northern Resource Corridor Development: Prospects for Arctic and Northern Surface and Marine Corridors*, prepared for the CTA Review, (August 15, 2015), at 56.

## Chapter 4: The North

1. The Review recommends that the Government of Canada develop and implement an infrastructure strategy for all modes of transportation in the North by:
  - a. increasing the base level of funding in the federal government's infrastructure fund for the territories, and adapting funding initiatives and programs to take account of such northern realities as higher costs and longer time frames for planning and constructing infrastructure.
  - b. focusing federal corridor development efforts on transformative nation-building projects, based on territorial and CanNor recommendations, including immediate support for the following projects:
    - i. the Cassiar-Campbell Corridor, improving tidewater access from resource development areas in the Yukon and western Northwest Territories, with preference given to the port of Stewart, British Columbia;
    - ii. the Mackenzie Valley Corridor, from the Tuktoyaktuk Peninsula South to Yellowknife along the Mackenzie River, including immediate infrastructure investment in an all-season road from Yellowknife to Whatì;
    - iii. the Coronation Yellowknife Corridor, connecting resource development projects in the Slave Geological Province to the Arctic coast in the North and Yellowknife in the South; the intention is to facilitate the development of a central Arctic transportation corridor for both Nunavut and the Northwest Territories, beginning with funding for the Grays Bay Road and Port Project;
    - iv. Immediate paving and improvements to a few key northern airports that would set the groundwork for other economic and resource development.
  - c. Renewing responsibility for and increasing investment in navigational assistance and sealift infrastructure to facilitate fluid, safe, and environmentally sustainable marine transportation in Canada's North. This renewed commitment would include federal funds to support dredging in Hay River and marine infrastructure (i.e. harbours, docks and landings) on the Mackenzie River, Northwest Territories Arctic coast, and in Nunavut. In addition, increased resources should be made available to support the Canadian Hydrographic Service to significantly increase charting and surveying, including securing opportunities on private vessels and those of partner organizations. For hydrographic surveying, the procurement and construction of government-owned vessels should address the need to have surveying technologies integrated into the designs.
  - d. Providing targeted financial support for runway extensions and surfacing (e.g. paving), as well as for 24-hour automated weather systems and modern landing and approach systems in applicable communities in the territories. To facilitate these improvements, an investment of \$50 million per year over ten years is recommended to address the most significant infrastructure gaps, either by augmenting the Airports Capital Assistance Program, or by creating a new "Northern Airports Capital Assistance Program."

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- c. compulsory reporting to NORDREG for all vessels and small crafts, regardless of size or purpose;
- d. establishment of an Arctic-wide governance model for port development, including an appropriate timetable for a Port authority to be established, and in consideration of the Marine recommendation on port governance (see Chapter 10, recommendation 3);
- e. support for the Canadian Hydrographic Service, in consultation with government and Indigenous partners, to develop a program to engage, educate, and enable Northerners to undertake hydrographic surveying work in northern waters.

**3. The Review recommends that the Government of Canada act to maintain and improve access to air transportation for communities and for the economic well-being of the North by:**

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- b. adjusting policies for the federal public service procurement of northern air transportation:
  - i. upon renewal of the federal travel directive travel agency services contract, including as a requirement that northern carriers be considered for government travel to the *north* and be displayed by the travel provider on an equal basis, on the understanding that final travel decisions will continue to be based on price;
  - ii. using the federal government's purchasing power to give northern carriers equal opportunities to compete for government travel.
- c. adequately and consistently considering the unique needs and challenges of the North in respect of all regulatory changes. The federal government should ensure that its regulations are reasonable for northern circumstances and should compensate the territories for mandated safety and security measures.

# Appendix D

## The North

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## Northern Infrastructure Milestones

The development of transportation infrastructure has occurred in a largely incremental and *ad hoc* manner with some key programs and projects representing the most significant advances.

Historical development of northern infrastructure, including transportation infrastructure, has been undertaken and financed largely by the federal government for economic objectives (i.e. resource projects) and for defence purposes.

- **1942** – CANOL Project was the pipeline and road that brought oil from Norman Wells, Northwest Territories, to be refined in Whitehorse, Yukon, and brought by pipeline to Skagway, Alaska. This project was financed by the United States.
- **1943** – The Alaska Highway was built and financed by the United States government to connect the contiguous United States with Alaska through Canada. It starts in Dawson Creek, British Columbia, and continues through Watson Lake and Whitehorse, Yukon, to Fairbanks, Alaska.
- **1958 to 1960s**– Roads to Resources was intended to enable access to remote resources and thereby financed the construction of hundreds of kilometres of major roads and new bridges in the Yukon and Northwest Territories. These projects included the Dempster Highway, for which construction began in 1959.<sup>1</sup>
- **1961 to about 1990** – Northern Road Program provided funding and other help to support road development in the territories, including the completion of the Dempster Highway, the Robert Campbell Highway and the Mackenzie Valley Highway.

Other key developments in the history of transportation in Canada's North include:

### TRAILS

- The Inuit of Canada's North have long been connected to each other and to the land, sea and ice by a complex system of trails.<sup>2</sup>

### MARINE

- Waterways have been an essential mode of transportation since Aboriginal northerners used rivers, lakes and the sea to travel between camps.<sup>3</sup>
- Between 1903 to 1906, Roald Amundsen, captain of the Gjoa, succeeded in being the first European ship to transit the Northwest Passage.
- Between 1940 and 1942, Henry Larsen, aboard the St. Roch, became the first to transit the Northwest Passage from west to east.
- At a practical level, Canada's Arctic marine transportation system has developed into two main components for community resupply and resource development; the western Arctic and the eastern Arctic sealifts.

### AIR

- Air transportation became a part of northern life as early as the interwar period, even with the lack of infrastructure, for bringing much needed supplies to communities and resource projects.
- Many of the airstrips in Canada's territories were built during the Cold War for the Distant Early Warning (DEW) Line of air defence stations for DC-3 propeller aircraft that delivered supplies and could land on gravel.<sup>4</sup>



## ROAD

- The development of roads in the North has taken the form of roads built on trails, and ice road networks once lakes and rivers freeze.

## RAIL

- The northernmost rail line connected to the continental network reaches Hay River, Northwest Territories, from High Level, Alberta. It was built by the federal government between 1961 and 1964 to connect mines with the southern rail network. It is reported that about 3,000 rail cars per year bring cargo, mostly bulk fuel. There is very little cargo that travels from Hay River by rail.<sup>5</sup>

## SATELLITE

- Canada's Anik A2 was launched in 1973 and brought about improved communications (radio, television and improved telephone services) in Canada's North.<sup>6</sup>
- RADARSAT-1 was launched in 1995 as Canada's first Earth-observation satellite, which provided much needed information on cartography, hydrology, oceanography, ice conditions and coastal monitoring.<sup>7</sup>
- RADARSAT-2 was launched in 2007. It "offers powerful technical advancements that enhance marine surveillance, ice monitoring, disaster management, environmental monitoring, resource management and mapping in Canada and around the world."<sup>8</sup>

## Where we are Today

The National Snow and Ice Center has published data showing that the average extent of Arctic sea ice was lower between 2011 and 2015, relative to the 1981-2010 average.<sup>9</sup> The anticipated continued decline of Arctic sea ice will affect the utilization of Arctic marine routes since such changes could result in longer shipping seasons yet lead to challenges and hazards associated with increasing mobile sea ice.

The figure below displays data on importance of mining, in terms of employment, for Canada's North:

Contributions	Nunavut	NWT	Yukon
Total employment in mining	2,215	3,689	2,589
Total employment in all sectors	12,500	22,500	19,300
Employment in mining as a proportion of total employment	18%	16%	13%
Mining (and oil and gas) percentage contributions to GDP	18%	27%	12%

**FIGURE 1 –  
MINING'S ECONOMIC  
CONTRIBUTIONS TO  
THE TERRITORIES–2013** <sup>10</sup>

## TECHNOLOGICAL INNOVATION

As satellites have played and continue to play an important role in facilitating transportation and economic development in Canada's North, it is useful to provide an overview of Canada's satellites.<sup>11</sup>

## BACKGROUNDER: Canada's Satellites

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### Communications Satellites

- Space-based systems are among the best methods for providing communications across the vast, but sparsely populated, Arctic. Current demand below the 75 degrees North parallel is being met mostly by existing Geosynchronous Earth Orbits (GEO) systems. Above 75th parallel north, there is a gap in coverage, due to the GEO orbit location with existing systems providing unreliable, limited capacity and at low data rates. Most of the demand above 75°N will be from vessels and aircraft, although exploration expedition teams also require support.

### Weather Satellites

- Systems currently in use are mostly GEO in near-equatorial orbits and are unable to provide weather information on high-latitude atmospheric conditions. Some weather satellite systems look to the Polar Regions employing Low Earth Orbit that provide high-quality spatial resolution information over high latitudes but on a narrow flight path—it may six hours before the same area is imaged again.

### Navigation Satellites

- Global Navigation Satellite Systems (GNSS) provide autonomous geo-spatial positioning with global coverage. They are used in the Arctic as the preferred method of navigation for transportation and a variety of other positioning and timing applications. The lack of navigation infrastructure (radio beacons) and the high magnetic deviation make satellite-based solutions particularly attractive to users in the North. GNSS have some limitations in higher latitudes. New systems are being implemented that could improve higher latitude coverage.

### Earth Observation Satellites

- Given the Arctic region's vast geography, remoteness and isolation, Earth Observation is frequently the only cost effective and technically feasible means of obtaining reliable information in a timely fashion for applications such as:
  - the systematic monitoring of shipping routes to detect vessels and icebergs;
  - search and rescue, and disaster response; and
  - the assessment of land stability within permafrost regimes.
- Limitations of current Earth Observation systems are largely due to restricted spatial coverage and revisit frequency. Future Earth Observation sensors of most importance for Arctic applications are the European Union's Sentinel 1 and Canadian Radarsat Constellation radar satellites. These satellites will offer increased frequency of coverage.
- In addition, the North is in darkness for a significant part of the year. The Synthetic Aperture Radar technology used in RADARSAT provides high-resolution images of the Earth's surface independent from daylight, cloud cover and weather conditions, and allows for imaging to be acquired night or day.

### Surveillance Satellites

- Space-based surveillance systems are useful sources of information for sovereignty and safety applications in the Arctic. The expansion of movement through the Arctic, enabled by climate change, is increasing the need for effective search and rescue capabilities and the protection of borders from movement of illegal goods.

## Marine Transport in the North

In terms of cruise ship tourism, in 2008, 2,400 passengers travelled in northern Canada on 26 transits.<sup>12</sup> It is anticipated that with melting sea ice in the North and increasing interest on the part of tourists, cruise ship tourism will grow.

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**“The amalgamation of Lower Mainland ports creating Port Metro Vancouver led to effective regional long-term planning. A similar approach could be taken in Canada’s north with the creation of a regional Canada Port Authority under the aegis of the *Canada Marine Act*.”**

— *Association of Canadian Port Authorities, Submission to the CTA Review, May 2015*

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There are no Canada Port Authorities or pilotage authorities in place to oversee marine infrastructure and service delivery in the North.

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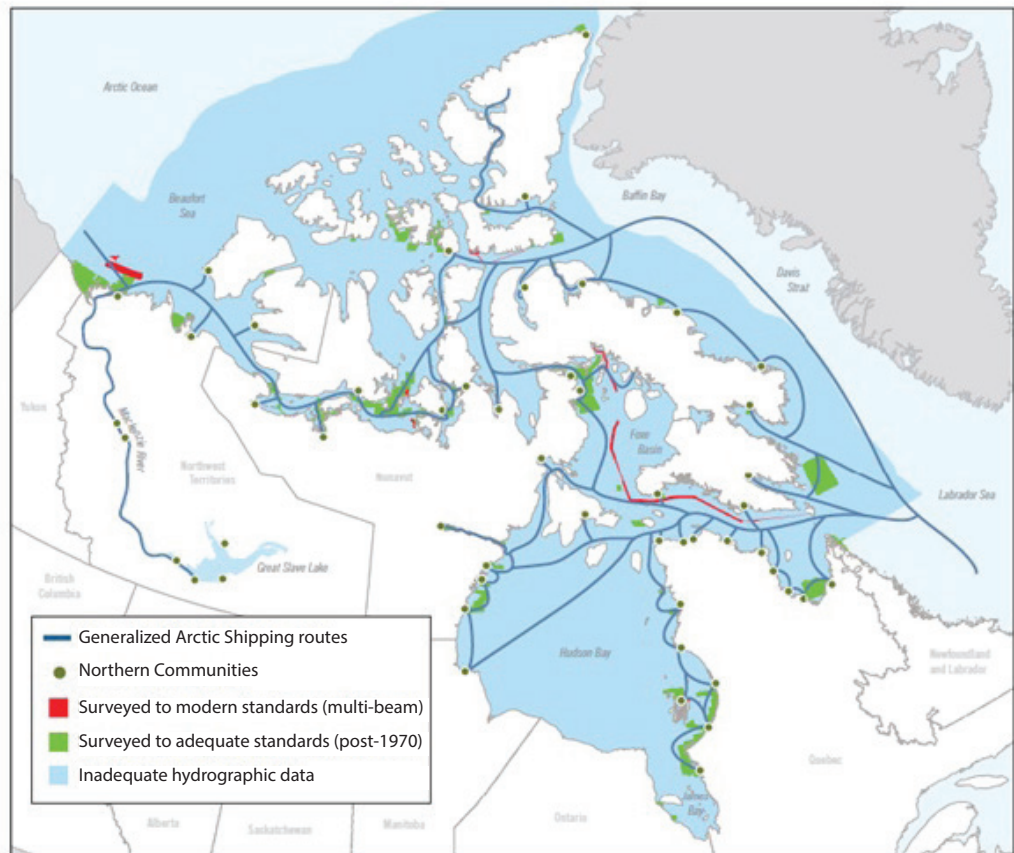
**“Government should establish a working group to put an arctic pilotage service in place, with draft regulations setting out the compulsory areas and other requirements for pilotage. The working group should also identify the elements of a strategy for recruiting and training a cadre of pilots to deliver the service and an appropriate administrative structure for the proper and most cost-effective management of the service.”**

— *Canadian Marine Pilots’ Association, Submission to the CTA Review, December 2014*

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Figure 2 shows the status of surveying of Canadian Arctic shipping as included in the 2014 Fall Report of the Commissioner of the Environment and Sustainable Development.

**FIGURE 2 –  
CANADIAN ARCTIC  
SHIPPING ROUTES<sup>13</sup>**



Note: Not all northern communities are represented on the map.  
Source: Adapted from Fisheries and Oceans Canada.

## Aviation in the North

Canada's northern territories have 48 certified airports and 73 aerodromes, 20 of which receive jet aircraft operations. In most cases, outside of the Territorial capitals, jet service is by older, less fuel-efficient, aircraft which can be equipped with "gravel kits" to enable safe operations on unpaved runways.<sup>14</sup> There are only 10 paved runways in Canada's North.<sup>15</sup> The last model of passenger jet with gravel capability was built in the 1980s.

## RESEARCH: REMOTE AIR SERVICES

Comparable jurisdictions with public subsidy programs for scheduled air services to remote communities include the United States, Australia, and the European Union and its member states. Observations from these jurisdictions that are relevant to the consideration of whether and how to support northern air services in Canada include:

- Criteria for the provision of public subsidies, and what constitutes a remote region vary considerably;
- Significant administrative burden to define needs, monitor markets and prices, and manage scope and cost; and
- Ongoing risk that programs may disrupt markets and competition.

In consultations, Northern Canadian operators did not seek government subsidies to support the provision of services. Instead, they have called for a level playing field for competing for public service travel, more cooperation with large southern carriers and infrastructure improvements.

Source: RP Erickson & Associates Aviation Consultants, *Comparison of Approaches for Supporting, Protecting & Encouraging Remote Air Services*, prepared for the CTA Review, July 2015.

Figure 3 illustrates the large number of roundtrip seats for the territorial capital cities when compared with other Canadian cities with comparable population sizes.

Airport	City Population	Territorial Population	Number of Carriers	Daily North-South Flights	Annual R/T Seats
Whitehorse	28,000	37,000	3	4 to 6	270,500
Yellowknife	21,000	44,000	5	7 to 9	226,800
Iqaluit	7,000	36,000	2	2 to 3	73,000
Red Deer	91,000	—	1	3	19,700
Brandon	56,000	—	1	1	25,500
St John	68,000	—	1	4*	102,200

\*St John to Toronto

**FIGURE 3 –  
COMPARISON OF AIR  
CARRIER TRAFFIC IN THE  
TERRITORIAL CAPITALS  
AND SIMILARLY-SIZED  
CITIES<sup>16</sup>**

The following figure shows the market environment between carriers operating between the North and southern hubs.

**FIGURE 4 –  
COMPARISON OF  
AIR CARRIER MARKETS<sup>17</sup>**

Routing	Distance in km	Airfare Same Day	Yield per km	Airfare 14 Day	Yield per km
Vancouver-Calgary	686	\$275	0.40	\$154	0.23
Vancouver-Winnipeg	1862	\$327	0.18	\$402	0.22
Calgary-Winnipeg	1193	\$327	0.27	\$186	0.16
Calgary-Yellowknife	1261	\$337	0.27	\$337	0.27
Whitehorse-Vancouver	1485	\$474	0.32	\$183	0.12
Yellowknife-Edmonton	1018	\$288	0.28	\$148	0.15

**“Government should establish a new fund dedicated to addressing the specific needs of northern and remote airports, namely extreme climate and the limited number of asphalt runways. Changing weather patterns are affecting service levels at the most northern and remote airports, up to 25 percent of flights at many northern airports are cancelled or diverted due to weather/visibility conditions. Automated Weather Observation Systems (AWOS) can help address these issues, but the cost of setting up electronic infrastructure can be prohibitive.”**

— Federation of Canadian Municipalities, Submission to the CTA Review, December 2014

## International Comparisons

Other Arctic countries have more mature transportation infrastructure to support development and security needs. Canada’s Northern transportation system is underdeveloped due to a number of factors. Notable aspects of developments from other Arctic countries are shown below.

### GREENLAND

- For its size and remoteness, Greenland has relatively well-developed marine and aviation transportation infrastructure. It has no road network but of its 18 airstrips, 14 have paved runways,<sup>18</sup> and there are port facilities in 16 centres.<sup>19</sup>
- Greenland has significant public subsidies for air services; 2009 numbers from Statistics Greenland indicate that the real cost of providing district flights in Southern Greenland is five times higher than the average ticket price.

### RUSSIAN FEDERATION

- Russia’s infrastructure improvements in the Arctic are focused on making the Northern Sea Route a viable trade route over the long term. The Northern Sea Route goes from about the Barents Sea in the West to the Bering Strait in the East and, depending on the sailing lane, is between 2,200 to 2,900 nautical miles of “ice infested” sea.<sup>20</sup>

## UNITED STATES

- With 61 paved airports, Alaska has more than six times as many paved runways as the three Canadian territories combined.<sup>21</sup>
- With respect to the subsidization of remote air services, the United States Essential Air Services program has a budget of US\$249 million supporting commuter airlines in 120 communities in the contiguous United States and 43 communities in Alaska.<sup>22</sup>

## FINLAND, NORWAY AND SWEDEN

- These three Arctic countries have sophisticated transportation systems, but the conditions are different than those in Canada.
- Each has ports that operate year-round as they are not impacted by winter ice. Permafrost and discontinuous permafrost in these countries do not exist, which means that construction of transportation infrastructure is generally easier and less costly.
- Norway has 61 subsidized remote air routes (i.e. Public Service Obligation routes), more than Sweden and Finland, but only 10 percent of domestic seats are offered through the program.<sup>23</sup>
- As of December 2014, Sweden had 10 designated Public Service Obligation routes.
- Finland is reported to have only one domestic Public Service Obligation route.<sup>24</sup>

## The next 20 to 30 years

### NORTHERN INFRASTRUCTURE-RELATED INITIATIVES OF CANADIAN PROVINCES

Quebec's *Plan Nord* (initiated in 2011 and renewed in 2014) has a stated objective to "promote the potential for mining, energy, tourism, and social and cultural development in Quebec, north of the 49th degree of latitude." The current iteration of *Plan Nord* constitutes an "adaptable framework for future years" that will allow for other projects to be added to it, based on input from communities, and government entities, so long as they are consistent with the directions of the Plan. The development of transportation infrastructure is identified as a cornerstone of *Plan Nord* and calls for a coherent network.<sup>25</sup>

In Ontario, the Ministry of Transportation is developing the Northern Ontario Multimodal Transportation Strategy, to assist in the implementation of the Growth Plan for Northern Ontario. The Government of Ontario states that the strategy "will identify transportation policy, program and investment opportunities for a modern and sustainable multimodal transportation system."<sup>26</sup>

### DEVELOPMENT OF NORTHERN RESOURCE CORRIDORS

The CTA Review commissioned a report to evaluate potential transport corridors in the North.<sup>27</sup> The focus was on those transport corridors that, if developed sufficiently for natural resource extraction, could also provide complementary economic benefits for the North.

The report concluded that corridor planning should "move beyond the economics of an individual project," vet prospective infrastructure on a number of criteria, and establish a corridor coalition to "build multi-user legacy infrastructure that the North could not otherwise afford."<sup>28</sup>

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**“The future of mining lies in Canada’s vast and remote northern regions. There is a synergy between resource development and social and economic policy objectives. The government should make strategic, material, and long-term infrastructure investments in remote and northern regions that increase the viability of mining projects, and support the local, regional, and national social and economic benefits they bring to northerners, Aboriginals and all Canadians.”**

— *NWT & Nunavut Chamber of Mines, Submission to the CTA Review, June 2015*

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The Review heard from stakeholders that investors looking to develop mining projects in remote and northern regions are required to build the infrastructure for their operations, including ports, road and railways, and airstrips. They may also need to provide their own ice breaking and other services to support safe and reliable transport to their operations. The Northwest Territories and Nunavut Chamber of Mines call the cost of these facilities and services “a northern premium.”

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**“Transport Canada must play a greater role in coordinating federal safety responsibilities, and lead development of a “Northern Transportation Vision” in consultation with stakeholders.”**

— *Nunavut Eastern Arctic Shipping Incorporated, Submission to the CTA Review, June 2015*

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## Notes

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