Exploring Plausible Futures for Marine Transportation in the Canadian Arctic

A Scenarios' Based Approach

Prepared for

Transport Canada

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DISCLAIMER

The goal of this project is to identify and evaluate possible alternative 'futures' for marine transportation in the Canadian Arctic, using a 'scenarios approach.' This objective stems from an appreciation that the Arctic is presently experiencing numerous significant and fast moving trends and developments taking place across a diverse range of economic, societal, safety, security and environmental fields. Given the significant complexity and global reach of developments, traditional forecasting approaches have proven to be largely ineffective in providing valid insights into how marine transportation in the Canadian Arctic might be expected to unfold. This project uses the scenario based approach, an alternative emerging methodology that is directed at developing a limited number of plausible, challenging and contrasting scenarios for consideration and debate by industry and policy leaders.

The Report does not necessarily reflect the official position or the views of the Government of Canada or Transport Canada.

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List of Abbreviations

AIS	Automatic Identification System
AMSA	Arctic Marine Shipping Assessment
ASPPR	Arctic Shipping Pollution Prevention Regulations
AWPPA	Arctic Waters Pollution Prevention Act
BIMCO	Baltic and International Maritime Council
BWM	Ballast Water Management
CH4	Methane
CCG	Canadian Coast Guard
CF	Canadian Forces
CO_2	Carbon dioxide
COLREG	International Regulations for Preventing Collisions at Sea
CSA	Canada Shipping Act
CSR	Common Structural Rules
dB	Decibel
DWT	Deadweight tonnage
EC	European Commission
ECA	Emission Control Areas
EEDI	Energy Efficiency Design Index
EEZ	Exclusive Economic Zone
EMSA	European Marine Safety Agency
EU	European Union
GBN	Global Business Network
GBS	Goal Based Standards
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GT	Gross Tonnage
HNS	Hazardous and Noxious Substances
IAATO	International Association of Antarctica Tour Operators
IACS	International Association of Classification Societies
ICS	International Chamber of Shipping
ILO	International Labour Organization
IMF	International Monetary Fund
IMO	International Maritime Organization
ISPS	International Ship and Port Facility Security Code
kHz	Kilohertz
LNG	Liquefied Natural Gas
LRIT	Long-range Identification and Tracking
MARPOL	International Convention for the Prevention of Pollution from Ships
MCTS	Marine Communications and Traffic Services
N_2O	Nitrous oxide
NEXTAW	Network of Expertise on Transportation in Arctic Waters
NGO	Non-governmental Organization
NOx	Nitrogen oxide
NORAD	North American Aerospace Defense Command

NORDREG	Northern Canada Vessel Traffic Services
NSR	Northern Sea Route
NWP	Northwest Passage
OECD	Organization for Economic Co-operation and Development
OPA90	Oil Pollution Act of 1990
OPEC	Organization of the Petroleum Exporting Countries
OPRC	International Convention on Oil Pollution Preparedness, Response and Co-operation
PA	Protected Area
PAME	Protection of the Arctic Marine Environment
PSSA	Particularly Sensitive Sea Area
SAR	Search and Rescue
SEEMP	Ship Energy Efficiency Management Plans
SOLAS	International Convention for the Safety of Life at Sea
SOx	Sulfur oxide
STCW	Standards of Training, Certification and Watchkeeping
UK	United Kingdom
UN	United Nations
UNCCC	United Nations Framework Convention on Climate Change
UNCITRAL	United Nations Commission on International Trade Law
UNCLOS	United Nations Convention on the Law of the Sea
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
US	United States
UV	Ultraviolet
VHF	Very high frequency
VLCC	Very Large Crude Carriers
VMS	Vessel Monitoring System
WHO	World Health Organization
WMO	World Meteorological Organization
WTO	World Trade Organization

Executive Summary

It is clear that very significant and most likely irreversible changes are occurring throughout the Arctic, driven by both global and regional trends and developments that including climate change, globalization of trade, population growth, ever expanding demands for resources, and ground-breaking advances in technology. The broad aim of this project is to offer a means of examining these changes and in so doing offer plausible futures for marine transportation in the Canadian Arctic.

Due to the global origin of many of these trends and developments, it is clearly not possible to rectify any adverse impacts on the Arctic through measures developed and applied solely within an Arctic context. Thus a premise for this study is that the complexity of current trends and developments in the Arctic region is sufficiently extreme to negate the value and effectiveness of applying conventional forecast methodologies. This premise has led to the pursuit of an alternative 'scenarios' approach, which offers a broader perspective than is offered by forecast-based analysis.

Whereas a forecast may be regarded as a prediction of future events based upon an extrapolation of a limited number of key variables, a scenario-based methodology draws upon a range of possible trends and uncertainties which may combine in different manners to generate a diverse range of outcomes. A key contribution of a scenario approach is that it allows for consideration as to how these alternative futures may be influenced by differing policy choices. The use of this methodology is thus able to offer a range of insights into complex, multi-dimensional situations such as those found in relation to economic development issues, public interest concerns and governance challenges associated with Canadian Arctic marine transportation.

The scenario-based methodology revolves around the identification of future trends and uncertainties arising from an analysis of certain key 'forces'. Each of these forces comprises a selection of 'drivers' that impact the nature and extent of change, and by examining these various changes, the project seeks to identify the associated key uncertainties. These uncertainties and the manner in which they may evolve or interact are the essential elements in the development of the scenario framework. Each uncertainty is tested against a proposed 'focal question,' the purpose of which is to set out the key issues that the scenario approach is endeavouring to address.

The final objective of the project is to ensure that each of the scenarios generated during this process offers a plausible, contrasted and challenging description of a possible future for marine transportation in the Canadian. In concluding the exercise, the reasonableness of each of these scenarios is examined and confirmed to the satisfaction of the project team.

As outlined above and as a starting point, the authors have identified three key forces, specifically market motivation, public interest considerations, and governance, that they believe constitute the principal influences on the manner in which shipping may evolve in the Canadian Arctic.

Market motivation, the first of these key forces to be examined by this project, is discussed in Chapter 2. International economic trends, particularly those driven by a growing global demand

for non-renewable resources and expanding international trade, are expected to have important consequences for the scale and configuration of shipping activities in Arctic waters. Factors that may stimulate or depress private sector motivation are identified, and the impacts which they will have on marine transportation demand are also addressed.

The issues surrounding the second key force addressed by this project, that of public interest concerns, are discussed more fully in Chapter 3. In this chapter, it is recognized that global trends and the market responses to such trends have the capacity to give rise to substantive environmental, societal, safety and security considerations for the Arctic region. Elements considered include the risks to the Arctic environment from marine transportation, possible safety and security threats, and socio-economic concerns for northern communities resulting from a warming Arctic environment. Examination of the various trends in these considerations, that constitute the 'public interest' dimension of the 'forces' at play in the Canadian Arctic, have led to the identification of a number of associated key uncertainties.

The third key 'force' is the evolving framework and effectiveness of the prevailing governance regime. Chapter 4 considers whether the governance regime that oversees the quality and conduct of marine transportation activities in the Arctic will continue to be effective in not only controlling any negative influences of marine transportation, but also providing support to commercial operators. The accepted premise is that an appropriate governance regime acts to maximize the benefits of economic development while protecting the public interest in all its forms.

An important dimension of this analysis has involved the identification of key developments in Arctic marine transportation technology that can aid in the oversight and support function, leading to the adoption and incorporation of international conventions and protocols. The analysis also recognizes that there is a hierarchy of levels at which oversight is exercised., from international bodies such as the International Maritime Organization (IMO) to regional bodies such as Canada's territorial governments. How this hierarchy will evolve in the future is also examined.

In Chapter 5, the process shifts to an examination of how the identified uncertainties interrelate, using the 'focal question' to assess their importance and the nature and degree of risk each uncertainty presents. A final step involves the construction of the four scenario descriptions which identify plausible variations as to how the various forces and uncertainties will interact.

Included in the project activities has been the conduct of a brief literature review (included as Annex A) of available scenario development work undertaken to date, including exercises that have recently been completed in the marine transportation field and more specifically, marine transportation in the Arctic. Related work on scenario planning as a strategic tool has also been researched. All such material, and particularly the methodology incorporated in it, has been carefully considered and adapted for use as guidance for this project.

A program of consultation was also undertaken at the same time in order to test the validity of emerging perspectives. Those consulted included experts drawn from the NEXTAW membership as well as other experts who were either identified by the project team or by NEXTAW members.

The central messages emerging from the consultation process were incorporated and organized, and are presented for consideration in Annex B.

Finally, a workshop was convened in Ottawa, attended by members of the NEXTAW team and others with knowledge and expertise in Arctic marine transportation. The conduct of this workshop is summarized in Annex C.

Chapter 5 concludes with the presentation of four 'candidate' scenarios, where the goal has been to ensure that each scenario is equally plausible. That said, the authors are aware that Scenario 4, while similar to the other scenarios with respect to degree of plausibility, likely constitutes a more attractive outcome than the first three scenarios. This reflects the fundamental thesis that stable market functioning, involving the provision of economic, efficient, and adequate shipping services, combined with responsible protection of the public interest in all its environmental social, safety and economic dimensions, and supported by an effective framework of governance and oversight make up the essential ingredients for success.

This thesis also reflects the view that there is a clear need to achieve a balance between the three identified 'forces.' The focus of attention is then placed on the evolving circumstances and the initiatives that need to be taken to address the factors that may be viewed as the essential elements for achieving this balance.

In summary, the aim of this project has been to illustrate the underlying rationale and logic flow behind the scenario approach, and hopefully to demonstrate that simple forecasting is not the only, nor necessarily the best, way of looking at the future. It should be stressed that it is the methodology, and the opportunities that it offers for collective debate that make up the real value of this project. Put another way, a key objective of this project is to provide a range of alternative perspectives on possible Arctic futures for consideration by policy makers so as to shed light upon key options and priorities, and their relative desirability. In this respect, the value of the exercise is at least as much in the 'journey' as in the 'destination.'

Chapter 1 – Introduction: Why Scenarios?

1.1 The Project Objective

The broad aim of this project is to offer a means of examining plausible futures for marine transportation in the Arctic, and more specifically, in the Canadian Arctic. A natural starting point for this project is recognition that very significant and most likely irreversible changes are occurring in the Canadian Arctic, driven by both global and regional forces. Indeed, numerous, fast moving trends and developments are impacting a diverse range of economic, societal, safety, security and environmental factors throughout the entire Arctic region. Examples of these global developments include climate change, globalization of trade, population growth, expanding demands for resources, and groundbreaking advances in technology. This project seeks to shed light on plausible futures for Arctic marine transportation in light of the continuing turbulent evolution of these trends and developments.

1.2 The Problem with Forecasting - Introducing the Scenarios Approach

Due to the global origin of many of these complex trends and developments, their impact on the Arctic is not only uncertain and unpredictable, but also not amenable to adjustment or mitigation through measures developed and applied solely within an Arctic context. Thus this project bases its rationale on the premise that the complexity of current trends and developments in the Arctic region is sufficiently extreme to negate the value and effectiveness of applying standard forecast methodologies.[1]

This premise, that there are circumstances that can give rise to shortcomings in traditional forecast methodology, has led to the pursuit of an alternative 'scenarios' approach.[2] The rationale for this alternative approach lies in the argument that it provides a mechanism for examining possible Arctic marine transportation 'futures' from a broader perspective than is offered by forecast-based analysis.

In distinguishing the scenario-based approach from a forecast-based methodology, it is important to appreciate that each method constitutes a distinct independent process, with corresponding strengths and weaknesses. Forecasts may be primarily categorized as narrow predictions of future events based upon an extrapolation of a limited number of key variables - in essence, projecting the present into the future. On the other hand, a scenario based methodology generates a range of possible trends and uncertainties which, based upon the interaction of key variables, may combine in different manners to result in a diverse range of outcomes. Each of the future scenarios generated in this process represents a reasonable possibility, with no particular one being necessarily more probable than any of the others.[3]

A further benefit of the scenario approach is that it allows for consideration as to the degree to which these alternative forms may be influenced by differing policy choices. In this way, the

1 See http://gbn.com/about/scenario_planning.php for more insights on this
2 Again see http://gbn.com/about/scenario_planning.php for more insights on this subject.
3 See the Arctic Council's Arctic Marine Shipping Assessment (AMSA) 2009 Report p96

'scenarios' approach helps to bring to the fore various issues and perspectives that do not emerge naturally from a traditional forecasting methodology. Royal Dutch Shell, as an early proponent of scenarios thinking, used this methodology to help shed light on the uncertainties affecting the volubility of the future price of oil to great success during the Organization of the Petroleum Exporting Countries (OPEC) oil crisis.[4]

The scenario development process also involves the identification of trends and critical uncertainties that 'drive' the evolution of these outcomes. The use of this methodology is thus able to offer a range of insights into complex, multi-dimensional situations such as those found in relation to economic development issues, public interest concerns and governance challenges associated with Canadian Arctic marine transportation.

The process of 'scenario building' is still an evolving methodology, and represents an opportunity to gain an appreciation as to how a range of factors such as market conditions, societal and environmental trends, and political/governance initiatives may all influence and guide future Arctic development. A scenario-based analysis allows an organization to challenge its own assumptions about the future, including how this future is expected to unfold, and how the organization is positioned to confront this changing landscape. Further, identifying a range of possible outcomes for the future can assist organizations in adapting to rapidly changing circumstances.

In order to appreciate the contributions that can be made by adopting a scenario-based approach, it is helpful to think of scenarios as stories or narratives that are developed through a process of research, testing and collaboration. The aim is to construct these narratives as descriptive, and at times even evocative statements of the world yet to come, presented in a manner that identifies a range of alternative and plausible futures. The development of these scenarios should be an imaginative process, in which the implausible becomes the plausible and even basic assumptions as to the possible routes forward become open to challenge.

J. Warfield of the Battelle Institute described the scenario-based methodology in the following manner:

> ***A scenario is a narrative description of a possible state of affairs or development over time. It can be very useful to communicate speculative thoughts about future developments to elicit discussion and feedback, and to stimulate the imagination. Scenarios generally are based on quantitative expert information, but may include qualitative information as well.***[5]

Scenarios are not predictions; they do not offer the reader a glimpse of the future, nor do they provide answers with any degree of certainty. Each scenario is presented as an equally valid perspective on the future, a product of the relationship between the assorted forces underlying the development of that particular scenario. Some of those who have engaged in scenario development to date have made significant efforts to ensure that the scenarios that are generated

4 See 'Why Scenarios – A Brief History at' http://gbn.com/about/scenario_planning.php

[5] Warfield, J. (1996) An Overview of Futures Methods, 1996, in: Slaughter, R. (ed) (1996)

do not constitute best or worst-case situations with a middle ground scenario that is 'most attractive.' Others, including those involved in this project, are not as concerned if a particular scenario emerges where the alignment or balance of forces provides for a future that may be viewed as a more desirable outcome than other scenarios, so long as it is equally plausible.

1.3 Drawing on Past Arctic Marine Scenario Development Exercises

Perhaps the most significant use of this methodology, in the context of the Arctic, was undertaken in support of the Arctic Council's Arctic Marine Shipping Assessment (AMSA) project, as set out in the sixth Chapter of its report. This exercise emerged from a series of workshops facilitated by a United States (US) based company, Global Business Network (GBN), which had previously undertaken important scenario and strategic analysis work in a number of diverse fields.[6] In the AMSA Report, the scenario development and analysis material is limited, and it is suggested that it does not clearly identify and develop effectively the contribution that scenario development is capable of making in relation to perspectives on possible marine transportation futures in the Canadian Arctic.

Wärtsilä, an important ship-design firm in Finland, and a branch of the shipbuilding and ship design firm STX Europe, has also undertaken interesting work on scenarios, principally in relation to possible futures for international shipping.[7] This effort has made a tangible contribution to the scenario methodology, but is more generally focused on the technological consequences for deep sea shipping design and development.

While being guided by the broad concepts reflected in past applications of the scenario methodology, this project has 'massaged' past approaches to come up with a new perspective. These changes are believed to strengthen opportunities for collective examination and policy-making for Arctic shipping activity, an especially important feature as shipping and associated activities are expected to evolve over the next ten to fifteen years.

More particularly, the project has set as its objective to examine the interplay between three key 'forces' impacting the region (see below). The product of this examination ultimately leads to the identification of several alternative, plausible and challenging future scenarios for the Arctic. Each of these scenarios provides alternative insights into possible futures for shipping activities, marine infrastructure and service support operations.

1.4 How does it Work? – A More Detailed Look at the General Methodology

The scenario-based methodology revolves around the identification of future trends and key uncertainties arising from the interaction of certain key 'forces'. Each of these forces generates various 'drivers' for change. These drivers may be endogenous or exogenous to an organization, industry or region, and may develop in either predictable or unpredictable ways. By examining these forces and associated drivers, it is possible to identify a set of selected key uncertainties. These uncertainties and the manner in which they may evolve or interact are essential elements in the development of the scenario framework. By using this approach, and through testing and

6 See http://gbn.com/about/scenario_planning.php
7 See Wartsila Global Scenarios of Shipping in 2030.

validation by expert third parties, an organization is able to develop a series of scenarios for consideration and ultimately validation.

The process of identifying trends and key uncertainties, and the eventual development of a limited selection of scenarios, typically three or four, provides organizations with a realistic and holistic glimpse into how the future might evolve. In this way, each scenario provides an opportunity for organizations to engage in strategic thinking that is to a degree confined to the scope and content of the described scenarios. Decisions regarding both long and short-term strategies may then be tested against the backdrop of different conditions.

Critical uncertainties and potential 'tipping points,' namely major discontinuities that result in radical step changes in trends, are also examined, and tested against a proposed 'focal question.' This question is viewed as a useful tool in the scenario development process, as it provides a basis against which key uncertainties may be tried. Such a question captures the essence of what the scenario approach is endeavouring to address within a particular context.

The final objective of the project is to ensure that each of the scenarios generated during the process offers a plausible, contrasted and challenging description of a possible future for Arctic marine transportation within Canada. In concluding the exercise, the reasonableness of each of these scenarios is examined and confirmed to the satisfaction of the project team.

1.2 Introducing the Three 'Forces'

The authors of this study have identified three forces, specifically Market Motivation, Public Interest Considerations, and Governance, that they believe constitute the principal influences on the manner in which shipping may evolve in the Canadian Arctic.

Market motivation, the first of these key forces to be examined by this project, is discussed in Chapter 2. International economic trends, particularly those driven by a growing global demand for non-renewable resources and expanding international trade, are expected to have important consequences for the scale and configuration of shipping activities in Arctic waters. These market development interests and those associated with the transportation needs that they generate are mainly positioned in the private sector, and may be viewed as the principal 'drivers' for Arctic shipping activity. As Arctic environmental circumstances change, including the expectation of expanded and longer lasting ice-free periods, it is reasonable to expect commercial activity to adjust and expand in response to these trends and opportunities.

It is important to note that because of the consequences for the public interest and ultimately for governance oversight, a key reality of modern international shipping practice is the virtual absence of any external influence or control over private sector decisions regarding entry into, participation in, or exit from international marine trade and transportation activities. Since the private sector makes investment choices and takes business decisions based on where it perceives its best commercial interests may lie, the scale and nature of future Arctic shipping activity is, initially at least, driven principally by these actions and decisions.

Factors that may stimulate private sector motivation include advances in cold climate technology such as icebreaking techniques, cold weather cargo handling techniques and ship design

improvements. Factors that may depress private sector motivation include the limited availability of a skilled workforce, particularly in relation to Arctic competencies, constraints imposed on shipping by governing bodies, and fluctuations in the availability of ships associated with volatility in the shipbuilding sector. The factors identified above and the impacts which they will have on marine transportation demand are addressed in Chapter 2.

The issues surrounding the second key force addressed by this project, that of public interest concerns, are discussed more fully in Chapter 3, In this chapter, it is recognized that global trends and the market responses to such trends have the capacity to give rise to substantive environmental, societal, safety and security considerations for the Arctic region. Climate change is both a crucial driver and a key uncertainty that is causing what is widely believed to be irreversible alterations to the Arctic environment. While it is assumed that the scale of expanded northern shipping activity is not sufficient in itself to cause major contributions to pan-Arctic climate change trends, such activities are nonetheless viewed as having the potential to impact the environment to an important degree. Such impacts include the discharge of greenhouse gases (GHGs), refrigerant gases such as Halon, nitrogen oxide (NOx) and sulfur oxide (SOx) gas emissions and deposits of carbon and other particulate matter on ice and snow causing accelerated melting through the albedo effect. Similarly, marine pollution through oil or hazardous and noxious substances (HNS) discharges, introduction of alien species through ballast water discharges, or noise pollution are all viewed as potentially problematic shipping impacts upon the Arctic environment.

Another dimension of this second force is safety of life. The potential increase in the risk of accidents and potential loss of human life associated with expanded shipping activity in harsh operating conditions highlights the need for a greater focus on prevention technology such as ship construction requirements, cold weather equipment, and enhanced navigational capabilities Also at issue is the existing capability to respond effectively to safety incidents, which requires expanded capacity for search and rescue (SAR) and the possibly provision of ports or places of refuge.

Furthermore, while not presently a major concern, the Arctic is not immune to the possibility of security threats from sources such as terrorism, piracy, drugs, human smuggling. The current federal Northern Strategy emphasis on protection of sovereignty and may be viewed, at least in part, as a response to these security concerns.[8]

Last but not least, in the context of this second force, Arctic communities are facing serious social challenges as they adjust to rapidly changing climatic and societal trends, after millennia of stable, predictable and relatively isolated Arctic conditions. Northern developments and their associated shipping activities have the capacity to create turbulence and upheaval in the social norms of Arctic communities, and to disrupt traditional northern hunting and fishing patterns, while cruise ship activities have the potential for both positive and negative consequences for Arctic communities.

8 See Government of Canada (2009), Canada's Northern Strategy

All these trends constitute the 'public interest' dimension of the 'forces' at play in the Canadian Arctic, and have led to the identification of major uncertainties in relation to these environmental, societal, safety and security considerations.

The expectation of an expansion in shipping activity in the Canadian Arctic, driven principally by global business interests and aimed at capitalizing on the commercial advantages offered by less challenging operating conditions resulting from climate change, interacts directly with the wide range of public interest concerns triggered by such an increase. This interaction gives rise to a third key 'force' that is evaluated in this project, namely the effectiveness of the prevailing governance regime, which is discussed in Chapter 4.

For consideration in Chapter 4 is whether the governance regime that oversees the quality and conduct of marine transportation activities in the Arctic is effective in not only regulating, but also providing support to, commercial operators. An appropriate governance regime acts to maximize the benefits of economic development while protecting the public interest, in all its forms. It is not only the vulnerability of the many northern communities but also the complex and fragile Arctic environment that calls for efforts to ensure that any negative impact of expanded shipping activity is eliminated or mitigated to an acceptable degree.

An important dimension of this governance analysis has involved the identification of key developments in Arctic marine transportation technology that can aid in the oversight and support function, leading to the adoption and incorporation of international conventions and protocols such as the International Maritime Organization's (IMO) Polar Code. This technological contribution to governance effectiveness is discussed more fully in Chapter 4

In examining the governance function or force in relation to Arctic marine transportation, it will be recognized that there is a hierarchy of levels at which control is exercised. This hierarchy includes multilateral initiatives driven by such international bodies as the IMO and the International Labour Organization (ILO), as well as initiatives at the national level, which may or may not be fully consistent or compatible with those emerging from the international level. Regional bodies such as Canada's territorial governments are gaining in influence in the management of shipping and related activities in their region. This interplay between various levels of governance, as each aspires to influence the nature and extent of shipping operations, has important consequences for the collective governance regime.

1.3 The Project's Research Dimension

All the above considerations have shaped the conduct of this project. Included in these activities has been the conduct of a brief literature review (included as Annex A) of available scenario development work undertaken to date, including efforts which have been completed with regard to the marine transportation field and more specifically, marine transportation in the Arctic. While there is a very large amount of material available that addresses all aspects of Arctic trends and developments, the modest scale of this study has dictated that the literature review only select a small representative sample of the available analysis of Arctic trends and developments. Related work on scenario planning as a strategic tool has also been researched. All such material, and particularly the methodology incorporated in it, has been carefully considered and adapted for use as guidance for this project.

A program of consultation was also undertaken at the same time in order to test the validity of emerging perspectives. Those consulted included experts drawn from the Network of Expertise on Transportation in Arctic Waters (NEXTAW) membership as well as other experts who were either identified by the project team or by NEXTAW members. Drawing on the products of this consultation phase, a final distillation and confirmation step was undertaken, where all the material emerging from the consultation was incorporated and organized, with a view to developing and validating updated scenarios (see Annex B).

Finally, a workshop was convened in Ottawa, attended by members of the NEXTAW team and others with knowledge and expertise in Arctic marine transportation. The conduct of this workshop is summarized in Annex C.

Chapter 2 - Market Force Considerations in Relation to Marine Transportation in the Canadian Arctic

2.1 Introduction

This is the first of a series of three chapters which will examine, in turn, each of the three key 'forces' as set out in Chapter 1. The role of these chapters is to establish a common level of understanding regarding the characteristics of each of these forces, and the interplay between them that will form the basis of the scenario development exercise.

The aim of this Chapter is to examine the first 'force', relating to the commercial and economic elements associated with the private sector driven marine transportation market. It is these elements and the circumstances that impact them which are responsible for shaping the future course of this industry. The following examination is intended to provide the project with insights into the main drivers influencing the conduct of business in the shipping industry, and to highlight key uncertainties associated with these drivers. In turn, these uncertainties may then be factored into the development of scenarios for marine transportation through to 2025.

In line with the methodology outlined above, the Chapter will first examine the marine transportation industry from a global market perspective. It will then narrow its focus to consider the market dimensions of Arctic shipping activity generally, before finally considering the elements at play specifically within the Canadian Arctic.

2.2 Appreciating the Scope of the Marine Transportation Industry

In order to examine the underlying aspects of the marine transportation market, it should be made clear how the term 'marine transportation industry' is being used in the context of this exercise. A useful description is provided by the Rochdale Report which was published in 1967.

> ***Shipping is a complex industry and the conditions which govern its operations in one sector do not necessarily apply in another; it might even, for some purposes, be better regarded as a group of related industries. Its main assets, the ships themselves, vary widely in size and type; they provide the whole range of services which are needed to transport passengers and a great variety of goods, whether over shorter or longer distances. Although one can, for analytical purposes, usefully isolate sectors of the industry providing particular types of service, there is usually some interchange at the margin which cannot be ignored.***

More particularly, it is important to appreciate that this term is not only meant to cover the carriage of goods and passengers by sea, but also the wide range of services supporting this industry, such as the provision of seafarers, financial services, ship insurance, ship management services, classification services, ship building and repair, ship design, and naval architecture.

2.3 Global Trends in Marine Trade and Transportation

In 2011, well over eight billion tonnes of cargo were carried by marine transportation according to the United Nations Convention on Trade and Development (2012), making shipping the vastly preferred method for carrying goods to market in terms of total cargo carried. However, despite this impressive figure, the international marine transportation industry continues to grapple with significant economic challenges following the 2008economic downturn. .

Given that the industry operates on a derived demand basis, its commercial success is largely dependent on the health of the world economy. And thus the significant contraction in shipping activity that occurred in 2008 may be directly attributed to the rapid decline in the global economy, resulting in considerable excess ship capacity and a corresponding decrease in shipping rates for most seaborne cargoes. These difficulties still largely prevail today.

Further exacerbating the difficulties faced by the marine transportation industry is the current backlog of building contracts for new ships ordered during the heady economic times prior to 2008. As ship orders are typically placed based on market projections for three to four years in the future, even as the demand for ship capacity has fallen dramatically, the shipbuilding industry continues to inject further capacity into the supply of marine transportation tonnage.

There are some modest plusses amongst the minuses. Though there continues to be serious concern in the industry regarding the financing and subsidy by governments of contracts for the construction of new vessels that still remain outstanding, the continuing steady flow of new vessels has generated increased pressure on ship operators to seek greater efficiency in their operations. This search for efficiency includes the scrapping of older and potentially more polluting vessels. Further, the glut of new ships provides for increased availability of modern vessels for ship charters at a relatively low cost.

While the last few years have been difficult for many in the marine transportation industry, the recent decline in shipping rates and corresponding loss of profitability is very much a part of the cyclical nature of shipping. Recent events may be viewed as an expression of the episodic rise and fall of the industry, which has long been affected by shifting trends such as technology developments, economic upheavals, and political instability. In Figure 2.1, using the Clarksea index, it may be seen that the recent economic instability closely resembles the similarly economically turbulent times of the mid-1990s.[9]

Thus, the present situation, where too many ships are pursuing too few cargoes, that is currently plaguing ship operators may be viewed simply as a product of the free market in action. It is reasonable to presume that the oversupply situation will correct itself in time. Nevertheless, the exact manner in which the future cyclic nature of the industry will unfold constitutes an important uncertainty.

[9] The Clarsksea Index is the weighted average index of earnings for the main vessel types, where the weighting is based on the number of vessels in each fleet sector.

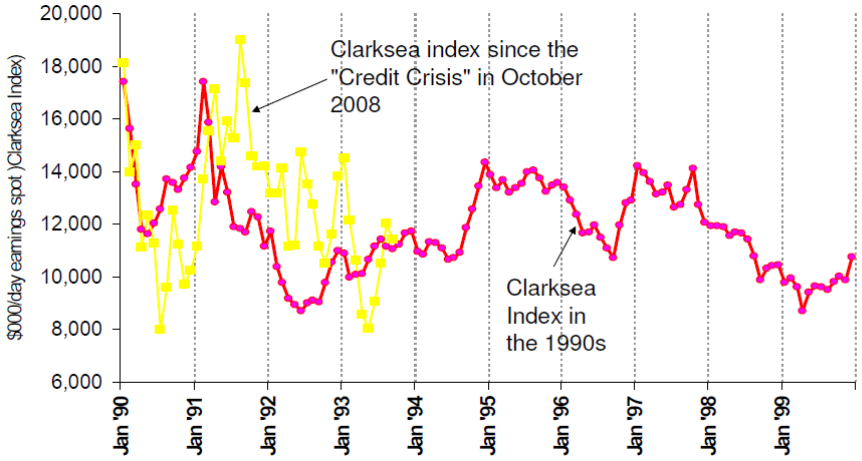


Figure 2.1 Clarksea Index - Comparison of rate fluctuations 1900-1999 and 2007-2012

2.3.1 Introducing the Shipping Market Model

Given the complexities of the global marine transportation industry, it is useful in the context of scenario development to briefly consider the components that comprise this industry, in order to better understand the directions that marine transportation may take in the future. One means of providing insights into the regular shifts in the industry is to identify and examine the underlying drivers through a basic supply and demand model.

There are five central variables that are principally responsible for creating the demand for marine transportation services. These variables are: the health of the world economy, amount of annual seaborne commodity trades, average haul per vessel, impact of political events such as the Suez Canal closure and transport costs, including the price of fuel oil. It may be taken as a given that any changes in these variables will affect the level of demand for shipping.
There are also elements on the supply side that provide the primary influence on the capacity of global shipping to meet the needs of the market place. These elements include: size of the world fleet, level of fleet productivity, rate of ship building production, number of vessels scrapped or lost and the freight rates for various cargo types.

In an ideal scenario, the elements on either side of the supply-demand ledger attain a balance of sorts, an equilibrium point resulting in steady and consistent outcomes. However, data from nearly a century of international shipping has demonstrated that more often the opposite is true, as demand variables are prone to sudden, unpredictable shifts, with supply variables often delayed in their response. The dynamic relationship between these variables is best captured in Figure 2.4 below, which demonstrates the functioning of the shipping market model as it operates (more or less) in the real world.

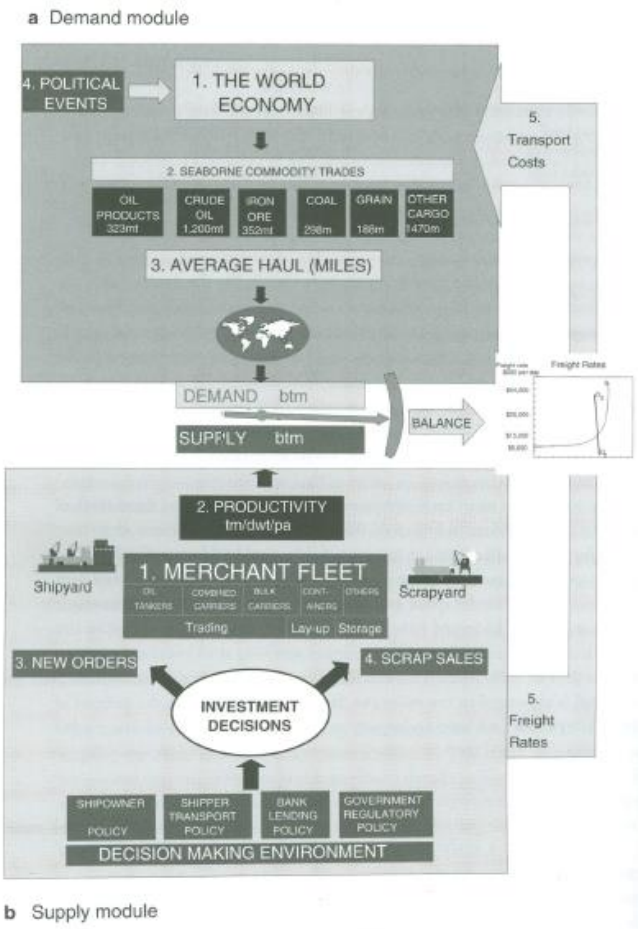


Figure 2.2 The Shipping Market Model[10]

This market model also needs to accommodate the numerous behavioural elements - such as political events - as well as natural occurrences which add a further level of complexity to the mix. For this reason, the economic conditions prevailing in the marine transportation industry are notoriously difficult to predict, and represent a key uncertainty for scenario development.

2.3.2 The World Economy

Ships engaged in marine transportation need cargoes (or passengers) to ship. In Figure 2.3, the close correlation between shipping activity, world merchandise trade and world gross domestic product (GDP) should be noted. For the most part, the health of the global economy serves as a valuable predictor of the demand for marine transportation services. As shipping operates on a derived demand basis, fluctuations in the health of the global economy have a direct impact upon the growth and profitability of this industry. Thus the dependence of this industry on the health of the global economy represents a vital uncertainty for the development of any scenario.

[10] Source: Martin Stopford, Maritime Economics, pg. 116.

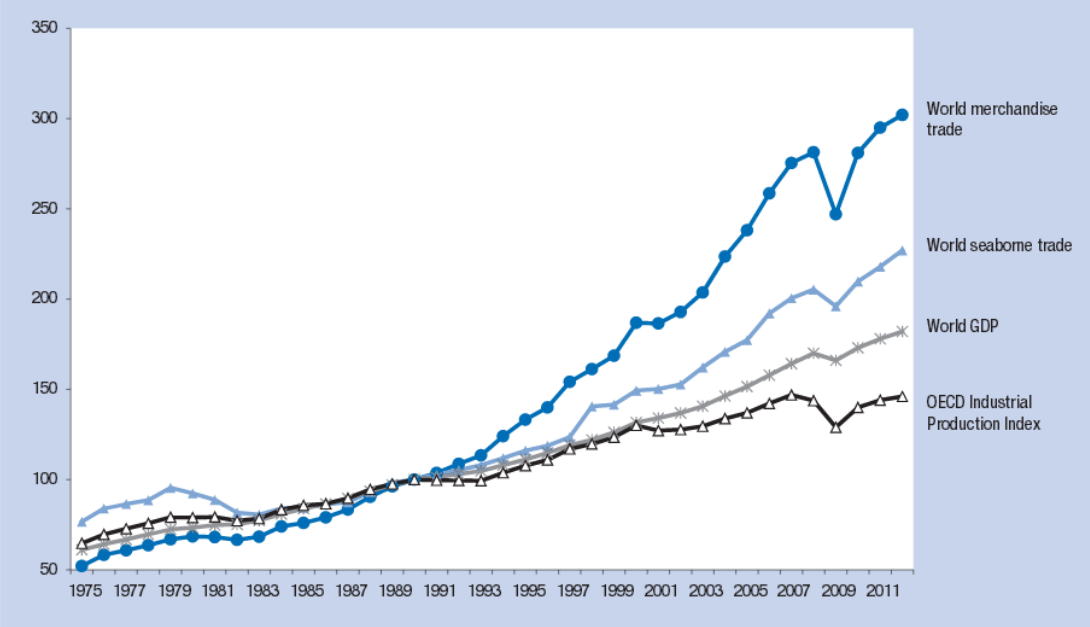


Figure 2.3 The OECD Industrial Production Index and indices for world GDP, world merchandise trade and world seaborne trade (1975–2012) [11]

2.3.3 Freight Rate

Shipping is a service, in which consumers look for the best possible arrangement through which to have their goods transported to market. If trade grows faster than the global fleet, as was the situation prior to the 2008 downturn, then the market experiences a shipping boom, with the relatively short supply of ships driving up the freight rate. However, if the fleet expands faster than global trade, then the shipping market experiences a recession and the freight rate is forced lower, as ship owners seek to compete for the limited amount of available cargoes for their ships.

As demonstrated in Figure 2.4 below, these freight rates are subject to significant annual variability. The sudden decline in 2009 is dramatic, but it is also important to note that the rate spike in 1973, following the OPEC crisis, was also soon followed by a dramatic decline in freight costs.

[11] Source: UNCTAD secretariat, on the basis of OECD Main Economic Indicators, May 2012; UCTAD, The Trade and Development Report 2012; UNCTAD Review of Maritime Transport press release 658, April 2012, World Trade 2011, Prospects for 2012. The 2012 index for seaborne trade is calculated on the basis of the growth rate forecast by Clarkson Research Services in Shipping Review & Outlook, spring 2012.

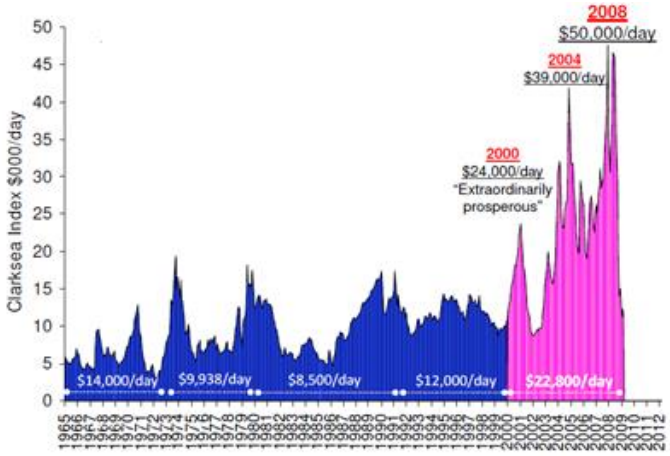
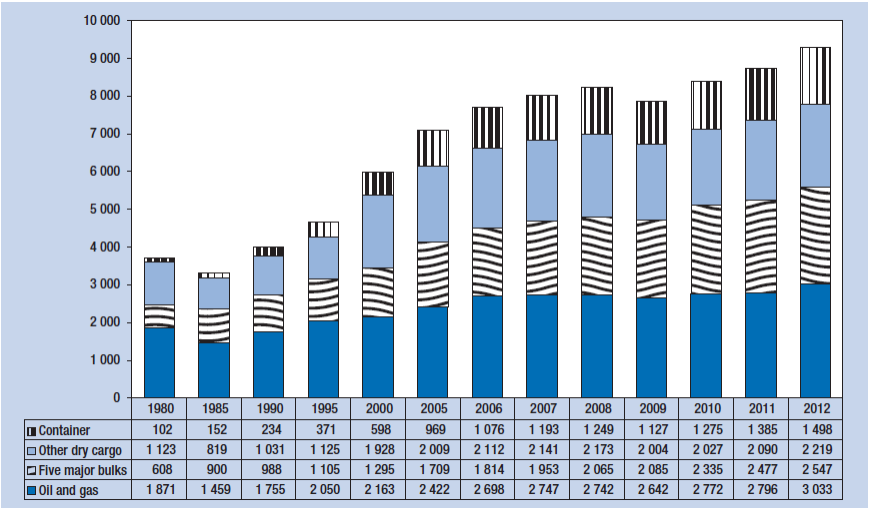


Figure 2.4 Shipping Cycle from 1965 to 2012

Beyond demonstrating the inherent cyclical nature of the marine transportation industry, the freight rate serves as an indicator of the state of this industry and, in turn, the health of the global economy. The volatility in the trends of factors affecting the freight rate constitutes an important global uncertainty which needs to be accommodated in any consideration of future scenarios for the marine transportation industry.

2.3.4 Commodity Prices

A more nuanced view needs to be taken in order to gain a deeper understanding of the relationship between the world economy and the marine transportation industry. In particular, commodity prices and the corresponding profitability of transporting these cargoes represent a more exact expression of the relationship of the demand for shipping. With regard to the total volume of global seaborne trade, there are four dominant cargo types: oil and gas, containers, dry bulk (principally iron ore, grain, coal, bauxite/alumina and phosphate), and other dry cargos. By volume, oil and gas represented a third of the total cargo transported in 2012, a total which was buoyed by recent increases in liquefied natural gas (LNG) production, despite falling crude prices.



	1980	1985	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012
Container	102	152	234	371	598	969	1 076	1 193	1 249	1 127	1 275	1 385	1 498
Other dry cargo	1 123	819	1 031	1 125	1 928	2 009	2 112	2 141	2 173	2 004	2 027	2 090	2 219
Five major bulks	608	900	988	1 105	1 295	1 709	1 814	1 953	2 065	2 085	2 335	2 477	2 547
Oil and gas	1 871	1 459	1 755	2 050	2 163	2 422	2 698	2 747	2 742	2 642	2 772	2 796	3 033

Figure 2.5 - International Seaborne trade, by cargo, selected years (Millions of tons loaded)

Containers represent the most profitable cargo for ship operators, as this cargo type accounted for over fifty percent of the global share in terms of value in 2011. Containerization of non-traditional cargoes is expected to increase in popularity, which will pose an issue for ports in terms of infrastructure development, especially in countries with emerging economies.

In recent years there has been an increase in profitability in the five major bulks, fuelled by growing demand for these commodities from emerging developing countries such as China and Brazil. However, despite the increase in demand, there is expected to be little substantial increase in the profitability of this sector. Since 2007, the dry bulk fleet has increased by 85%, while bulk trade has grown by only 32%. The major bulk market is of particular interest to this study, given the type of proposed projects within the Arctic, especially the Canadian Arctic. The role of emerging economies and their demand for raw materials to fuel their growth represents an important uncertainty moving forward.

Although at present both fresh water and food shipments represent a minimal market, in the future it is expected that these commodities will be increasingly in demand. Driven by unpredictability in global population growth, demand for fresh water and food supplies may thus be viewed as constituting an important uncertainty.

2.3.5 Global Fleet Characteristics

In 2012, the global commercial fleet increased by nearly 10%, bringing it to well over 100,000 commercial vessels with a combined total tonnage of 1,534 million deadweight tonnage (DWT).[12] As explained above, the influx of new vessels is in large part a residual effect of the pre 2008 days, and the order book for vessels due for delivery within the next two years remains high. Orders placed in 2010 and 2011 have been significantly lower, as the glut of available ships has cooled the enthusiasm of ship owners for new vessels.

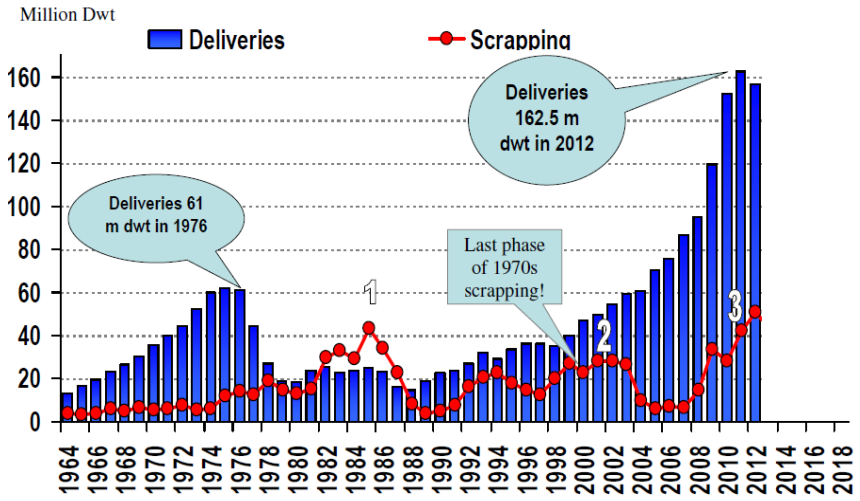


Figure 2.6 The Shipbuilding Cycle- 1964 to 2012

[12] UNCTAD Report

It is expected that there will be a market correction over the coming decade, as narrowed margins due to a lower shipping rate will dissuade ship owners from placing orders for new ships, as occurred following the ship building boom of the early 1970s. However, with the possibility of expanded regulatory regimes and concerns regarding both the environmental impact and the ever-increasing cost of bunker fuel, it is possible that a new round of shipbuilding or at the very least retrofitting will occur. Again these trends in the size of the global fleet constitute an important uncertainty.

2.3.6 Vessel Age

Given the number of new vessels entering the market, some ship owners have found it more profitable to send their vessels directly to the scrap yards rather than operate them at a loss or sell them to potential competitors. While the average age of the fleet is presently around 21.9 years, there are substantial differences in fleet age according to cargo type. In 2012, the average age of dry bulk carriers was 13.2years, and over 40% of the fleet was less than five years old. Container ships have an average age of 10.9 years, while oil tankers exhibit a downward trend with a 15.7 year average, down from 16.4 years in 2011. Due to the employment of general cargo vessels in generally less well-developed markets their average remains high at 23.3 years.

In light of technological advances as well as the coming into force of mandatory regulations for standards such as exhaust emissions and ballast water treatment requirements, owners of older vessels are finding it increasingly difficult to operate their vessels at a profit. Continued adjustments in the preferred age and quality of ships may be expected as the maritime industry faces increased pressures to respond to issues surrounding economic efficiencies and environmental sustainability. Thus trends in vessel age and their implications for ship performance and reliability constitute another important uncertainty.

2.3.7 Vessel Size

In terms of vessel size, ship operators continue to demand larger ships with ever increasing DWT capacity in the pursuit of economies of scale. It should be noted, that most of the vessels in the recent influx of larger containerships have been primarily gearless, and thus reliant on ports having the necessary infrastructure to offload their cargoes. These vessels are limited to trading along traditional routes that service developed economies, particularly within Europe and Asia. Emerging economies are principally served by smaller (and often older) geared vessels, which have not needed large investments in shore-based cargo handling equipment. Consequently there is some concern regarding the need for expanded port infrastructure with these countries, in order to accommodate larger, likely gearless, vessels.

Concerns regarding the increasing size of vessels continue to emerge. One might offer as a good example the statements made by the Chinese government regarding size of the ships ordered by the Brazilian controlled Vale Corporation. Designed to carry iron ore to the Asia market, these Vale-max vessels each have a 400,000 DWT capacity. Chinese officials have expressed concern regarding the ability of these vessels to safely navigate.

Similarly, in terms of oil tankers, the abundance of available vessels in 2012 resulted in numerous tankers being used as floating storage facilities rather than for transportation. As ship

operators struggle to maintain profitability within a challenging market, it can be expected that vessel sizes will continue to increase. These mammoth ships pose a number of complications, both for land based resources such as finding ports with sufficient draft and infrastructure, to limitations in route selection due to draft and beam restrictions.

2.3.8 Fleet Ownership/Registration

The role of open registries, previously pejoratively referred to as 'flags of convenience,' has now been firmly established and broadly accepted, with the top ten open registers containing nearly 57% of the world fleet. Further, foreign ownership has become the norm, as 82% of this tonnage operates under a flag different to that of the nationality of its owners. With this shift in registration seemingly a lasting trend, questions regarding the effectiveness of Flag State versus Port State control will continue to be raised. In particular, this shift triggers concerns for the implementation of various international regulatory regimes, particularly those with the potential to impose significant costs upon ship operators, and especially surrounding environmental regulations. Thus flag ownership and registration constitutes another uncertainty for consideration in the scenario development exercise. The governance considerations of this issue are discussed further in Chapter 4

2.3.9 Bunker Fuel Prices

A growing concern for the marine transportation industry in recent years has been the significant increase in the price of bunker fuel. As Figure 2.7 demonstrates, decades of relatively stable prices have given way to a substantial increase in the cost of bunkers, a trend which is expected to continue. The increased cost of fuel has led some industry experts to predict a movement away from traditional, low fraction burning engines toward non-traditional forms of propulsion, including gas powered units.

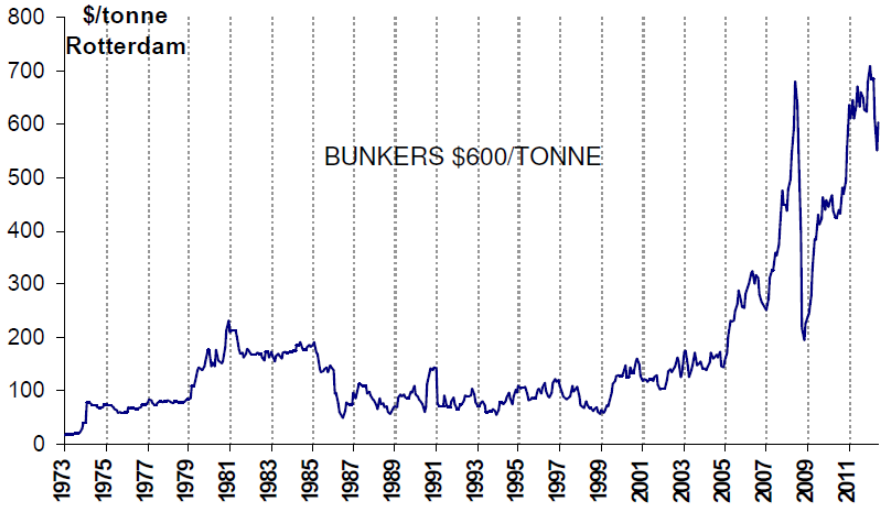


Figure 2.7 Cost of Bunker Fuel (1973 to 2011)

This shift will require a revolution in ship design, in order to accommodate these new forms of propulsion. Increased fuel costs have had, and will continue to have, an impact on the marine

transportation industry, from the use of 'slow steaming' (which, it should be noted, also assists in absorbing excess cargo capacity) to forcing ship operators to seek further efficiencies in their route selection, including the use of non-traditional routes, such as routes through the Arctic.

In addition, there is a clearly evolving movement away from traditional fuels due to concerns regarding the emissions from high sulphur based fuels. Environmental regulations that require ship operators to shift their vessels to a low-sulphur (yet more costly) fuel are expected to lead to a transition to higher fraction distillate fuels or LNG, motivated by both environmental and economic concerns.

2.4 Arctic Trends in Marine Trade and Transportation

From the perspective of the marine transportation industry, Arctic shipping activity may be expected to occur, if operating in the region is viewed as financially viable.

Marine transportation activity within the Arctic can be divided into two primary forms: transit shipping and destinational shipping. Each type of transportation activity has its own unique characteristics. Under certain market conditions, the use of northern passages for transit of the Arctic, whether it be the Northwest Passage (NWP), the Northern Sea Route (NSR) or the trans-polar route, may be considered over traditional southern routes. However, the relative appeal of these routes for vessels traveling through the Arctic will be determined by their respective characteristics. Each passage reflects differing levels of uncertainty with regard to transit feasibility. For example, the NSR and the trans-polar route do not possess the same draft limitations, navigation challenges and regulatory restrictions as the channels of the NWP.

Among the factors affecting the selection of a northern passage over a southern alternative is the need for specialized ships and crews, heightened insurance rates and uncertain cost savings due to unpredictable variables such as weather conditions and seasonal ice-break up. These differing variables are particularly important as they affect the shipping rate that all ship operators consider in determining the appropriate route for their vessels.

Given the inherent uncertainties with regard to using the NWP for transit purposes, it should be recognized that the scale of marine transportation activity in this area of the Arctic in the near future is likely going to be inextricably tied to industrial projects. Heightened global demand for bulk commodities such as iron ore and energy resources have been driving interest in establishing northern resource extraction projects, all of which will likely require marine transportation during both construction and extraction phases.

However, if there is insufficient demand for resources driving commodity prices, northern extraction projects are simply not going to be financially viable. Such development will therefore depend on the health of the global economy.

2.4.1 Arctic Oil and Gas Exploration

Since the 1970s and 1980s, the Arctic has represented for many the last, untapped region for oil and gas. The oil shocks of that era prompted a boom, most famously exemplified by the controversial voyage of the USS *Manhattan* and the corresponding regulatory response from the Canadian government. While industry experts note "the economics of producing any oil or gas

from possible discoveries is uncertain, at least at current oil and gas prices," the estimated reserves of oil and gas located beneath the Arctic Ocean will continue to attract the attention of resource hungry countries[13]. Though estimates regarding Arctic hydrocarbon resources vary widely, studies place the offshore potential at between 3-25% of the total remaining global supply.

Recent finds of significant natural gas reserves within continental North America have the potential to undermine the traditional hydrocarbon market, as these gas reserves are much closer to major urban markets, and therefore require significantly less capital expenditures. This gas type also has certain environmental benefits over traditional fuels. The degree to which natural gas replaces oil as the fuel of choice is a key uncertainty which will affect the growth of northern hydrocarbon projects.

The exploration and development of these Arctic resources is a costly enterprise. Projects will only be attempted in economic conditions where the price of oil may justify these additional costs. Due to these heightened costs, it is only in circumstances where there is a clear business motivation that northern hydrocarbon extraction efforts will move forward. The possibility of an unstable market for oil, coupled with a shift towards natural gas and the introduction of a restrictive regulatory regime resulting in increased production costs, may prohibit the growth of this industry within the Arctic in the short to medium term.

2.5 Canadian Arctic Trends in Marine Trade and Transportation

Having examined some of the principal factors influencing the demand for shipping in the Arctic generally, it is now appropriate to consider the likely nature and extent of shipping activity in the Canadian Arctic.

2.5.1 The limited appeal of the Canadian Arctic for Transit Traffic

An often repeated phrase – at least within political circles – is that the Arctic Ocean is on the cusp of becoming a northern Mediterranean, and that the NWP and the NSR are poised to enjoy regular amounts of shipping traffic.[14] For some, this possibility raises the concerns of old, sub-standard ships crewed by inexperienced captains with little ice training plying the Arctic waters, risking their crews and the health of northern ecosystems.

However, industry experts caution that, while voyages through the NWP do shorten the distance between traditional ports, potential savings in fuel costs are offset by additional financial costs.[15] Therefore, the principal interest of industry in the NWP is not as an international shipping route but rather for destinational activity, in particular Arctic sea-lift operations.

The disinterest in the NWP revolves around the uncertain cost-saving advantages of using this route, as well as important safety issues. These concerns include insufficient maritime services available to support commercial traffic; loss of fuel economy due to the need to adopt variable

[13] (Blaizot, 2011)
[14] (Grímsson, 2010)
[15] (Seidler, C. & Traufetter, G., 2010)

speeds while navigating the narrow channels of the NWP; the additional costs of constructing ice-class ships; and heightened insurance premiums for Arctic voyages.

2.5.2 Expected Forms of Maritime Activity within the Canadian Arctic

Transit Traffic

Despite strong predictions and pronounced expectations over the last four decades, stirred in part by the intense political rhetoric over the transit passages of the USS *Manhattan* in 1969 and the USCG *Polar Sea* in 1985, there has in fact been very limited commercial traffic passing through the Canadian Arctic in recent years, and virtually no commercial transit traffic. While contemporary developments, driven by increased accessibility and technological advancements have resulted in modest increases in activity, no major expansion is expected in the near future.

Cruise Tourism

Since 1984, cruise ship operators have offered trips to Arctic destinations and even through the NWP. In 2008, over 2,400 passengers toured the Canadian North during 26 different transits.[16] This total is expected to increase in coming years, and is cause for concern given the considerable number of passengers and crew carried by these vessels, the tendency for voyages to venture outside of well-charted shipping routes and the potential for environmental damage in the event of an accident. These vessels may act as engines of economic growth, but this benefit carries with it significant social impacts which must be considered. There is limited opportunity for continued expansion within this industry, and it is expected that tourism traffic levels will enjoy only modest expansion in the coming years. At the same time, there is expected to be a modest but growing amount of recreational pleasure craft activity.

Community Re-supply

The Northern territories are home to over 100,000 Canadians, a growing demographic which expanded by nearly 20% between 1996 and 2006.[17] With a lack of road infrastructure within much of the Canadian Arctic, transportation requirements of additional supplies must be satisfied by either air or marine deliveries.

Changes to permafrost integrity will have a negative impact on both the safety and effectiveness of moving goods and people overland through the Canadian Arctic. More particularly these changes will result in the increased use of sea lifts for community re-supply.[18] As noted by Stephenson *et al*, "barring construction of new all-weather road networks, and contingent upon sufficient river levels, late-fall ground traffic in the inland Arctic may increasingly take the form of river vessels rather than automobiles".[19]

The northern transportation network will clearly need to adapt in the face of the changing Arctic environment. Inland transportation losses will be offset by increased accessibility for marine transportation, as the Canadian Arctic is expected to become 30% more accessible to capable

[16] (Lück *et al*., 2010, 4).
[17] (Nunavut Bureau of Statistics, 2010)
[18] (Doré, 2010)
[19] (Stephenson *et al*., 2011, 157

vessels by mid-century. The Mackenzie River represents a further opportunity for ship operators in the region, and in 2013, several companies announced that they would be expanding operations into this region during the coming years.

Of all Canadian Arctic activities giving rise to marine transportation demand, community resupply is perhaps the most predictable as an operation, which will continue to generate a steadily expanding need for northern shipping.

Oil and Gas Exploration in the Canadian Arctic

Speculation regarding potential hydrocarbon reserves within the Canadian Exclusive Economic Zone (EEZ) has prompted renewed interest in offshore Arctic exploration, particularly in the Beaufort Sea. Between 1972 and 1989, 86 wells were drilled in this region, and though nearly two decades have passed since the last commercial offshore operation, oil corporations have spent millions on exploratory licences during recent years. Despite this interest, it should be noted that there are no projects presently underway within the Canadian Arctic.

Further, shifts in fuel types and the rise in the demand for natural gas have the potential to undermine the economic feasibility of northern hydrocarbon projects in the Canadian Arctic

Regardless of the status of offshore exploration, the Canadian oil industry may still have an impact upon Arctic marine activity. There have been proposals to use the port of Churchill to expedite the delivery of oversized loads to Albertan oil operations. There is also a proposal (albeit still lacking any persuasive rationale) for developing the 'Arctic Bridge' route between Canada and Murmansk, Russia. Churchill's development thus remains in doubt, as there are questions regarding the long-term economic viability of the port. These questions include the lack of a significant population base, the absence of infrastructure servicing inland rail transportation to bring goods to and from the port, and inadequate marine support services.

In summary, with a lack of clear support from industry or government, the status and influence of oil exploration within the Canadian Arctic remains uncertain.

Mineral Resources

Both private and government funded mineral based initiatives have been announced in recent years. Projects such as the Ekati, Diavik and Snap Lake diamond mines have operated in the western Arctic for nearly a decade, and the Raglan mine in Quebec and the Voisey's Bay mine in Labrador have both produced nickel for a number of years.[20] The feasibility of developing mineral deposits within the Arctic such as iron ore, nickel, copper, zinc, cobalt, antimony and rare earth metals are in the process of being evaluated, including projects in Doris River (Gold), Thelon Basin (Uranium) and Chidliak (Diamond).

One project that is expected to commence regular shipments in the not-too-distant future is Baffinland's Mary River Iron Ore Mine. However, shipments remain unscheduled, in large part due to the economic decline in 2008 and the emergence of new mines in such foreign locations as Brazil.

[20] (Costello & Senkow, 2011)

The depressed market for bulk commodities, coupled with the possibility of an oversupply of these materials and a sluggish global economy, continues to inject uncertainty into the future of northern extraction projects.

Arctic Fishery

While not strictly falling within the definition of marine transportation, it is to be noted that commercial fishing operations, which constitute marine activity requiring support and oversight, are pushing further northwards over an ever-lengthening season. Further, the possibility of foreign fleets seeking to fish within Arctic waters may present a challenging governance situation for Canadian authorities that will have to be addressed.

2.6 Chapter Summary

From this brief overview of the market forces underlying the marine transportation industry, it is reasonable to assume that shipping activity will only expand into northern waters if a substantive demand exists, and it is financially viable to do so. As set out above, any decision to use the Arctic for transit purposes is contingent on a number of circumstances that have yet to materialize. It is also important to note is that the demand for ships to service northern extraction projects will only occur as and when the bulk market attains a freight rate that is able to sustain the significant extraction and transportation costs.

What is clear is that there are a number of commercial and market factors that constitute important uncertainties as to how the marine transportation industry will evolve over the course of the next ten or fifteen years in the Canadian Arctic. These uncertainties will be further considered later in the study.

Chapter 3 - Public Interest Considerations in Relation to Marine Transportation in the Canadian Arctic

3.1 Introduction

This Chapter will examine the second 'force', namely the public interest elements associated with the marine transportation industry. Again, these elements will be addressed, from three levels of consideration: from the global context and then in relation to the Arctic and Canadian Arctic.

A first step is to explain the meaning of 'the public interest' in the context of this scenario development exercise. There is also a need to understand how the public interest interacts with the other 'forces' influencing the evolution of marine transportation, the economic and commercial drivers of shipping activity and the associated governance regimes.

In this respect, Chapter 3 will explore the issues that are likely to be of concern to society at large, including issues related to climate change, the environmental impacts of marine transportation, as well as major safety and security concerns at the three levels of consideration.

3.2 What is meant by 'Public Interest'?

It is important to clarify the notion of 'Public Interest' for the purpose of this project, both generally and as it relates to marine transportation. 'Public interest' is commonly defined as the well-being or welfare of the general public. With respect to marine transportation, the protection of the public interest represents those societal norms and standards that constitute benefits or problems attributable to marine transportation. Typically, the public interest is best served when marine transportation services are economical, efficient, adequate, socially beneficial, safe, secure and environmentally sustainable.

3.3 Dimensions of the 'Public Interest' as it relates to Marine Transportation

3.3.1 Climate Change Considerations

Global Climate Change

Not surprisingly, the starting point in our analysis of the 'Public Interest' is clear recognition and acceptance that climate change constitutes a major issue. A necessary assumption is that climate change is a global phenomenon and a key uncertainty, not only in terms of the rapidity at which change is occurring, but also the fact that anthropogenic influences are an important contributing factor to this rapid change. It is also important to highlight the fact that the Arctic is particularly vulnerable to the impacts of climate change, and that this fundamental reality needs to be fully accommodated in the scenario development process.

Other important factors that need to be taken into account in the development of future scenarios include recognition that energy consumption has risen significantly in the past decade, and population increase has undoubtedly contributed to this trend. Furthermore, human consumption of energy and the use of fossil fuels such as oil, natural gas, and coal are imposing major stresses

on the environment and this trend will likely continue at least over the course of the next decade, until viable alternatives become more accessible.

It is well documented that the burning of fossil fuels releases high levels of GHGs into the atmosphere, the majority of which is carbon dioxide (CO_2). Annual emissions of CO_2 have increased by approximately 80%, from 21 to 38 gigatonnes between 1970 and 2004.[21] In addition, between 1995 and 2004, the average rate of growth for CO_2 emissions was double the average rate of growth between 1970 and 1994. These rising CO_2 emissions, along with other GHGs such as methane (CH_4) and nitrous oxide (N_2O) emissions contribute to the Greenhouse Effect. These trends may be expected to have an important influence on our scenario development.

When GHGs build up and prevent infrared radiation from passing through the atmosphere, it is instead re-emitted towards the Earth, causing it to retain heat energy. Although this process happens naturally and is necessary for the planet to maintain a consistent temperature balance, anthropogenic influences are a relatively recent and major contributor. Therefore, human energy consumption and the resulting increases in GHGs are causing this equilibrium to shift and are altering the state of the global environment. This shift could impact many industries and again represents a key uncertainty that must be considered in our scenario development.

Furthermore, the global warming process may well lead to major shifts in climate including changes in temperature, severe precipitation events, the melting of Arctic sea ice, changes in ocean circulation, increased ocean acidification, and the thermal expansion of ocean waters.[22] Both the melting of Arctic sea ice and the thermal expansion of ocean waters contribute to the issue of sea level rise. Sea level rise is a global issue; however, it will have more serious localized impacts, especially for low-lying coastal areas.

Climate Change in the Arctic

While the effects of global climate change are, and will continue to be, felt worldwide, it is important to highlight the fact that the Arctic is particularly vulnerable to the impacts of climate change. This fundamental vulnerability needs to be accounted for. Furthermore, it must be understood that the Arctic environment is unique and particularly sensitive to change. Due to the ice-albedo feedback loop, climate change will have a more prominent impact on the polar regions. In the Arctic, the solar rays hit at a sharper angle during the summer when sea ice is melting to become open water, which then absorbs more radiation.[23]

Both the extent of Arctic sea ice and its average age are important indicators of global warming, and both have decreased in recent decades. According to satellite records for the Arctic Ocean dating back to 1979, annual ice extent has decreased by approximately 2.7% per decade, with a decrease in summer ice coverage by approximately 7.4% per decade.[24] Diminished ice extent, age, and thickness over the past several decades have also caused air temperatures in the Arctic

21 See IPCC Fourth Assessment Report: Climate Change 2007.
22 See UNEP 2009 Blue Carbon: A Rapid Response Assessment.
23 See Arctic Meltdown: The Economic and Security Implications of Global Warming by Borgerson (2008).
24 See Forecasting the consequences of climate-driven shifts in human behaviour on cetaceans by Alter et al. (2010).

to rise at more than double the rate of anywhere else in the world.[25] These trends have been consistent and it is therefore safe to predict that they will continue over the next ten to fifteen years.

Additional Arctic warming of about 4-7°C over the next 100 years is expected to occur due to the continued burning of fossil fuels.[26] Rapid warming in the Arctic attributable to this cause, and the subsequent melting of sea ice is a key uncertainty that must be recognized in the scenario development process. The rate at which warming occurs will play a key role in how climate change may impact the marine transportation industry in coming years.

It is also critical to look beyond the reduction of sea ice and consider its implications on the Arctic marine ecosystem as a whole. These ecosystems are inherently more vulnerable to change than other temperate and tropical ecosystems. This can mainly be attributed to the short and sensitive Arctic food chain, which is entirely dependent on seasonal phytoplankton and algae blooms that form underneath the ice and ice edges of Arctic waters. Sea ice regulates pelagic and benthic production, as it plays a role in controlling the stratification of the water column and light penetration.

Sea ice algae also contribute to total primary production from 4-26% in seasonally ice-covered waters.[27] As a result, ice breakup and a pronounced retreat in snow and ice cover will greatly affect primary production. This in turn will cause unknown cascading effects on other trophic levels, particularly impacting marine wildlife with narrow habitat and niche requirements.

Research shows that reductions in sea ice will drastically shrink marine habitat pushing some species toward extinction, especially those species which are heavily dependent on sea ice.[28] In addition, caribou, reindeer, and other land animals are likely to be increasingly stressed as climate change alters their access to food sources, breeding grounds, and historic migration routes. Species' ranges are projected to shift northward on both land and sea, bringing new species into the Arctic while severely affecting established northern species. As new species move in, animal diseases that can be transmitted to humans, such as West Nile virus, are likely to pose increasing health risks.[29]

Furthermore, the direct and indirect impacts shipping and icebreaking will have on Arctic ecosystems are key uncertainties that must be taken into consideration when it comes to scenario development.

In addition, the impact on land is also uncertain, but it is expected that the treeline will move northward and to higher elevations, with forests replacing a significant fraction of existing tundra, and tundra vegetation moving into polar deserts. While increased areas of tree growth in the Arctic could help absorb CO_2 and supply more wood products and related employment, it is

25 See Challenges of Climate Change: An Arctic Perspective by Corell (2006).
26 Ibid.
27 See Sea-ice algae: Major contributors to primary production and algal biomass in the Chukchi and Beaufort Seas during May/June 2002 by Gradinger (2009).
28 Implications of Climate Change for Northern Canada: Freshwater, Marine, and Terrestrial Ecosystems by Prowse (2009).
29 See Challenges of Climate Change: An Arctic Perspective by Corell (2006).

also likely to intensify regional warming and encroach on habitat for many birds, reindeer, caribou, and other species. Forest disturbances such as fires and insect infestations could allow invasive species to succeed. In addition, agriculture will have the potential to expand northward due to a longer and warmer growing season. Some Arctic marine fisheries are likely to become more productive, while Northern freshwater fisheries that are currently the mainstays of local diets are likely to suffer.[30]

Research shows that severe coastal erosion will be a growing problem as rising sea level and a reduction in sea ice allow higher waves and storm surges to reach the shore. It is predicted that along some Arctic coastlines, thawing permafrost will weaken coastal lands, adding to their vulnerability. With this, the risk of flooding in coastal wetlands is projected to increase, with expected negative impacts on northern communities and natural ecosystems.

Furthermore, under these conditions, land based transportation and industrial projects, including oil and gas extraction and forestry, will increasingly be disrupted by the shortening of the periods during which ice roads and tundra are frozen sufficiently to permit travel. Many existing buildings, roads, pipelines, airports, and industrial facilities are likely to be destabilized, requiring substantial rebuilding, maintenance, and investment.[31] Changes in permafrost poses many issues for increased infrastructure in the Arctic and will certainly impact any infrastructure development in the Arctic, including projects related to the marine transportation industry.

Climate Change in the Canadian Arctic

There are several ecologically significant and sensitive marine areas in the Canadian Arctic that are especially vulnerable to climate change and other stressors, as demonstrated in Figure 3.1.

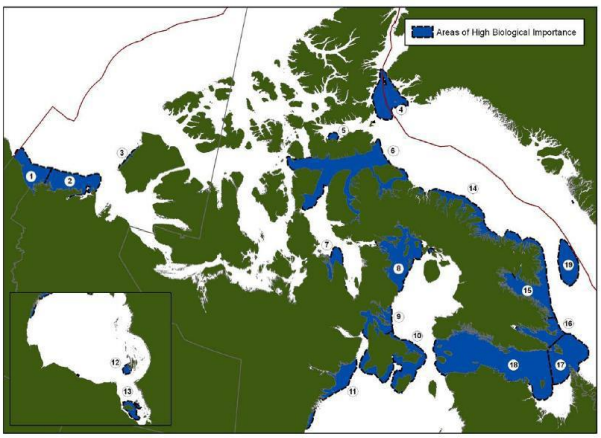


Figure 3.1 Map of the areas in the Canadian Arctic of high biological importance.[32]

Many of these areas of high biological importance also have a high overlap of species, demonstrated in Figure 3.2. The effects of climate change will be most heavily felt by the communities that depend on species located in these particular areas of the Canadian Arctic.

30 See Challenges of Climate Change: An Arctic Perspective by Corell (2006).
31 See Challenges of Climate Change: An Arctic Perspective by Corell (2006).
32 See The Arctic Marine Workshop Report, February 16-17, 2010, from the Department of Fisheries and Oceans.

	SPECIES/SPECIES GROUP									
AREA	Toothed whales	Bowhead Whale	Seals	Walrus	Fishes	Polar Bear	Seabirds	Shrimp, coral and sponges	Productivity	Total overlapping in area
1. Yukon North Slope	X	X	X		X	X	X			**6**
2. Cape Bathurst/Tuktoyaktuk Peninsula	X	X	X		X	X	X		X	**7**
3. Banks Island East Coast		X	X			X	X			**4**
4. North Water Polynya	X	X	X	X			X		X	**6**
5. Jones Sound			X	X	X	X				**4**
6. Lancaster Sound complex	X	X	X	X		X	X		X	**7**
7. Pelly Bay/Cape Chapman	X	X	X		X	X				**5**
8. Northern Foxe Basin	X	X	X	X	X					**5**
9. Frozen Strait/Repulse Bay	X	X	X	X	X		X			**6**
10. Southampton Island		X	X	X		X	X			**5**
11. Chesterfield Inlet	X	X	X	X	X					**5**
12. Belcher Islands			X	X	X		X		X	**5**
13. Akimiski Island/James Bay	X		X			X	X			**4**
14. East Baffin Coast	X	X	X	X			X	X		**6**
15. Cumberland Sound	X	X	X	X	X	X	X			**7**
16. Frobisher Bay	X	X	X	X	X	X	X			**7**
17. Resolution Island	X	X	X	X			X	X		**6**
18. Hudson Strait	X	X	X	X			X	X	X	**7**
19. Davis Strait	X	X	X					X		**4**

Figure 3.2 Species and species groups found within the areas of high biological importance in the Canadian Arctic.[33]

Such areas of high biological importance will likely play a critical role in how marine transportation in the Arctic develops. How these areas are viewed and the importance they are given by the local communities, the public, and the government may impact the shipping industry, especially if any form of future protection is established. This is an important consideration that must be taken into account in our scenario development.

Therefore while it is assumed that the scale of expanded northern shipping activity is not sufficient in itself to cause major contributions to pan-Arctic climate change trends, such activities are nonetheless viewed as having the potential to impact the environment to an important degree.

3.3.2 Environmental Protection and Response Considerations

Another dimension of the 'public interest' that must be considered in the scenario development process is the potential increase in the risk of environmental incidents associated with expanded shipping activity. The possibility of an environmental incident highlights the need for prevention technology such as ship construction requirements, cold weather equipment, and navigational technology. Also of concern is the current capability or capacity to respond effectively to environmental incidents, such as oil spills.

33 See The Arctic Marine Workshop Report, February 16-17, 2010, from the Department of Fisheries and Oceans.

The maritime shipping industry contributes minimally to the degradation of the marine environment relative to other anthropogenic activities. However, there are always going to be risks to critical marine habitat and species associated with shipping. Environmental threats to the marine ecosystem related to maritime transportation include vessel strikes with large marine mammals, noise disturbance, habitat disturbance, light disturbance, invasive or alien species and marine pollution from emissions, accidental spills or operational discharges.

Vessel Strikes

Vessel strikes are a major issue for various species of cetaceans, as they must surface for respiration, while other species must surface for feeding purposes. Furthermore, studies have shown that large whales do not often make attempts to avoid vessels. This could be because they have become accustomed to the sound of approaching vessels or because of other unknown reasons yet to be examined. In addition, while acoustic devices used to deter Harbour porpoises from approaching fishing gear, other studies have indicated that Humpback and Minke whales often approach these devices. It has been suggested that these 'alarms' cause whales to swim to the surface, potentially putting them at even greater risk of being struck by a vessel.[34]

Noise Disturbance

Increased shipping traffic will lead to increased ambient noise within the surrounding area. Increased ambient noise in Arctic waters may disrupt species' behaviour; cause the abandonment or trampling of young; or displacement from traditional habitat. Cetaceans rely on sound for communication, navigational purposes, and for detecting the presence of predators. Therefore, noise from ships can easily disturb important behavioural characteristics of whale populations or even lead to temporary or permanent hearing loss. It has been found that many whales are calling louder to be heard over vessel noise or are simply not calling at all. Noise induced stress negatively affects reproduction, causes a shift in feeding habits, or leads to site abandonment. In addition, icebreaking near important haul-out sites, where pinnipeds manoeuvre themselves out of the water onto land or ice using their pectoral flippers, or near important areas for birds, could disrupt behaviours critical to mating, foraging, or migrating, and could lead to site abandonment.[35]

Kipple and Gabriele (2007) studied a variety of vessels and found that at a speed of 10 knots, the minimum sound level produced by a vessel was 157 decibels (dB) and the maximum was 182 dB. However, ice-breaking vessels have been regularly known to produce sound levels over 200 dB. Studies done on bowhead and gray whales have indicated that baleen whales avoid continuous noise levels above 120 dB, suggesting that the majority of ships will disturb whales within close proximity.[36] Furthermore, the speed of sound in water is much higher than it is in air, and noise can travel much greater distances in water. Therefore, the greater the number of ships in an area, the more difficult it will be for various species to avoid ships and the noise they produce.

34 See Reducing the risk of lethal encounters: vessels and right whales in the Bay of Fundy and on the Scotian Shelf by Vanderlaan et al. (2008).

35 See Do Marine Mammals Experience Stress Related to Anthropogenic Noise? by Wright et al. (2007).

36 See Swimming Against the Tide: Empty nets and barren seas by the Environmental Investigation Agency (2010).

In addition, the size and speed of a vessel, as well as its propulsion type and horsepower may have an effect on the level of noise disturbance and the implications for marine organisms.[37] Frequency also plays a role, as cetaceans have the broadest acoustic range of any other group of marine mammals. While toothed whales are particularly sensitive to high frequency sounds above 1 kilohertz (kHz), baleen whales are most sensitive to low frequency sounds below 1 kHz. Although animals are more vulnerable to sound at their more sensitive frequencies, they can also be affected by sounds at other frequencies.[38]

Icebreakers and Habitat Disturbance

In addition to the issue of noise disturbance caused by icebreakers, the process of icebreaking may possibly have an impact on critical habitat for various marine Arctic species. Sea ice is of the utmost importance for marine mammals such as pinnipeds and polar bears. Therefore year-round icebreaking in the Arctic could aggravate the issue of reduced ice cover for these species. Furthermore, pinnipeds, which include various species of seal and walrus, are highly dependent on sea ice for pupping, foraging, moulting, and resting. Polar bears are also reliant on the sea ice for efficient hunting and traveling. In addition, the timing of migration for Arctic cetaceans is affected by the breakup of seasonal ice, which has been documented in Baffin Bay and Davis Strait for narwhal.[39] Therefore, expanded icebreaking activity in the Canadian Arctic might result in modest shifts in marine mammal migrations and distributions.

Invasive Species

The potential for introduction of invasive species to Arctic waters from shipping activity could result in a cascade of impacts on the northern marine environment. While it is difficult to predict the consequences of such an event they can be expected to be serious. Furthermore, the nature and extent of impacts that invasive species may have on a marine area are dependent on many factors, making the predictive process extremely complex. Other species may be expected to be directly or indirectly impacted by a reduction or increase in species lower or higher on the food chain, particularly key prey or predator species. Therefore the risk associated with the introduction of an invasive species may be viewed as an important uncertainty in the scenario development process.

The most likely scenario for this to occur has been through the discharge of a ship's ballast water that contains some form of alien species. Ballast water is used to manage the stability, trim, and structural integrity of a vessel, usually in situations where it is not carrying a full load of cargo. In the past, ships have used rocks, sand, or metal as ballast material, but today ballast management is nearly universally accomplished with the use of (usually sea) water.

While ballast water is not particularly conducive to sustaining marine life, in some cases particularly resilient species are capable of surviving when transported long distances by ship. In the Arctic the likelihood of an invasive species surviving is no doubt even lower due to colder

37 See Underwater Noise from Skiffs to Ships by Kipple and Gabriele (2007).
38 See Swimming Against the Tide: Empty nets and barren seas by the Environmental Investigation Agency (2010).
39 See Observations and Predictions of Arctic Climatic Change: Potential Effects on Marine Mammals by Tynan and DeMaster (1997).

temperatures, but without proper precautions the introduction of such a species remains a possibility.

Concern over the transportation of invasive species has led IMO to develop the International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM) Convention, which calls for ballast water to be treated before it is discharged. Before this treatment requirement becomes obligatory, offshore exchange is regarded as an acceptable alternative. There are, however, certain safety issues associated with dumping ballast water in mid-transit, and to mitigate this risk, ships are currently authorized to exchange ballast in designated coastal waters. This could present difficulties for the Arctic, at least in the short term, until the treatment of ballast water becomes mandatory.

The introduction of invasive species can also occur through the transport of organisms attached to the hulls and external structures of ships. In order to prevent hull contamination, anti-fouling paints are applied. In the recent past, however, certain paints such as tri-butyl tin have been used, but these paints were found to leach harmful chemicals. In 2001, under the auspices of IMO, the International Convention on the Control of Harmful Anti-fouling Systems on Ships, 2001 (AFS 2001) came into force, banning the use of such paints New anti-fouling paints and coatings that are less toxic have been developed over the years and many nations, including Canada, now regulate marine coatings. As a result, the industry has taken the lead in continuing to develop better ballast water treatment systems and anti-fouling coatings are expected to have less of an impact on the environment. However enforcement of this requirement presents some challenges in the Arctic.

Air and Marine Pollution

Pollution in Arctic waters from ships' exhaust emissions, accidental spills or the dumping of waste oil, garbage, sewage, grey water or other hazardous waste are issues that demand attention if the fragile ecosystems of the North are to be protected. Exhaust emissions from ships include CO_2, SOx and NOx, which contribute to the Greenhouse Effect and ozone depletion. The most recent GHG study from IMO estimated that the emissions of the shipping sector in 2007 amounted to 3.3% of annual global emissions in. While this total is more than international aviation and rail transport's emissions combined, it must be remembered that the global shipping fleet carries 90% of the world's cargo by weight. As demand for additional transportation capacity continues with a corresponding growth in the industry, and unless strong steps are taken to counter this trend, it may also be expected that these emissions will continue to increase, which makes it an important consideration for the scenario development process.

While there were around 25 major spills (over 700 tonnes spilt) per year in the 1970s, there were only approximately four spills per year in the 2000s.[40] It is then reasonable to conclude, that the shipping industry's implementation of pollution prevention standards is having a positive impact. However the issue is still of considerable concern for particularly vulnerable areas, a spill of any size would have serious consequences for the Arctic environment.

40 See International Tanker Owners Pollution Federation Report on Statistics: Numbers and Amounts Spilt (2010).

While there has been a significant decrease in the average frequency and size of large oil spills over the past several decades, the risk of a large spill occurring can never be completely eradicated. In 2010, there were three major spills from ships, and a devastating spill from the Deep Horizon oil rig in the Gulf of Mexico. While this last spill did not originate from a ship, it presented to an extreme degree the challenges facing marine oil spill response. Small and medium spills whether of less than 7 tonnes or between 7 to 700 tonnes, remain a concern, as they can negatively impact habitat and wildlife. It is reasonable to assume that spills arising from collisions and groundings are more likely to occur in coastal waters.

The dumping of garbage, as well as accidental or operational discharges of oily and chemical wastes in the offshore marine environment can pose serious environmental problems to marine biodiversity. Specifically in the Arctic, migratory birds and pinnipeds are more likely to be affected by oiling than cetaceans because of their feathers or fur, which lose their insulating properties when oiled. However, oil may still harm the eyes and baleen of a whale, and inhaling vapours from the water's surface could also be hazardous to these animals.[41]

The consequences of a spill depend greatly on the type and amount of substance released into the environment. In some cases, waste may be more easily broken down than in others and may impact various organisms differently.[42] However, it is to be expected that critical ecosystem processes will be affected and that prolonged exposure or ingestion will be toxic to marine life, including plant, plankton and invertebrate species, seabirds, and marine mammals. Due to the presence of ice, spills in Arctic waters are more difficult to contain and mitigate because of operational challenges. Furthermore, colder water temperatures in the Arctic reduce the ability of petroleum hydrocarbons to be broken down naturally. This heightens the potential for cumulative impacts to be felt in the long term, in addition to the immediate impacts of a spill.

The Canadian Coast Guard (CCG), working in collaboration with industry and local communities, is responsible for the Arctic response capability. Masters of vessels 300 gross tonnage (GT) or more are required to report to Northern Canada Vessel Traffic Services (NORDREG), operated by Marine Communications and Traffic Services (MCTS).[43] When a spill occurs, it must be immediately reported. The complicated logistics associated with assembling response equipment is an important limiting factor in providing effective emergency response in the Arctic. Therefore, the response effectiveness of existing infrastructure is a vital component in reducing the level of exposure and disturbance to marine organisms if a spill occurs.

The CCG recently spent more than $2 million supplying 19 Arctic communities with environmental response equipment. Containers with surface booms and accessories, shoreline clean-up equipment, small vessels, outboard motors and trailers were provided.[44] While communities have been supplied with this response equipment, there is clearly a need for the

41 See Forecasting the consequences of climate-driven shifts in human behaviour on cetaceans by Alter et al. (2010).

42 See International Tanker Owners Pollution Federation Report on the Effects of Oil Spills: Environmental Impacts (2010).

43 See Transport Canada (2010), Northern Vessel Traffic Services (NORDREG).

44 See Department of Fisheries and Oceans article titled Government of Canada Invests Over $2 million in Arctic Environment Response Equipment (2010).

CCG to focus on training community members in how to use the equipment provided. This is particularly important since most of the vessels in the CCG's icebreaking fleet are over 30 years old and may not operate in the Arctic year-round.[45]

Due to the vastness of the Arctic and the difficulty of navigating during the winter season, spill response is extremely difficult. While having plans in place is crucial, the remoteness of the Arctic will limit the ability of the CCG to respond to an emergency in a timely manner. Therefore, it is clearly desirable for all ships operating in the Arctic to carry a limited amount of response equipment, such as surface booms and accessories, and protective gear for crew members.

Despite these modest efforts, a major oil spill in the Arctic still remains an ecological 'nightmare', and a potential 'showstopper' for the marine transportation industry. The implementation of the International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC) and its translation into national legislation in many countries has resulted in large investments in organizational arrangements, response equipment provision and extensive training for all responders. Despite this, virtually no major spill has been effectively contained and controlled before extensive damage has been caused. It is clearly, therefore, one of the most important risks to consider during the scenario development process.

3.3.3 Safety of Life Consideration

Another important dimension of the public interest is safety. In the context of marine transportation, safety concerns are primarily directed at seafarers but can extend to others such as the passengers on a ferry or cruise ship, and indeed all members of the general public. Well-established international regimes such as the International Convention for the Safety of Life at Sea (SOLAS), the Standards of Training, Certification and Watchkeeping (STCW), the International Convention on Load Lines and International Regulations for Preventing Collisions at Sea (COLREG) conventions provide a very effective safety regime, if carefully and comprehensively implemented.

Marine transportation safety in the Arctic is less well understood and provided for. Very recently, efforts have been invested in the development of the Polar Code in order to address this shortcoming, but this Code has yet to be implemented. The Code and parallel initiatives to provide information and support are urgently needed, since northern conditions present unique and serious challenges to the safe operation of ships in these regions.

More particularly, as ice cover continues to diminish, the melting of sea ice has resulted in increased ice movement within the NWP. This is tending to make shipping activities more difficult and more dangerous due to hazardous, free-flowing multi-year ice. This situation gives rise to increased potential for more accidents to occur at sea, putting the lives of many people at risk. It is necessary to consider the implications of a major safety incident in order to understand its implications for regulation and support in the Arctic, and to factor those implications into the scenario generation process.

45 See 2009 Arctic Marine Shipping Assessment Report.

Navigating Arctic waters is always a risk, due to extremely cold temperatures, ice, and strong seasonal variability. According to the CCG, there are two major problems with using navigational charts in the Arctic: the uncommon projections that must be used, and the accuracy of the surveys.[46] The preferred Mercator projection cannot always be used, as the meridians converge near the poles, causing distortion in the chart. In addition, the accuracy of charts can vary widely according to survey dates. Frequently travelled areas such as Lancaster Sound and the Barrow Strait are well surveyed, but most other less travelled areas are not well surveyed. Furthermore, there are currently no designated shipping lanes through the Canadian Arctic that identify a safe route for vessels.

The Arctic Shipping Pollution Prevention Regulations (ASPPR) require ice navigators to be carried on board many vessels operating in Canadian Arctic waters. Ice navigators "must have served on a ship as master or person in charge of the deck watch for 50 days or more. Thirty of those days must have been spent in Arctic waters where the ship required assistance from an icebreaker or had to make manoeuvres to avoid concentrations of ice."[47] There is currently no standardized ice navigation training or international standard, although requirements addressing these standards are expected to be included under the Polar Code.

The best way in which to monitor vessel traffic is through the use of vessel monitoring systems (VMS), automatic identification systems (AIS), and long-range identification and tracking (LRIT) systems. These systems not only facilitate communications, which could be invaluable in the case of an emergency, but also allow maritime authorities to track vessels and their activity. Information provided may include a vessel's IMO number, the type of vessel, as well as its position, course, speed, destination, and any hazardous cargo that it may be carrying.[48]

Under Regulation 19 of SOLAS, Chapter 5, all internationally voyaging ships of 300GT, as well as cargo ships of 500GT and all passenger vessels must carry AIS. However, the lack of communication infrastructure limits the use of AIS in the Arctic. In addition, very high frequency (VHF) signals from traditional AIS only have a range of 74 km, which severely restricts coverage.

While the range of VHF signals from traditional AIS has limited its use in polar regions, LRIT and Satellite AIS will provide better coverage of shipping activity in the Arctic. In addition, the use of these systems facilitates improved response time for emergencies, including, environmental spill response. In contrast, while these types of monitoring and enforcement systems helps in preventing vessels from entering restricted areas or travelling too fast, they cannot be used to enforce regulations with respect to spills or other forms of disturbance that may occur during transit.

Other hazards in the Arctic that could lead to accidents and threaten the safety of lives at sea include long polar days in summer, and long polar nights in winter. This variability in light and dark can disrupt sleep patterns and influence human error rates. In addition, knowledge of local oceanographic conditions (e.g. currents) may be limited, as well as the availability and/or

46 See Canadian Coast Guard Report on Ice Navigation in Canadian Waters (2010), Chapter 4: Ice Navigation.
47 See Transport Canada (2010), Ice Navigators.
48 See IMO DE 55/12/9 (2011).

interpretation of meteorological data and forecasts. Arctic weather conditions may be highly variable and unpredictable, and there could be long periods of limited visibility.

Despite all precautions, situations arise where equipment or back-up capacity fails because of extreme cold or ice. The remoteness of polar waters and extreme cold also makes ship repairs more difficult, a situation exacerbated by limited infrastructure support, such as ports or shore based navigation support (lighthouses, beacons, vessel traffic services). Ship stability problems can arise due to extreme icing on a ship's superstructure. The remoteness or proximity to magnetic poles may result in some systems not functioning as specified (e.g. compass, gyro, INMARSAT communication reliability or reduced download speeds).

Safety challenges as described above present major challenges for ship operators in the Arctic, and it is a not an unreasonable expectation that a major safety incident will occur in Arctic waters during the next decade. The likelihood of such an incident occurring could therefore be viewed as an important uncertainty in the scenario development process.

3.3.4 Security and Sovereignty Considerations

The core issue in relation to Canadian Arctic sovereignty is control, and the core issue in relation to Canadian Arctic security is having the capability to respond to threats to this sovereignty. These two are closely interconnected and should not be separated. Security issues in the Canadian Arctic are complex and go beyond the traditional threats posed by other nation states. Today the concept of security has been expanded to include issues of "human security" including threats that involve economic, environmental, societal, and cultural issues.[49] For example, transboundary pollutants are already an issue since they impact Northern communities that rely on country food, in which toxins are bio-accumulating. Moreover, as major societal transitions occur in the Arctic, it may lead to further alcohol and drug abuse in local communities, or contribute to higher suicide rates.

There are additional dimensions to security. The Arctic is not immune to the possibility of criminal threats (terrorism, piracy, drugs, human smuggling) as well as more traditional - albeit unlikely - military threats. On the other hand, security issues elsewhere may increase the attractiveness of routes through the Arctic. As piracy and terrorism become more common in certain areas of the world, such as the Gulf of Aden, it is important to consider the possibility that other global shipping routes could befall a similar fate in the near future. Political and public unrest in many countries around the world could compromise the safety of other global shipping routes, such as the Panama Canal. If this were to occur, demand for new, more secure routes of transit such as the NSR or the NWP could increase substantially.

There has been some speculation as to whether any Arctic issues are sufficiently controversial that they could lead to major confrontations between Arctic States. Even accepting that there are a number of jurisdictional issues to resolve, there is no indication at present that any of these disputes will give rise to serious tensions. The Arctic Council and other international fora provide opportunities for discussion and collaboration, and any scenario leading to armed conflict seems difficult to imagine. In this respect, Canada's preoccupation with protecting

49 See Boomerang Effect: The Convergence of National and Human Security by Liotta (2002).

sovereignty might be viewed as excessive given the desire amongst most Arctic States to find collaborative solutions to common areas of concern. How this sovereignty and security situation will play out in the Arctic therefore needs to be factored into the scenario development process.

3.3.5 Community Considerations

Again in the context of public interest considerations, ensuring the wellbeing of global societies may be viewed as a critical objective. Nowhere is this more important than in the Arctic. It is clear that Arctic communities are facing serious social challenges as they adjust to rapidly changing climatic and societal trends, after millennia of stable, predictable and relatively isolated conditions. Northern development and its associated shipping activities have the capacity to create turbulence and upheaval in the social norms of Arctic communities, and to disrupt traditional northern hunting and fishing patterns. Cruise ship activities also have the potential for both positive and negative consequences for Arctic communities.

Possible increases in environmental damage that often accompany shipping and resource extraction could cause serious harm to the marine habitat and negatively affect the health and traditional lifestyles of indigenous peoples. There is much uncertainty regarding how climate change will impact humans at the community level. Most research has been focused on a large geographical scale and not at the distinct, more local scale of widely dispersed communities.[50] How a community responds to change depends on many factors, including local conditions, population attitudes, cultural history, or economic relationships, and this is another key uncertainty that must be addressed in the scenario development process.

The impacts of climate change will clearly be felt particularly strongly by Arctic communities. As infrastructure or the economy is affected, the well-being of communities may diminish considerably. The most commonly articulated concerns about impacts are related to the structural integrity of buildings, modifications of the community economic base, impacts on traditional food harvests and transportation, and shifts in industrialization, flooding, forest fires, and landslides. Furthermore, many studies have examined impacts of change on specific aspects of life in the Arctic in general. Impacts include an increased incidence of "natural hazards," communication disruption, and stresses on traditional harvesting, changes in forest resources, expansion of northern agriculture, and increased oil and natural gas development resulting from cheaper, more reliable navigation in Arctic waters.

However, it would be inaccurate to generalize the effect of these impacts on small, diverse communities. Such impacts will not equally affect each of the local communities that comprise northern Canada's population. Furthermore, community response will be largely determined by existing conditions, including endogenous factors that vary considerably from location to location, reflecting variations in culture, economy, social history, and land-use practices.

As a result of the thawing of ice-rich permafrost, coastal erosion and retreat will damage infrastructure and sites along the coast. Reductions in the extent, stability and seasonal duration of sea ice and the increased unpredictability of the weather have altered, and will continue to influence traditional hunting and subsistence practices. In addition, new species, and changes in

50 See Translating Climate Change Impacts at the Community Level by Duerden (2004).

the migration patterns of traditional species have been observed by Northern Aboriginal communities. These changes have the potential to impact deeply the consumption of traditional food in the Arctic. As a result, community members are already being forced to change their harvest mechanisms in order to adapt to climate change and to ensure adequate supplies of food.[51]

Most communities have the ability to cope with normal climatic conditions and a range of deviations around norms. People have learned to modify their behaviour and their environment to manage and take advantage of their local climatic conditions. Adaptive capacity relates to communities' resilience, resistance, flexibility, and robustness. It is influenced by economic wealth, social networks, infrastructure, social institutions, social capital, experience with previous risk, the range of technological adaptation available, and equity of access to resources within the community, as well as by other stresses that contribute to the environment in which decisions are made.[52]

Arctic communities have demonstrated significant adaptability in the past, but there is concern that future changes in conditions may exceed conventional coping capacities. Furthermore, how communities react to climate change and vessel traffic is dependent on various factors. Conflict may arise over certain areas important for shipping as well as traditional use, whereas in some cases the potential for more jobs will outweigh any negative aspects. These uncertainties will play a large role in the scenarios developed to address how shipping could evolve in the Arctic.

The tourism industry has the potential to benefit local residents of Arctic communities. At present the industry is relatively small in Nunavut, and the industry's potential impacts on the natural and human environment have to be closely evaluated, due to the "fragility of some of the Canadian Arctic environments and the vulnerability of small, remote, largely aboriginal communities, where great care must be exercised in using the area for cruise tourism. [53]

Furthermore, as already recognized, denser, hull-penetrating, multiyear ice may present navigational hazards for ships in certain regions of the Canadian Arctic. The minimum ice class of tourist vessels currently operating in the Hudson Bay region is 1A. This class of ship can navigate safely during the summer and autumn in first-year ice (70 – 120 m). However, ridges of ice up to 2 – 3 m in height have been observed during this season, which exceed the recommended thickness for safe travel in 1A ice-rated vessels.[54]

The sinking of the *Explorer*, an ice class 1A tourist vessel, in relatively benign ice conditions in the Antarctic Ocean in November 2007, highlights the risk associated with trace, yet extreme, ice features. In that case, other vessels were nearby and available to assist as International Association of Antarctica Tour Operators (IAATO) members had previously agreed to an emergency contingency plan. This plan was implemented at the time of the distress call. If such

51 See Local Observation of Climate Change and Impacts on Traditional Food Security in two Northern Aboriginal Communities by Guyot (2006).

52 See A Framework for assessing the Vulnerability of Communities in the Canadian Arctic to Risks Associated with Climate Change by Ford and Smit (2004).

53 See Working towards policy creation for cruise ship tourism in Parks and Protected Areas of Nunavut by Marquez and Eagles (2007).

54 See Cruise Tourism and Sea Ice in Canada's Hudson Bay Region by Stewart et al. (2010).

an incident were to occur in the Arctic, it could have a dramatic impact on how the cruise tourism industry continues to develop. The possibility of such an incident is therefore an important consideration for the scenario development process.

In the Canadian Arctic, there is no equivalent of IAATO for cruise ships, although many of the vessels travelling through Arctic waters are already members of IAATO, as these vessels operate in Antarctica during the austral summer.[55] The development of an equivalent body for the Arctic has been discussed for years, but no clear path of action has been determined. The closest parallel organization is the Association of Arctic Expedition Cruise Operators that is working to ensure that voluntary codes of practice are adhered to in the European Arctic, but the Canadian Arctic falls outside its jurisdiction.

3.4 Conclusions

All these trends constitute the 'public interest' dimension of the 'forces' at play in the Canadian Arctic, and have led to the identification of major uncertainties and possible ‘tipping points’ in relation to the various environmental, societal, safety and security considerations. These issues could all have critical implications for the future development of the marine transportation industry in the Arctic and will be further addressed in the scenario development process.

55 See The Sinking of the MS Explorer: Implication for Cruise Tourism in Arctic Canada by Stewart and Draper (2008).

Chapter 4 - Governance Considerations in Relation to Marine Transportation in the Canadian Arctic

4.1 Introduction

As set out earlier, the aim of this project is to develop insights into future Arctic scenarios based on the interplay between three key 'forces' within the Canadian Arctic. The first two of these 'forces' have been discussed in the previous chapters. The aim of this chapter is to examine the third 'force', namely those elements associated with the governance and oversight dimensions of marine transportation. The product of this examination will then be utilized to develop plausible scenarios through to 2025.

A preliminary step is to establish what is meant by 'governance' in relation to the marine transportation industry. The aim will then be to examine how governance interacts with the two other 'forces' influencing the evolution of this industry and related activities. Thus Chapter 4 will explore, at the three levels of consideration, namely global, Arctic, Canadian Arctic, the various trends and issues that call for governance action. 'Governance,' as it is used in the context of this project, will be defined and certain governance fundamentals will be discussed. This chapter will also address the manner in which technology may impact the governance process. Finally, as a key feature in the evolution of Arctic marine transportation governance, Chapter 4 will examine the hierarchy of levels at which governance of marine transportation may be exercised, and the nature and extent of interactions between these various levels.

4.2 Defining Governance

For purposes of this scenario development exercise, it is proposed that 'governance' in the context of marine transportation be defined as:

> ***That authority that is directed at monitoring, evaluating, and ultimately modifying the behaviour of marine transportation activity, with the objective of ensuring that such activity is operating sustainably and in the best interests of the public at large.***

This definition is based on the premise that the public interest is best served when marine transportation services are economic, efficient, adequate, socially beneficial, safe, secure and environmentally sustainable. If certain aspects of the marine transportation system are not operating in the public interest, then it is reasonable to expect society to look to those who are empowered to exercise the necessary authority to rectify this situation.

Rectification action can take the form of a wide variety of mechanisms for achieving compliance, including not only regulatory control regimes, but also the provision of support services, assistance measures and incentives. Such mechanisms would, of course, have as their objective to influence the manner in which marine transportation activities are conducted either globally or in the Arctic in order to maximize benefits while mitigating or eliminating any negative or undesirable trends or impacts.

4.3 Marine Transportation Governance Fundamentals

Governments can exercise governance functions at a variety of levels. Whether it is in a global context or a more focused context such as the Arctic or the Canadian Arctic, governance may be exercised at the multilateral, regional - sometimes termed supranational, national or sub-national level. Each level displays different characteristics in the focus of its interests and priorities, and in the degree to which it may wish to exert influence over shipping activities.

A key defining characteristic of governance in marine transportation at the global level is a broad acceptance of the desirability for a strong multilateral dimension to its policy formulation function.[56] Because marine transportation industry is global in scope, there are persuasive arguments supporting the need for uniformity and consistency in the manner in which business is conducted, and standards of safety, security and environmental protection are established. It follows that it is highly desirable to have associated policy and administrative regimes developed in multilateral fora. Thus bodies such as the IMO, and to a lesser extent the World Trade Organization (WTO), the ILO, and the UN Committee on International Trade Law (UNCITRAL), presently provide the principal means for establishing appropriate policies and procedures governing the oversight of international shipping, particularly in relation to safety, security and environmental protection. Once these policies and procedures are established through the 'international convention' development process, it is then for the essential content of the convention to be incorporated into the laws and regulations of each member State through the actions of national legislatures and administrations.

However, as discussed later in this chapter, multilateral governance is complex, and relies on consensus. It is therefore susceptible to compromise and delay; whether as a natural consequence of the complexity of the issue, or as a result of deliberate action on the part of particular groups as they endeavour to protect their national or regional interests. Furthermore, what may be viewed as constituting the best public interest at one level of governance may not always align with what may be viewed as constituting the best public interest at another. Put another way, an appropriate compromise at the multilateral level of governance may be viewed very differently at a lower level, where the task of defining the public interest may be driven by different priorities, interest groups and constituencies. Hence there exists a 'tension' between multilateral governance and governance initiatives at other levels. How this 'tension' will play out over the next ten to fifteen years constitutes a key uncertainty in relation to global, Arctic and Canadian Arctic marine transportation governance, and features as an important factor in any consideration of the scenarios that flow from it.

Again it should be recognized that in the multilateral debate, there may well also be 'tensions' between Flag States, Port States and Coastal States. Most of the major Flag States offer 'open registry' opportunities. They are predominantly developing countries of a comparatively small size and with only limited economic leverage beyond the fleets that they register. However, despite their size, such States register significant percentages of the international fleet and may

[56] While in theory intra-national 'domestic' shipping falls exclusively under national jurisdiction, and is therefore not obliged to align with international norms, the situations are rare where major departures are made from standards established in international fora. Some shipping operations on inland lakes and rivers may adopt standards that depart from international norms in order to fit the unique operating conditions

be expected to be strongly supportive of Flag State interests. On the other hand, the 'closed' registries of several developed States having significant economic leverage, Canada among them, only participate in international shipping to a very limited extent as a Flag State. The dominant interest of Canada and other such States is therefore from the perspective of a Port State or Coastal State. Thus another key uncertainty in the multilateral process is how these tensions between Flag, Port and Coastal States will evolve over the next decade or so.

4.3.1 Governance in Relation to the Commercial Dimension of Shipping

As discussed above, the entrepreneurial dimension of marine transportation is driven principally by the private sector, and it is therefore predominantly ship-owners or ship charterers who decide upon entry into, exit from, and participation in, particular marine transportation markets. Involvement is clearly an industry choice, and there are virtually no substantive entry or exit controls or qualifications. Furthermore, in international shipping, there are few imposed constraints on the choice of route, market or activity, or on the types, sizes and numbers of ships to be utilized. While there are more constraints in relation to the Arctic, shipping activity is still driven largely by entrepreneurial opportunity and governance of Arctic shipping activity remains largely reactive in nature.

As explained in Chapter 2, the health of the marine transportation industry is dependent on the health of the global economy and international trade, so turbulence in global trade will give rise to turbulence in the shipping industry. This has been very apparent over the years since the 2008 economic crisis, where many shipping interests have struggled to maintain profitability in very demanding circumstances. It is reasonable to expect that these fluctuations will continue to prevail so long as turbulence continues to occur in global trade.

It should also be noted that the more challenging the commercial environment, the greater the likelihood of tension arising between an industry struggling through tough economic times, and governments that are seeking to contain the negative consequences of industry activities. At the present time, industry is grappling with such requirements as the fitting or retrofitting of ballast water treatment equipment, exhaust gas cleaning systems, modifications to reduce CO_2 emissions, and compliance with requirements to shift to distillate fuel or LNG. This is in addition to the costs of implementing the personnel training and social support obligations contained in the new Maritime Labour Code. This potential tension between industry and governments constitutes another important uncertainty in the scenario development process.

Again, while the specialized nature of Arctic shipping development may provide some protection from the challenges and turbulence being experienced in global shipping markets, some important uncertainty regarding the degree of tension between shipping interests and those bodies exercising governance may still be anticipated

4.3.2 Governance in Relation to the Public Interest - The Concept of Sustainability

We have seen in Chapter 2 that the principal commercial interest in marine transportation activity and its initial stimulus, resides mainly among those business interests that are either seeking marine transportation services or supplying such services. We have also seen in Chapter 3 that there is a broader 'community' of interest where the concern is focused more on the impacts and consequences, both positive and negative, of shipping activity. The nature of this 'public

interest' dimension is broadly captured in the concept of sustainability, and provides the basis for defining the broad preoccupations and concerns of civil society.

The concept of 'sustainability' is still evolving and presently has a quite wide range of definitions and possible interpretations. Probably the most well-known definition, and one that is adopted for use by this project, is that contained in the Brundtland Commission Report, where 'sustainability' is defined as:

> ***Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.***[57]

This definition essentially reflects a broad aspiration to ensure, on an ongoing basis, that economic benefits are maximized, while social, safety, security and environmental norms and values are protected. It is also to be noted that the imperatives of economic sustainability often generate issues in relation to the other sustainability objectives. Thus the goal is to find ways in which the full range of economic, environmental and social sustainability objectives might be achieved. This is sometimes referred to as the "triple bottom line" approach, or more euphemistically as 'profit, planet and people'. At issue, then, in the context of this scenario development exercise, and an important uncertainty, is the degree to which this objective of sustainability in international marine transportation might reasonably be realized and maintained, both globally and in the more sensitive Arctic, through to the 2025 timeframe.

4.3.2.1 Governance Considerations in Relation to Economic Sustainability

Intervention by governments in relation to the economic sustainability of shipping services has certain characteristics that set it somewhat apart from intervention in relation to other sustainability objectives. More particularly, while there is frequently some degree of collective dialogue between States, the motivations that argue for international economic collaboration in the marine transportation sector are not as persuasive as those that argue for social, safety, security and environmental uniformity. [58] This may be attributed to the fact that the economic sector is normally characterized by competition between participants, while no such divisive dimension exists in considerations relating to the other sustainability elements.

Because of this competitive dimension, there is significant diversity of view across national governments as to the most appropriate economic policies, regulation and governance approaches that are seen as constituting their best interests. While there have been instances where conventions addressing economic performance have been contemplated and indeed advanced, these conventions have tended to encounter difficulty and do not feature strongly as key elements in the conduct of international marine transportation practice. [59]

[57] See the 1987 Report of the World Commission on Environment and Development (the Brundtland Commission).
[58] For example in the case of many developed States through the Organization for Economic Cooperation and Development (OECD)
[59] For example, the UN Convention on a Code of Conduct for Liner Conferences (Geneva 1974). The difficulties associated with adoption of the Hague-Visby rules governing carriage of goods illustrate the same problem of achieving consensus on issues with a strong economic dimension

Economic intervention by governments in marine transportation is therefore normally exercised at the national level. This intervention can take a number of forms, for example the provision of open registry opportunities by certain, usually developing, States, moves to remain competitive with this trend through the establishment of international registers, second registers, or the provision of state aid through such measures as a 'tonnage tax'. How trends in open registry will play out in the future constitutes an important uncertainty

Cabotage constitutes another form of economic intervention, and again there is significant divergence in cabotage approaches from the comparatively unrestricted regimes of certain European States such as the United Kingdom (UK) and Norway, to the severely restricted regimes of North America - notably the US *Jones Act* and Canada's *Coasting Trade Act*. Cabotage controls gives rise to important commercial constraints and complications for Arctic shipping in particular, due to the seasonal nature of Arctic operations, and the major impediments faced by such high cost 'domestic' market vessels competing in international markets during the closed season. Canada has taken some steps to reduce these impediments by the removal of tariff duties on imported ships, but the problem remains significant. Whether and if so how, Canada decides to adjust future cabotage policy in the Arctic constitutes another important uncertainty in the scenario development process.

Again it should be noted that whether shipping is transiting the Arctic or engaged in destinational activities that involve carrying resources or tourists between Canadian Arctic ports or places and foreign ports, they will almost certainly be registered in foreign, likely open registry States. On the other hand, community resupply activity, involving as it does the carriage of cargoes with both origins and destinations in Canada will continue to be undertaken by shipping that falls under Canada's cabotage laws. These are very different commercial models with very little interaction between them.

At issue in the context of scenario development is whether this is the most attractive policy option. More particularly for consideration is whether Canada's current shipping policy posture in relation to the Arctic is ideally suited to the protection of Canada's best interests in its Arctic regions, or whether it is time for policy-makers to consider adoption of policies that enable more flexibility between domestic and international shipping regimes.

4.3.2.2 Governance Considerations in Relation to Social, Safety, Security and Environmental Sustainability Considerations

The remaining dimensions of sustainability extend across the full range of community, safety, security and environmental sustainability considerations. These will be discussed in turn.

Social Sustainability

Recognizing that sustainability of cultures and communities around the world is of critical importance, sustainability of northern communities, and the governance framework needed to achieve it, are particularly important priorities in the Arctic. The body that is increasingly viewed as having important responsibilities for protecting the sustainability of Arctic communities is the Arctic Council. The founding document of the Council sets out in its preamble the importance attached to "affirming our commitment to the wellbeing of the inhabitants of the Arctic, including recognition of the special relationship and unique

contributions to the Arctic by the indigenous people and their communities."[60] In recently assuming the chair of the Arctic Council, Canada has set as an objective "to continue to encourage a greater understanding of the human dimension of the Arctic to improve the lives of Northerners".[61] The positive and negative impacts of shipping will clearly need to feature in this expanded understanding. How the impact and effectiveness of the Arctic Council will evolve constitutes another important uncertainty.

Safety Sustainability

As noted in Chapter 3, society attaches considerable importance to ensuring the safety of those whose livelihood depends on the sea. Safety objectives, together with the best means of achieving them in terms of reducing risk of injury or loss of life, are usually reasonably clear, as is the desire for international uniformity in the steps taken to fulfill those objectives. Therefore, the need for the exercise of governance in support of safety objectives may be viewed as relatively non-controversial and ideally based upon multilateral norms and standards. Thus the focus of any debate is limited to the (generally technical) means of achieving those objectives.

Throughout much of its first 50 years of existence, the IMO has enjoyed considerable success in reaching consensus on steps necessary to achieve safety in the marine industry. Such consensus extends not only to the regulation of safety obligations governing the design, construction, manning, equipping, operation and (more recently) disposal of ships, but also to the range of services designed to support safe shipping operations through. For example, these services include coordinated navigational assistance measures, and a comprehensive management framework for responding to incidents through internationally cohesive, technologically advanced SAR services.[62] More recently, international intervention has extended beyond the prescription of technical standards to measures designed to improve management effectiveness.[63]

With respect to the Arctic, the current initiative to develop a Polar Code illustrates IMO's commitment to multilateral consensus in ensuring safety in Arctic waters. The voice of shipping's private sector, in the form of the International Chamber of Shipping (ICS), fully supports this initiative and is "developing its relations with the Arctic Council."[64] In doing so, ICS is stressing that it is critical that Arctic nations avoid unilateral measures that might cut across IMO Conventions or the provisions of the United Nations Convention on the Law of the Sea (UNCLOS), and is emphasizing the need for "full recognition that IMO is the proper forum for addressing detailed concerns."[65] For its part the Arctic Council has recently concluded an agreement on cooperation in SAR.[66]

[60] See the preamble in *The Ottawa Declaration* dated September 19 1996
[61] See Government of Canada Brochure *Canada's Arctic Council Chairmanship 2013-2015* May 2013
[62] The Global Maritime Distress and Safety System (GMDSS) came into effect on February 1, 1999.
[63] For example, through such mechanisms as the International Safety Management (ISM) Code, the STCW 'White List' approach, and the Voluntary IMO Member State Audit Scheme.
[64] See The International Chamber of Shipping *Annual Report 2013 p20*
[65] Ibid
[66] See the Arctic Council's *Agreement on Cooperation in Aeronautical and Maritime Search and Rescue in the Arctic* signed in Nuuk on May 12, 2011.

Security sustainability

Again as noted in Chapter 3, society also attaches importance to security in relation to marine transportation, and hence the governance regime needed to ensure its achievement. Security in the past been principally associated with such criminal activities as piracy -until recently viewed as a fairly low profile and regionally specific problem- or the smuggling of drugs or illegal immigrants. Since September 11th 2001, terrorism has taken on a significant profile as a further dimension of security that has consequences for marine transportation. While this appears to be generally of more concern to developed, rather than developing, maritime States, various dimensions of terrorism may now be found in many parts of the world. In addition, piracy has recently attained new prominence in such areas as the Malacca Straits, West Africa, NE Africa, and the Gulf of Aden.

A comprehensive governance regime designed to ensure security for international shipping entered into force on 1 July 2004, and resulted in several amendments to the 1974 SOLAS Convention, including introduction of the new International Ship and Port Facility Security (ISPS) Code, which contains detailed security-related requirements and guidelines for Governments, port authorities and shipping companies. While the IMO Convention is not very explicit with regard to the organization's security responsibilities, it has chosen to assume a leadership role in addressing this emerging challenge.[67] A particularly important consideration is the potentially negative impact that such security measures may have on the efficient and economic performance of marine transportation services.

Recent actions by the US serve to illustrate this point. For example, the recent unilateral action by the US regarding container scanning and inspections has potentially far-reaching extra-territorial consequences.[68]

The degree to which security issues are an important factor in relation to shipping operations in the Arctic is less certain. While the possibility of incidents involving piracy, drug or human smuggling, or terrorism should not of course be ruled out, there is little or no evidence to suggest that this might become a substantial threat. Indeed the security implications for Arctic marine transportation may be viewed as being more to do with its appeal as a safe haven from security threats along routes in more southern waters.

Environmental Sustainability

Once again as explained in Chapter 3, the environmental sustainability dimension of societal concerns encompasses the impacts of shipping upon the oceans and the atmosphere, and includes climate change related issues such as GHG emissions, pollution in all its forms, and physical

[67] The IMO website explains that a comprehensive security regime for international shipping entered into force on 1 July 2004. The mandatory security measures, adopted in December 2002, include a number of amendments to the 1974 Safety of Life at Sea Convention (SOLAS), the most far-reaching of which enshrines the new International Ship and Port Facility Security Code (ISPS Code), which contains detailed security-related requirements for Governments, port authorities and shipping companies in a mandatory section (Part A), together with a series of guidelines about how to meet these requirements in a second, non-mandatory section (Part B).

[68] The US HR1 legislation introduces 100% scanning of US bound cargo containers. More particularly it includes a provision that, effective July 2012, requires that all maritime cargo containers being imported into the United States must be "scanned" at foreign ports of loading or they will be denied entry into the country.

impacts such as propeller action and noise. While environmental protection objectives enjoy broad collective support in principle among nation States, they also introduce a number of complexities that render it more difficult to achieve international consensus on a uniform governance approach. This may be attributed, at least to some degree, to the manner in which environmental issues have emerged in relation to international shipping.

It is evident that, over the course of the last 150 years, the potential for ships to damage the environment has been significantly increased by technological trends and developments. Changes in ship design have clearly increased the potential for environmental damage through impacts such as toxic hull coatings, ballast water contamination, various exhaust gas emissions, propeller noise or injury to marine mammals, or pollution (whether intentional or accidental) by oil or HNS. This expansion in environmental damage potential has raised significant governance challenges and concerns (and hence heightened political interest) among numerous Coastal States, particularly those that have experienced environmental catastrophes.[69] This has in turn led to an increased focus on the respective rights and responsibilities of Flag States and Coastal States, including such complex and sensitive policy issues as a Coastal State's right to control the types of ships that may make a passage through its waters, and its obligation to provide 'places of refuge'[70]. It has also led to the concept of enhanced protection through designation of protected areas (PAs) under the International Convention for the Prevention of Pollution from Ships (MARPOL) or Particularly Sensitive Sea Areas (PSSAs) as adopted by resolution.[71] Similar enhanced protection from sulphur emissions has been adopted through the designation of Emission Control Areas (ECAs).[72] There are also continuing concerns regarding the treatment standards prescribed in the recently adopted (but yet to enter into force) ballast water convention, which have the potential to trigger further unilateral action. [73]

As mentioned earlier, and unlike safety, there is a wider diversity of views throughout the international community regarding appropriate remedies for the provision of protection of the environment. In this respect, there is an increased likelihood of unilateral action, particularly if the standards emerging from the collective international consensus are deemed to be insufficient by certain States with heightened environmental concerns. This is particularly true where Coastal State interests are considered to be seriously threatened by the exercise of Flag State 'rights.' Obviously the more economic leverage a Coastal State can exert, the more effective, and therefore attractive, unilateral action to achieve environmental goals can become. Initiatives taken by the US, as well as the EU at the supranational level, serve to illustrate this point.

It may be seen then that governance in relation to environmental protection is perhaps the most complicated and potentially sensitive dimension, since it brings the marine transportation

[69] The Exxon Valdez, Erika and Prestige disasters are good examples

[70] Resolution A.949(23) *Guidelines on places of refuge for ships in need of assistance*

[71] Resolution A.982 (24) *Revised guidelines for the identification and designation of Particularly Sensitive Sea Areas (PSSAs)*.

[72] Annex VI contains provisions allowing for special Emission Control Areas (ECAs) to be established with more stringent controls, particularly on sulphur emissions. In these areas, the sulphur content of fuel oil used onboard ships must not exceed 1.5% m/m. Alternatively, ships must fit an exhaust gas cleaning system or use any other technological method to limit SOx emissions.

[73] More formally titled the *Convention for the Control and Management of Ships' Ballast Water and Sediments* adopted by IMO in February 2004

industry face-to-face with interests having little direct interest in marine transportation beyond the negative impact that the industry may be having on the environment. This circumstance, coupled with the difficulties surrounding the search for international consensus regarding what should constitute acceptable standards and procedures, almost certainly makes issues related to environmental management one of the most challenging drivers in any consideration of future governance scenarios.

With regard to the environmental sustainability of the Arctic, the same broad issues and concerns are evident, and are further complicated by the harsh conditions, the presence of ice and the fragility of the Arctic marine environment. In this respect, however, UNCLOS 234 provides a degree of multilateral justification for Coastal States to apply non-discriminatory controls to shipping, and Canada has chosen to apply such controls through the Arctic Waters Pollution Prevention Act (AWPPA) and Canada Shipping Act (CSA) 2001. No doubt more influential changes will be forthcoming as and when the Polar Code enters into force, and thus the contribution and effectiveness of the initiative to implement a Polar Code constitutes another important uncertainty.

4.4 The Governance Implications of Technological Evolution in the Marine Transportation Industry

Technology has been, and continues to be, an important influence on not only the evolution of marine transportation, but also in the context of this Chapter, the evolution of the governance and oversight of the shipping industry.

With respect to safety it is really only in the last 150 years that any focus has emerged on the need for regulation of the safe design, construction, equipping, crewing and disposal of ships. Likewise the provision of support services to shipping was until quite recently limited to a scattering of basic fixed or floating aids and lighthouses, the purpose of which was to provide ships with information regarding various coastal navigational hazards. Again, in the absence of over-the-horizon communications, shore based SAR services were in reality only useful in responding to casualties occurring within sight of land.

While the rudimentary nature of early safety technology had important and largely negative implications for the safety of seafarers often involving loss of life, the comparatively limited impact of early shipping operations on the environment meant that the need for expanded oversight of shipping only emerged within the last century or so. Recognition of this need has now grown quite dramatically as modern shipping has evolved and maritime commercial aspirations expanded. Cargoes have become more diverse, and notably more potentially dangerous, while vessels have become larger, faster, more numerous, more specialized and, it must be recognized, more potentially damaging. It is therefore considerably to the credit of IMO's multilateral policy-making efforts that despite these trends, the frequency of occurrence of incidents resulting in serious environmental damage or loss of life have been largely contained, and, in many cases, significantly reduced.

In a parallel technological field, the invention and subsequent evolution of radio has not only transformed communications, but also enabled the evolution of long-range navigational and distress alerting aids. These technological advances, while directed principally at enhancing

safety of navigation, have also provided the means by which governments can exercise more effective oversight of shipping activities, and also provide expanded assistance (through satellite based distress alerting for example), when required, thus strengthening the effectiveness of the governance function.

In summary, it may be seen that technological developments potentially impact the governance process in two main ways. Firstly, there are technological developments driven by entrepreneurial interests as they seek a commercial advantage. Such developments, while of interest to the governance process, are driven principally by industry, and may include developments to improve performance in hull design and construction, propulsion efficiency, and cargo handling. Secondly, there are technology issues and challenges arising out of threats to sustainability. Such technology challenges, include the search for solutions to ballast water treatment, anti-fouling coatings and exhaust emissions, are issue-driven by governance bodies, rather than entrepreneurially driven by industry.

Both dimensions need to be accommodated in any analysis of the governance and oversight process, and any consideration of plausible scenarios for governance of marine transportation globally and more specifically in relation to Arctic shipping.

4.5 Examining the Hierarchy of Governance Levels

Having examined the nature and scope of the broad analytical challenge associated with governance of international marine transportation generally, and the Arctic in particular, the aim now is to explore the current hierarchy of governance regimes that provide oversight of shipping. More specifically, it is to identify and quantify the broad characteristics associated with the each of the various levels within the governance hierarchy where external oversight of shipping may be performed.

4.5.1 Governance Characteristics, Challenges, Uncertainties at the Multilateral Level

As mentioned earlier, the principal argument supporting a uniform, cohesive, multilaterally developed, governance regime for marine transportation is that the industry needs predictable, globally consistent performance standards in order to operate efficiently. The multilateral process endeavours to respond to this need, principally through the convention generation procedure, which facilitates the collective development of policy while respecting the autonomous authority of States to convert obligations accepted in the convention development process into national legislation and regulations.

As mentioned earlier, the principal negotiating mechanism upon which this process relies for its success is consensus, and achieving consensus is a complex and slow process. In addition, the more technologically complex or sensitive the problem to be solved, the more extreme the challenge encountered by international institutions in achieving consensus. This situation becomes particularly difficult in circumstances where there are highly complicated, far-reaching issues, extending across a range of scientific, technological, economic and other disciplines. Such situations have become much more likely with the emergence of complex environmental challenges, such as ballast water and exhaust emissions, where the interaction of scientific, technological, educational, operational, regulatory and enforcement considerations inevitably gives rise to extensive deliberation, discussion and delay.

Not only have global solutions become more complex but, as mentioned earlier, the emergence of serious environmental and security issues has expanded the range of interests with legitimate concerns regarding how these issues should be addressed. For many years the marine transportation industry and its associated institutions have addressed predominantly safety issues in comparative isolation from the public eye, and participants in the debate were largely confined to those with a direct interest and involvement in marine transportation. Now however, other groups whose focus of interest extends well beyond the field of marine transportation have quite reasonably and legitimately demanded to participate in these debates. This external dimension has introduced important new challenges in the search for consensus.

Other considerations that influence the effectiveness of the multilateral process, and more specifically IMO's success in fulfilling its multilateral responsibilities include the degree to which there is broad public confidence in the multilateral governance process generally, and the perceived effectiveness of other multilateral entities. While IMO is generally viewed as performing quite effectively in its field of endeavour, the more questionable performances of other multilateral bodies, such as the International Monetary Fund (IMF), World Bank, and indeed the UN itself have impacted the confidence of the global community in the effectiveness of multilateral governance generally.[74]

Other factors complicating multilateral governance efforts include: the increasing complexity of the responsibility interfaces between IMO and other multilateral governance bodies (e.g. ILO, United Nations Environment Programme, WTO, Organization for Economic Co-operation and Development (OECD), UNCTAD and UNCITRAL); questions regarding the lack of democratic accountability in the multilateral process; the technical, scientific, economic, and other competencies of the members and support staff of respective multilateral governance bodies; and increased complexity in many structural and procedural issues.[75]

This quite diverse and incomplete listing of potential stumbling blocks serves to illustrate the high degree of sensitivity in the conduct of IMO's business, and therefore the potential for some uncertainty regarding its continued effectiveness. Clearly this effectiveness in fulfilling its multilateral role depends on a wide variety of factors, some of which are within the powers of the Organization to manage and some which are not. Equally, it is apparent that, should the IMO become less effective, this would significantly increase the likelihood of unilateral governance initiatives at the regional, national and sub-national levels in the future. Thus the future of multilateral governance in relation to marine transportation constitutes an important uncertainty in this scenario development process.

In the context of the Arctic, the reliance on consensus presents the same potential difficulties and risk of ineffectiveness. IMO's efforts to develop the Polar Code run a clear risk of delay and compromise due to the need to find consensus on a range of complex and potentially costly

[74] See *Reform of Global Governance Priorities for Action* Colin Bradford, Johannes Linn , Brookings Institute Policy Brief No. 163 dated October 2007 for some interesting insights into this issue

[75] An example of this last complication might be the use of 'aspirational' provisions in various conventions-for example the Ballast Water Convention.

policy issues. The challenges associated with deciding upon appropriate Arctic SAR and pollution response regimes also provide good examples of the difficulties faced by the multilateral process.

4.5.2 Governance Characteristics, Challenges, Uncertainties at the Regional (Supranational) Level

In a global context, the most obvious example of the exercise of supranational governance in marine transportation is the European Union (EU) and more particularly its executive branch, the European Commission (EC). This entity, along with the European Parliament and the Council, was established in the 1950s.

In the context of shipping, the Commission, while operating largely outside the ambit of oversight of IMO, nevertheless sees itself as having a substantial policy formulation role in relation to shipping, and hence a perceived need to exert influence on the policy positions of its member States. The exercise of this influence does not mesh well with the processes and procedures of IMO, and so the policy-making processes in IMO could be negatively impacted by this complication. More specific issues include the degree to which European member States' positions in IMO negotiations are conditioned or constrained by Europe-wide policy direction, and the Commission's declared role to be the "coordinator of Europe's point of view in negotiating forums such as the International Maritime Organization and the International Labour Organization."[76] In the context of shipping, the European Marine Safety Agency (EMSA), established following the '*Erica'* and '*Prestige'* incidents, already aspires to perform a number of supranational policy and program functions.

Again in the context of the Arctic, the EU is clearly interested in how future shipping activities will unfold, and the manner in which it chooses to exercise that interest in the future constitutes an important uncertainty.

As mentioned earlier, another important supranational body is the Arctic Council. While the Council has a more limited influence over the multilateral debate, the same desire to generate policies tailored to its regional interests apply, and the same complexities exist in relation to seeking to ensure that the Arctic Council's member States speak with one voice on initiatives impacting the Arctic.[77]

Several issues in relation to this exercise of supranational governance over marine transportation are worthy of mention. Already touched upon is the issue of non-membership in the responsible multilateral body, IMO. Because these bodies are not nation States, they do not fit tidily within the membership parameters of the IMO. In this respect, while no doubt such bodies would prefer to become full IMO members, they can presently only at best be given 'observer' status with the Organization.

[76] See "Maritime Transport Policy - Improving the competitiveness, safety and security of European shipping, published by the EC DG for Energy and Transport 2006

[77] It is interesting to note that the EU has applied for observer status at the Arctic Council! As of the fall of 2013 the application was still under consideration.

Also for consideration under this heading is the degree to which initiatives being pursued by supranational bodies and directed at improving maritime safety and environmental protection in regions under their respective jurisdictions are likely to facilitate or frustrate the work of IMO in developing multilateral positions on safety and environmental protection issues. In line with a number of Coastal States, the EC has signaled its wish to exert more control over non-EU ships transiting the EEZ of EU member States beyond their respective territorial waters, and in particular to place restrictions on traditional interpretations of freedom of navigation. The Arctic Council could well wish to pursue a similar aspiration. This could raise important issues regarding the future rights and privileges of shipping, and the effectiveness of the governance regime that oversees it. While presently viewed as unlikely, it is not beyond the bounds of possibility that the EU could press for amendments to UNCLOS.[78]

Regional entities also introduce issues regarding democratic accountability, which act as impediments to effective governance and policy-making at the supranational level. More particularly, member States are the sole entities that can be held accountable by their respective electorates. The supranational nature of bodies such as the EC and the Arctic Council tends to inhibit the normal exercise of national democratic accountability, and thus possibly gives rise to a heightened sense of distrust.

Clearly all these considerations constitute important uncertainties in relation to regional institutions that need to be taken into account in developing future scenarios for the Arctic.

4.5.3 Governance Characteristics, Challenges, Uncertainties at the National Level

The focus of IMO's endeavours is encapsulated in its five year Strategic Plan,[79] where the mission of the Organization, as a United Nations (UN) specialized agency is stated to be:

> ***To promote safe, secure, environmentally sound, efficient and sustainable shipping through co-operation. This will be accomplished by adopting the highest practicable standards of maritime safety and security, by efficiency of navigation, and by the prevention and control of pollution from ships, as well as through consideration of the related legal matters and effective implementation of IMO's instruments with a view to their universal and uniform application.***

It is a reasonable assumption that all States Party to the IMO Convention would be fully persuaded by the soundness of these objectives and purposes, particularly the commitment to universal and uniform application, and that they would ensure that their respective policies and procedures were directed at achieving this aspiration. However, various States appear in practice to have quite differing perspectives on how this mission might best be pursued.

As touched upon earlier, unilateral governance initiatives in relation to social, safety, security or environmental issues are not infrequently taken at the national level in situations where urgent action is perceived to be necessary, and where procedures followed by IMO are not seen to be

[78] See the European Commission Green Paper "Towards a future Maritime Policy for the Union: A European vision for the oceans and seas" dated June 7, 2006

[79] A 24/Res970 dated January 23, 2006

capable of delivering on that urgency. For example, the US has demonstrated a frequent tendency to unilateral action, usually brought on in large part by the nature and extent of the influences, particularly political influences, at both federal and US state levels, to which the policy formulation processes are subjected. This has frequently led to the adoption of a unilateral approach, despite its potentially negative consequences for an internationally cohesive management regime.

Oil Pollution Act of 1990 (OPA90), with its constraints on single hulled tankers, and security governance initiatives such as container inspections, may be viewed as a good example of unilateral action in response to a perceived urgent need.[80] Again it was only rapid reaction by IMO in the development and adoption of the ISPS Code that removed the threat by the US to move unilaterally on its high priority ship security initiative following 9/11. In the context of the Arctic, the inability of the US to ratify UNCLOS is not only complicating its own hopes and aspirations in the Arctic, but also injecting complexity into the positions of others, including bodies such as the Arctic Council.

The registry dimension is another issue arising in the context of national governance. More particularly at issue is the manner in which registry introduces complexities to the legal regime that prevails on the high seas, and where responsibility for its enforcement resides. UNCLOS is perhaps the most important source of legal guidance in this respect and prescribes a number of basic legal parameters, amongst which are the broad directions governing the registration of ships. As mentioned earlier, the evolution of ship registration practice has had fundamental consequences for the conduct of modern international marine transportation activities including the emergence of the concept of open registries.

Also, largely as a consequence of the open registry phenomenon, the current de facto situation is that almost all elements of the international marine transportation industry conduct business in what is virtually a tax free environment. This has important implications for the interface between international and domestic shipping activities, and in particular for the competitiveness of cabotage operations and short sea shipping in relation to international shipping. As mentioned earlier, particularly in the context of the Canadian Arctic, it also raises important issues regarding Canada's domestic and international shipping policies, and whether they remain appropriate and relevant as shipping activities in the Arctic evolve.

The evolution of open registry services, offered principally by developing countries with often quite rudimentary maritime administrations, has also raised questions regarding the condition of such ships from a safety, security and environmental protection perspective. There is, however also evidence that several of these open registry States, particularly those with large numbers of ships (for example, Liberia) have instigated quite effective measures that now provide relatively strong assurances regarding the condition of ships flying their flag and the competence of the

[80] Subsequent to the grounding of the oil tanker EXXON VALDEZ in 1989, the U.S. introduced the *Oil Pollution Act of 1990* (OPA 90) which included provisions for the double hulling of oil tankers. OPA 90 required new oil tankers to be double hulled and established a phase out scheme for existing single-hulled tankers. New oil tankers under OPA 90 included those built after 1990, but for tankers already on order it also included tankers delivered up to January 1, 1994. Older single-hulled tankers were phased out starting in 1995 and the final date for phase out of all single-hulled tankers was 2015.

crews that operate them. It is to be noted also that there are also quite a number of 'closed' ship registries with poor safety records, so that the relationship between ship condition and registry type is now much less apparent than before, and the issue has become much more clearly one of regulatory compliance versus non-compliance.

Certainly there is no expectation that the concept of open registry and its consequences for international governance will disappear any time soon. In this respect, there is considerable uncertainty as to how the future of ship registration will unfold, and what its future implications will be for the governance and oversight of international shipping. It is interesting to note that Europe and North America have chosen very different strategies for responding to the open registry phenomenon. While Europe has largely sanctioned state aid provisions that enable the application of a tonnage tax concept and tax relief for seafarers engaged in international voyages, no such approach has ever received any substantive examination in the US and Canada. Instead the de facto choice, beyond the US' strategic cargo shipments, has been non-participation in international deep sea shipping.

Turning to the Arctic, and from a nation State perspective, it is perhaps appropriate to make some observations with respect to Canada's current policy and governance posture in relation to the North, both generally and from a marine transportation scenario perspective.

Canada's Arctic aspirations are reflected in several documents released over the past few years. Under its *Northern Strategy*, the Government has set for itself the pursuit of four main themes: exercising Arctic sovereignty, promoting social and economic development, protecting Canada's environmental heritage, and improving and devolving northern governance. Since 2008 sovereignty has been identified as the most important of these priorities. However, more recently this issue has received less attention, and northern development and devolution of governance has been given more prominence.

In May 2013, Canada reassumed chairmanship of the Arctic Council, and took the opportunity of that occasion to outline its proposed program for the next two year period. The highlights of this program were set out under three main headings: responsible Arctic resource development, safe Arctic shipping and sustainable circumpolar communities. More particular initiatives included establishing a Circumpolar Business forum, maintaining a focus on preventing oil pollution, developing guidelines for sustainable tourism and cruise ship operations, development and implementation of a polar code, incorporation of traditional and local knowledge, promoting mental wellness, and conservation of migratory birds. It is evident that several of these initiatives impact on shipping.

It is difficult to find fault with the laudable goals contained in this documentation. However, the optimistic tone is somewhat at contrast with the more pessimistic expectations of other observers, who tend to see climate change, with its related issues of melting ice, loss of permafrost, ocean acidification, sea level rise, black carbon issues, methane release problems and contaminant issues as posing a serious threat that demands urgent and substantive attention. An important uncertainty is the degree to which, in the face of climate change and its potential to become a 'tipping-point', it is realistic to continue plan on life proceeding as normal.

Also open to question is the degree to which, at least in relation to marine transportation, Canada is delivering on its strategic commitments. While progress has been made in regulatory initiatives, for example with recent amendments to AWPPA and CSA 2001, important contributions to the development of the Polar Code, and adoption of mandatory reporting under NORDREG, other important initiatives, perhaps because they involve significant investments, have made less than satisfactory progress. Sovereignty initiatives such as the construction of the Arctic Offshore Patrol fleet and a base port at Nanisivik, are moving with agonizing slowness.

The completion of construction of a single polar class P3 heavy icebreaker is now being pegged at or after 2025, which perhaps begs the question as to whether, if a ten year plus delay is somehow deemed acceptable, the vessel is necessary at all. The service capacity provided by this ship will, in any event, be inadequate to meet Canada's needs for icebreaking services in scenarios involving year round operation in widely separated locations in the Canadian Arctic. Again, despite the Arctic Council agreement, little progress has been made in defining what would constitute a satisfactory Canadian Arctic SAR regime, and there continues to be no expectation of an effective capacity to respond to a major oil spill in the near future. This disparity between declared objectives and actual progress constitutes another key uncertainty

Perhaps more fundamental from a strategic policy perspective, is any clear insights into what Canada views as desirable in relation to shipping activity in the Arctic. It is reasonable to assume that efficient, low cost community resupply vessels will continue to be needed, and some pattern of cruise ship activity may be viewed as beneficial so long as it is suitably regulated. With regard to resource extraction, there is little discussion as to whether utilization of extracted resources in Canada would be preferable to the export of resources to foreign destinations. Certainly the very large disparity between transport costs for domestic and international movements makes export the preferred choice in a number of cases, for example the Mary River iron ore project. These considerations serve to confirm once more that the present lack of clarity regarding Canada's future shipping policy aspirations is another important uncertainty.

The de facto situation is that the large majority of ships that may choose to operate in the Canadian Arctic will be registered under foreign and probably open registry flag. This places a significant onus on Canada's Coastal State/Port State Control role, in ensuring that all shipping entering the Arctic is appropriately constructed, certificated, equipped, manned and operated. This includes ensuring that the vessel carries a suitably trained, qualified and certificated ice navigator. With only a relatively modest presence at sea in the Arctic, Canada will have only limited capacity to generate Arctic competent officers and crew, let alone ice-navigators. The degree to which shortages of Canadian Arctic seafarers inhibits Canada's ability to ensure safe operation of shipping may be considered another important uncertainty.

Notably, there appears to be little or no discussion as to whether transit traffic through the Canadian Arctic should be encouraged or discouraged. Because Canada presently provides Arctic icebreaking services free, along with a variety of navigational support services, and albeit modest and largely ineffective emergency response services, it may be argued that the Canadian taxpayer is effectively subsidizing all foreign flag shipping that passes through the NWP. Moreover, taxpayers are incurring this cost despite the fact that such ships bring no benefits to Canada and constitute potentially serious risks to the fragile Arctic environment through exhaust

gas emissions, discharge of black carbon, propeller noise, propeller action, ballast water discharges, hull fouling contamination, or even worse, a major pollution incident. This is in sharp contrast to the situation in the NSR, where Russia controls and indeed often refuses entry and imposes significant charges for the support services that transiting ships may receive. The lack of clarity surrounding Canada's 'vision' for Arctic marine transportation, and its operational and financial policies with respect to the provision of Arctic services constitutes additional key uncertainties in the scenario development process.

An important characteristic in the pattern of melting ice in the Arctic is that it is disappearing from the NSR more quickly than the NWP. This is resulting in significantly increased interest and activity along the former route. This increased interest, coupled with Russia's activist stance in relation to managing shipping activity, its considerable advantage in terms of technological capability, particularly in relation to nuclear powered heavy icebreaking, the initiatives taken in developing offshore hydrocarbon resources and the more populated and developed north in both Norway and Russia, is clearly providing Russia with the opportunity to advance development of Arctic skills and expertise. These factors place Russia well ahead of Canada and other Arctic States in terms of taking leadership within the region. The manner in which Russia will likely emerge as a global leader in Arctic shipping expertise should be viewed as another important uncertainty

It is also not beyond the bounds of possibility given present melt trends that an 'over the Pole' route may become an attractive choice before the NWP becomes fully accessible. Again at issue is whether such a development should be viewed as advantageous or disadvantageous to Canada. Certainly Canada clearly needs to identify, understand and address the policy issues presented by this situation.

4.5.4 Governance Characteristics, Challenges, Uncertainties at the Sub-National Level

Perhaps the best global example of the exercise of governance at the sub-national level is seen in the actions and influence of certain US states. The constitutional distribution of powers assigns considerable influence to the US state level, where the 'voice' of international marine transportation is largely suppressed by debate around important local public interest issues. These issues include the impact of exhaust emissions on port communities, or the risks associated with the possible introduction of alien species or pathogens.

A good example may be cited in relation to Great Lakes shipping and the risk of introduction of alien species. The possibility of such introduction has led to unilateral action being taken by certain US states (e.g. Michigan, New York, Minnesota, Indiana and Wisconsin) to place significant restrictions on the operation of ocean-going ships in waters over which the state has jurisdiction. This approach, while undoubtedly responding to legitimate concerns regarding the potential negative impacts on, for example, the drinking water supply for 30 million people, also gives rise to important drawbacks with regard to ensuring a seamless and cohesive international regulatory framework. However, despite the complexities it creates, this trend towards independent state action may be expected to continue so long as there is concern about the progress being made towards effective standards and procedures at the national and international levels under the BWM Convention.

Another example with respect to exhaust emissions is the policy stance taken by the state of California. This state has been active in its efforts to apply restrictions to ships, due to the very high SOx emissions attributable to shipping using low fraction distillate fuel with comparatively high sulphur content, particularly in the greater Los Angeles area.[81] Again this initiative has been driven principally by concerns that the national and international authorities have not been moving far or fast enough to implement the necessary standards.

In the Canadian context, the federal government has set as an important objective in its Northern Strategy the delegation of authority to territorial governments. This has generated a number of concerns, for example with regard to possible reductions in the effectiveness of the environmental impact analysis process. It is not clear whether and to what degree such delegation will touch upon marine transportation activities, but this possibility needs to be taken into account in any consideration of possible future uncertainties associated with the exercise of governance by such sub-national bodies.

4.5.5 Governance Characteristics, Challenges and Uncertainties in Relation to Industry

In any discussion on governance of the marine transportation industry, it is important to note that industry itself performs an important governance role. As mentioned earlier, this industry comprises not only ship operators but also a wide range of other participants and interests, each exerting an influence on, or being influenced by, the governance regime for marine transportation. Such participants include: technical agencies such as classification societies; naval architect and marine engineering associations; equipment providers; shipbuilders; ship repairers; ship breakers; insurance providers; protection and indemnity clubs; financial services; legal services; port and way service providers; communications providers; ship charterers; shipbrokers; emergency response providers; salvage services; marine training and development services; and international, supranational and national shipper and ship operator associations.

Clearly, each of these entities is in some way impacted by the governance process, and therefore aspires to have some means of influencing the policy generation and governance decision-making process. In this respect, the international marine transportation industry has a quite extensive interest and involvement in the governance debate, and therefore has important potential to influence the manner in which governance in marine transportation will evolve in the future.

It is also fair to say that, industry is generally speaking very largely supportive of governance initiatives to address sustainability issues. It is also well positioned in certain instances to apply leverage to encourage compliance. An example of such leverage is direction given to ship-owners not to utilize registries offered by administrations with poor reputations. More specifically, ship-owners have been encouraged by ICS to register solely with States that have not only undergone the IMO 'Voluntary Audit' process, but have chosen to make public the results of that audit.

[81] See Frances Keeler *Air Quality Regulations in the US - Impacts on the Maritime Sector.* CMA Conference Stamford Ct, March 2008

Again industry, in the form of the International Association of Classification Societies (IACS) performs a substantive role in regulating the ship design and development process. While this arrangement has frequently come under scrutiny in the past, and has indeed been subjected to examination through the Erika 1 package and by the European competition authorities, no satisfactory alternative arrangement has to date been forthcoming.

Industry's principal interest aligns closely with that of IMO in aspiring to ensure that whatever measures are implemented, they are as internationally uniform as possible. Clearly, industry satisfaction depends very largely on the degree to which the IMO driven, multilateral process effectively accomplishes its objective in providing a consistent, cohesive, global oversight regime and regulatory framework. Industry comfort and satisfaction is also influenced by the degree to which it feels that it is able to participate in the policy debates, and so influence the outcome, even though it has no formal 'voice' in the decision-making process.

On the whole, governments and industry have managed to work collaboratively and productively to arrive at mutually satisfactory solutions. There are however certain issues, usually with an environmental orientation, where difficulties have been encountered in arriving at a satisfactory consensus.

Such issues include, for example: slow implementation of waste reception facilities, as required by various MARPOL Annexes (I, II, IV and V); slow progress on identification of places of refuge; complexities associated with the implementation of the ballast water treatment requirements as called for in BWM Convention; liability provisions under the HNS Convention; provision of appropriate chemical incident response measures under the OPRC-HNS protocol; and strengthening of MARPOL Annex VI – *Regulations for the Prevention of Air Pollution from Ships*. The development of satisfactory solutions to these issues is seen as both important and urgent by the majority of responsible industry interests, and some frustration has been expressed with a governance process that continues to encounter difficulties in implementing the final solution directed at meeting the needs of all interested parties.

This concern regarding the failure of certain States to meet their mainly Coastal State responsibilities has led to the development by Baltic and International Maritime Council (BIMCO) of the concept of a 'Quality Coastal State.' This initiative is directed at focusing attention on what industry views as a double standard, where States take steps to hold industry to account for meeting certain convention obligations, while failing to ensure that they meet their own obligations under these same conventions.

Industry is also concerned that certain -usually environmental- conventions provide for varying degrees of unilateral adoption of more stringent standards, thus constituting a departure from uniform standards. Examples include the regional establishment of ECAs, PAs under MARPOL or PSSAs under the relevant resolution. The BWM Convention also provides for the discretionary application of more stringent standards. At issue as an uncertainty is whether this trend may be viewed by industry as being sufficiently problematic for it to result in a total loss of industry's confidence in the multilateral process.

As mentioned earlier, industry has recently voiced its concerns with the tendency to adopt 'aspirational' provisions in certain conventions.[82] Such conventions are adopted on the assumption that, while the technology necessary for their implementation and effective oversight is not available at the time of adoption, it will be designed, developed and marketed in the timescale predicted for ratification and entry into force. The BWM Convention may be viewed as perhaps the best example of the problem with this approach. In this instance, untidy delays in the entry into force of the convention have resulted from the inability of designers and manufacturers of BW treatment equipment to achieve the standards required and to make available shipboard-capable equipment on the market in the timescale anticipated by the convention. This has introduced some quite serious complications for those ship operators trying to plan for installation of very expensive ballast water treatment equipment, either through conversion on existing ships or during the new ship construction process.

Despite important concerns expressed by industry regarding the policy development and implementation process, it has clearly found it productive to participate in the policy formulation debate. More particularly industry is participating in the development of Goal Based Standards (GBS), refinement of the IACS Common Structural Rules (CSRs), development of the concept of providing ships with 'green passports' to facilitate safe ship recycling, and examination of the implications of arranging for Classification Societies to act principally on behalf of the shipyard during construction instead of the ship-owner.

Generally speaking, industry has been strongly supportive of IMO and the multilateral process. However, the increasingly challenging policy formulation situation that has been generated by environmental and security issues has given rise to some important misgivings in industry regarding certain aspects of the process. As to how these misgivings will play out in the future, and specifically in relation to industry's perspective on Arctic governance constitutes another important uncertainty.

4.6 Summary of the Characteristics, Challenges and Uncertainties in the Marine Transportation Governance Regime

A clear message emerging from this brief review of the hierarchy of governance, both globally and in the Arctic, is that, for the large majority of sustainability issues surrounding international marine transportation, particularly those relating to environmental or social sustainability issues, the first choice among virtually all interests is the multilateral process. It is only when difficulties are encountered in that process that alternative unilateral approaches at other levels in the governance hierarchy begin to emerge.

Again, as touched upon earlier, the interests of individual States may be such as to favour protecting the rights and privileges, powers and authorities of a particular category, be it Flag State, Coastal State or Port State. To date it has been possible to bridge differences of view and so achieve consensus, albeit frequently with some degree of compromise. For consideration is

[82] See, for example, the ICS/ISF 2008 Annual Review, page 20 which states "More generally, ICS has greatly welcomed the significant statement by the IMO Secretary General that care should be taken when laying down 'aspirational' dates in future conventions, the implementation of which may rely, in particular on technologies which may not be available when needed; thus acknowledging an issue which has been highlighted consistently by ICS for several years."

whether there are circumstances that could give rise to fundamental differences of view sufficient to undermine this ability.

At issue, then, is whether the multilateral process for the governance and oversight of international marine transportation, as it applies both globally and in the Arctic, is sufficiently robust to ensure a continued healthy economic environment in marine transportation, while at the same time ensuring continued globally uniform environmental and social sustainability.

The above analysis sets out the main considerations regarding future trends, challenges and uncertainties in relation to governance and oversight of international marine transportation generally, and in the context of this study, to the operation of international and domestic shipping in the Canadian Arctic. The next steps are to distil these critical uncertainties into contrasting, plausible and challenging scenarios for the 2025 timeframe.

Chapter 5 - Scenario Development

5.1 Introduction – Revisiting the Three 'Forces'

As broadly outlined in Chapter 1, the scenario development process involves a series of discrete steps to be taken. The process as described below relies upon a time frame through 2025.

5.1.1 The Steps in the Process

Step 1 involves presenting and explaining the proposition behind this project, namely that insights into possible future outcomes for Arctic marine transportation may be obtained by examining the interaction between three broad 'forces.' The first of these forces is Market Motivation, and the factors that stimulate private sector interest and participation in Arctic shipping. The second force is that associated with protection of the Public Interest in all its forms from the impacts of commercial shipping, whether driven by economic, social, safety, security or environmental interests or concerns, with the ultimate goal of achieving sustainability. The third force is that associated with Governance, its oversight of Arctic shipping, and its effectiveness in monitoring and ultimately influencing the interaction between the first two forces, so as to maximize the benefits of Arctic shipping while at the same time ensuring sustainability in all its forms.

Step 2 involves an analysis of each of the forces and their respective drivers in order to identify key trends and uncertainties. These trends and uncertainties are summarized later in this Chapter.

At Step 3 in the process, this project has chosen to be aided by the concept of a 'focal question' against which the uncertainties associated with each of the three forces may be tested. The following focal question has been developed for this purpose:

> ***How is it expected that shipping activity in the Canadian Arctic will evolve over the next fifteen years, as it responds to varying degrees of influence exerted by three key forces namely:***
>
> - ***Trends and uncertainties in global trade patterns, international shipping markets and commercial opportunities in the Arctic;***
> - ***Increasing pressures on shipping to conform to heightened priorities attached by global and regional societies to the achievement of economic, social and environmental sustainability;***
> - ***The evolving framework of governance exercised at the global, Arctic and Canadian Arctic levels, and comprising various elements of regulatory control and provision of support services?***

Step 4 involves a process of evaluating and prioritizing the uncertainties identified in Step 2 against the focal question developed in Step 3. The objective is to establish their importance and the degree or risk that each key uncertainty or trend presents.

Step 5 involves the exploration of possible variations in the relative influence of each force upon the other two. The answers generated through this process of exploration shed light on the potential impact of respective uncertainties as the influence of each force is varied. Variations in this range of potential impacts drive the generation of possible scenarios.

Step 6 involves the development of a small number of plausible, contrasting and challenging scenarios.

5.1.2 The Force Triangle – The Rationale Behind it

Figure 5.1 below illustrates the 'force' triangle and the hierarchy of principal drivers acting upon each force, namely Global, Arctic, Canadian Arctic influences, as addressed below:

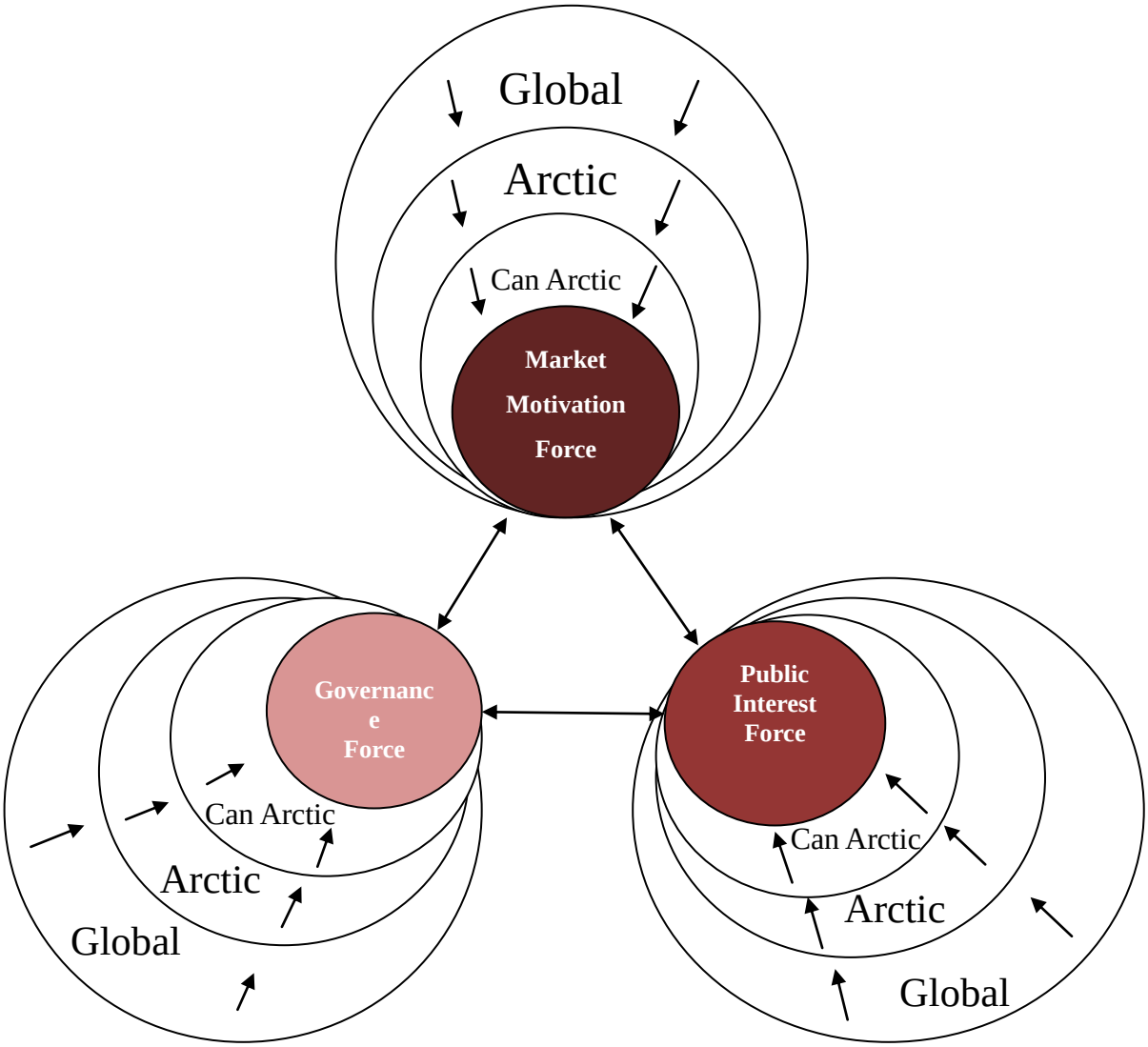


Figure 5.1 - Diagram Illustrating the Nature of the Interaction between the Three 'Forces'

5.2 Summaries of Key Uncertainties

The following summarizes the key uncertainties identified in the analysis of the three 'forces'.

5.2.1 Market Motivation Force

1. Global Market Uncertainties

a. World economic health

As the marine transportation industry operates on a derived demand basis, its health correlates closely with the health of the world economy. Accordingly, depending upon the performance of the global economy, the marine transportation industry may experience booms with significant profitability margins for ship owners, or a recession, with depressed shipping rates and a decline in profits.

b. Shifts in energy demand

Crude oil constitutes an important commodity for shippers. However, concerns regarding climate change and continued carbon emissions may undermine this market, particularly if a 'tipping point' is reached. New technologies resulting in increased yields from existing wells and the rise of natural gas also inject further instability.

c. Shifts in minerals demand

Construction booms within emerging markets have driven up bulk commodity prices in recent years, but economically challenging times have undercut these prices. Significant finds in developing countries, coupled with demand for these commodities linked closely with the economic condition in fragile markets, suggests an uncertain future for this market.

d. Shifts in food, freshwater demand

With projected shortages of food and freshwater expected in coming decades, there may be an increased market for transportation of these products, particularly from developing nations. However, predicting the scale, timing, or location of any such emerging demand is uncertain to say the least, as is the nature of the government involvement that would be needed to manage this activity.

e. 'Entrepreneurial' technology developments

Most shipping operates with only a narrow margin of profitability, and as such, ship owners and operators are continually seeking different means to improve profit margins. Technological shifts are notoriously hard to predict, but increases in operating costs, particularly the price of bunker fuel, will likely drive shifts in both ship design and the selection of power plant fuel.

f. Shipping activity shifts to the Far East

The past high rate of economic development has resulted in a continued demand for significant amounts of raw materials, in particular bulk commodities such as iron ore and coal. However an uncertain global economic outlook raises doubts as to whether this

rapid growth will continue. Further, there is the potential for a marked adjustment if manufacturing capacity is shifted away from China in favor of other Asian states with less developed economies, but which are capable of providing cheaper manufacturing services.

g. Shifts in flag choice, open registry developments

The establishment of open registries as an embedded feature of the marine transportation industry has forced changes to the governance, policies, and regulatory structure of this industry. The pattern of concentration of registration within a select number of flags will continue to affect the manner in which this industry is regulated.

h. Vessel financing

A pressing concern that has yet to be addressed is the significant number of contracts for new ships in order books around the world that have yet to be financed. With billions of dollars of contracts remaining unfinanced, the industry as a whole faces a challenging task ahead, a task which may have lasting consequences for traditional shipping nations.

i. Shipbuilding shifts, influences

The shipbuilding boom of the last decade has begun to decline due to market conditions, forcing the shipping industry to manage a glut of new vessels ordered at prices significantly over-cost, as compared to the current market. The trend towards larger vessels to take advantage of economies of scale is likely to continue, and may strain the resources of developing nations to accommodate these ships. The search for further efficiencies will likely drive an increased number of technological innovations within ship design and propulsion.

2. Arctic Market Uncertainties

a. Arctic marine transportation evolution

i. Destination related shipping activity

Dependent on favourable economic conditions, marine traffic servicing northern industrial projects may increase, as these efforts require transportation both for materials to establish production facilities as well as for the carriage of bulk commodities to market. This traffic is dependent on sufficient financial incentives to undertake these initiatives, relying especially on stable and inflated commodity prices. Local community resupply will likely continue to play a role.

ii. Transit shipping activity

The potential for transit passage within the Arctic varies widely. Uncertainties include the availability of support services from national governments, the provision of maritime services such as icebreaker support, an accommodating regulatory structure, as well as the preference of ship operators in terms of route selection. Additional variables include the continued (potential) warming of the pole, a corresponding decline in ice coverage, and possibly the rise of significant political or security concerns on other traditional routes, rendering them less attractive or inoperable.

b. Issues regarding year round operations and seasonal challenges

An inescapable reality is the seasonal limitation of operating within the Arctic. Regardless of a warming trend, the polar winter will remain a harsh operating environment with extended periods of darkness. Pack ice is likely to continue to form in significant amounts for the coming decades, and operating year round will continue to face challenges, particularly for offshore exploration efforts.

c. Arctic technology developments

With economic considerations driving northern exploration efforts and renewed interest in the potential for transit passage, technological changes to ship design are likely to occur, as ship owners seek to maximize the efficiencies available through accessing northern routes. Addressing issues such as ice navigation and extended self-support capabilities, as well as the exploration of alternative fuel sources in the face of environmental concerns, may give rise to ground-breaking shifts in existing ship design for northbound vessels.

d. Cost considerations compared with southern routes

In considering route selection, ship operators are largely bound by four elements: cost, speed, security, and reliability. Northern transit routes will need to represent a clear gain for ship operators if they are to attract any significant amount of vessels. Challenging environmental considerations, a lack of trained personnel for northern operations, and seasonal variability, offset advantages such as shorter routes. However, these limiting factors may be reduced through the involvement of national governments, who may seek to promote marine transportation within their northern territories. Conversely, the use of these northern routes may be minimized through the introduction of stringent regulatory regimes.

3. Canadian Arctic Market Uncertainties

a. Economic/marine transportation development potential

i. Energy resource potential

Concerns regarding carbon emissions are driving the search for alternatives fuels and the rise of natural gas threatens to undercut the profitability of this industry. Given the inflated costs associated with operating in the harsh northern environmental conditions within a shortened working season, operators will only pursue opportunities within the Canadian Arctic if there is sufficient financial motivation to do so, namely a stable, inflated price of oil within a favourable regulatory structure.

ii. Mineral resource potential

Recent proposals for industrial development in the Canadian Arctic primarily involve mineral extraction projects. The inflated costs associated with northern projects require a sufficiently high market rate for bulk commodities. As demand for these products is largely driven by the relative health of the global economy, decreased levels of economic development will render these projects financially unviable.

iii. Tourism potential

The Canadian Arctic has enjoyed steadily increasing visits from commercial tourist operations. This trend is likely to continue, but there are important uncertainties affecting the future development of this industry that include: the regulatory regime affecting these vessels; the possibility of an accident with serious loss of life affecting the public image of northern cruise tourism; and the substantial rise in costs associated with the industry to a point where these voyages are rendered cost prohibitive.

iv. Appeal of NWP for transit

The NWP is unlikely to be used for transit voyages, due to several limitations. These include the shallow draft of many of the passages, the uncertain weather patterns leading to challenging ice conditions, and the potential for the introduction of a demanding regulatory regime.

b. Cost comparison and alternative routes

The costs associated with the three Arctic routes available for transit are especially dependent on the provision of marine services and the significant infrastructure expenses which are required to support this activity. Competing levels of infrastructure, provision of services such as icebreaking on a free or user pay basis, the applicable regulatory regime and its corresponding requirements, as well as the more fundamental aspects of transit length, security concerns, and trade patterns will affect the relative cost competiveness of the routes available.

c. Mackenzie River trends

The Mackenzie River has seen the introduction of new players on the local marine transportation market who are seeking to take advantage of increased opportunities for deliveries to northern communities. Climate change, in particular its effect on traditional transportation modes such as ice-road trucking and the stability of northern runways, may increase the demand for marine transportation. .

d. Port of Churchill expectations

The port at Churchill is well situated to access the markets of the Canadian interior, and similarly could serve as a hub between other northern ports such as Murmansk and destinations farther afield. Despite the fact that development plans have been touted by local industry, the lack of a population center, a relative lack of infrastructure for both inland and marine transportation, and challenging environmental conditions present serious obstacles which may only be alleviated by significant investment.

5.2.2 Public Interest Force

1. Global Public Interest Uncertainties

a. Global Climate Change issues

The rapidity with which climate change is expected to occur and the severity of its impacts are not easily predicted. Many anthropogenic influences are involved, which makes it difficult to make predictions. Population increase has undoubtedly contributed to a steady rise in energy consumption. The use of fossil fuels such as oil, natural gas, and coal are imposing major stresses on climate change, and will continue until viable alternatives are more accessible. Various impacts of climate change that are likely to occur include changes in temperature, severe weather events, sea level rise and flooding, changes in ocean circulation, and ocean acidification. Storm surges and extreme weather events may also lead to coastal erosion and instability. This uncertainty is exacerbated by the high inter-annual variability in the ice conditions.

b. Exhaust gas emissions issues

The impact of exhaust emissions from ships, including CO_2, SOx and NOx is a key uncertainty. As demand for additional transportation capacity grows, these emissions will increase and could contribute to further global warming and ozone depletion, potentially leading to changes in public perception of the industry.

c. Marine pollution risks, impacts, concerns

The average frequency and size of large oil spills has decreased significantly over the past several decades, however the risk of a large spill occurring can never be completely eradicated. Even small spills can negatively impact habitat and wildlife. It is reasonable to assume that spills arising from collisions and groundings are more likely to occur in coastal waters where marine resources are heavily relied upon by coastal communities, and the impacts could be severe. Furthermore, dumping of garbage, as well as accidental or operational discharges of oily and chemical wastes in the offshore marine environment can pose serious environmental problems to marine biodiversity.

d. Alien species, (ballast water, hull fouling) concerns

The potential for introduction of invasive species to Arctic waters from shipping activity could result in a cascade of impacts on the marine environment. While it is difficult to predict with any accuracy the consequence of such an event, it is reasonable to expect these consequences to be severe. The nature and extent of impacts that invasive species may have on a marine area is dependent on many factors, and is extremely complex. Other species may be expected to be directly or indirectly impacted by a reduction or increase in species lower or higher on the food chain, particularly key prey or predator species. The most likely manner for the introduction of an invasive species is through the intake of ballast water in one location, and subsequent discharge in another.

e. Noise pollution and habitat disturbance.

Increased shipping traffic will lead to increased ambient noise within the surrounding area. It is uncertain how increased ambient noise will disrupt species' behaviour, but it

could cause the abandonment or trampling of young, or displacement from traditional habitat. Cetaceans rely on sound for communication, navigational purposes, and for detecting the presence of predators. Therefore, noise from ships can easily disturb important behavioural characteristics of whale populations or even lead to temporary or permanent hearing loss. Noise induced stress could negatively affect reproduction, cause a shift in feeding habits, or lead to major shifts in marine mammal migrations and distributions.

2. Arctic Public Interest Uncertainties

a. ***Arctic climate change issues***

The Arctic is particularly vulnerable to the impacts of climate change, but the severity of impact is difficult to predict. Uncertainty related to the extent of diminishing sea ice, the rate of warming, and ecosystem impacts are all important considerations. Potential impacts of climate change in the Arctic include reductions in primary production, shifts in the food chain, shifts in species ranges, invasive species, and melting permafrost and ground instability.

b. ***Marine pollution issues and pollution response capabilities***

The consequences of a spill depend greatly on the type and amount of substance released into the environment. In some cases, wastes may be more easily broken down than in others and may impact the ecosystem differently. How critical ecosystem processes will be affected in the instance of a major pollution event is uncertain. Ice presents major operational challenges for containing and mitigating such an occurrence. Colder water temperatures reduce the ability of petroleum hydrocarbons to be broken down naturally. This heightens the potential for cumulative impacts to be felt in the long term, in addition to the immediate impacts of a spill.

c. ***Arctic Community issues and needs***

Arctic Communities are facing serious social challenges as they adjust to rapidly changing climatic and societal trends. Northern development and associated shipping activities have the capacity to create turbulence and upheaval in the social norms of Arctic communities, and to disrupt traditional northern hunting and fishing patterns. Cruise ship activities also have the potential for both positive and negative consequences for Arctic communities. Possible increases in environmental damage that often accompany shipping and resource extraction could cause serious harm to the marine habitat, and negatively affect the health and traditional lifestyles of indigenous peoples.

d. ***Safety issues and SAR concerns***

The likelihood of a major safety incident occurring in the Arctic in the near future is a key uncertainty. Situations where critical equipment fails, or back-up equipment fails because of extreme cold or ice could pose severe risks. The remoteness of polar waters and extreme cold also make repairs more difficult, and shortage of infrastructure support exacerbates the situation. Operations in the NWP are further complicated by seasonal darkness and inadequate charting. The ability to mount an emergency response, in terms of both equipment and preparedness training in the case of an incident is unclear under current circumstances.

e. ***Sovereignty and security issues.***
It is unlikely that any Arctic issues are sufficiently controversial that they could lead to a major military confrontation between Arctic States. How sovereignty and security issues will play out in the Arctic is a key uncertainty. Furthermore, the role that other Nation States could play, for instance China, Japan, and South Korea is unclear. Security issues elsewhere may increase the attractiveness of routes through the Arctic, as piracy, terrorism, and political and public unrest could lead to demand for new, economical routes of transit such as the NSR or the NWP to increase substantially.

3. Canadian Arctic Public Interest Uncertainties

a. ***Canadian Arctic climate change issues***
There are several ecologically significant and sensitive marine areas in the Canadian Arctic that are particularly vulnerable to climate change and other stressors. How these areas will be impacted by climate change in the future is uncertain, but the effects will be most heavily felt by the communities that depend on these areas of the Canadian Arctic.

b. ***Environmental protection issues and infrastructure***
The CCG, working in collaboration with industry and Arctic communities, is the lead response agency for spills in the Arctic. The response effectiveness of existing infrastructure is a vital component in reducing the level of exposure and disturbance to the marine environment and it is uncertain whether future infrastructure will be sufficient in the next 10 to 15 years. Most of the vessels in the CCG's icebreaking fleet are over 30 years old and do not operate in the Arctic year-round. The remoteness of the Arctic will limit the ability of the CCG to respond to an emergency in a timely manner.

c. ***Canadian Arctic Community needs***
How Canadian Arctic communities will react to climate change and vessel traffic is dependent on various factors that make it difficult to predict with any certainty. Conflict may arise over certain areas that are important for shipping as well as traditional use, whereas in some cases the potential for more jobs may well outweigh any negative aspects. Concerns are often related to structural integrity of buildings, modifications of the community economic base, impacts on traditional food harvests and transportation, and shifts in industrialization, flooding, forest fires, and landslides. Community response will vary among the various, diverse communities in the Canadian Arctic, and is difficult to predict.

d. ***Shifts in community resupply needs***
Population has been steadily increasing in the Canadian Arctic over the past several years, and many communities have grown substantially. As climate change continues to affect the Arctic region, it is expected that there will be shifts in species ranges and therefore impacts on traditional food sources. The level of impact on traditional hunting is uncertain and will have implications for community re-supply. Trans-boundary pollutants are already an issue, since these substances bio-accumulate in tradition country food, which some Northern communities rely on. As traditional sources of food become

increasingly unreliable or unsafe, there will be considerably more demand for regular community re-supply.

e. ***Security issues***
Security issues in the Canadian Arctic are complex and go beyond the traditional threats posed by other nation states. Issues of "human security" include threats that involve economic, environmental, societal, and cultural issues. The Arctic is not immune to the possibility of criminal threats (terrorism, piracy, drugs, human smuggling), as well as more traditional military threats.

5.2.3 Governance Force

1. Global Governance Uncertainties

a. ***Loss of global confidence in the multilateral governance process***
A possible worldwide loss of confidence in the effectiveness of the multilateral governance process generally would result in increased tensions with other levels of governance and a shift towards increased unilateral action. These difficulties may arise due to problems of increasing complexity of issues; increasingly blurred responsibility interfaces; confused democratic accountability; uncertain competency of institutional members and secretarial staff as complexity of issues shifts and expands and procedural issues delay progress. There is related uncertainty regarding possible trends towards increased unilateral actions by individual States.

b. ***Tensions between Flag, Port and Coastal States***
There is some potential uncertainty with regard to increasing tensions between Flag States and Port/Coastal States respecting management of the quality of shipping and potential threats to safety and the environment. Linked to this, there is some uncertainty regarding the future of 'open registry' and its implications for regulatory compliance.

c. Tensions between governments and industry
The possibility of increasing tensions between governments, either collectively or individually, and industry regarding the challenges associated with implementing complex fixes particularly environmental fixes, especially in tough economic times.

d. Feasibility of finding solutions to global environmental trends
Growing doubt as to the feasibility of finding workable solutions for shipping that address global environmental and other threats such as climate change, population growth, shortages of fresh water.

2. Arctic Governance Uncertainties

a. Effectiveness of the Arctic Council
b. There is some uncertainty regarding the future effectiveness of the Arctic Council as the leading multilateral body exercising governance in the Arctic. Its contribution as a supranational body is also open to question, in view of the governance challenges it faces, including the difficulties associated with defining the rights, privileges, authorities and

manner of participation of its various hierarchies of membership, and its evolving relationships with other multilateral agencies such as IMO.

c. Effectiveness of the Polar Code

Uncertainty regarding the effectiveness of the Polar Code, as it is introduced and applied, in preventing, or at least mitigating the likelihood of major Arctic safety and environmental incidents.

d. Future technology trends

There is uncertainty regarding future trends in technology as they relate to both Arctic shipping performance and 'governance oversight.' The latter includes Arctic regulatory monitoring and control, and support services such SAR and pollution response. There is also uncertainty as to whether future technology trends might also give rise to increased risk of serious accidents and environmental damage.

3. Canadian Arctic Governance Uncertainties

a. Absence of a vision for the Canadian Arctic

In the absence of any substantive vision statement for the Canadian Arctic, there is uncertainty as to Canada's hopes and aspirations with regard to Arctic shipping, including, whether or not different types of shipping activity are viewed as desirable or undesirable, and therefore what measures might be taken to stimulate or discourage these types of activity.

b. Underestimation of the severity environmental issues

Uncertainty as to whether the current government policy posture, placing priority as it does on sovereignty and economic development, underestimates the seriousness of environmental issues such as climate change, including water level rise, loss of permafrost, ocean acidification, black carbon, methane.

c. Increasing disparity in the levels of shipping activity in the NSR and NWP

Uncertainty regarding emerging disparities between the scale of shipping activity in the NSR and that occurring in the NWP, and whether this is perceived by Canadian authorities as a positive or a negative.

d. Infrastructure investment

Uncertainty regarding the timing and future scale of investment in infrastructure and support services in the Canadian Arctic including icebreaking support, navigational services, port services and SAR, and whether the provision of such support services should be, at least to some degree, cost recoverable.

e. Enforcement effectiveness

Uncertainty regarding Canada's enforcement strategy to ensure that ships operating in waters over which Canada claims jurisdiction meet the requirements of the CSA, the AWPPA, the potential imposition of a PSSA or ECA, including military oversight if, as and when required.

f. Research and data collection

Uncertainty regarding the effectiveness of Canada's Arctic research and data collection activities in support of Arctic hydrography, oceanography, meteorology, ice data, and its implications for the safe navigation of ships.

g. Environmental Impact Analysis

Uncertainty regarding the future conduct of Environmental Impact Assessments to ensure the safe fulfilment of specific shipping projects, particularly those associated with major resource developments.

h. Canadian Arctic Shipping Policy

Uncertainty regarding future directions for Canadian Arctic shipping policy, and the implications of such directions for future cabotage operations and Canadian participation in international shipping activities in the Arctic. This includes a possible reduced effectiveness in the oversight of shipping, reduced competency in Canada's Arctic seafaring expertise, and more limited provision of ice navigators.

5.3 Evaluating, Prioritizing Uncertainties and Developing Selected Scenarios

Development of plausible scenarios flows from an examination of particular variations in the relative strengths and influences of the three forces, which are in turn dependant on assessment of the risk and importance of their associated uncertainties. Such force variations may be illustrated graphically as in Figure 5.2 below. Each hexagon is intended to 'locate' a particular scenario. The nearer the hexagon is to a particular 'force' circle the more influence that 'force', and its associated trends and uncertainties will have in the consideration of the characteristics of the scenario.

Thus in the case of Scenario 1, the hexagon is located quite close to both the Market Motivation force and the Governance force, but some distance from the Public Interest force. In this scenario it is hypothesised that there is a strong market influence with a supportive governance process that favours commercial and economic success over environmental and social sustainability, and that there is a muted voice of the public in having its sustainability arguments recognized and accommodated.

In the case of Scenario 2, the hexagon is located in close proximity to both the Public Interest force and the Governance force but some distance from the Market Motivation force. In this scenario, it is hypothesised that the governance process will be receptive and sympathetic towards protection of environmental and societal sustainability, perhaps at the expense of economic development opportunities. The shipping industry may encounter difficulty in conducting commercially viable operations in or through the Arctic.

In the case of Scenario 3, the hexagon is located in close proximity to both the Public Interest force and the Market Motivation force, but some distance from the Governance force. In this case, despite somewhat ineffective governance efforts, perhaps as a result of tensions between Arctic States over jurisdictional issues, the shipping industry has acted responsibly to work with Arctic communities to accommodate respective needs. While this scenario may seem unusual, it is considered to be a plausible option.

In the case of Scenario 4, the hexagon is located equidistant from each of the three forces. This scenario may be expected to provide the most harmonious and possibly effective scenario, as set out below.

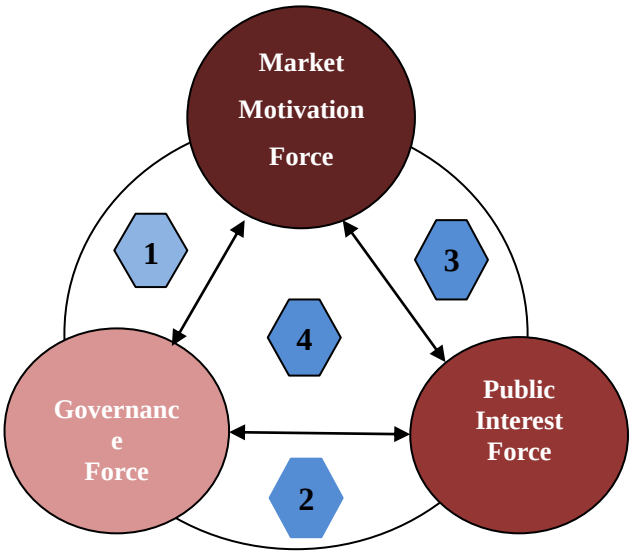


Figure 5.2- Graphic Depiction of Possible Scenario Variations

5.4 Descriptions of the Four Scenarios

Scenario 1: Strong market motivation force, strong and economically sympathetic governance force, weak public interest force

It is 2025. Continued turbulence in world trade has led, over the last decade, to a global preoccupation with economic performance to a point where accommodation of 'green' considerations has seriously suffered. The needs of a continuously expanding global population have given rise to ever growing demands for essential commodities such as food, freshwater, essential minerals and of course, energy. And while some progress has been made in the development of renewable energy sources, the world has made little progress in 'weaning itself' from its ongoing reliance upon hydrocarbon origin energy, particularly in relation to the needs of the transportation industry. Demand for the major bulks (iron ore, coal, bauxite, and phosphate) has continued unabated, while demand for higher value minerals has also continued to grow.

In response to this economic situation, the size of the global shipping fleet has continued to expand in response to demand. Shipbuilding subsidies and other industry support initiatives designed to deal with struggling economies have resulted in an ongoing oversupply of capacity and a continuing downward pressure on freight rates and hence profit margins. At the nation State level, economic priorities have trumped other public interest considerations including societal and environmental priorities. While climate change has long been recognized as in urgent need of attention, with ocean levels continuing to rise and becoming more acidic, melting of the permafrost continuing to generate problems, and serious weather events becoming ever more frequent, the global remedy requiring initiatives that may put a State's competitive advantage at any serious risk remains elusive.

The shipping situation in the Arctic has evolved. The rapid and accelerating trends in climate change have led to much longer seasons of open water, particularly in the NSR, which is increasingly becoming an attractive alternative, both economically and from a security perspective. Security risks include continuing high risks associated with political disruption of passage through the Suez Canal, and frequent threats of piracy in the Arabian Sea and approaches to the Canal. The NWP is lagging in terms of choice as an alternative transit route, held back not only by more serious navigational challenges, but also by continuing lack of government financed infrastructure. The shortage of support services, albeit free when available, is also acting as a disincentive. However, this has not to date been viewed as a major concern, as transit traffic is not seen as bringing any major benefits to Canada, which has preferred to focus on resource development opportunities in the Arctic Archipelago.

In this respect, an ever-increasing demand for resources has triggered a major expansion in the exploration, development and ultimately transportation of energy and mineral resources out of the Arctic, particularly the Canadian Archipelago. The Canadian government, with its continuing priority on economic development within secure borders, has moved to encourage such an expansion in activity in order to maximise economic development benefits flowing from such activities.

An important consequence of this focus on economic development is that other public interest dimensions have been neglected, and in certain instances, largely ignored. This has resulted in a number of serious consequences for social, safety, security or environmental sustainability in the Arctic. Environmentalists continue to sound the alarm regarding a major Arctic catastrophe which could occur at any time.

This preoccupation with development has meant that important environmental risk management strategies, including any initiative to adopt a precautionary approach with regard to the carriage of crude oil or heavy fuel oil through or out of the Arctic, have been ignored. For some time, Canada has shown little enthusiasm for such an approach, and neither IMO nor the Arctic Council has been able to achieve a consensus on this issue, due in part to Russia's wish to transport such cargoes through the more navigationally hospitable NSR.

Very recently a high ice-class, Marshal Islands registered, Japanese owned icebreaking very large crude carriers (VLCC), crewed by Indian officers and Filipino crew, and carrying crude oil out of the high Arctic in late November, hit an uncharted obstacle west of Devon Island in Zone 6, ASPPR. While the crew have eventually been rescued, a large amount of crude oil has been spilt. Limited light levels, coupled with cold temperatures and increasingly heavy ice conditions have made assessment of the spill difficult, let alone mounting any sort of effective response. While modest oil spill response equipment already positioned in the Arctic has been transported to the location, it is woefully inadequate to address the size of the spill. Given the time of year, there are few if any CCG or other vessels positioned in the Arctic capable of assisting in the response. Spraying of dispersants by chartered aircraft is being organized, but there are serious doubts about the effectiveness of this tactic, in addition to deep concerns as to the further damage these dispersants could do to fragile Arctic eco-systems.

Environmentalists around the globe have declared this incident to be an ecological disaster. Arctic communities are appalled by the damage being done to the local environment, and are calling for immediate global assistance to remedy the situation.

Scenario 2*: *Strong public interest force, strong, socially and environmentally sympathetic governance force, weak market motivation force

It is 2025. A number of serious environmental events in various parts of the world, including increasingly violent storms causing significant fatalities and serious flooding of low-lying communities due to a continuing rise in sea levels have shifted global opinion and persuaded responsible multilateral institutions of the urgent need to find solutions to global warming. The principal culprit has been identified as GHGs resulting from use of energy derived from hydrocarbon sources. This focus of concern has triggered renewed efforts to expand energy generation from renewable sources. Demand for 'dirty' energy resources such as crude oil and coal has dropped considerably, driven in part by the imposition of taxes and other mechanisms, as advocated by several multilateral bodies with related responsibilities aimed at discouraging their use. While hydrocarbon-based energy consumption by transportation providers such as shipping has presented particularly serious challenges, the high cost of transport of both goods and passengers has placed a downward pressure on demand, and at least stalled any further growth in transportation activity.

A worldwide enhanced awareness of the environmental fragility of the Earth has led to recognition that unconstrained economic growth can no longer be viewed as an acceptable objective if any degree of long term environmental and societal sustainability is to be achieved. Economic development objectives have come under close scrutiny, as governments seek new ways of meeting the social support and environmental protection needs of an expanding global population. There is a widespread recognition that success in the management of climate change depends upon broad acceptance that much of the world's remaining hydrocarbon resources will have to remain in the ground.

All this has precipitated a significant downward pressure on the demand for new resources, and for the related capacity to transport them. This has led to a marked reduction in commercial interest in pursuing resource development opportunities, particularly in the Canadian Arctic. As a result, while community supply activities have continued and indeed have undergone some growth, and the cruise tourism trade has grown modestly in response to a longer season, there has been little or no growth in shipping activity in support of resource development opportunities. The growing disinterest in Arctic opportunities has meant that northern communities are receiving little or no benefits from economic development in that region. Coupled with the impacts of Arctic climate change that continue despite global efforts to address the problem, considerable hardship and serious social issues are being experienced by many Arctic communities.

The serious impacts of climate change have had consequences for northern communities that rely on traditional Arctic eco-systems for sustenance. Efforts principally driven by southern interests to mitigate the negative impacts of climate change have brought little solace to the North, where communities struggle to maintain their economic, physical and social health and well-being.

Slowing down the continuing trends in climate change has done little to reverse the negative impacts on Arctic mammals, and numerous Arctic species continue to face competition from other species that have traditionally resided in more southern latitudes. Melting permafrost continues to create havoc in Arctic communities, as essential infrastructure is impacted by major subsidence problems

In summary, the global preoccupation with finding solutions to some of the major social and environmental challenges has had some success, but only to the degree that it has slowed the rate of environmental degradation. At the same time, constraints placed on various stimuli driving economic development have generated significant problems for Arctic communities, due to downward trends in resource development and associated transportation activity.

As Arctic communities grapple with apparently insoluble problems, and Arctic development activity stalls, social issues in the communities continue to increase. The government has recently announced an extensive multi-billion dollar program of emergency social assistance to address the increasingly desperate situations now faced by many Canadian Arctic communities.

Scenario 3: Strong market motivation force, strong public interest force, ineffective governance force

It is 2025. Over the past ten to fifteen years there has been a growing frustration with the inability of multilateral governance institutions to generate timely, effective solutions to the world's serious problems. The WTO, the World Bank, UNEP, UN Framework Convention on Climate Change (UNCCC) have all struggled to manage the increasing complexity of the world's economic, social and environmental challenges. In turn, multilateral bodies with responsibilities for marine transportation such as IMO, ILO, UNCTAD and the OECD have been impacted by this global loss of confidence in the multilateral process. As a result, there has been a growing shift to unilateralism by nation States, as each seeks solutions to the local impact of global problems.

This disenchantment with governance exercised by nation States, either collectively or unilaterally, has led industry to assume a more prominent role in responding to the global challenges. The international marine transportation industry has been no exception. The ICS has promoted the role of the industry in supporting the goal of 'green growth,' and has not only continued to lend its full support to such initiatives as the IMO Member State Audit Scheme, but has also been an important influence in pressing for such audits to become mandatory. ICS has also continued to publish its Shipping Industry Flag State Performance Table as a means of highlighting where certain States are failing to meet their obligations.

Meanwhile INTERTANKO has continued to promote its "Poseidon Challenge", albeit encountering some difficulties as the industry tries to cope with the consequences of dysfunctional multilateral governance issues. Organizations such as Rightship have become more prevalent in offering private sector advisory service on responsible ship performance. Classification Societies have endeavoured to maintain common international standards through the continued application of the Common Structural Rules.

In short, the marine transportation industry has endeavoured to maintain a uniform, responsible approach to the conduct of its business, despite the growing disfunctionality of governments at the multilateral level.

In the Arctic, unresolved jurisdictional issues have continued to fester, causing heightened tensions in such fora as the Arctic Council, making for difficult negotiations on a number of fronts where previously good progress had been made in a collaborative approach. While some Arctic States favour strong application of the precautionary approach in reducing the risk of an environmental disaster, other States have not supported this approach as a priority, despite being signatories to the *Rio Declaration on the Environment and Development*.

Canada has continued to claim that the waters of the NWP are internal waters, but both the US and Europe have continued to challenge this position, claiming it to be an international strait. Article 234 of UNCLOS has given Canada some leverage to place constraints on shipping through the NWP, but not to the point of disallowing passage.

Russia has encountered no such challenges to its control of the NSR. Through heavy investment in Arctic infrastructure and support services, funded by charges levied on shipping wishing to utilise the NSR, Russia has steadily built up its knowledge, experience, competencies and reputation as the global leader in Arctic shipping expertise.

Citing the US and European position that the NWP is an international strait, a Russian nuclear icebreaker recently embarked on a transit of the NWP in December, escorting a Chinese four season ice-capable tanker carrying heavy fuel oil and a variety of hazardous cargoes through the NWP. While both vessels meet the ASPPR zone requirements, the Canadian government is extremely upset, not to say embarrassed by this situation, particularly recognizing that the recently operational Arctic Offshore Patrol Vessels do not have the necessary ice-class to operate in these waters at this time. Further, it is unclear what action could be taken even if these vessels were capable of operating in these waters. Canada's claim of sovereign control is viewed by many experts as being seriously weakened.

Scenario 4: A broad balance between the market motivation force, public interest force, and governance force

It is 2025. Climate change continues to be a major worldwide concern as communities around the globe deal with its consequences. However a strong global consensus has recently emerged that this issue must be addressed if there is to be any hope of a sustainable future. This has led to some important agreements on the collective action required. This action has attempted to accommodate the urgent need to mitigate the impact of climate change, while continuing to recognize the importance of global economic sustainability.

This has led to moderation in energy demand and shifts to cleaner fuels such as LNG. Indeed natural gas, whether extracted directly as in the North Sea, or through such processes as hydraulic fracturing, has become the energy source of choice, particularly for transportation industries such as shipping.

This shift to natural gas as the fuel of choice, coupled with the continuing refinement in technical and operational measures to be adopted by shipping, such as the Energy Efficiency Design Index (EEDI) for new ships, and the mandatory adoption of the Ship Energy Efficiency Management Plans (SEEMP) across the existing world fleet, have significantly improved ship performance. The shipping industry now meets management standards for addressing the impact of climate change. The expanded acceptance of 'green ships' has allowed world trade to continue at levels of activity that might not otherwise have been regarded as acceptable.

In the Arctic, particular efforts have been made to protect the environment from pollution while permitting resource development to continue. This has been achieved by encouraging extraction and transportation of Arctic gas, while banning the extraction and carriage of crude or heavy fuel oil. These initiatives have facilitated increased extraction and transportation of Arctic mineral resources

In Canada, the government has adopted a balanced approach to Arctic development that meets its environmental and social management goals while encouraging a number of focused economic development objectives. Efficient, non-discriminatory oversight of shipping, in accordance with the CSA 2001 and the AWPPA has received growing acceptance by regular international ship operators. Bilateral agreements have been negotiated with regard to jurisdictional issues, and national governments are no longer concerned about future disputes over access to under-sea resources.

Economic development successes have generated strong revenue, sufficient to have provided the necessary rationale for the government to make major investments in Arctic infrastructure and icebreaking capacity while imposing reasonable charges for support services. Revenues from these charges have helped to make modest contributions towards the financing of this infrastructure. No charges are imposed on community resupply activities.

While differences in the rates at which Arctic ice has been melting has meant that shipping activity in the NSR has tended to significantly exceed the activity levels in the NWP, increasing levels of transit traffic is occurring, either passing through the Archipelago or following a more northerly route over the Pole. Again, where a transit passage is made through the Canadian Archipelago, the revenues generated by the application of a compulsory tariff are put towards further strengthening Canada's Arctic surveillance and support capabilities.

The positive, stable commercial environment has enabled industry to work closely with the government to ensure that environmental, social and safety objectives are met. In several circumstances, through appropriate training and certification of seafarers, as well as construction and equipment standards flowing from the Polar Code, shipping has been operating on a year round basis to performance standards agreed with the government. These operations have occurred without direct government support and assistance during certain periods of the year.

The Canadian government has also recognized that, beyond the CCG, there is only limited Canadian Flag (Canadian crew, Canadian owned, Canadian Flag State Implementation assurance), involvement in Arctic shipping, primarily involved on seasonal community resupply. The government has noted that this situation has seriously weakened the collective scope and

depth of the Arctic knowledge and experience of Canada's seafarers. Some have argued that the government has also biased choice of delivery for Arctic resources to export markets rather than for domestic consumption, thus handicapping domestic processing opportunities.

More importantly, the government has noted with concern that, with the dominant characteristics of shipping operating in the Arctic being foreign flag, foreign crew, and very possibly foreign beneficial ownership, the risk of regulatory non-conformance has markedly increased. This situation has meant that while the benefits flowing from the provision of subsidized services are flowing overseas, the regulatory enforcement challenge is being made more difficult.

The government has further recognized that the appeal of utilizing Canadian flag ships for Arctic operations other than cabotage applications depends on these ships being competitive with the choice of alternatives, most notably with 'open registry' vessels. The government has also concluded that the inability to compete with foreign flag alternatives might be mitigated by providing European style 'ring-fenced' relief from the full imposition of corporate taxation through the application of a 'tonnage tax.' Further, crews engaged in international trade for a certain percentage of the year may be extended some relief from income tax, thus providing ship-owners with options for reducing crew costs. This special regionally focused tax relief was recently implemented, and has not only triggered a marked expansion in the use of Canadian Flag shipping for resource development in the Canadian Arctic, but has also provided an opportunity for ships engaged in community supply to utilize their ships in international trade during the closed season. This has led to a marked reduction in the cost of the transportation component of community resupply. In addition, there has been an important expansion in personnel with extensive Arctic ship-operating expertise.

While the consequences of climate change have not gone away, their impact has been eased somewhat. Arctic communities have benefited from environmentally and socially sustainable Arctic development. Any tensions around Arctic jurisdictional issues have been largely mitigated by fostering a growing climate of trust and collaboration between Arctic States, and between these States and other nations and non-governmental organizations (NGOs) with a strong interest in the Arctic. There is a high level of comfort with how sustainable Arctic development is occurring.

5.5 Conclusions to be drawn from the Scenario Exercise

The descriptions set out in the previous section have as their goal to offer plausible, challenging and contrasting scenarios as to how marine transportation in the Arctic might unfold over the next ten to fifteen years. As repeatedly stressed, these scenarios do not constitute forecasts, but are instead intended to relate alternative credible futures. What may be drawn from these scenarios will be discussed in the next chapter.

Chapter 6 - Summary and Conclusions

The starting point for this exercise has been the recognition that unprecedented climatic changes are occurring on a global scale, with even more extreme changes in the Arctic. These changes will have important consequences for the users and providers of marine transportation. It is equally evident that policy-makers need to equip themselves now in order to prepare for what must be clearly viewed as significant - some may say 'game-changing' – challenges that will arise in the near future.

In response to this broadly accepted reality, and in order to plan more effectively for the evolving situation, considerable effort has been invested in constructing forecasts of the future for international shipping, including expectations with regard to Arctic shipping. Despite these efforts, little consensus has emerged as to the reliability of any single extrapolation of current trends into the future. Stated bluntly, no dependable prediction of an expected outcome has been put forward. Forecasting has not worked, and there is a need to find a better way.

This increasing acceptance of the shortcomings of forecasting as a policy tool, particularly in situations such as in the Arctic, where the trends and influences are complex, frequently externally driven, and fraught with uncertainty, has been the principal driving force behind recent efforts in various quarters to develop a new approach. The use of scenarios is one such approach, which may provide insights into possible policy options in preparing for future marine transportation activity in the Arctic.

While the use of a 'scenarios' approach is being increasingly viewed as a valuable technique for examining complex futures, the exact methodology is still evolving, and it has been up to those engaged in such projects to 'massage' the methodology in order to meet their particular needs. To date, several of those who have utilised a 'scenarios' approach to examine credible futures for a specific initiative or activity have made careful efforts to construct their scenarios with the aim of ensuring that these scenarios cannot be differentiated on the basis of their positive or negative appeal. This project has taken the position that investing effort to avoid constructing positive or negative scenarios is not essential for purposes of drawing value from the exercise, as long as all scenarios pass the test of being generally equally plausible. Indeed this project has gone out of its way to illustrate, through the scenario approach, how particular policy choices may be viewed as preferable to others due to thier influence on how the future might unfold.

More specifically, the project authors are aware that Scenario 4 constitutes a more attractive outcome than the first three scenarios. This reflects the fundamental thesis that stable market functioning, involving the provision of economic, efficient, and adequate shipping services, combined with responsible protection of the public interest in all its environmental social, safety and economic dimensions, supported by effective governance and oversight make up the essential ingredients for success. This thesis also reflects the view that there is a clear need to achieve a balance between the three identified 'forces.' The focus of attention is then placed on the evolving circumstances and the initiatives that need to be taken to address the factors that may be viewed as the essential elements for achieving this balance.

The previous chapter has presented, though a series of steps, the process used in order to develop four 'candidate' scenarios for marine transportation in the Canadian Arctic. This process begins with summarizing descriptions of the three forces as presented in Chapters 2, 3, and 4, and identifying the uncertainties associated with the future evolution of these forces. Then, in Chapter 5, the process shifts to an examination of how these forces interact, and provides a 'focal question' against which the various key uncertainties can be assessed. A final step involves the construction of the four scenario descriptions which identify plausible variations as to how the various forces and uncertainties will interact.

In presenting this progression, the aim has been to illustrate the underlying rationale and logic flow behind the scenario approach. More particularly, it has hopefully been demonstrated that simple forecasting is not the only, nor necessarily the best, way of looking at the future. A further hope is that it has been clearly shown that there is value to be gained by providing insights into the various 'forces' at play with a given context and how the identification of the uncertainties associated with each of those forces can lead to a productive debate regarding plausible scenarios.

It is suggested that not only the NEXTAW group, but also policy makers, regulators and shipping industry leaders, as well as those NGOs that have as their role the protection of various dimensions of the public interest, may wish to draw upon the scenario methodology. Through a process of consultation and debate, hopefully these groups could agree upon plausible alternative outcomes.

In this respect, it should be stressed that it is the methodology, and the opportunities that it offers for collective debate that make up the real value of this exercise. Readers do not have to feel as though they must choose the most likely scenario from those offered here. Instead, it is suggested that the true value of this exercise is in providing a framework for consideration by individuals or groups as to possible likely outcomes, and hence assist in forming expectations as to what factors will become the dominant influence in dictating how marine transportation in the Arctic will unfold. In short, the value is as much, if not more, in the 'journey' rather than the 'destination.'

To assist in stimulating this debate, this final chapter closes with some illustrative 'candidate' subjects for collective discussion in relation to the forces, trends and uncertainties set out on the previous chapters, either at NEXTAW or in other policy fora. The questions are as follows:

- Recognizing the radical changes occurring in the Arctic, due in large part to climate change and other exogenous factors, how might Canada's vision for Arctic marine transportation in the next decade best be articulated? What should comprise the principal elements in Canada's vision for achieving economic, environmental and social sustainability?

- More specifically, what scenarios should Canada view as being desirable or undesirable with regard the evolution of Arctic shipping? What types of traffic (be it transit or destinational in character) should be encouraged or discouraged? What actions might best be taken to either encourage or discourage this activity?

- Recognizing that some shipping activities present more benefits and/or less risk than others, what goals should Canada set for its regulation of, and provision of support to, Arctic shipping? How might the precautionary approach best be applied in shaping these goals?

- In what way, and to what degree, might adjustments be made to Canadian shipping policy in addressing both cabotage and international shipping dimensions, in order to generate maximum economic, social, safety and, security benefits to Canada from an enhanced Canadian Flag presence in Arctic shipping operations?

- Recognizing that sovereignty and protection of the Canadian Arctic remains a priority, in the context of marine transportation, what specifically are Canada's Arctic sovereignty aspirations? How might the achievement of these aspirations be measured? What considerations should guide Canada in deciding the appropriate balance between sovereignty goals and other developmental, societal and environmental goals? Are Canada's sovereignty goals best achieved through unilateral, bilateral or multilateral actions?

Hopefully discussion prompted by these questions, and as necessary expanded to embrace other related topics, can assist Canadian policy-makers in the articulation of a clear and comprehensive strategic plan for Canada's north, one which includes an clearly defined role for shipping activity within the Canadian Arctic.

Annex A - Literature Review

Scenario Planning:

Global Business Network (2008).The Future of Arctic Marine Navigation in Mid-Century: Scenario Narratives.

This report summarizes the scenario narratives developed for the Arctic Marine Shipping Assessment by GBN, the final *Scenario Narratives Report for the Future of Arctic Marine Navigation in Mid-Century,* a project of the Arctic Council's Protection of the Arctic Marine Environment (PAME) working group. The report discusses the basis of scenario planning and how this planning is conducted and used, while also describing the scenario framework applied in developing the scenarios presented.

It is explained that scenario planning is a tool for ordering individual and organizational perceptions about alternative future environments in which today's decisions might play out. One of the positive aspects of using scenarios is that it forces leaders to examine their deeply held assumptions, and to practice what they would do if the unthinkable or unexpected happens.

The report discusses the task of developing scenarios as a "highly interactive, intense, and imaginative process." The initial phase usually involves challenging the mental maps that shape our perceptions, and searching for relevant information that challenges our assumptions. It states that our perceptions are shaped by our past successes and failures, which may no longer be relevant. A critical aspect of effective scenario planning is to expand people's peripheral vision and force them to examine their assumptions.

The following steps in the process are more analytical and involve identifying:

1. Driving forces (social, economic, environmental, political, and technological);
2. Predetermined elements (i.e., what is inevitable, such as stable demographic factors); and
3. Critical uncertainties (i.e., what is unpredictable or a matter of choice, such as public opinion).

The next step is to prioritize these factors according to importance and uncertainty. The result should culminate in two to four carefully constructed scenarios. These scenarios will resemble a set of stories built around carefully constructed plots. This report describes stories as a time-honored way of organizing knowledge. When they are used as planning tools, they encourage imaginative thinking and defy denial by "requiring the willing suspension of disbelief."

A key point made in this report is that each scenario should represent a plausible alternative future, not a best case, worst case, or most likely to occur. Furthermore, "the test of a good scenario is not whether it portrays the future accurately but whether it enables an organization to learn and adapt."

Once scenarios have been fully developed, they can be used to identify implications for the organization and for the focal question. Possible courses of action are developed first within each

scenario and then across the set, looking for the strongest strategies that will work regardless of which future unfolds.

Next, the indicators that will help point to which future (or combination of futures) is actually unfolding are distinguished and should be monitored on an ongoing basis. Wild cards or "what if?" events that have a low probability of occurring but a high impact should also be identified and considered. These may be related to environmental challenges, political tensions, ice, technology breakthroughs, and positive potentials. By going through these steps, scenarios enable an organization to adapt more quickly to what is actually happening, and to anticipate better what could happen.

The four AMSA Scenarios developed and described in this report include: Arctic Race, Polar Lows, Polar Reserve, and Arctic Saga. They are based upon material created by participants through brainstorming, group work, and plenary discussion at the two AMSA scenario creation and analysis workshops held in 2007. The scenarios are based on two factors: 1) governance and 2) resources and trade, as these were agreed to be the most important and uncertain factors in shaping the future of Arctic marine navigation by project participants. By crossing these two critical uncertainties, a scenario matrix was formed which allowed for four plausible and relevant scenarios to be created. This also allowed other critical uncertainties to be considered and incorporated within the scenarios.

The Arctic Race scenario is characterized by a high demand for resources and unstable governance, which sets the stage for a rush for Arctic wealth and resources. Arctic Saga, is characterized by a high demand for resources and stable governance leading to a healthy rate of development that includes concern for the preservation of Arctic ecosystems and cultures. Polar Preserve is characterized by a low demand for resources and stable governance which results in slow development, while introducing an extensive Arctic eco-preservation strategy with stringent no-shipping zones. Finally, the Polar Lows scenario is characterized by low demand for resources and unstable governance bringing a murky and underdeveloped future for the Arctic.

Schwartz, P. (2010). Getting Ahead of the Curve.

This article summarizes comments made by Peter Schwartz at the Global Futures Forum General Meeting on "Building Resilience in the Face of Future Shocks" which took place on September 12-15, 2010 in Singapore. Peter Schwartz is the leader of GBN and has significant experience with scenario planning.

He states that anticipation, recognition, and preparation are "survival skills in a world shaped by short-term turbulence and long-term uncertainty." Due to the numerous interconnections created by the Internet, global logistics, and travel, the world is becoming more crisis prone, as one crisis instantaneously cascades into the next. He also points out that the rise of China and India, along with the new realities of global economic competition and climate change lead to fundamental longer term economic and geopolitical uncertainties. As a result, being able to see more clearly and usefully into the future just ahead, as well as decades into the future has become increasingly important.

Schwartz states that because the world is now so much more interconnected, the near future is likely to be more turbulent. Due to this interconnectedness, changes in global business are occurring much more quickly and the impacts are reaching much further. For instance, changes related to interconnection made possible by the Internet and globalization take place today in the context of an extended recession in the US and Europe, huge currency and trade imbalances with China, a growing threat of currency dislocations, and a dangerous rise in protectionism. In addition, the perpetual risk of a major terrorist incident also increases the potential for short-term turbulence.

With respect to long-run uncertainty, it is a function of the answer to four basic questions. The most disruptive events of the first half of the twentieth century were World Wars I and II. Schwartz states that those "conflicts and their consequences sapped most of the growth potential of the world."

Therefore the first question is whether we can avoid a similarly big war in the future, especially between the most obvious candidate antagonists, the US and China. The second question is whether we will be able to sustain economic growth at a fairly high per capita level. The third is will the benefits of that growth be distributed more equitably? And finally, the last question is whether growth can be achieved without destroying the Earth's ecosystems and further disrupting the climate?

According to Schwartz, if the answer to all four questions is "yes", then we can be very optimistic about the future. On the other hand, a "no" to any of them is highly problematic. Four negatives would be catastrophic. Therefore, it is critical that we see our choices in terms of their long-term impacts.

In conclusion, he states that the objectives of getting ahead of the curve are threefold: "to take advantage of opportunities that might otherwise be missed, to prevent disasters if you can, and to be better prepared if you can't." Organizations are rarely good at improvising. and effective preparation is the best way to avoid the need for improvisation.

Curry, A. and A. Hodgson (2008). Seeing in Multiple Horizons: Connecting Futures to Strategy.

This paper describes a planning tool called the 'Three Horizons' approach which enables the integration of different futures and strategic methods. This approach shares some similarities with GBN's scenario planning, but is a distinct approach for developing different views of the future. Some of the strengths of this approach include its ability to relate drivers and trends-based futures analysis to emerging issues. It also enables policy or strategy implications of futures to be identified. A further strength of this approach is that it links futures work to processes of change.

One of the gaps in this strategy is between the work of scenario builders in constructing a range of plausible and coherent futures, and that of the vision builders in helping organizations to identify a preferable future, based on a set of preferred values, and to act on that preference. There are techniques which enable scenarios to be used in support of vision-building, even if the notion that scenarios should be used in this way remains contentious in the literature.

The “Three Horizons" technique “connects the present with desired futures, and helps to identify the divergent futures which may emerge as a result of conflict between the present and these imagined futures.” The model provided in the paper shows three conditions of the same system, over time, against its level of viability in its changing external environment.

In summary, the model is comprised of the following:

a. '1st Horizon': the current prevailing system as it continues into the future, which loses "fit" over time as its external environment changes;

b. '3rd Horizon': ideas or arguments about the future of the system which are, at best, marginal in the present, but which over time may have the potential to displace the world of the first horizon, because they represent a more effective response to the changes in the external environment.

c. ‘2nd Horizon’: an intermediate space in which the first and third horizons collide. This is a space of transition which is typically unstable. It is characterized by clashes of values in which competing alternative paths to the future are proposed by actors.

In the example given in the paper, Horizon 1 is described as a world in which fossil fuel sources are dominant in terms of consumption, production, and distribution infrastructure. It is also generally centralized. The prevailing consumption model is that energy is "always on"; continuous power is supplied to whoever wants it and can afford it. This prevailing system is falling away because of concern over carbon emissions and resource shortages.

Horizon 3 is characterized by propositions for the production of energy from renewable energy sources, more local or decentralized energy systems, and reduced consumption. In addition, high levels of energy use are explicitly linked to the degradation of eco-systems and biodiversity. Emerging technologies are supported and different energy-based business models are put to the test.

Therefore, Horizon 2 becomes a space of both conflicts and options, which is turbulent and ambiguous. There are various potential outcomes from this Horizon 2 model. This state involves a considerable amount of instability and uncertainty.

A major difference between this approach and scenario-building, as described by GBN, is that the latter does not seek to influence or change the future, but to be aware of possible shifts in the external environmental and to be prepared to respond when that environment changes. Scenario-building is about being prepared for any possible scenario. With respect to the ‘Three Horizons’ approach, emphasis is placed heavily on vision and values when developing future scenarios. Furthermore, scenario building focuses on what futures are most plausible, and the ‘Three Horizons’ approach focuses on what kind of future is most desirable.

Wartsila (n.d.). Global Scenarios of Shipping in 2030.

This report gives an overview of the global shipping scenarios in 2030 developed by Wartsila. The purpose of the project was to support their strategy work and provide a foundation for finding ways, together with industry, of being prepared for the future. As a result, three different, yet plausible scenarios about what shipping could look like in the year 2030 were developed by combining expert input, quality research and some creative thinking.

The scenarios that were created are stories describing alternative, plausible futures and how they might come about. Wartsila views them as a method of making sense of a complex and changing environment, and believes they are a valuable tool for enhancing strategic decision-making by challenging conventional modes of thinking.

In order to develop these scenarios, it was important to identify and examine uncertainties and certainties which could shape the future. Two certainties identified were that shipping will continue to be part of the transportation matrix and fresh water will become more valuable in the near future. A large number of key uncertainties were identified and were refined into five dimensions: 1) Trade and economic growth, 2) Response to climate change and sustainability issues, 3) Geopolitical issues and global leadership, 4) Solutions to deal with scarcity issues, and 5) Control of power.

The scenarios that were developed include Rough Seas, Yellow River, and Open Oceans. In Rough Seas, a scarcity of resources, such as energy water and food is predominant, climate change adds further stress, cartels and bilateral agreements have overtaken free markets, and wealth is divided unequally among nations, resulting in tension. In addition, the logistics chain is optimized regionally, fleets are partly nationalized, changed goods flow, there is reduced container traffic, there are new trade routes, and an increased need for armed escorts.

In Yellow River, China dominates the global arena, resource-intensive manufacturing has moved to Africa and other Asian countries, and economic growth is significantly slower in the West. In addition, climate change is tackled only on a regional level and no global agreements exist. Furthermore, in this scenario the largest shipping companies are Chinese-owned and there are new ports in Africa, Eastern Russia, and India. Furthermore, the Chinese energy demand is counterbalanced with efficiency and clean technology and Western societies adapt to sustainable living.

In Open Oceans, global mega-corporations and megacities have gained power over the nation states, and governments cooperate on the governance of climate issues and free trade protocols. Climate change is perceived as an opportunity and innovating green solutions is a lifestyle. In this scenario shipping is only a component within an optimized and integrated logistic system and ships are simply tools in the process. Goods are transported between megacities and areas rich in resources. In addition, new types of vessels are being developed based on environmental challenges.

Public Interest:

Corell, R.W. (2006). Challenges of Climate Change: An Arctic Perspective.

This article gives an overview of the various challenges that climate change presents in the Arctic environment. It begins by explaining how the earth's climate is changing due to the process of global warming and rising GHG emissions and why this has a more severe impact on the Arctic in particular. Furthermore, the article discusses Arctic warming and how its consequences have worldwide implications, how Arctic vegetation zones are likely to shift causing wide-ranging impacts, how animal species' diversity, ranges, and distribution are likely to change, how many coastal communities and facilities face increasing exposure to storms, how reduced sea ice is very likely to increase marine transport and access to resources, how thawing ground will disrupt transportation, buildings, and other infrastructure, how indigenous communities are facing major economic and cultural impacts, how elevated UV radiation levels will affect people, plants and animals, and how multiple stressors can interact to cause amplified impacts to people and ecosystems.

Climate change is being experienced particularly intensely in the Arctic. Arctic average temperatures have risen almost twice the rate as that of the rest of the world in the past few decades. While GHG emissions do not primarily originate in the Arctic, they are projected to bring wide-ranging changes and impacts to the Arctic region. Increasing global concentrations of CO_2 and other GHGs due to human activities, primarily fossil fuel burning, are projected to contribute to additional Arctic warming of about 4–7°C over the next 100 years.
Possible increases in environmental damages that often accompany shipping and resource extraction could harm the marine habitat and negatively affect the health and traditional lifestyles of indigenous peoples.

The tree line is expected to move northward and to higher elevations, with forests replacing a significant fraction of existing tundra, and tundra vegetation moving into polar deserts. The article states that increased areas of tree growth in the Arctic could serve to take up CO_2 and supply more wood products and related employment, providing local and global economic benefits. Agriculture will have the potential to expand northward due to a longer and warmer growing season. This increased tree growth is likely to add to regional warming and encroach on the habitat for many birds, reindeer and caribou, and other locally beneficial species, thereby adversely affecting local residents. This could lead to increases in forest disturbances, such as fires and insect infestations which could allow invasive species to succeed.

Reductions in sea ice will drastically shrink marine habitat pushing some species toward extinction. Caribou, reindeer, and other land animals are likely to be increasingly stressed as climate change alters their access to food sources, breeding grounds, and historic migration routes. Species' ranges are projected to shift northward on both land and sea, bringing new species into the Arctic while severely limiting some species currently present. As new species move in, animal diseases that can be transmitted to humans, such as West Nile virus, are likely to pose increasing health risks. In addition, some Arctic marine fisheries are likely to become more productive, while Northern freshwater fisheries that are mainstays of local diets are likely to suffer.

Severe coastal erosion will be a growing problem as rising sea level and a reduction in sea ice allow higher waves and storm surges to reach the shore. Along some Arctic coastlines, thawing permafrost weakens coastal lands, adding to their vulnerability. The risk of flooding in coastal wetlands is projected to increase, with impacts on society and natural ecosystems. Transportation and industry on land, including oil and gas extraction and forestry, will increasingly be disrupted by the shortening of the periods during which ice roads and tundra are frozen sufficiently to permit travel. Many existing buildings, roads, pipelines, airports, and industrial facilities are likely to be destabilized, requiring substantial rebuilding, maintenance, and investment.

In conclusion, all of these issues touched on in the Article stem from the much larger global issue of climate change. Therefore, it is important to note that climate change will have many direct, as well as indirect impacts on the development of marine transportation in the Arctic.

Governance:

Young, O. R. (May 2008). Whither the Arctic? Conflict or cooperation in the circumpolar north.

This paper sets out persuasive arguments for eschewing a comprehensive legally binding Arctic treaty in favour of a three-pronged approach to governance that addresses the handling of jurisdictional claims including those related to the continental shelf, adjustments to the role and contribution of the Arctic Council to meet emerging Arctic needs, and identification of the need for certain issue-specific regulatory regimes to address various concerns including, for example, shipping, fishing and offshore oil and gas.

Why potential conflict is unlikely

The starting premise of the paper is that the quite frequent, usually media-driven paranoia occurring around the time of writing (2008), regarding the potential for tensions, and even possibly armed conflict, between Arctic States, is overblown. However, while such potential for confrontation is not supported by the facts, the focus on the issue provides an opportunity for a more measured consideration of ways in which Arctic governance might be strengthened.

The argument supporting a scenario anticipating tension and conflict is driven by a perspective that nation States will continue as the "dominant force seeking to maximise control over sectors of the Earth's surface" ultimately leading to diplomatic gridlock and a mad rush for resources.

The paper takes issue with the likelihood of such a scenario. It points out that the jurisdictional foundation provided by Article 76 of UNCLOS provides a workable basis for the settlement of jurisdictional claims (although recognizing that the US is still not a signatory to this Convention). The paper also makes the point that future Arctic focal points of interest are largely confined to areas where there is no contention regarding competing claims.

This said the paper suggests that it is now timely to consider existing governance regimes in the Arctic and explore way in which they might be improved.

Legally binding Arctic Treaty or a less legal governance regime

The paper recognizes that arguments have been put forward supporting some form of legally binding Arctic treaty, but suggests that such an approach was not only 'politically infeasible', but also likely to be less effective than an alternative less formal approach.

The paper points out that the track record of support for formal treaties by certain Arctic States, notably the US and Russia, is limited to say the least, making the likelihood of implementing a treaty highly doubtful. It also points out that it may also be disadvantageous. Treaties are between States thus complicating the participation of non-State actors, including the Arctic Council's Permanent Participants.

Also, recognizing the fast moving and potentially quite turbulent evolution of the Arctic, it may be advantageous to have more flexibility in adjusting the governance framework to meet changing needs. Again, many of the issues impacting in the Arctic, such as climate change and globalization, originate from external forces; and therefore a treaty between Arctic States would not be able to accommodate the means to address these issues. Finally several issues lend themselves to the development of a specialized regulatory regime that is better addressed in the appropriate international forum such as the IMO or the WTO.

The best way forward

In advocating a less formal governance initiative, the paper proposes three principal focal points of effort: stabilization of jurisdictional claims and boundary issues; enhancing the role of the Arctic Council, and integrating the contributions of certain issue-specific regulatory regimes. With regard to the first point, the paper suggests that the potential for tension around the resolution of boundary issues could be easily removed by following the precedent set out in Article 4 of the 1959 Antarctic Treaty, and agreeing to freeze jurisdictional claims in the area in a manner that neither enhances nor detracts from any existing claims. This would allow for a strengthening of cooperative arrangements, based on the concepts of trusteeship and stewardship. Secondly the paper advocates that steps now be taken to strengthen the role and effectiveness of the Arctic Council. It points out that the Council was established as a very weak international body, with virtually no regulatory or decision-making authority, and no secretariat. Rather it was viewed as a 'high level forum' for the discussion of policy issues. Despite this the Council has had a number of successes, pioneering opportunities for non-State actors to participate in the policy formulation process.

The Arctic Council can increase its effectiveness by making adjustments to its operating procedures, and facilitating the participation of non-State actors. The Council also needs to strengthen the participation of non-Arctic States and other bodies such as the EU, by granting them a recognized status in Arctic governance discussions. It also needs to find ways to enable the participation of actors from levels of government below the State level, and non-governmental interests such as industry and other elements of civil society, such as environmental NGOs and the scientific community.

Thirdly the paper believes that the Arctic Council should play a useful role in integrating issue-specific regulatory regimes, whether it involves Arctic focused issues, (for example commercial shipping, hydrocarbon extraction or fishing), or issues with origins external to the Arctic, such as the generation of pollutants, or the transfer of disease. The intent is firstly to ensure that global governance institutions such as IMO are well informed, and secondly to act broadly as a 'facilitator' in addressing problems arising from the interplay between various issue-specific regulatory arrangements.

In this way the paper concludes that it should be perfectly possible to "adjust and adapt the Arctic's governance complex in a manner conducive to the pursuit of sustainable development."

Report of the Arctic Governance Project (Arctic Governance in an Era of Transformative Change: Critical Questions, Governance Principles, Ways Forward) April 14, 2010

A starting point for this Report is recognition that the Arctic is experiencing a profound transformation, driven by climate change and globalization, and that climate change is giving rise to 'tighter' economic and geopolitical links between the Arctic and the rest of the world.

The principal objective of the Report is to assess the adequacy of the existing governance mechanisms, and to examine ways in which they might be improved. The Report recognizes that, as a result of climate change, there is heightened global interest in the Arctic, which rules out any choice to go its own way. Thus its goal is to examine current governance arrangements, identify potential adjustments, and in this way construct a proposed Arctic Action Agenda.

The Report notes that existing governance arrangements include global frameworks (UNCLOS and UNCCC), regional agreements (e.g. the Arctic Council), and functionally specific regimes (e.g. IMO, World Health Organization (WHO), UNEP, UN Development Programme (UNDP), etc.). It particularly notes the establishment of the Arctic Council in 1996, comprising eight Arctic States together with a number of 'Permanent Participants'.

The Report views the Arctic as a 'governance barometer'. It attributes the rapid change that is occurring to both socioeconomic and geopolitical influences. It notes that developments are often non-linear, abrupt and frequently irreversible. In evaluating options, the Report concludes that stewardship needs to be the overarching goal. What is therefore needed is a suite of governance arrangements to support this stewardship role. Nation states continue to be the key players. However, also important are intergovernmental organizations, indigenous peoples' organizations, multinational corporations, environmental NGOs, and sub-national units of government.

In the light of this complex interplay of interests, the Report concludes that there is a need for more nuanced thinking about concepts such as identity, citizenship, community, sovereignty, etc., which in turn leads to the identification of a significant range of critical questions relating to: building trust; enhancing regulatory frameworks; introducing holistic approaches; promoting adaptation; establishing the Arctic as a zone for peace; achieving regional sustainability; strengthening policy mechanisms; amplifying Arctic voices; etc.

The Report attaches particular importance to strengthening the Arctic Council as a policy-shaping body so that it can play an effective role in national and international decision-making. In order to achieve this, a range of governance principles need to be formulated, including: articulating more clearly the interests, rights and duties (of Arctic States); recognizing that governance is multileveled, and that all levels have a role to play; documenting the essential features of effective governance; ensuring that governance strategies are based on the best available information (both traditional or scientific knowledge); utilizing holistic or systems approaches (that makes use of participatory and integrative thinking), and attaching importance

to flexibility and adaptability (so as to accommodate the pace of change and associated uncertainty).

A key conclusion of the Report is that a single comprehensive agreement is not recommended. Rather it concludes that there is a need to find a way of joining various entities together in a mutually supportive manner. This can be achieved by focussing on a number of specific initiatives aimed at strengthening the suite of Arctic governance systems.

These specific initiatives include: responding to the need for improved regulatory arrangements, developing service agreements (e.g. SAR); incorporating integrative, holistic approaches, e.g. ecosystem-based management, spatial planning, comprehensive environmental impact assessment, etc.; respecting and honouring indigenous rights through building more productive partnerships and mutually beneficial coalitions, rather than adversarial strategies; optimizing the role of the Arctic Council; and responding to the need for more funds and human resources.

The Report concludes that Member States must work together to enhance the capacity and clout of the Council and in so doing respond to the need to bring a higher awareness of the Arctic in the debate regarding what to do about climate change. Arctic voices need to be enhanced, so as to ensure that Arctic concerns are communicated to the range of international bodies addressing climate change.

In summary the Report recommends the framing of an Arctic Action Agenda that honours, implements and enhances existing governance systems. It also recommends the strengthening of the Arctic Council in a number of ways, for example through establishing regulatory mechanisms to address sectoral issues proactively; increasing participation in international bodies; institutionalizing the science/policy interface in the Arctic, and creating Arctic stakeholder forums or roundtables so as to build trust, and stimulate dialogue.

Statement on Canada's Arctic Strategy- Exercising Sovereignty and Promoting Canada's Northern Strategy Abroad (Released August 2010)

This Statement by the Federal government declares that the Arctic is fundamental to Canada's national identity and that it represents tremendous potential for Canada's future. Exercising sovereignty over Canada's North is identified as the number one Arctic foreign policy priority. Canada's Arctic aspirations are described to be a stable, rules-based region with clearly defined boundaries, dynamic economic growth and trade, vibrant Northern communities and healthy and productive ecosystems. The Statement recognizes that new opportunities and challenges are emerging, in part as a result of climate change and the search for new resources, and while opportunities are great, there are also important social, economic and environmental challenges, with some having important international dimensions.

Canada's Northern Strategy lays out four areas where Canada is taking action to advance its interests: exercising sovereignty, promoting economic and social development, protecting our environmental heritage, and improving/devolving northern governance. In pursuing these 'pillars' the Strategy commits Canada to exercising the full extent of its sovereignty, sovereign rights and jurisdiction in the region.

The Strategy sets out what Canada's international efforts will be focussed upon. These include: engaging Canada's neighbours in seeking to resolve boundary issues; securing international recognition for Canada's extended continental shelf; addressing Arctic governance and related emerging issues; creating the appropriate international conditions for sustainable development, seeking trade and investment opportunities; encouraging a greater understanding of the human dimension in the Arctic; promoting an ecosystem-based management approach; enhancing Canada's efforts on other pressing environmental issues; strengthening Arctic science; engaging Northerners in Canada's Arctic foreign policy; supporting indigenous 'Permanent Participant' organizations; and providing opportunities for Canadian youth to participate.

The Statement declares that Canada's first and most important pillar is the exercise of sovereignty. Canada's sovereignty is seen as the foundation for realizing the full potential of Canada's North. The full resources of the Government of Canada are declared to be behind the exercise of sovereignty, sovereign rights and jurisdiction in the Arctic. Protecting national sovereignty and the integrity of Canada's borders is the first and foremost responsibility of the national government and the Strategy stresses Canada's resolve to protect its sovereignty throughout the Arctic.

The Strategy identifies a number of initiatives that Canada is taking to allow it to better monitor, protect and patrol Arctic land, sea and sky. These initiatives include: a new Coast Guard polar icebreaker; new patrol ships; a new berthing and refuelling facility at Nanisivik; a new Canadian Forces (CF) Training Centre in Resolute Bay; collaboration with the US to enhance monitoring and control of airspace through NORAD; conducting annual sovereignty operations through CF Operation Nanook so as to demonstrate the government's commitment to control over air, land and sea; and last but not least, moving forward on three priority areas - seeking to resolve boundary issues, securing recognition for Canada's extended Arctic shelf, and addressing Arctic governance and related issues.

The Strategy recognizes the need to consider how to respond to issues such as emergency response and SAR capability, as well as organized crime and illegal trafficking in drugs and people. It also attaches importance to creating a dynamic, sustainable Northern economy and improving the social well-being of Northerners so that the true potential of Canada's North can be 'unleashed'. The potential for wealth and job creation through resource development is highlighted. These resources are viewed as a cornerstone of sustained economic activity in the North and a key to building prosperous Northern communities.

The Statement stresses the priority being given to creating the appropriate international conditions for sustainable development in the Arctic, conditions that will complement domestic measures to support economic development. At the same time it declares that Canada, as an emerging clean energy superpower, will continue to support the responsible and sustainable development of oil and gas in the North.

The Strategy notes that the 2007 Arctic Council Oil and Gas Assessment examined the impact of current and future oil and gas activities, and that Arctic Offshore Oil and Gas Guidelines were

issued in 2009. The Strategy commits Canada to acting on the Arctic Council request that all States apply these guidelines as minimum standards throughout the Arctic.

It is noted that the AMSA provides insights into anticipated shipping activity and also provides guidance on enhancing marine safety, protecting Arctic peoples and the environment, and building Arctic marine infrastructure. Based on this advice the 2009 Arctic Council Ministerial supported the development of a mandatory Polar Code. The Strategy commits to strengthening the delivery of marine services so as to make available enhanced navigation and meteorological and hydrographic advice

The Strategy commits Canada to continuing to seek trade and investment opportunities that benefit Northerners and all Canadians, and that enhance trade ties with other Arctic States. It attaches importance to encouraging a greater understanding of the human dimension of the Arctic so as to improve the lives of Northerners. It declares that Canada will promote a better understanding of the interests, concerns, culture and practices of Northerners, and in this respect, will play a lead role in the Arctic Council on a range of health related projects.

The Strategy highlights the fact that Canada has long been in the forefront of protecting the Arctic environment, through for example, the AWPPA. It notes that the application of the Act was recently extended to 200 nautical miles, and that mandatory reporting requirements entered into force from July 1, 2010.

The Statement stresses that Canada is acting domestically while cooperating internationally. It is promoting an ecosystem-based management approach, supporting international efforts to address climate change, enhancing efforts to pursue and strengthen international standards, and strengthening Arctic science. In this respect, the Statement highlights a number of steps to be taken by Canada in order to combat climate change and other pressing environmental issues. It also commits to strengthening Arctic science, including the establishment of a new world-class research station in the High Arctic.

The Statement commits to providing Canadian Northerners with more control over their economic and political destiny. Initiatives identified include participation in the shaping of Canadian Arctic policy, participation in the Arctic Council, and assisting Canadian youth to participate in the circumpolar dialogue.

With regard to the way forward, the Strategy makes clear that Canada will work with other Arctic States to advance shared interests such as trade and transportation, environmental protection, natural resource development, the role of indigenous peoples, oceans management, climate change adaptation and scientific cooperation. However it also notes that the key foundation for any collaboration will be acceptance of, and respect for, the perspectives and knowledge of Northerners and an Arctic State's sovereignty. It is stressed as a fundamental position that each Arctic State is best placed to exercise leadership in the management of the region under its jurisdiction.

With regard to Canada's recently assumed role as Chair of the Arctic Council, Canada's priorities are identified as: pursuing a greater policy dialogue with the Council; leading efforts to develop a

more strategic communications role for the Council; working with member States to address the structural needs of the organization, including secretariat functions and funding.

Market Motivation:

Stopford, M. (1997). Maritime Economics, 2nd edition. Routledge; New York.

In the second edition of Maritime Economics, Martin Stopford provides an updated version of his seminal text on the complex and sometimes confounding working of the global maritime transportation industry. This text remains required reading for any maritime professional, as it explores both the economic theories underpinning the structure of the maritime industry while also addressing the mechanics and operational realities of international shipping.

The subject matter considered is significant, covering every aspect of a ship's life, from financing a new construction to demolition, as well as considering the often understated by vital elements which shape the decisions of ship operators and owners such as commodity pricing and geopolitical events. Despite the range of material examined, the author nevertheless delves into substantial detail, and in providing clear summaries at the end of each chapter, the book serves as an invaluable reference tool for any researcher.

While the text touches on nearly every aspect of maritime transportation, particularly valuable is the discussion regarding shipping (market) cycles, the elements that affect shipping rates and maritime forecasting. Understanding the content described in these chapters is necessary for any scenario-type project. The text situates modern shipping practices within a historical context, and this approach allows for a better appreciation of the patterns of trade and how they are affected by technological changes (such as the trend towards containerization), political/security crises (such as the closure of the Suez Canal) and economic shifts. The consideration of the elements which affect transportation demand (price/speed/reliability/security) is especially helpful when attempting to imagine a range of possible future scenarios for maritime development.

Key uncertainties identified include:

- Freight rate and the factors affecting the level of this rate
- Shipping cycles, in particular the role of commodity pricing on the profitability of the transportation industry for ship owners and operators.
- Influence of political events/crises on the shipping industry
- Role of new ship construction and the effect of technological changes on the shipping industry.
- Elements of transportation demand (price, speed, reliability, security) and their affect on the freight market.

UNCTAD 2012 Maritime Transportation Review

The UNCTAD 2012 Review of Maritime Transportation provides a comprehensive overview of the state of the global maritime industry. The Report canvasses a wide range of relevant subject

matter for this report, including the ownership structure of the global fleet, continued and emerging regulatory and legislative trends, annual economic performance of various cargo types as well as associated variables/indicators such as freight rates.

The strength of this document is the breadth of the Report, as the document captures the global performance and future outlook of the maritime industry. The UNCTAD report serves as a valuable source of information and data regarding the current state of the maritime industry, and a necessary starting point for any scenario based project. The addition of historical data helps to reveal patterns, and tie together indicators pointing the health of this industry. These indicators may be used to identify future trends, based upon data such as the correlation between world GDP and world seaborne trade or the continuing shift towards a containerized model.

The weakness of the report is very much tied to what makes it a valuable reference document for this project, in that taking such a broad view necessarily obscures the more detailed and nuanced regional analysis for areas such as the Arctic in general and specifically the Canadian Arctic. In addition, breadth of subject matter is valued over in-depth analysis, resulting in significant points being given only a cursory examination. The Report does provide footnotes with the full record of any document cited, which does help to minimize this shortcoming.

The 2012 Report dedicates an entire chapter to the discussion of the future of the maritime transportation industry. In considering the various issues confronting the industry in terms of both sustainable financial as well as environmental development, the Report provides an interesting if somewhat abbreviated consideration of this topic. However, this chapter, in addition to the various sections detailing emerging trends, provides a valuable starting point for any further research into this topic.

Key uncertainties identified included:

- Shifts in changing trade patterns, especially as regional economies such as the Asia market continue to develop.
- Concerns regarding climate change and the potential impact of the transportation industry. In addition, the potential for further environmental regulation being imposed upon vessel operators
- Rising fuel costs forcing shifts in ship and engine design

Annex B - Consultation Findings

As an early step in the project, various NEXTAW members and other subject matter experts were contacted individually to conduct a series of brief, informal interviews. The purpose of conducting these interviews was to obtain the views of these experts on the key issues regarding future developments in marine transportation in the Canadian Arctic, as well as their expectations as to how future events might evolve through 2025.

Interviewees were encouraged to draw from their personal and professional knowledge in their respective fields or particular 'field of endeavour,' while also using their imagination to take an expansive "out of the box" view of the future for Arctic marine transportation. It was explained that, while the ultimate focus of this project was on the Canadian Arctic, the manner in which the future unfolded would not occur in isolation but would be influenced by circumstances occurring elsewhere in the Arctic and indeed globally over the next ten or fifteen years. Each interviewee was therefore asked to provide their own perspectives in relation to factors influencing shipping in a global context, in the Arctic region, and finally in relation to the Canadian Arctic.

The consultations were conducted throughout July, August, and September 2013. The discussions within these interviews were guided by a series of questions, distributed prior to the interview (For these questions, please see Appendix B1).

This consultation process followed a 'scenarios' based approach that involved examining the interplay between the three key 'forces' in the Canadian Arctic and beyond, namely:

- Market Motivation, being the factors that stimulate or discourage commercial interest in shipping operations in the Canadian Arctic;
- Public Interest concerns (economic, social, safety, security environmental) that arise as a consequence of such market activities and other related factors;
- The nature, extent, influence, impact, and ultimately the effectiveness of national and international governance oversight on this interplay between commercial initiatives and public interest concerns.

In order to best identify key trends and concerns stemming from the consultations, the results presented below are organized by the applicable force, namely: Market Motivation, Public Interest concerns, and Governance.

Market Motivation

Throughout the consultations conducted, there was a considerable amount of discussion with regard to how commercial interests might be expected to influence, and be influenced by, further trends and developments in the Arctic. There was consensus that commodity prices and infrastructure will play a key role in the evolution of marine transportation in the Arctic over the next ten to fifteen years.

Overall, it was expected that economic and commercial interest and activity would increase in Arctic regions, and that these overarching drivers would be the most important influence on the

nature and scale of future Arctic marine transportation. However, the health of the world markets and the world economy was viewed as problematic, especially in relation to difficulties being experienced in the US, China and Europe. It noted by several interviewees that several major Asian states, notably Japan, China, and South Korea, are currently taking a keen interest in Arctic opportunities, relating to both transit and development possibilities. However, in order for there to be real interest in the Arctic for resource development, commodity prices would have to recover to make a sufficiently attractive business case for expanded northern development.

In addition, multi-year sea ice remained a significant variable with regard to the cost of resource development and shipping in the Canadian Arctic. Bulk carriers would likely find the NWP more attractive than container ships, as their schedules were less time sensitive. The oil and gas industry indicated that if profit margins were favourable, they would find a way of managing the ice through engineering and technology, and that overcoming challenges was a matter of costs, not technological limitations. This statement highlighted the issue of infrastructure and icebreaking capabilities in the Arctic, as it was a widely accepted view that there was currently a serious lack of support infrastructure for marine transportation in the Canadian Arctic.

It was particularly stressed that current and projected levels of capacity to provide support services to the Canadian North were inadequate. It was observed that the one new Canadian polar icebreaker (the *John Diefenbaker*) would not begin to meet the minimum needs of industry, and that to maintain the provision of multi-season icebreaking services in the Arctic, three such icebreakers would likely be necessary. The possibility of charging fees to offset the cost of icebreaking and other services was also discussed during several of the consultation interviews, and differing opinions were expressed as to the merit of some form of cost recovery.

More particularly, while some interviewees considered icebreaking capabilities to be an important aspect of the future Arctic support infrastructure, it was also suggested that due to the increasing absence of ice, further spending on icebreaking capabilities would be a questionable investment. Furthermore, while it could be argued that charging for icebreaking made sense for certain Arctic shipping activities, charging for this service could be problematic for community re-supply services, which supported the basic, essential needs of northern communities.

In another interview it was suggested that commercial projects should be required to have ships with sufficient icebreaking capability to operate independently with no government icebreaker assistance, and that government-funded icebreakers should only be utilized to support community resupply, scientific research, and SAR. For instance Fednav, a leading ship operator in the Canadian Arctic, had made it a policy to be largely self-sufficient while operating in the Arctic. However, with respect to transit traffic, for example a tanker travelling through the NWP, such a strategy could be more problematic.

A common theme that emerged throughout the consultations was a need to strike a balance between promoting industry and discouraging rapid expansion. The point was also made that the provision of infrastructure needed to be done appropriately. In many situations, the creation of a network of small ports located across the Canadian Arctic Archipelago would be more valuable than a few large ports. Several of the members consulted touched on the importance of developing an overarching infrastructure investment strategy with a clearly articulated vision.

A common idea that surfaced was the potential for creating public-private partnerships with buy-in from the local communities, directed at covering the financial cost of northern infrastructure. It was suggested that clearly defined roles associated with building, operating and maintaining facilities and equipment would have to be established, with government initiating construction and then stepping aside to allow industry to continue forward. However, there remained the issue as to whether private interests and industry should be responsible for the cost of infrastructure constructed in remote and/or isolated areas.

Another aspect of market motivation influencing shipping in the Arctic involved the delineation between destinational traffic and transit traffic. Destinational traffic (particularly that linked to oil and gas operations) was considered to involve significantly more extensive and complex operations than transit operations. Expansion of the mining, seismic industry and a northern commercial fishery were all clearly seen as important stimuli for Arctic marine transportation.

At the moment, there was no commercial transit traffic in the NWP. Cruise rates have held steady at 15-20 voyages with less than 300 passengers, and there are no major cruise operators with any interest or involvement in the Canadian Arctic. This situation was not expected to change other than modest increases within the 10-15 year time line.

On the other hand, significant expansion had occurred in Arctic transit in the NSR. This route had been open now for seven years with the support/benefit of a heavy investment from the Russian government in the form of a large and powerful icebreaking fleet. Due to reduced multi-year ice, the shipping season extended later into the fall each year and the NSR supported semi-regular traffic, though whether the capability for year round support existed was debatable, based on advice provided during these consultations. The NSR was primarily used for transit between Europe and Asia, but the passage was also very expensive. While there was significant planned industrial investment, there was less potential for mining operations and other extraction projects as compared with the Canadian Arctic. Canada has significant heavy industry projects, and most activity has involved locally generated (destinational) traffic, unlike the trans-polar transit activity over the Pole and in the NSR. Finally, Chinese interests have also used this route and were jointly involved in the Arctic Ocean Drift Study with Canada, which focused on the possibility of transit traffic using the Trans-Polar route.

There was broad consensus that the NWP would be the last passage to ‘open’ to commercial traffic due to the effect of the currents which propelled ice through the passages and channels of the Canadian Arctic Archipelago, causing increasing amounts of extreme ice features which could interfere with shipping lanes on an episodic basis. With respect to year round traffic, the NWP would face many of the same problems as the NSR and it would have difficulty competing with this route, as the NSR was favoured in terms of population base, support infrastructure and environmental factors.

In conclusion, some of the major concerns that emerged from the consultation process regarding future influences on the further development of Arctic shipping included commodity prices, shortcomings in icebreaking capacity and other support services, and absence of port infrastructure. Furthermore, it was apparent that the issues associated with destinational and

transit traffic respectively would play a large role in how the marine transportation industry evolved in the Canadian Arctic. Finally, there is no overarching Canadian ‘vision’ for the Arctic and as a result, it is unclear whether a high level of shipping activity is viewed as desirable.

Public Interest

Climate Change

Firstly, global warming resulting from climate change was identified as the single most important driver within the Arctic and a potential 'game changer', especially in terms of accessibility to the North. Amplifications of warming in the Arctic occur at a factor of 5 compared to the global average. Again it was recognized that while globally there were several potential routes across the Arctic, they all possessed very different characteristics.

The NSR was the first of the passages to 'open' and currently had the longest open season. This was due in part to ocean currents, specifically the Beaufort Gyre within the Pacific sector. This current has reversed itself several times over the past years, pulling apart the ice pack, and creating large areas of open ocean. These gaps in turn released heat into the atmosphere, which caused increased precipitation (snow), which, as an insulator, further slowed the creation of ice. It was stated that these snowstorms, as ‘high frequency’ events, were not captured in models. As such, these storms were partially responsible for the faster than predicted loss of multi-year ice, explaining why the NSR had the greatest potential for shipping.

Conversely, the trans-polar drift moved rapidly, and transported ice into the North Atlantic. Five years ago, it was thought that the polar ice cap could never melt, but this melting had now been demonstrated as a probability and more a matter of when, not if. This melting was in large part due to the transportation of heat through surface currents. Therefore, a route over the pole could be expected to be a possibility within the near future. As the shortest route with no land barriers, this route would be the most economical. Furthermore, the lack of land meant that there were no pressured ice formations created, greatly reducing complications for ships navigating through this area.

Similarly, the islands of the NWP prevented ice formations from forming due to lack of fetch. However, there was the issue, at least in the short term, of large, hardened, multi-year ice hazards. Therefore, environmental conditions would be unpredictable, with variable multi-year sea ice conditions and major climatic shifts. Under these circumstances, pressures to reduce environmental impacts of increased shipping in the Arctic would be highly influential as a serious environmental incident would be a ‘game changer.’ As a result, strict environmental regulations for shipping in Arctic waters and a proactive approach would be necessary.

Considerable focus was put on the potential for there to be reestablishment of sea ice over the next few decades in one interview. It is important to distinguish between natural variability and anthropogenic causes of global warming. More specifically, the Atlantic Multi-decayal Oscillation is a natural 60-70 year cycle which leads to a slow surface temperature change. There is a possibility that this natural cycle could lead to cooling trends and the reestablishment of sea ice in the near future before contributing to further warming.

It was made clear that a current priority for the Canadian Ice Service was to improve the quality of ice information. This was being accomplished by use of such technology as Synthetic Aperture Radar. Efforts were also being invested in tracking multi-year ice, tracking ice islands, and looking at what happened to oil when trapped in ice.

Arctic meteorology was also receiving attention in the form of a five year project working in support of IMO/World Meteorological Organization (WMO). The Arctic had been divided into five areas, and three countries had taken responsibility for one or two of these areas. Canada and Russia were both responsible for two of these areas, and Norway for one.

Climate change was also having a direct impact on land. Warmer temperatures and melting permafrost created challenges for land transportation and could have further indirect impacts on shipping in the Arctic. The season during which ice roads were available was diminishing and other transportation and related infrastructure would likely become compromised due to the deteriorating stability of the landmass.

Communities

Social and environmental concerns were increasingly becoming an issue for Arctic communities, and many groups were greatly concerned about the potential impact of a northern commercial fishery, mining, oil and gas exploration, and seismic activity. One of the most important trends with respect to Arctic communities was the 'social license' issue where Arctic resource development in its various forms was required to obtain community support.

This point really stood out from the consultations, and it was also stated that industry needed to be encouraged to talk to local communities very early in the planning process, to assess both what was possible and what the community could support. Furthermore, it was critical that industry and the local communities explored various opportunities together for mutual benefit.

Another discussion topic that arose was how Canadian Arctic communities could influence the regulation of Arctic marine transportation. It was believed by at least one interviewee that Canadian Arctic communities needed to insist on stricter social and safety regulations that were aimed at protecting their communities. It was also stated that a code of conduct should be required for tourism providers and that cruise ship operators should press to have community marine infrastructure improved in order to better serve the communities. For example, currently there was only one harbour in Nunavut (Pangnirtung) and most communities had only a sealift area which required the aid of loaders and barges in order to handle the annual sealift operations.

Furthermore, many community members were adjusting their hopes and expectations for the Arctic, including finding the middle ground between protection of hunting and the operation of shipping. After some difficulties, successful employment strategies had emerged for engaging members of the local communities in the work force. The cruise and eco-tourism industries had seen some development in recent years. If the benefits were provided to the communities, there was more likely to be collaboration and joint opportunities for the future.

Environmental Response

Arctic Emergency Response capability was identified as a major problem linked to expanded shipping in the Arctic, and a serious environmental incident was seen as a potential 'game changer'. According to one interviewee, little money was currently being spent on the prevention of environmental disasters, which was the most problematic part of Arctic development, Additionally, the CCG is now shifting towards a fleet of smaller vessels with reduced horsepower, which was a worrying and short sighted approach which would not provide the necessary minimum support to Canada's emergency response capabilities.

At the moment energy operators were pushing, continuously for Arctic development, but none had very much experience, and they needed to take a more responsible approach. Furthermore, one interviewee mentioned that the maintenance of internal (proprietary) records by Oil and Gas companies, that were not generally available to all, significantly increased the risks within the Arctic by limiting the opportunities for mapping and other data. In contrast, a very cautious approach was most often adopted by local boards when examining environmental concerns and how environmental impacts could affect their land, water supplies, and food sources.

Safety

Safety was viewed as a major concern when dealing with such a hazardous, unpredictable environment as the Arctic. In order for shipping operations in the Arctic to be conducted safely and efficiently it was critical that ice navigators be trained, and that they have sufficient experience to safely navigate Arctic channels. One of the most important aspects of ensuring safety was training vessel crew. Ice navigators were also an important requirement and had to have sufficient experience. At the present time most pilots had only limited experience outside the summer open season in the Arctic.

To remedy this it was suggested that training programs offering an ice navigation curriculum should be made available through Transport Canada. Basic requirements for training and development for icebreaker operations were being developed by the IMO, but it was up to each Arctic State to meet the requirements. Memorial University in Newfoundland probably had the potential to provide such training. An established model course was that offered by the Admiral Makarov Maritime Academy in St. Petersburg, Russia.

The Canadian Ice Service was working alongside Transport Canada to provide critical information on ice conditions. At the moment, Arctic pleasure craft activity was expanding rapidly and issues of competence in ice had generated important safety concerns. In addition, navigational aids and support were lacking, as well as important infrastructure for SAR. It was important that these deficiencies be addressed as they were all critical components for ensuring maritime safety within Arctic regions and providing quick, efficient response.

Northern SAR could not be expected to 'mirror' that provided in the South. Instead, it was critical to focus on distinguishing what constituted the appropriate mix of response capabilities. The Department of Defence had recently announced that it planned to review the provision of SAR in Canada, which would presumably include the Arctic and should address SAR related to cruise ships.

Security and Sovereignty

A few interviewees suggested that security/sovereignty would be a key driver through to 2025. With the increase in economic and commercial activity and as these Northern Routes began to open, there would be several nations that might challenge claims to various parts of the Arctic. Control over the rights of passage would also play a major role. There could well be an abundance of red tape to cut through in order for various countries to use Arctic routes and, while unlikely, it was not impossible that amendments to UNCLOS could be considered.

Increasing Arctic pleasure craft activity could also lead to occasional incidents involving smuggling of drugs and firearms. It was additionally problematic because due to their size, these vessels were not required to report entry into the Arctic under NORDREG. In addition, further resource development projects raised important questions about risk, especially if there was a possibility for year round operation, with a much reduced level of support services available. Furthermore, these were likely to be foreign flag ships, with foreign crews, raising questions about the effectiveness of Canada's Port State Control enforcement efforts in the Arctic.

Governance

Some perspectives offered during the consultation process with respect to governance included how there needed to be better cooperation and collaboration among governing institutions in both a top-down manner and across jurisdictions as well. While legislation and regulations were critical for governing marine transportation in the Arctic, enforcement was also an important issue that needed to be addressed.

At a global level, some concerns were shared regarding the effectiveness of multilateral governance, and in particular the IMO. These concerns stemmed from the length of time needed to generate collective policy, and a tendency to 'water down' initiatives such as the Polar Code, thus weakening the standards that Canada was currently applying. On the other hand, IMO did have the advantage over many UN institutions in that its challenges were predominantly technical, and not political, which made consensus somewhat easier to achieve. The IMO was also currently considering establishing a PSSA in the Arctic, but it is still unclear whether this proposal will go ahead. Finally, there was some brief discussion on whether developing an equivalent of UNCLOS specifically for the Arctic would be beneficial.

Another issue was that the Polar Code did not presently appear to distinguish between open water and icebound navigation and there were too many "one size fits all" solutions. However the AWPPA could be expected to be easily adjusted to accommodate the requirements of the Polar Code once the latter was formally adopted. There also needed to be further cooperation and coordination with industry in the regulation generation process for marine transportation in Arctic waters.

While there appeared to be optimism that development of the Polar Code would be finalized by 2014, there was some risk that certain provisions would be watered down. Sewage remained a contentious issue and there seemed to be some risk that ballast water issues would be left 'hanging'. On a more positive note, because implementation of the Polar Code would be

principally through amendments and additions to SOLAS and MARPOL, most of it would come into immediate effect.

On a more regional level, regulators of all Arctic states needed to collaborate more. It was suggested that presently there was not enough knowledge and experience to ensure effective regulation. There were questions raised about whether the Arctic Council is the right model for better governance. It was stated that the Arctic Council was still evolving and should play a more significant role but lacked sufficient funding, and the rotation of the chair every two years was somewhat disruptive to a consistent mandate.

The Arctic Council also needed to ensure that other non-state actors, as well as non-Arctic states had a voice, even if they did not have a vote. Six additional state observers had been added (Japan, Korea, China, India, and Singapore). This participation was important and such states might be willing to provide funding for research.

Overall, the Arctic Council had done some good work, such as the AMSA study, and new work had been emerging from the Arctic Council's Oil Spill Response Treaty, which was calling for further comprehensive data and information. Northern communities were also requesting more information. Task Forces had been formed to address such issues as black carbon, scientific cooperation and oil pollution prevention.

A trend that was identified was in relation to the creation of more legislation (global and regional) in order to address various concerns. With respect to legislation, finding common ground among all jurisdictions could be problematic. However, it was also stated in one interview that pressures to reduce the environmental impacts of increased shipping in the Arctic would be the greatest influence upon how marine transportation was governed and suggested that the Arctic Council would be heavily involved.

As Canada assumed chairmanship of the Arctic Council, priority was being attached to the creation of a Circumpolar Business Forum, but it was still unclear as to its exact form and function. There was a need for much more openness and transparency in the debate on Canada's Arctic aspirations. Without an overarching vision, Canada would only continue to perform its functions through 'knee-jerk' reactions to issues as they arose. If Canada wished to be a leading player it needed to take a more proactive and well planned approach to Arctic policy initiatives.

Transport Canada and the governments of Nunavut and the Northwest Territories were expected to be very influential in the evolution of marine transportation governance, paying particular attention to safety and community social concerns. Canada had an important role to play in shaping how marine transportation was governed and regulated in the Arctic. While the SAR Agreement and Oil Spill Response Agreement were steps in the right direction, they lacked depth and needed to be improved upon. Furthermore, there were split motivations regarding marine transportation in the Arctic. It needed to be determined whether Canada's aim was to encourage or discourage traffic through the Arctic.

Another opinion with regard to the Canadian Government's approach to Arctic governance was that it was generally quite 'silo-ed' with numerous departments tending to act independently of

each other. There was a need for more cohesion and collaboration. At the moment there were split motivations and priority areas for spending needed to be identified. It was stated by one interviewee that the government needed to determine whether Canada was going to encourage increased traffic and economic development in the Arctic or discourage it due to environmental concerns.

The point was also made that there was too much preoccupation with sovereignty (manifested in the fleet of Arctic Patrol Vessels and a port at Nanisivik) when instead the priorities should be community prosperity, environmental sustainability, safety, and economic development.

A guiding influence was the Federal Government's Northern Strategy, which was complicated by its heavy emphasis on sovereignty. It was suggested that more emphasis should be placed on regional challenges such as northern cost of living increases, and reluctance by industry to make investments without some sort of port infrastructure. Canada seemed to be advancing without a clear vision as to what, in a perfect world, the future Canadian Arctic should look like. A common theme throughout the consultation process highlighted the need for Canada to develop a clear vision for the Arctic, balancing development and environmental protection. It was also made clear that Canada should not encourage transit traffic through Canadian Arctic waters.

Another issue raised was that of enforcement. During the winter season it was almost impossible to regulate the passage of non-compliant vessels. Enforcement would greatly depend on the Polar Code, classification societies, and insurers. Recognizing that many of the ships operating in the Arctic were foreign flagged, it would be critical to establish an effective Port State Control presence in the Canadian Arctic. Finally, there was a mixed perspective on the timing and manner in which northern development should proceed. Aboriginal government was increasingly involved as well as other federal departments such as Environment Canada and the Department of Fisheries and Oceans and CCG.

Appendix B1: Consultation Questions

1. Looking ahead to 2025, first at the overall global picture, then the Arctic in general, then the Canadian Arctic, what 'drivers' (commercial, economic, environmental, social, safety, security, etc) do you foresee influencing the evolution of shipping activity in the Canadian Arctic?

2. Again from a global, Arctic, and then Canadian Arctic perspective, what do you foresee as the principal 'drivers' influencing the evolution of governance of marine transportation in the Arctic at the multilateral; regional (e.g. Arctic Council); national and sub-national (e.g. territorial) levels?

3. What do you see as the resulting dominant trends and key uncertainties associated with these principal drivers? Do you see any possible 'show stoppers' or 'tipping points?

4. What do you foresee as the most problematic of these trends and uncertainties? Can you think of specific challenges that this evolving interaction of commercial influences, public interest perspectives and governance responses may present?

5. What do you foresee as the range of possible situations and circumstances that might prevail in 2025 resulting from this evolving interaction of commercial influences, public interest concerns and governance responses?

6. What initiatives or measures do you believe might usefully be considered in order to influence the evolution of shipping and associated activities in the Canadian Arctic, with the aim of minimization the negative impacts and maximizing the positive impacts stemming from this activity?

Annex C – Summary of Ottawa Workshop, November 8, 2013

A closing stage in the project involved a half-day presentation and discussion with a number of Arctic experts drawn from diverse backgrounds. In attendance at the November meeting were the following individuals:

- Jackie Dawson, University of Ottawa
- Paul Reader, Transport Canada, Marine Policy Branch
- Ivana Kubat, Natural Resource Canada,
- David Avey, Transport Canada, Marine Safety
- David Barber, University of Manitoba, Marine Science
- Drummond Fraser, Transport Canada, Marine Safety
- Patrice Cote, Transport Canada Surface and Marine Statistics and forecasts
- Roberto Bruni, Transport Canada, NEXTAW Secretariat
- Frédéric Sirois, Transport Canada, NEXTAW Secretariat.

The presentation and discussion was led by Dick Hodgson and Will Russell from the project team. The comments generated in this discussion may be grouped in four categories; the methodology of the scenarios' approach, the content of the report itself, commentary on the four scenarios presented, and suggestions for possible 'next steps' for the project. The following Annex will address each of these categories in turn.

There was significant interest in, and indeed support for, the project methodology. Many of the comments and questions centered upon the application or use of this methodology, in particular how to translate the developed scenarios into a course of action that could lead to the generation of policy options, rather than just further questions. Some clarification was sought regarding the requirement that these scenarios be "contrasting, plausible, and challenging," and in particular what was meant by a "challenging" scenario. Interestingly, it was suggested that rather than amalgamating the scenarios into cohesive parts, consideration should be given to assembling a cluster of 'similar' outcomes from the various uncertainties, in order to provide a more nuanced and responsive outlook. As a final point, there was significant discussion regarding how best to conduct the ranking of the various uncertainties and how to account for the relative weight accorded to each element within the scenario development process.

With respect to the content of the report itself, there appeared to be a broad level of comfort with this aspect of the project, and few concerns were raised. It was suggested that a further level of study, involving consideration of the three drivers and associated uncertainties from a regional or local perspective might have been useful. A question posed by the presentation was the impact of the devolution of powers to the territories and the consequences that this might have for environmental governance. It was suggested that the devolution of these responsibilities would in fact strengthen, rather than weaken, environmental governance, particularly with respect to Environmental Impact Assessments. However, it was also suggested that, as the role of the community increased, there might well be further questions raised regarding how local standards might be out of alignment with international principles. In a similar vein, the issue of the 'regionalization' of governance initiatives within Canada was raised as a significant issue. There

was broad agreement among all attendees that an important missing element in Canada's future strategy for marine transportation in the North was the lack of a comprehensive vision for the Canadian Arctic.

The discussion of the scenarios developed by the project was limited by time constraints, but overall they were well received as realistic and plausible depictions of future Arctic development. A general comment was raised as to the limited consideration given to shifts in the northern environment and the various impacts this would have on Arctic development. It was noted that Scenarios 1 and 2 had negative consequences for northern communities, and further examination of these consequences, in consultation with representatives of Canadian Arctic communities, would be valuable.

It was recognized and readily acknowledged by all that a full-fledged consideration of the scenario methodology and the results it generated required further investment of time and effort. In particular, it was clear to all that more time was needed to be devoted to the weighting of the various uncertainties identified by the project team and the impact which these varying degrees of uncertainty/probability and importance might be expected to have for the generation of scenarios. It was suggested that a useful next step might be for the scenarios to be presented to industry, policy leaders and community groups at some appropriate upcoming gathering.

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