RESILIENT TRANSPORTATION FOR CANADA

A Path Forward

Building upon our existing infrastructure and emerging capabilities, the establishment of a resilient transportation infrastructure supporting its export economy is in reach. This document describes the framework for this infrastructure and identifies how Canadian seaports can contribute to this national goal./

About the Author

Allan McDougall has focused on critical infrastructure protection and assurance over the past 30 years. This has included formal streams encompassing military, public sector, and private sector activities, including within the Department of Fisheries and Oceans/Canadian Coast Guard, Transport Canada (as the Senior Inspector for Ports), and Canada Border Services Agency. Within the private sector, this has included working to support transportation networks and maritime operations both domestically and in higher-risk environments. He is a founding member of the International Association of Maritime Security Professionals and one of Canada's original trainers under the IMO Train the Trainer program. He has worked across the lifecycle from design activities within the CSC Program at Irving Shipbuilding.

Allan has co-authored four books on Critical Infrastructure Protection and one book on Transportation Systems Security, which focus on establishing and managing resilient networks. These works have been used as graduate texts at several universities.

Allan holds an MA in Security Management from the American Military University (focusing on autonomous shipping) and a BMASc from the Royal Military College of Canada. Additionally, he holds a BA from the University of Western Ontario. He holds several security-related certifications, including the Certified Protection Professional (ASIS), Physical Security Professional (PSP), Professional in Critical Infrastructure Protection (PCIP), Certified Master Anti-Terrorism Specialist (CMAS), and Computer and Information Systems Security Professional (CISSP).

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About the National Center of Excellence and Innovation

Founded in 2024, the National Center of Excellence and Innovation is a multi-disciplinary focal point for communities coming together to address complex maritime security challenges While young, it brings together academics, practitioners, and others who have experience ranging from law enforcement to the impacts of severe weather and changing ocean conditions. You can visit the website at https://marseccoe.com.

Limitation of Examples

Place names and specific locations listed here should be viewed as illustrative rather than prescriptive. The final configuration of any transportation system is based on a combination of engineering-led (such as capacity) and social (including communities) factors.

Contents

Executive Summary

As Canada faces significant economic and sovereignty challenges, it would benefit from the discussions necessary to create a robust and resilient transportation network, terminating at seaports, across which goods and can enter and leave the country without undue interference and in support of our overall economic interests.

Our current transportation infrastructure, however, falls short in several areas. Addressing this challenge is neither insignificant nor unsurmountable. Using network assurance principles derived from multiple sources, this document presents one potential approach to establishing a resilient transportation infrastructure that both supports our national priorities and helps build the nation towards all three oceans.

The focus of this effort looks at an approach that balances the demand for economic activities with the capacity of the infrastructure to deliver services to meet those demands. Principles of resilience can be used to manage capacity in such a way that the flow of demand (represented by the movement of goods)

While the Pacific region is largely addressed, the Arctic and Eastern Canada present opportunities to establish greater opportunities and capacity. Most notably, there is an opportunity to work collaboratively with projects such as the Gray's Bay, Port of Churchill, and NeeStaNan (Nelson River) that could establish a highly resilient and attractive set of shipping corridors to European (and other) markets. By focusing on cooperation versus competition, the Arctic approach adopts a philosophy that the additional infrastructure may result in some competition but could also be leveraged to offer a greater degree of certainty for international clients and markets. This certainty addresses key risks currently present in the approach that may limit those responsible for risk management to making decisions that limit their exposure to challenges associated with operating single ports only.

This aspirational document adopts an approach of leveraging existing infrastructure projects and making improvements where needed. This is to both speed the rate at which the investments made can translate into returns on those investments but also to limit other risks, including environmental risks.

The paper discusses the framework in the first part and then presents a working example of that model intended to assist decision-makers and planners who are engaged in addressing this challenge.

Section 1: Explaining the Framework

Purpose

This document outlines an initial structure or configuration of a coordinated set of transportation corridors and capabilities to move Canadian goods to external markets independent of the USA

Background

Canada seeks to diversify its export markets to be less vulnerable to shifts in any particular market.

Currently, Canada's exports flow towards the USA. The current US administration, however, has made this trade relationship more challenging by imposing a range of rules and measures, such as tariffs (or threats of tariffs). Specific trade grievances on either side fall outside the scope of this examination.

Canada's primary markets include Asia and the European Union. Canada may also seek to develop markets worldwide, including Africa and South America. Given the nature of the current challenges, new markets are being explored.

Canada also faces several key challenges. These include the following:

- **Geographic**: in terms of size and terrain. This also includes significant areas where there is limited to no infrastructure upon which to rely and where construction would likely pose significant challenges.
- **Climate**: in terms of a variety of conditions and severe weather. This includes severe weather that can affect significant areas (even regions).
- **Network Topography**: many of the significant routes run North-South versus East-West. Similarly, there are large areas where the network lacks supporting infrastructure and services.
- **Treaty**: Discussions must be held concerning the use of and how to proceed so that both parties covered under various treaties can benefit from and sustain the effort. This approach must consider the concept of two peoples seeking to travel the same route together without unduly interfering the other.
- **Sovereignty**: The current US administration has made statements that question whether it would respect agreements with Canada. These statements include comments that it would take Canada over and integrate it into the USA through the use of economic force.
- **Funding**: Any one of these projects would be considered generational. Given the size and scale of the effort needed, leveraging existing infrastructure and capability may be necessary to establish an interim operating capability (IOC)
- **Time**: Depending on the commodity being moved, the time available for shipping may vary significantly. While some products may not have any particular time constraints (non-perishable), others may be highly perishable.

Challenge Being Addressed

The challenge is being able to accomplish the following:

> *The movement of persons or goods from their intended point of departure so that they arrive at their intended destination on time, in acceptable condition, and for reasonable cost.*

This can be applied to any transportation activity. Consequently, it provides a practical and reasonably high-level or overarching goal for this effort.

The framework surrounding this challenge is the concept of system resilience. In this context, system resilience is defined in terms of the "ability to carry out its mission in the face of adversity." (Ref A)

Applying this framework appropriately when attempting to meet this challenge results in a transportation system (or network) that supports supply chains and other broader goals. (Ref B)

Goals to be Achieved

Performance-Based Goals

Performance-based goals seek to describe how the transportation network performs its function.

The goals are derived from the challenge being addressed. They include the following:

1. Minimal movement from the point of origin to the entry point in the larger supply chain.
2. Minimal movement from the end of the larger supply chain to the intended destination.
3. Minimal shipment delays due to foreseeable or preventable factors.
4. Minimal losses associated with spoilage, damage, or other forms of loss.
5. The cost of movement is kept as efficient as possible.
6. The network can identify risks to the above proactively and make operational adjustments in managing those risks.

Goals Shift at Different Levels

These goals operate slightly differently as one moves from the national to regional to local to facility levels. Consider the following:

- At the **national level**, the goal is to maintain the flow of goods supporting Canada's economic priorities. This ability to assure the movement of goods is one of the factors that helps build confidence in Canada's economic capability and its ability to be a good place to do business.
- At the **regional level**, the goal is to establish a subsystem of ports and coordination points that maintains a level of surplus capacity and situational awareness of that surplus capacity. This surplus capacity allows the system to respond to events (disruptions) by rerouting demand and informing of those changes so that the shipping side of the system can respond as efficiently as possible.

- At the **local level**, the goal is to manage the local operations with a reasonable surplus capacity. The level of surplus capacity is then communicated to others within the region and can be made available through "Mutual Aid Agreements." Should a disruption occur at the facility, it would be able to leverage the nearby surplus capacity to maintain the flow of goods Should a neighbouring facility be disrupted, then it could offer that surplus capacity under the same mechanism to assist. The value of this approach operates the "client confidence level" in that where such agreements exist, the client has greater confidence that its shipment is less exposed to the risk of disruption.

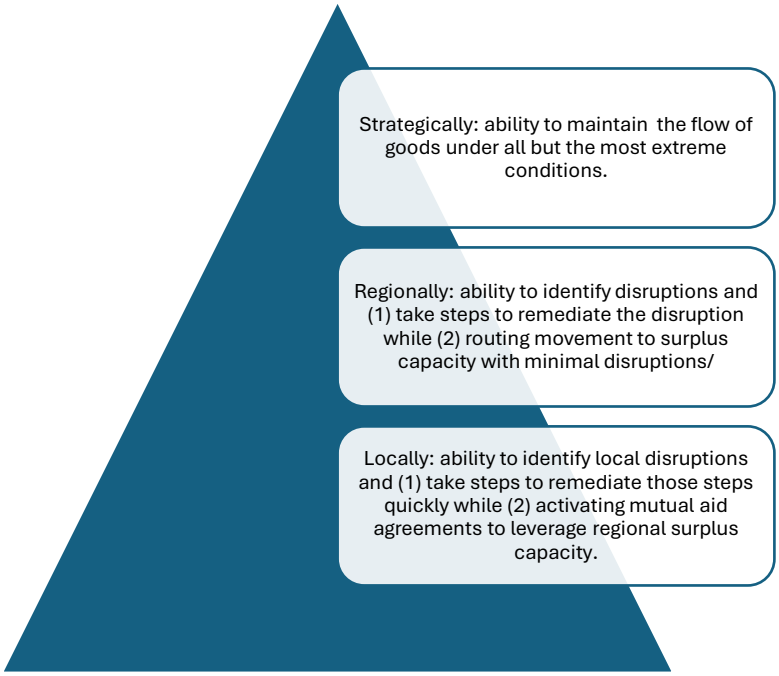

Figure 1 - Refining our understanding of the goals.

Non-Functional Goals / Goals Associated with Attributes

Non-functional goals tend to focus on attributes that describe the network's state or "what it is" rather than its performance.

Other goals are not linked to the performance of the system but are tied to what the system is:

- **Engaged First Nations** communities so that the infrastructure benefits both communities and its management supports both as they work towards success together.
- **Environmentally sound** in the context of not only being designed with environmental concerns in mind but also facilitating effective detection, response, and recovery efforts in case of issues.
- **Sovereign in Nature and Support** regarding the infrastructure relies as little as possible on outside support and demonstrates Canadian care, control, and presence in potentially contested areas.

Core Attributes for Success

Resilience as Frame

The use of resilience as a frame reflects the reality of balancing operations and the ability to assure that services can be delivered. Only focusing on operations leaves the organization vulnerable (in terms of its existence) due to a cumulative impact of avoidable losses, degradation in customer confidence, and, ultimately, the risk-management decision to re-route shipments elsewhere by clients. Establishing a resilient network, however, has costs. The challenge, therefore, is to strike the appropriate balance between operations and costs.

Resilient networks can be described in terms of their ability to maintain operations during adversity. The overarching system (and those entities in it) can demonstrate that they are able to meet the challenge described above under a broad range (including difficult or adverse) conditions.

Attributes and Objectives Aligned with Resilience

Resilient transportation networks share some common attributes. These include the following (Ref C):

- The ability to **anticipate** and maintain an informed understanding of potential adverse conditions.
- The ability to **withstand** reasonably foreseeable acts or conditions and maintain their essential mission/business functions.
- The ability to **recover** critical then progressively refined mission/business functions during and after adversity.
- The ability to learn from and **adapt** from those events, including modifying or adjusting across the mission/business functions and those efforts that support them.

The objectives that derive from these attributes include the following (Ref C):

- To **prevent or avoid** the impacts of adverse events through effective risk management.
- To **maintain readiness or preparedness** by having a realistic and relevant plan to be brought into action in response to adverse events.
- To maintain an understanding and focus on its critical services and infrastructure so that they can be sustained or **continued** during adversity.
- To **constrain** the damage from critical infrastructure and services (that infrastructure and those services necessary to maintain operations).
- To **reconstitute** critical services as quickly and effectively as possible should they be disrupted.

Translating Resilience from Cyber to Transportation

While these attributes and objectives are derived from doctrine generally used in IT Security, they can be tailored or modified to operate for transportation networks. The following considerations flow out of this tailoring:

- When **preventing or avoiding attacks**, this focuses on the physical and cyber-related controls that protect the full spectrum of deliberate, accidental, and natural threats. This looks at those administrative, physical, and technical steps (controls) that are intended to ensure that the mission, goals, and objectives can be assured to be met, even during adverse conditions. (examples: mutual aid agreements, resilience policies, business continuity plans, appropriate design to meet operational demands and environmental conditions, physical security, personnel security, IT / Cyber security)
- **Preparedness** involves understanding the threats to operations (deliberate, accidental, and natural), having plans or strategies for addressing those challenges, ensuring that the resources are available to execute those plans, and training/exercising so that those plans can be brought to bear when and as required.
- **Continuing** services involves understanding critical services (including supporting services) and then being able to maintain those services under increasing levels of adversity. This often flows from structures like the Emergency Management Cycle of mitigation, preparation, response, and recovery and through efforts brought forward in Business Continuity Planning. This can also be addressed by maintaining redundant infrastructure or services that can be brought into service should an adverse impact occur.
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Constraints and Restraints

Constraints are limiting factors resulting from external controls or agreements. The external body must grant some form of variance, approval, authorization, or allowance to lift, bypass, or otherwise alter a constraint.

On the other hand, restraints are limitations resulting from internal decisions. Consequently, restraints can be lifted by the internal risk owner and are generally much easier to overcome.

In proposing this network, the following constraints were considered:

1. **Environmental** constraints with a focus on minimizing the overall impact of the network through either avoiding particularly sensitive areas or features of design. This would then carry over into ensuring sound operating practices and restrictions.
2. **Indigenous lands**. The use of existing infrastructure is intended to limit the infringement of additional infrastructure to the extent possible. Where new infrastructure is required, partnering with the applicable First Nations at the onset is designed to move the project forward to benefit all involved. This would apply across all phases of the lifecycle.
3. **Transportation**. A single corridor with road, rail, pipeline, power, and telecommunications is intended to ensure that responders can quickly reach any infrastructure disruption. Similarly, it would allow for positioning emergency materials (such as spill kits) in areas of particular sensitivity, such as the far north. The intent here would be to have resources to contain, isolate, and remediate any accidents.

Our restraints are primarily tied to performance-related location, time, condition, and cost issues. These restraints would guide the nature of the network's operations, routing the material being moved along the most efficient or expedient paths.

Key Elements to Measure Success

Ultimately, data collection is not an end to itself but is intended to help decision-makers understand their current situation (operating state). By carefully designing the metrics associated with this approach, subjectivity can be reduced, automation can be leveraged, and decisions can be made based on facts and evidence.

Ultimately, our first aspect of measurement involves the volume of goods being moved. This metric already exists in many organizations as it can be derived from their billing structures. In this context, the measurement may involve the number of containers, the material's volume, the material's weight, or something similar.

A key element here is understanding three elements: current performance in terms of movement, overall capacity to move, and the difference between the two. The "delta" between potential performance and actual performance can be described as surplus capacity, a key element in identifying opportunities to adjust the regional or strategic level of the system in case of disruption.

This measurement begins at the local level and then works from the regional to the strategic.

While performance is the core metric, the second metric involves tracking the system's resilience. On one hand, this involves tracking the nature of the threats (acts and conditions associated with adverse events) to determine if the robustness goals are being met. The second metric involves tracking resilience or, in this context, how long it takes for an impacted organization to return to its normal or anticipated operating state as reflected in its stated potential capacity.

This raises the second aspect of measurement, or how the system's capacity is described. To accomplish this approach, we need to approach the shipment of the material through the region's scope based on both "nodes" (ports, trans-shipment points, etc.) and "conduits" (roads, rail lines, etc.). Each of these should be uniquely identifiable and described in terms of its current and potential capability.

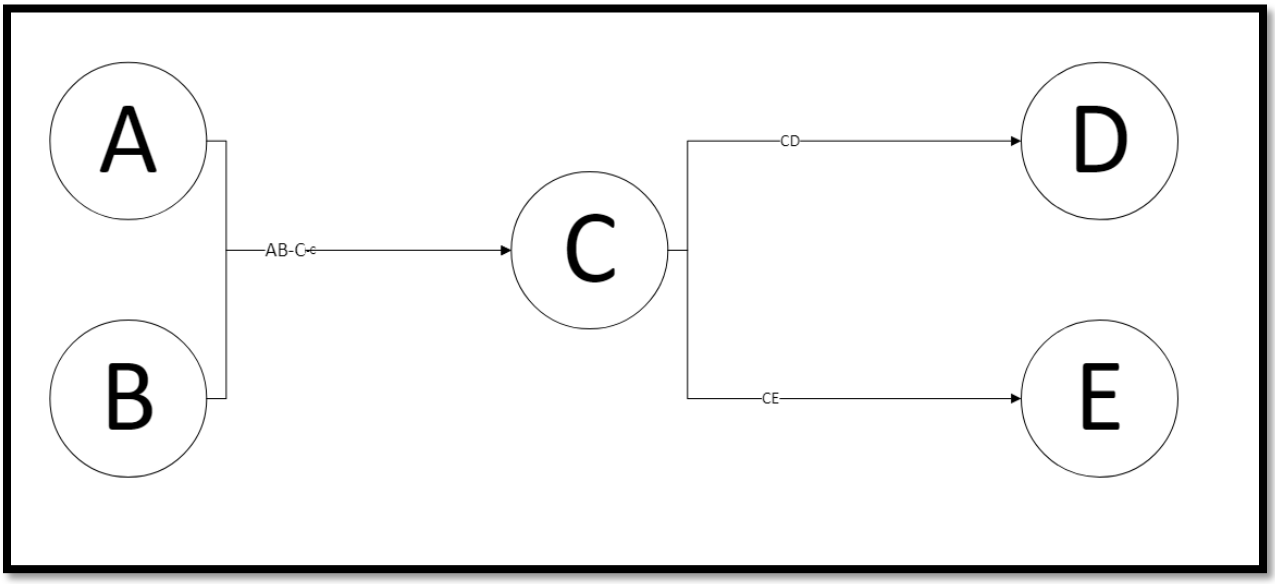


Figure 2 - Example of how the frameworks in a very simplified regional network

Consider that A, B,C, D, and E are all facilities that move goods in the system (nodes). The connectors (AB-C, CD, and CE) are the road, rail, or other means of moving between the nodes (conduits). For sake of simplicity, this will focus on exporting or moving from the side AB towards the side DE (left to right).

In this framework, we would want to know the potential capacity of both the nodes and conduits as this represents the upper limits of performance. It also helps us identify potential areas of disruption caused by demand overcoming the capacity to deliver (such as too many containers from Facilities A and B being pushed into the AB-C conduit.

Our second metric would be the performance level in real terms.

If Facility A could handle 1000 containers a day and is currently performing at 700 containers per day, we can then identify that there are 300 containers' worth of surplus capacity.

Where a single line is used, then A, AB-C, C, CD or CE, D, or E can all perform at the same levels. The challenge arises when multiple facilities or conducts come together at a common point. In those cases, then the performance level for that node (or conduit) must align with the sum of what is "feeding" it. For example, if Facility A and Facility B both handle 700 containers per day, then the capacity of AB-C (the conduit connecting to C) would need to be 1400 containers. If AB-C has a potential capacity of only 1000 containers (to align with either A or B), then there is a shortfall of 400 containers in terms of capacity. This creates a delay in shipment that will also begin to "fill" the system and ultimately damming it.

This same principle also applies when the system is disrupted. The disruption causes a loss of capacity (real and potential) and knocks the overall system out of alignment. While the impact may be at one end of the transportation network, the way that the disruption "fills" the system eventually creates delays that can be felt significantly inland (Ref D).

The keys to success, therefore, include the following:

1. Understanding the system's potential capacity and the infrastructure's state/performance in terms of meeting that level.
2. Understanding the potential impacts of adverse events or conditions (affecting both actual and potential capacity)
3. Understanding the current operating state and when operations, if disrupted, might return to "normal" should a disruption occur.

Aligning the Framework with Decision-Making

The Operational Decision-Making model proposed in this context is the OODA (Observe, Orient, Decide, and Act) model. These four steps can be described as follows:

- Observe: maintaining situational awareness of operations, infrastructure, and potential threats.
- Orientation: based on what is observed, this involves generating options on how to respond.
- Decide: Based on selecting the best or preferred option, the decision commits to a course of action.
- Act: involves taking those steps required by the decision and then observing the consequences or outcomes of that decision.

This is not a purely cyclical process. There are aspects of each step that overlap with the others, and all steps except the act have certain aspects that are ongoing.

	Local	**Regional**	**National**
Observe	Maintains awareness of operations at the site in terms of capacity and demand. Advises regional of local conditions.	Collates local conditions into a regional understanding of the picture to inform national entities of capacity opportunities or demand issues.	Monitors markets and larger conditions for acts or conditions to advise regional entities of potential influences on capacity or demand.
Orient	Focuses its decisions on local risk management decisions with awareness of Mutual Aid Agreements (MAA)	Advises local entities in terms of the impacts of their decisions on regional capacity and demand impacts.	Uses regional information to focus activities such as capacity building (infrastructure).
Decide	Make a decision to carry on with limited disruption or invoke MAA.	Upon receiving the decision, takes steps to constrain impacts from the transportation network.	Prioritizes supports based on demonstrable needs
Act	Executes course of action and monitors impacts locally.	Takes steps to constrain or isolate impacts from the rest of the regional network.	Providing supports and surge resources if necessary to establish new capacity baseline.

This table provides a brief and incomplete view of all aspects of the relationship between the national, regional, and local levels. It is provided as an example of how certain roles and responsibilities would be focused. The specific details would be decided as a result of discussions between the local entities (ports), regional entities (provinces and associations), and national entities (federal departments and corporate entities) as applicable and appropriate to the topics involved.

Section 2: Applying the Framework

An Approach

The figure below provides one option on how to apply the concept of resilience into the organization of trade corridors. These corridors are intended to service distinct markets but still be able to support the other corridors (if needed and as appropriate).

Figure 3 - General layout of network

A Concept of Operations

Restating the Goal

Again, our overarching goal is the movement of *goods from their point of origin to their intended destination so that they arrive on time, in acceptable condition, and for reasonable cost*. This represents our overarching mission.

We measure success based on the ability to meet the objectives inherent in that mission statement. One option is to look at each as a percentage of the total shipments that can demonstrate that they meet the criteria. While the specific percentage would be determined by the markets (performance being tied to costs), that performance baseline would focus on the ensuring that each entity within the overall transportation network could meet those objectives.

The transportation network would also monitor certain attributes that are not related to the mission but are considered important with respect to "what the transportation network" is. These would include the following major criteria:

- **Community engagement** in terms of being well-accepted by the communities in which they are operating, including Indigenous communities.
- **Environmentally sound** operations in terms of not creating local harm and also integrating longer-term strategies to reduce environmental impacts.
- **Economically** in terms of assisting in the development and implementation of infrastructure that positively impacts local and regional economies in terms of activities such as power generation, food security, employment, etc.

An Overview of the Components and Functions

Figure 3 provides an overview of the overall transportation network. Within this overall network, several elements play prominent roles. These include the following:

- **Seaports** (primary in blue, secondary in yellow) provide an entry point and exit gateway for goods entering and leaving the system. These will generally service ships (seaside) but also rail and trucking industries (landside). The port should be looked at as a combination of a gateway (entering the system), a transition point (between modes of transportation), and a service point (for any and all modes of transportation and the infrastructure on site).

- **Conduits** that are used between different nodes in the system and that consist of road, rail, or other similar infrastructure used to move the goods. The conduits are closely tied to the mode of transportation that use them (trucks, light trucks, rail, etc.) and should be understood in terms of their capacity to carry goods over distances. In this context, there are two areas of concern. The first involves the conditions along the route (storms, washouts, winds, landslides, etc.). The second involves the infrastructure in place (including its supply chains) that service those modes of conveyance.

- **Coordinating** (primary in blue, secondary in yellow) that acts to direct shipments to the appropriate conduits and towards the next appropriate coordinating point or seaport. These may shift the cargo from one mode of transportation to another or direct it along the route at the appropriate time. In this context, the entities further along the supply chain feed information into a system that then identifies the capacity of that system to handle the goods being moved. Those bodies also communicate what the step after them has communicated that they need to do or any restrictions. This allows the coordinating point to either pass on the goods, hold the goods, or redirect the goods to a preferred alternate location to support the overall mission.

Ultimately, the decision to proceed is based on the seaports' decisions. This is due to the nature of the shipping system (including its chartering process). The function of rerouting the ship due to a safety issue already exists within the maritime sector (for example, ships being instructed to hold off due to adverse weather conditions—such as hurricanes)

General Examples / Use Cases

The following "use cases" should be looked at in the context of how this system fits into the current supply chain and transportation network operations at different phases of the life cycle. Specific regions are used for illustrative purposes but only presented on the assumption that those who may make specific decisions will conduct their own feasibility and engineering studies (due diligence).

Use Case 1 – Arctic Resilience (Port of Churchill, NeeStaNan, Gray's Bay)

Establishing Resilience

The Arctic is poised to be one of the most contested spaces on the planet in within the next 20 years as different powers look northward towards shipping routes, minerals, and gas reserves. While Canadian interests will be impacted on the international/world stage, the population of this region will also be affected. This population has faced significant challenges associated with infrastructure, costs, food security, and the ability to access higher-end services.

The Port of Churchill is currently tied to the Arctic Gateway Group (AGG). The stated intent of the AGG focuses on efforts that can improve the local economies, such as through employment and local procurement. Its overall focus is on the agricultural industry of Canada to connect that industry to the Hudson's Bay railway. Overall, the Port of Churchill is already operating in the area, having sent various goods to export markets, including zinc to Belgium

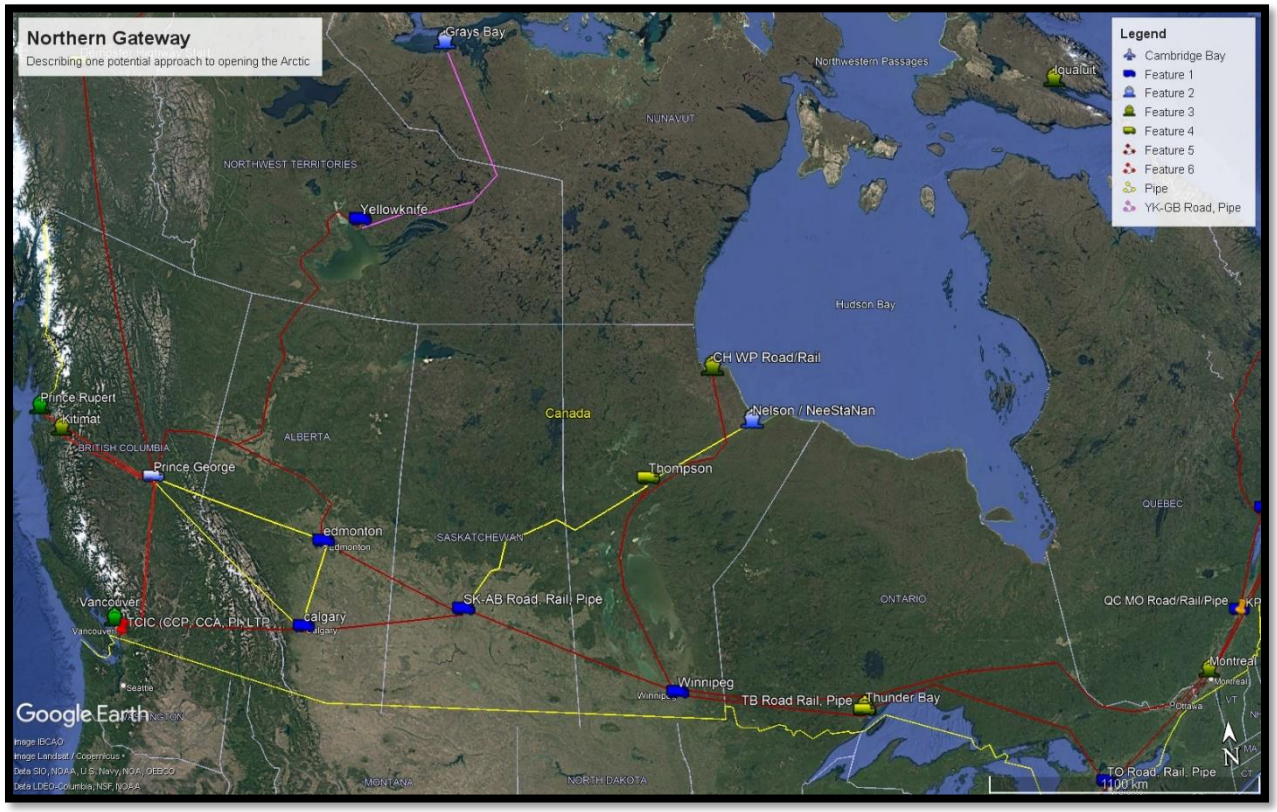
The Port of Churchill, however, faces three key challenges. First, it can require ice breaking services to open the port seasonally. Second, it requires a level of dredging that can only be expected to continue as ship sizes increase. Third, however, is that it is the only seaport in the region meaning that any disruptions at the port would force shipping companies in the area to have to balance the relative improvements in cost (due to shorter distances, etc.) with the delays while those services come into play. (Ref E)

In this context, the adverse event involves the disruption of the Port of Churchill, which would take a critical shipping service offline for longer periods. This could force the ships scheduled to call at the port to be delayed and be forced to wait, potentially under more difficult conditions, while the situation was resolved as there is no secondary port within reach.

This challenge can also be linked to what may be described as a capacity cap because the port is operating as the sole entity in the region. Should European markets (currently shifting their attention towards Canada) seek to make arrangements with the port, the port and its supporting rail infrastructure (currently balanced between goods and passenger services) would only be able to deliver services up to a certain level.

In this context, the Port of Churchill and its supporting rail infrastructure acts as a potential single point of failure. This is not because of any shortcoming at the port or its rail infrastructure, per se, but because it is the sole option available in the region. As a result, any disruption of at the port, in its enabling infrastructure, or in the rail line disrupts the overall system.

The NeeStaNan project offers an approach that breaks this impasse by creating an alternative to the Port of Churchill. While some would argue that this creates unnecessary competition, it offers the opportunity to offer surplus capacity and the ability to shift capacity as needed to service demand.



Example 1: Disruption (loss of services). If Ports are operating at 80%, the disruption at any one port can involve plans to shift the demand to the other port under a Mutual Aid Agreement that comes into force for the time of the disruption without affecting the overall contracts with shipping lines. This means that ships proceeding to either port are not forced into a decision to delay or redirect but can minimize the changes in their routing to the other port and still achieve the overall mission (right destination, on time, acceptable conditions, reasonable costs). This also applies to issues where an incident on the rail line "behind the port" causes a condition where the port cannot continue operations because its own infrastructure is full (such as occurred during the labour disruptions on the west coast and the ability to ship grain).

Example 2: Over-Demand (Insufficient Capacity). In the context of attracting new clients, the pairing of the ports through a cooperative effort creates a condition where each port has the ability to argue that the risks associated with disruption or the inability to meet demands are reduced. For example, if Ports are operating at 80% capacity and a new client looks for services that would require 30% capacity, neither port could meet the client's needs when operating independently. By functioning in a cooperative or mutually supporting model, each Port could offer 15% of its capacity, still maintain a level of surplus capacity, and be able to legitimately offer services to the client.

Example 3: Infrastructure Improvements (Bringing in New Capacity). Projects that bring new capacity online may result in conditions where the capacity is not available due to new integrations, construction, space restrictions, etc. This essentially results in the same conditions as Example 1 (disruption). Where the two ports are involved and operating in a cooperative manner, improvements at one port can include coordination with the other port to take on the surplus demand (under the context of the Mutual Aid Agreement) to prevent the loss of capacity at the port from impacting their clients. This can be marketed as a greater level of assurance that clients are less likely to be impacted by specific projects as the ports grow in expanding their client base.

The proposed option, in this context, involves the Province of Manitoba, in consultation with the Minister of Transport, declaring a port district that allows each Port Authority to operate independently but with the support of specific provisions that include the following:

- **Mutual Aid Agreement (MAA)** allows the Ports to shift demand and capacity in support of their operations. In this case, the benefit is a greater assurance to shipping companies that ships proceeding to these ports have alternatives and contingencies in place that would not force longer delays or long rerouting.

- **Efficiencies in Workforce Development** can be realized through this kind of model that reduces the overall training and workforce development. This would be accomplished by training to common standards for tasks and safety requirements. The result is that the demand for the workforce increases (meaning greater opportunities for those in the workforce) but also that the overall size of the workforce could allow for a surge in capacity from one port to the other as infrastructure projects or incident demands require them.

- **Efficiencies in Contingency Resources** can be realized through cost sharing. In this context, the cooperative effort of the port, when maintained with the ability to move these resources, means that an incident at one port can rely upon both the immediately available resources and the potential for resources to be protected off site and brought into the port if needed. This offers a greater assurance that the ports are able to respond effectively to emergencies (including environmental events).

- **Greater safety in landside coordination** can be realized by having a primary and alternate route for moving certain goods, particularly by rail or road. This will be particularly important when dealing with certain dangerous cargoes that would benefit from deconflicted routing. With the single port, single rail, and single roadway into the area, certain shipments may create scheduling challenges that impact the other operations or may even be limited because of the inability to deconflict schedules. Where the twinned port concept exists, each port has the ability, through coordination with the other, to move such shipments with minimal disruptions both within the context of their operations and also in the context of the needs of other stakeholders along the route.

- **Attraction of Specialized Services** can occur when ample demand for those services exists. Where the Port of Churchill or the NeeStaNan project may not achieve the critical mass necessary to attract certain services, the approach that creates the "port district" may well reach and cross that threshold. These specialized services include certain regulatory services (being on site versus being flown in or having to be managed through cumbersome remote processes) such as Customs, Immigration, Food Inspection, Marine Control and Traffic Services, and others. It may also include civil society oversight and support bodies such as the Seafarer's Chaplaincy or similar groups. The ability to attract these services not only demonstrates the port's performance status but also reduces potential areas of concern that could exist in the absence of those services. This is in addition to other services that may benefit from being shared between the ports (ocean-going tugs, etc.).

The declaration of the port district and the extension of membership along the transportation network offers an opportunity to leverage additional resources. For example, communities could be formed that bring together law enforcement and criminal intelligence groups to work with the port authorities to identify areas of concern and make them aware of specific issues. By bringing together participants from along the transportation system, the ability to gather data and information that can be collated into useful intelligence (meaning actionable and timely) offers more significant opportunities to keep the ports clear of criminal influences or exploitation.

Use Case 2 – National Security Blended with Commercial

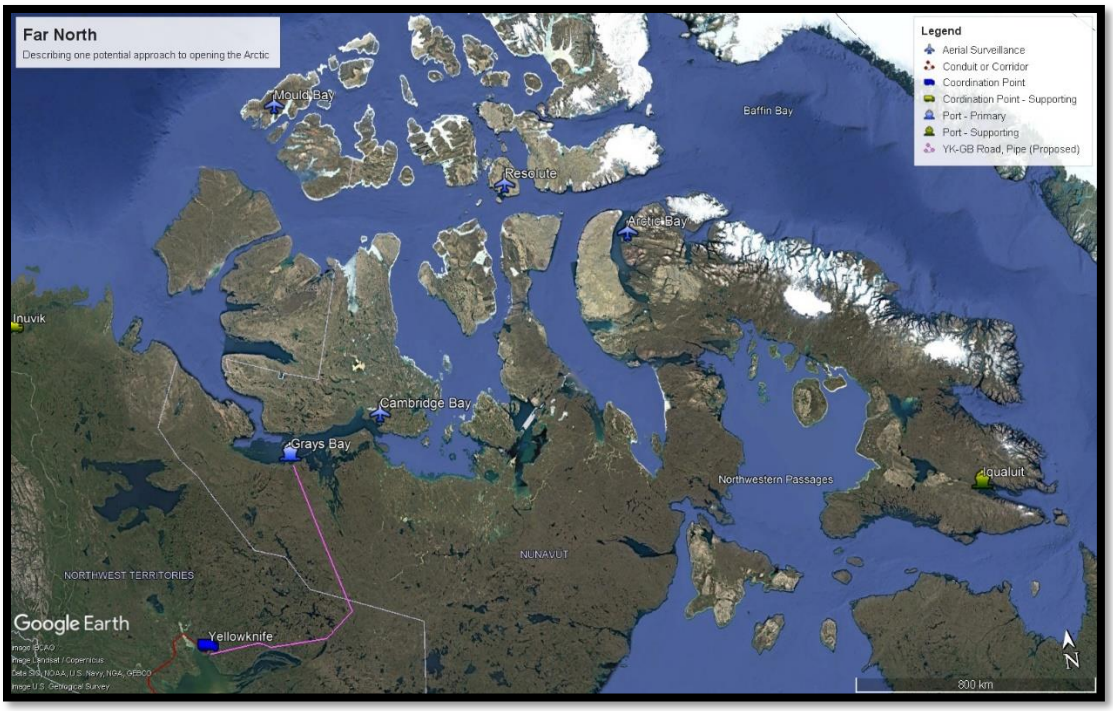


Figure 4 - An Approach to Far North

Canada's far north can be described as a contested territory. Significant international interest is focused on this region, with several countries working (some more openly than others) to gain access or rights to the region's potential resources and shipping routes. In this context, the Port at Gray's Bay may provide a significant enabling infrastructure for protecting Canada's north. The current project aims to connect mineral resources in the far north to the Arctic shipping routes. This should not be discouraged but instead encouraged. (Ref G)

The current project involves connecting Yellowknife to the Arctic Ocean (the route proposed differs from the one on the map, but the connection's importance is greater than the specific route) and terminating at a seaport on or near the Arctic shipping routes.

Use Case 2: Arctic Sovereignty

In this approach, the national security and environmental safety concerns provide additional impetus for funding the efforts in the region. The challenge here is identifying, detecting, and responding *effectively* to unauthorized incursions and activities into Canadian territory. Currently, limited northern infrastructure can do more than simply detect activity.

Expanding the Gray's Bay project to include the Royal Canadian Navy (RCN), Canadian Coast Guard (CCG), and Royal Canadian Air Force (RCAF) resources provides an opportunity to address this challenge. The creation of the all-weather road allows for the overland movement of certain resources should sea routes be unfeasible due to safety concerns or where threats escalate. Similarly, facilitating crew changes, replenishment, resupply, and other activities closer to patrol routes allows the assets to remain *in situ* longer and reduces the complexity of rotating vessels.

This infrastructure also opens possibilities for aerial surveillance in the region, as the port could also service locations such as Mould Bay, Resolute, Arctic Bay, and Cambridge Bay. While Iqaluit provides some capabilities, its primary challenge lies in its resupply challenges, particularly over the winter months. In the west, Inuvik and Tuktoyaktuk face challenges regarding Inuvik being inland and the port at Tuktoyaktuk being very small. (Ref H) Infrastructure at Inuvik, however, can support some air operations through its airfield/

With 1-2 Arctic Offshore Patrol Ships (AOPS) in the area and future naval combat assets (needed) in the north, this creates a clear presence and indication of Canadian control within the region. Combined with air assets/support that can move fuel and key personnel quickly across the airfields identified above, this also allows for the maintenance of a more robust aerial surveillance capability.

Use Case 3: Environmental Response

The CCG has significant environmental response knowledge and capabilities. What it lacks in the north is the ability to maintain the scale of resources necessary for large-scale response and the ability to move additional resources into the area quickly and efficiently. As the Arctic shipping routes increase in traffic, the potential for deliberate releases (such as illegal bilge dumping) or accidental spills (damage to ship, etc.) also increase.

When considering many of the mainstream methods of removing oil from the ocean, it is clear that this area could benefit from additional and innovative approaches. The Arctic environment is

delicate and has limited resources or the ability to move significant resources along the coastline. Manual removal, burning, and mechanical removal may prove challenging. Other options, such as the ability to deploy booms or absorbents by air to contain the spread of the slick may be worth exploring.

Ultimately, however, the factors of time and capability will require that more significant resources be located in the north to maintain an adequate response. Given that the distance from Gray's Bay to waters slightly NE of Inuvik is 550 nm, around 750 nm to Resolute, and approximately 2000 nm when following navigable routes to Iqaluit, there is a case to be made for establishing this kind of capability as part of the Gray's Bay project.

An Option for Implementation (Use Case 1-3)

This effort would not be insignificant on a national scale and many of its individual projects would evoke, as noted in the Gray's Bay briefing, efforts that would be considered nation-building on their own. That being said, years of lack of investment in the north now place Canada in a situation where massive investments may be the only option to maintain its sovereignty in the north.

The first step is to leverage the existing work being done. Given the work that has already taken place to move projects forward, this is simply a matter of pragmatism. It should also be clear that this effort would likely involve layers of concurrent activity.

Step 1: Press forward with the Existing

The first step involves advancing the following efforts that are currently underway:

1. Modernization and improvements at the Port of Churchill to address many of the challenges faced by that port's unique supporting infrastructure and operating environment.
2. Approval for the NeeStaNan project and supporting infrastructure project.
3. Approval for the Gray's Bay project, including the supporting road infrastructure.
4. Formation of the NE Manitoba port region (Province of Manitoba supported by Transport Canada).

This establishes the very early economic base to help support employment (including training of persons, etc.) while also setting the stage for the more resilient transportation network.

Step 2 – Establish the Initial Operating Capability

The second step involves establishing the Initial Operating Capability (IOC) and setting the stage for establishing the next tier of operations. This includes the following:

1. Bringing the Port of Churchill to 75% capacity, including its supporting rail network.
2. Construction is underway for the NeeStaNan project.
3. Start discussions on the Mutual Aid Agreement provisions to establish common structures for personnel training, emergency response, and shared capabilities.
4. Construction is underway for the all-weather road from Yellowknife to Gray's Bay.

As the Port of Churchill moves out of its implementation phase and into operations, it's efforts begin to attract a broader client base. The presence of verifiable work for the NeeStaNan project

becomes the reassurance to this expanding client base that the transportation network in the region will be appropriately resilient to avoid major impacts associated with the disruption at any one port.

Step 3 – Southern Initial Operating Capability

This involves establishing the basic resilience in the Hudson's Bay Region, including the following:

1. Both Port of Churchill and NeeStaNan operate at not less than 80% each.
2. Conduct the first joint "resilience-based exercise"
3. Verification that road and rail behind each port can support operations.
4. Establishment of the Regional Operations Center, Threat Intelligence capability, and Emergency Management coordination.

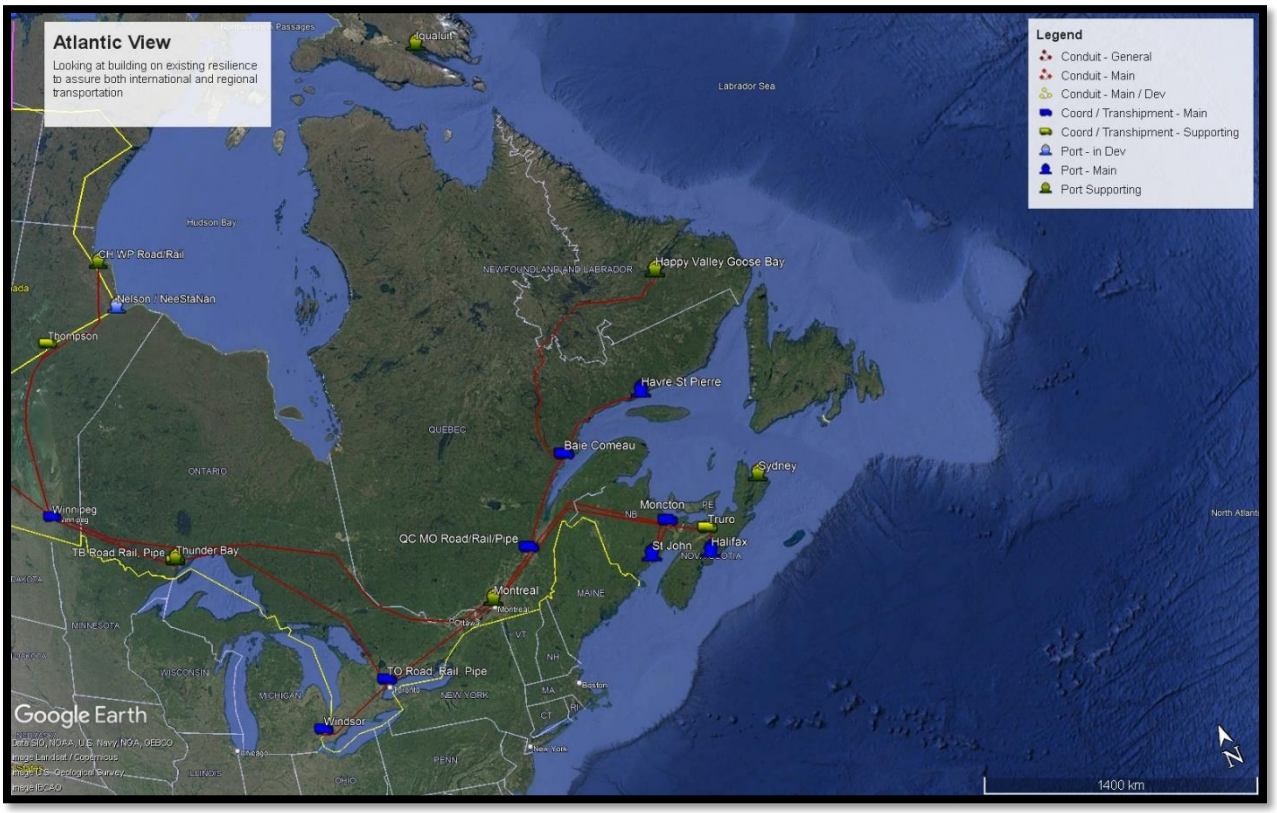
Once this level has been established, the southern region can be considered resilient and functioning at a managed maturity level. At this point, the focus shifts northward with respect to Gray's Bay. The Gray's Bay Port and all-weather road should be near completion at this point, but it is a matter of providing support for Gray's Bay to reduce its risk of disruption.

Step 4 – Establish Landside Resilience

At this point, each of the three ports should be functioning at not less than 80% capacity with each port now establishing and expanding its client base. The challenge here will not only be in terms of meeting the transportation demands but also the ability to meet market demands for the goods involved. At this point, the initial structures rely too heavily on single roads to the Ports and the focus becomes on establishing redundant infrastructure that also serves to reach communities previously accessible only by air. This includes the following:

Figure 5 -One option to a more resilient northern infrastructure.

Use Case 4: Atlantic Resilience



Atlantic Canada plays a significant role in the European, African, Eastern USA, South American, and mid-Asian (India, etc.) markets. The Port of Halifax not only boasts one of the shorter routes to many markets but has undertaken significant modernization efforts across its shipping activities. (Ref J).

The goal and objectives remain constant in terms of the movement of goods so that they arrive at their intended destination on time, in acceptable condition, and for a reasonable cost. As with the northern/Arctic considerations, the focus is on leveraging existing projects to reduce rework.

The challenge in Atlantic Canada is two-fold. First, the road and rail transportation networks must branch early (towards Quebec City) because of the St. Lawrence. The second is that large areas of Atlantic Canada's coastline are only accessible by truck and using a road network susceptible to severe weather.

While the current Atlantic corridor (running from Montreal to Moncton to either Halifax, NS or St. John, NB is well-established, this approach tends to leave large areas of Atlantic Canada underserved.

In the context of a resilient network, the following elements would be proposed to expand the seaport network to allow for both greater international opportunities as well as supporting regional economies during either normal operations or periods of crisis:

- Expand the capabilities at the Happy Valley / Goose Bay center to include regional shipments to markets like Iqaluit, Nuuk (Greenland), and Iceland. The port is already capable of handling moderate-sized vessels. This expansion would likely include expanding facilities and installing moderate-sized cargo-handling cranes.
- Expanding the capabilities of the Havre St. Pierre (QC) port to be able to handle both regional and international commercial shipping. The port currently acts as a port of call within the cruise industry. Expanding this capability, however, would require caution due to environmentally sensitive spaces closely tied to tourism in the region.
- Establishing a coordination point at Baie Comeau that would serve to either route towards Havre St. Pierre or the Happy/Valley Goose Bay.
- An option with respect to the establishment of a secondary Nova Scotian Port at Sydney, NS.

In this context, the focus for resilience involves the formation of cooperative communities that can ensure the movement of goods in support of international and regional commitments. It also serves to expand the Emergency Response capabilities given that may of the coastal communities in this area are serviced by single roads. Regional ports, when built appropriately to withstand these events, would allow for the movement of either materiel or resources to assist in regional recovery operations.

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