

# **The Future of Arctic Marine Navigation in Mid-Century**

*Scenario Creation Workshop Notes*

**Arctic Marine Shipping Assessment (AMSA)  
of the Arctic Council  
Protection of the Arctic Marine Environment (PAME)**

**April 2007**

**Compiled by**  
**GBN Global Business Network**  
a member of the Monitor Group

**Sponsors:**  
**U.S. NOAA, U.S. Department of State,  
and Institute of the North**

## Table of Contents

<b>Introduction</b> .....	<b>2</b>
<b>GBN Scenario Planning Process</b> .....	<b>3</b>
<b>Workshop Participants</b> .....	<b>4</b>
<b>Day 1 — Brainstorming Uncertainties</b> .....	<b>4</b>
<b>Prioritizing and Defining Uncertainties</b> .....	<b>7</b>
Small Group Report Out and Discussion.....	7
Finalized Critical Uncertainties and End Points .....	11
End of First Day Comments from Stewart Brand with Responses.....	12
<b>Day 2 — Overnight Reflections</b> .....	<b>13</b>
Content-Related Reflections.....	13
Process-Related Reflections .....	14
<b>Discussion and Refinement of Matrices</b> .....	<b>15</b>
Candidate Matrices.....	15
Choosing a Matrix.....	17
The Final Matrix.....	18
<b>Developing the Scenarios</b> .....	<b>19</b>
“Polar Lows” .....	19
“Arctic Development Put On Ice” .....	22
“Mediterranean Meltdown” .....	25
“Arctic Saga” .....	28
<b>Day 3 — What about Wild-Cards?</b> .....	<b>30</b>
<b>Regional Implications</b> .....	<b>32</b>
Northern Canada and Greenland .....	32
Bering Strait, Beaufort and Chukchi Seas .....	34
Barents and Kara Seas, and Iceland .....	36
Central Arctic Ocean .....	38
<b>Recommendations and Learning</b> .....	<b>40</b>
Issues to Address .....	40
Research Agenda Items .....	41

## ***Introduction***

This document contains the complete “raw” notes for the scenario creation workshop on the Future of Arctic Marine Navigation in Mid-Century. It captures the thinking and ideas generated by a diverse group of stakeholders during a scenario analysis workshop held on behalf of the Arctic Council (AC) for the Arctic Marine Shipping Assessment (AMSA) at the offices of Global Business Network (GBN) in San Francisco on April 4<sup>th</sup>, 5<sup>th</sup>, and 6<sup>th</sup> 2007. The output from this scenario workshop will form the basis of a chapter in the AMSA.

The purpose of the workshop and these scenarios is to systematically consider the long-term social, political, and economic impacts on Arctic Marine Navigation of Key Finding #6 of the Arctic Climate Impact Assessment (ACIA) published by the Arctic Council and the International Arctic Science Committee in November 2004. These notes will be used to generate more polished, summarized and communicable scenarios that take into account the influence of such changes on the Arctic region as a whole, as well as on the countries, peoples and industries active in the area.

*Setting the Stage* — As an introduction to the workshop, Lawson Brigham, Chair of the AMSA, briefly outlined ten key Arctic issues that participants should keep in mind during the workshop.

- 1. Arctic Council**
  - Intergovernmental forum (no treaty)
  - 8 Arctic states
  - 5 have Arctic Ocean basin coast lines
  - 2 have no Arctic coastlines
  - Permanent Participants (Arctic indigenous groups), observers, NGOs
- 2. Many Stakeholders**
  - Outside the Arctic
  - Such as global maritime industry
- 3. Circumpolar Issue**
  - Yet local/regional impacts
- 4. Climate Change and Global Economics**
  - Key relationship between these two forces
- 5. Arctic ‘Ocean’**
  - Politics of the Ocean
  - UNCLOS implications
- 6. Arctic Ocean is the Earth’s least explored ocean**
  - Surrounded by land
- 7. Arctic sea ice remains in Winter**
- 8. Arctic has vast natural resources**
- 9. Influential Documents**
  - Arctic Climate Impact Assessment
  - Arctic Marine Strategic Plan
- 10. Key Challenge**
  - Balancing freedom of navigation with robust marine safety and environmental protection efforts

# GBN Scenario Planning Process

As a very brief overview of the GBN scenario planning process and approach, several key slides from the opening workshop presentation are shown below. Scenario planning is different from forecast planning, and seeks to illuminate and discover fundamentally different core dynamics about how the future might play out. GBN's approach to scenario planning is based upon four principles: take the long view, think from the outside-in, involve multiple perspectives, and communicate memorably. Finally, GBN's process begins from a very expansive brainstorming of forces and factors, and moves through a winnowing process to determine just a few of the most critical uncertainties. These are then used to frame the set of scenario stories, within which many details are added back in the form of deep causes, future headlines, and ultimately implications about the focal issue. The "funnel" graphics below are meant to illustrate these steps — with the actual workshop output in the pages that follow.

### Scenario Planning anticipates Multiple Futures

Everyone must plan ahead — the question is how?  
 The future is unknowable and uncertain, but uncertainty is not unknowable.

Scenarios compensate for a tendency to oversimplify the future.

**A scenario is a story** about the way the world might turn out in the years ahead.

**A set of scenarios is a tool** for helping us recognize changing aspects of our current environment — and making better decisions, about tomorrow, today.

**Scenario Planning**  
...for multiple futures

knows & uncertainties  
TODAY

**Forecast Planning**  
...for one future

knowns  
TODAY

GBN Global Business Network a member of the Monitor Group

### Four Principles of Scenario Thinking

communicate memorably

**Organization**

**Industry**

**Environment**

**take the long view**

GBN Global Business Network a member of the Monitor Group

**use outside-in thinking**

ARCTIC MARINE SHIPPING ASSOCIATION

**encourage a diversity of perspectives**

ARCTIC MARINE SHIPPING ASSOCIATION

### Scenario Creation Process

- Brainstorming Factors and Forces that could impact the Future of Arctic Marine Navigation over the next 40 years
- Prioritizing, and defining, the Most Important and Uncertain Factors and Forces
- Creating Scenario Frameworks... and Deciding upon One

3 April

- Developing the Scenario Stories
- Considering Regional Implications

4 April  
5 April

GBN Global Business Network a member of the Monitor Group

### Scenario Creation Process

**Deep Causes & Endstates**

**Story & Headlines**

**Initial Implications**

GBN Global Business Network a member of the Monitor Group



## **Day 1 — Brainstorming Uncertainties**

Workshop participants brainstormed a list of nearly 120 Factors and Forces that could impact the Future of Arctic Marine Navigation in Mid-Century. They then voted individually, first for those items they deemed most Important, and then in another vote for those deemed most Uncertain. The table below lists all of the Factors and Forces, ordered by the sum of Importance and Uncertainty votes.

<b>Factors and Forces</b>	<b>Important</b>	<b>Uncertain</b>	<b>Sum</b>
Stable legal climate	12	12	24
Radical change in global trade dynamics	9	14	23
Climate change is more disruptive sooner	7	15	22
Safety of other routes	7	12	19
Socio-economic impact of global weather changes	5	14	19
Oil Prices	7	11	18
Major Arctic shipping disasters	8	9	17
Limited windows of operation (economics)	7	7	14
New Ice Age because gulf stream stops	3	11	14
Maritime Insurance Industry	4	8	12
China and Japan become Arctic maritime nations	5	6	11
Transit fees	4	7	11
Conflict between indigenous & commercial use	7	3	10
Arctic enforcers (police force)	5	5	10
Escalation of Arctic maritime disputes	4	6	10
Shift to nuclear energy	4	6	10
New resource discovery	2	8	10
World trade patterns	5	4	9
Catastrophic loss of Suez or Panama (combined with "Safety of other routes")	2	6	8
Global agreements on construction rules and standards	3	3	6
Development of shipping infrastructure	5	0	5
Nationalist energy security policies	4	1	5
Unilateral shipping policy	4	1	5
3rd gen. Avian flu epidemic	2	3	5
Major changes and shifts in ecosystems	1	4	5
Unresolved rights of passage	4	0	4
Arctic port development?	3	1	4
Highly restrictive shipping policies	3	0	3
Competition from other routes	3	0	3
Strategic navigation aids	3	0	3
Seasonal fee structures for the Suez and Panama	3	0	3
Global dimming in the Arctic area	2	1	3
Methane becomes an energy source	2	1	3
Resolution of continental claims	2	1	3
Land-based mineral mining	2	1	3
Security aspects of the Arctic	1	2	3

<b>Factors and Forces (cont.)</b>	<b>Important</b>	<b>Uncertain</b>	<b>Sum</b>
Continuing search for oil and gas	2	0	2
Decrease in other accessible oil and gas reserves	2	0	2
Potential transit fees	2	0	2
Additional release of methane accelerated	1	1	2
Disappearance of aboriginal culture	1	1	2
Explosive growth of aboriginal culture	1	1	2
Disintegration/integration of free trade	1	1	2
Collapse or entrenchment of the Arctic Council	1	1	2
Safety and rescue activities	1	0	1
Just-in-time production	1	0	1
High-Arctic becomes a world heritage park	1	0	1
Risk and fear of environmental spill	1	0	1
Inadequate navigation aids	1	0	1
Port development and expansion	1	0	1
Social and economic issues in the north	1	0	1
Capacity of existing communities to deal with change	1	0	1
Shipping super-cycles	1	0	1
Application of UNCLOS to Arctic Ocean in the next 10 years	1	0	1
Pipeline augment transport framework	1	0	1
Mid-east explosion	1	0	1
Failure of the US Dollar	1	0	1
Russia takes back part Bering Strait from Alaska	0	1	1
Ship size is not constrained	0	0	0
Rapid technological change in drilling	0	0	0
Possibility of war amongst Arctic countries	0	0	0
Power of aboriginal peoples in the region	0	0	0
Negative effect of pollution control	0	0	0
Endangered species	0	0	0
Safety of alternative routes	0	0	0
What comes after the container?	0	0	0
All future ships are ice-breaking ships	0	0	0
One large cruise ship to the Arctic	0	0	0
Resumption of Arctic arms race	0	0	0
Nuclear powered ships	0	0	0
Changing fishery patterns	0	0	0
Effect loss of permafrost on oil and gas development	0	0	0
Extreme tourism	0	0	0
Missile defense	0	0	0
Geography of trans-shipment hubs	0	0	0
Gov policy accelerates/decelerates regional development	0	0	0
Timing of land-navigation versus sea-navigation	0	0	0
Proliferation of aqua culture	0	0	0
Invasive species	0	0	0
Federate Republic of the Inuit	0	0	0
Depopulation of the Russian north	0	0	0
Global development of alternative energy	0	0	0
Massive land-based development in support of oil & gas	0	0	0

<b>Factors and Forces (cont.)</b>	<b>Important</b>	<b>Uncertain</b>	<b>Sum</b>
Availability of personnel to develop (labor supply)	0	0	0
Rise of virtual tourism (boomers stay home!)	0	0	0
Unilateral control of the Arctic Ocean by the Arctic states	0	0	0
Increasing communications of local communities	0	0	0
Creation of new communities and support infrastructure	0	0	0
Multi-lateral agreement w/18 nations (e.g. Antarctic treaty)	0	0	0
Capricious political agreements	0	0	0
Political confusion due to climate variability	0	0	0
Piracy	0	0	0
Modifying melting point of ice	0	0	0
Political instability vs. open ocean	0	0	0
Availability of low temperature steel	0	0	0
Temporary or migrant communities	0	0	0
New submarine technology	0	0	0
Robotic shipping	0	0	0
Better predictive models	0	0	0
Arctic as thoroughfare for blimp transport	0	0	0
Resettlement of coastal communities due to climate change	0	0	0
Improved technology for discovering sea ice	0	0	0
Need for search and rescue capability	0	0	0
Sub-sea completion of O&G extraction independent of ice	0	0	0
Rogue shipping companies test the ocean	0	0	0
Navigation neutrality	0	0	0
Tactical navigation aids	0	0	0
Break-up of the Russian Federation	0	0	0
Oil spill clean up in broken ice	0	0	0
Trans-Eurasian rail and pipeline	0	0	0
Canadian break-up	0	0	0
Investments in other shipping routes	0	0	0
American isolationism	0	0	0
Chinese hegemonic world	0	0	0
International small pox epidemic	0	0	0
Global nationalization of natural resources	0	0	0
Africa of new center of production	0	0	0
Undue influence of EU in Arctic affairs	0	0	0
Involving indigenous in economic benefits	0	0	0
Resource “Haves” and “Have-Nots”	0	0	0

## Prioritizing and Defining Uncertainties

Following participant voting results, the GBN Team extracted the top 19 areas of “critical uncertainty” for further discussion and definition. These items received 6 or more total Importance and Uncertainty votes, and are shaded in the above table. Participants worked in small groups to create “axes of uncertainty” with specific endpoints. Each group’s axes are shown below.

### Small Group Report Out and Discussion

#### Group A

<i>Growing unilateralism (preservation of status quo)</i>	<b>Legal Climate and Degree of Cooperation</b>	<i>International legal regime (buy-in from the 8 key nations)</i>
❖ Sub-Arrow – issue of where Russia goes ... increasing drift towards a “different form of democracy” is a critical part of this legal climate...		
<i>Limited</i>	<b>Climate Change Variability</b>	<i>Extreme</i>
❖ Predictable change, versus huge swings – frequency and amplitude – the ability to plan and cope with extremes.		
<i>Prohibitive</i>	<b>Nuclear Propulsion</b>	<i>Sustainable</i>

- In the middle one, if you had climate events that were stronger and less predictable, did you think about massive world destruction that would reduce global trade?
- If you’re really getting massive social disruption elsewhere, Arctic navigation will become a secondary concern.
- That might not necessarily be true if Nigeria and the Middle East were epicenters of conflict.
- The other key consideration is the momentum towards change. We’ve had a string of reducing ice, but if we have a string of years of stable ice conditions, does that rob the momentum?
- I completely disagree, it doesn’t matter. Regional destination voyages for resources will be defined.
- I agree it will keep moving. I’m talking about the momentum around building standards, regimes, etc.
- I would see that ice stability as a symptom in the world that we don’t really understand climate change. That would be very damaging to the current political momentum.
- On Nuclear Propulsion – did the group consider that we’re entering an era where nuclear propulsion might be at an all time low? It was much higher in the 1970s, with older technology...

**Group B**

<i>Regional Disputes</i>	<b>Escalation of Arctic Marine Disputes</b>	<i>Agreed Upon International Regimes</i>
--------------------------	---	--

<i>Lower levels of growth in the Developed World</i>	<b>Rapid Change in Global Trade Dynamics</b>	<i>Continued growth based on Asia-Pac growth</i>
--	--	--

❖ Driven by anything pandemic, terrorism on the low side, developing world growth

<i>Refuse to cover risks</i>	<b>Maritime Insurance Industry</b>	<i>Drive improvements in safety</i>
------------------------------	------------------------------------	-------------------------------------

❖ If the insurance industry can't control it, it will be prone to move toward not insuring for it. At the opposite end of the spectrum, the things they can control (shipping standards, specs, etc.) to insure a liability regime that drives change.

- Is there anywhere in the world that has been dealt with well? *The Antarctic treaty*
- First derivative might be interesting – if you're here, which direction are you moving?
- Right now are exploratory drilling activities insured? *No, there is no insurance for rigs blowouts. The rigs themselves are insured, but not environmental impact.*
- Usually the market adjusts to allow some form of insurance. Initially companies thought the rates were so high, and so many ways to break the caps they were talking about refusing to insure it, but a different regime involved (P&I clubs became re-insurers) so a different regime evolved.

**Group C**

<i>Minimum</i>	<b>Level of Impact of Arctic Shipping Disaster</b>	<i>Maximum</i>
----------------	--	----------------

<i>A little</i>	<b>Level of Trade determined by World Trade Patterns</b>	<i>A lot</i>
-----------------	--	--------------

<i>Loss/Conflict</i>	<b>Socio-economic Response to Global Climate Impact</b>	<i>Gain/Cooperation</i>
----------------------	---	-------------------------

- Just one small addition. We had a very interesting conversation about the level of trade. It addressed both trade as large numbers of global trading systems versus a disparate structure. We also had a conversation about what's moving around the world: lots of physical, and lots of virtual. At the end of the day is a lot of information, not as much tonnage.
- On level of impact, it seems like in your cloud did you have other impact beyond physical? Socio-economic? Industrial? *Yes, we had something like a dozen related factors.*

**Group D**

<i>Trans-shipment possible in a stable environment</i>	<b>Relative risk of Arctic Shipping Routes</b>	<i>Resource extraction (destinational traffic)</i>
<i>Far-sighted, mutual self-interest</i>	<b>Collaboration in resource extraction, by China, Japan, Russia</b>	<i>Unbridled competition &amp; conflict</i>
<i>Severe Climate Closes NSR</i>	<b>Northern Sea Route Trafficability</b>	<i>Technology maintains traffic flow</i>

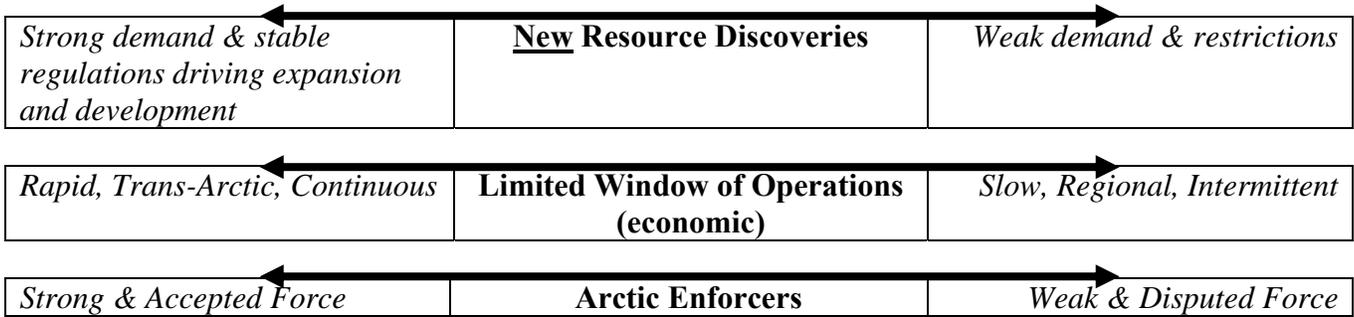
- There is a distinction between cooperation and collaboration. Cooperation is a very active, engaged division of labor, whereas collaboration is a much looser arrangement.
- I think the group got it right when you put China, Japan, and Russia together. There as a very real opportunity for collaboration, but also conflict given the historical trends between the three.
- Technically the window is much longer than what is actually achievable because of other political and other constraints that are not driven by ice or ice-breakers.
- Does an oil company lose or gain by blocking whaling? *Haha. You don't discuss blocking whaling in Alaska. If you do, you aren't allowed off the airplane when you land.*

**Group E**

<i>Fragmented (Wild West)</i>	<b>What will be the legal framework for Arctic Shipping?</b>	<i>International Agreement</i>
<i>Unpredictable</i>	<b>Transit Fees and Fee Level and Stability</b>	<i>Predictable</i>
❖ Also the level of fees, competitive with alternative routes? Destinational? Economically viable?		
<i>Development</i>	<b>Driving values causing conflict between indigenous people and commercial initiatives: Preservation driven values</b>	<i>Wealth Creation</i>

- Are there good analogies in other industries? I think of global radio standards – MARPLE?
- Some of the other dimensions are: who benefits and how are benefits distributed?
- The indigenous issues can be different in different places, so we need to be careful of it.
- The regulatory regime is much more advanced and crafted than many understand. We are well along in drafting a set of standards and regulations.

**Group F**



- If it is intermittent people will be much less willing to invest in infrastructure
- There may also be moves to limit navigation (ex. Antarctic treaty which is very restrictive towards exploration)
- On *Enforcer*, one of the interesting phenomena is the idea of radical transparency. Enforcement is becoming democratized. You no longer need to rely exclusively on government for exposure.
- Doesn't it depend on who you are policing? If you are policing individuals and companies, that's one thing, but what if you're policing a country?
- A general observation on the ability to predict and plan. Can you reliably anticipate the future and thereby make appropriate regulations that fit the circumstances (safety, communication, infrastructure, etc.). If you're in a world with high degree of variability, then the planning problems become very difficult.
- One of the things that interested me is that the length of the season is relatively negotiable. You can push through shallow ice if it's worth doing it and that is increasingly facilitated by technology and overlap of forces who want to push through.
- There is a category of events that traditional insurance and probability curves have encapsulated. If there is an avian flu epidemic suddenly the non-existent regimes might be come into places a very quick manner.
- In terms of limited windows of operation, even though the window may be increasing, it's narrowing at the same time because of conflict with other users (whaling, hunting, etc.).

**Plus**



## Finalized Critical Uncertainties and End Points

“Critical Uncertainties” are those factors that are judged to be the most “critical” for defining our future environment, yet they cannot be predicted confidently. We can, however, identify what is meaningfully—and more exactly—“uncertain” by showing them as a spectrum of possibilities, with distinct endpoints. Those shown below are the final result of the prioritization and definition exercise detailed above.

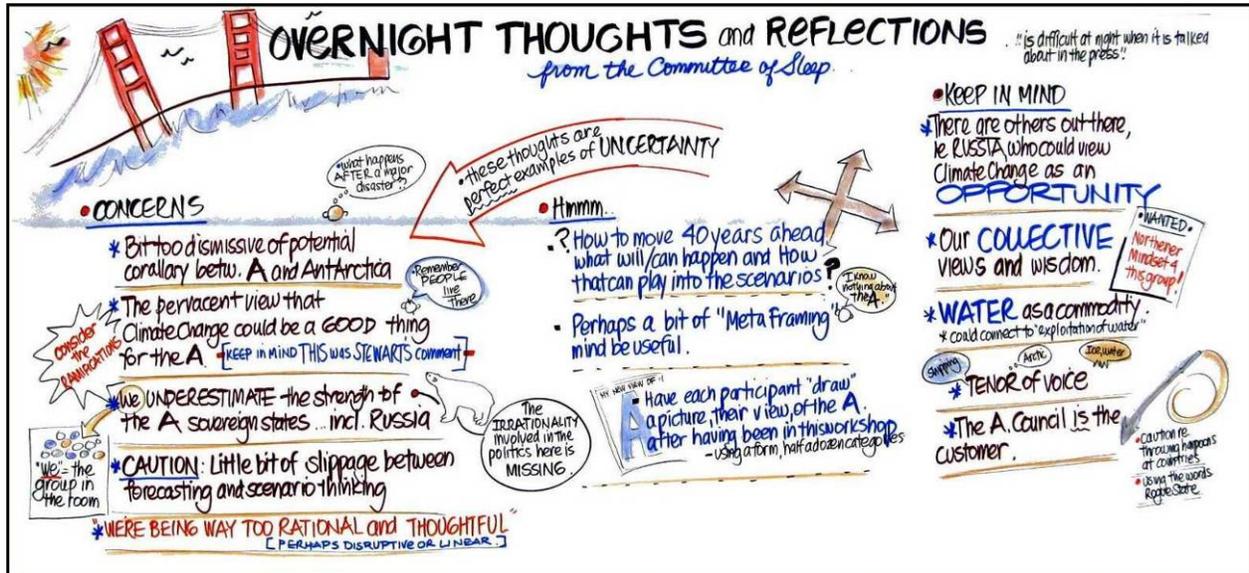


<i>Growing unilateralism (preservation of status quo)</i>	<b>Legal Climate and Degree of Cooperation</b>	<i>International legal regime (buy-in from the 8 key nations)</i>
<i>Limited</i>	<b>Climate Change Variability</b>	<i>Extreme</i>
<i>Prohibitive</i>	<b>Nuclear Propulsion</b>	<i>Sustainable</i>
<i>Regional Disputes</i>	<b>Escalation of Arctic Marine Disputes</b>	<i>Agreed Upon International Regimes</i>
<i>Lower levels of growth in the Developed World</i>	<b>Rapid Change in Global Trade Dynamics</b>	<i>Continued growth based on Asia-Pac growth</i>
<i>Refuse to cover risks</i>	<b>Maritime Insurance Industry</b>	<i>Drive improvements in safety</i>
<i>Minimum</i>	<b>Level of Impact of Arctic Shipping Disaster</b>	<i>Maximum</i>
<i>A little</i>	<b>Level of Trade determined by World Trade Patterns</b>	<i>A lot</i>
<i>Loss/Conflict</i>	<b>Socio-economic Response to Global Climate Impact</b>	<i>Gain/Cooperation</i>
<i>Trans-shipment possible in a stable environment</i>	<b>Relative risk of Arctic Shipping Routes</b>	<i>Resource extraction (destinational traffic)</i>
<i>Far-sighted, mutual self-interest</i>	<b>Collaboration in resource extraction, by China, Japan, Russia</b>	<i>Unbridled competition &amp; conflict</i>
<i>Severe Climate Closes NSR</i>	<b>Northern Sea Route Trafficability</b>	<i>Technology maintains traffic flow</i>
<i>Fragmented (Wild West)</i>	<b>What will be the legal framework for Arctic Shipping?</b>	<i>International Agreement</i>
<i>Unpredictable</i>	<b>Transit Fees and Fee Level and Stability</b>	<i>Predictable</i>
<i>Development</i>	<b>Driving values causing conflict between indigenous people and commercial initiatives: Preservation driven values</b>	<i>Wealth Creation</i>
<i>Strong demand &amp; stable regulations driving expansion and development</i>	<b><u>New</u> Resource Discoveries</b>	<i>Weak demand &amp; restrictions</i>
<i>Rapid, Trans-Arctic, Continuous</i>	<b>Limited Window of Operations (economic)</b>	<i>Slow, Regional, Intermittent</i>
<i>Strong &amp; Accepted Force</i>	<b>Arctic Enforcers</b>	<i>Weak &amp; Disputed Force</i>
<i>Stable</i>	<b>Oil Prices</b>	<i>Variable</i>

## End of First Day Comments from Stewart Brand with Responses

- I love this map. It is such a marvelous mandala of everything we're doing here this week. Every map is trying to draw attention to things you care about, and also leave out things you don't. This map has a very narrow view of the world.
  - In all of our scenarios, the kind of climate change we are implying means more openness (seen by many as good) for this region. Are we talking about a part of the world that wins in a climate change world? It would be bad for the rest of the world. Biodiversity and carrying capacity are dropping dramatically elsewhere. The rest of the world economy is in uproar. IF we believe that the rest of the world economy will function the same way, we will be in for a very sorry surprise.
  - A climate change world even with a gradual heating sets in motion what we call geo-engineering, e.g., dimming the atmosphere with seeding, ameliorating the sun's radiation. When that happens, when the folks who are now making money and are winning in this new world, do they resist the world getting fixed for everyone else? When you're composing scenarios, it is essential to decide how the worlds beyond this map play-out.
- This is the canary of the earth, when everything goes to pot in the Arctic is leading not lagging.
  - You might lose two of the largest fisheries in the world (Barents and Bering Seas).
  - Here is a counter – fishing is among the last of the hunter-gatherer activities in the world. I say by 2050 the fishing industry as we know it will be history. Everything will be farmed.
  - Things can only move so far north, it's not an infinite move. That type of concentration produces all sorts of ramification. Acidification of the oceans is a serious problem (already experienced a 30% increase in acidity). CO<sub>2</sub> over the ocean converts to carbonic acid that kills Phytoplankton. At 2000 ppm, the ocean died in the fossil record.

## Day 2 — Overnight Reflections



### Content-Related Reflections

- The concern that developed is the expression of some members last night that climate change would be positive for the north with the north acting as a remedy for the rest of the world. And I feel that view is pervasive, and the problem is that impression is based off the thought that there is no one living in the region, and that the north is merely a point to be used by southerners as remedy for southern interests, a resource on a purely economic basis. *I sense your comments were in response to Stewart. From the group that is in the room today, I sensed a great amount of push back to Stewart’s comments last night, so I don’t think anyone in this room is in agreement with his view. However, I think Stewart’s main purpose was to refocus the group in implications beyond just the region, to take the rest of world into account when creating the scenarios.*
- When I was involved in thinking about these things, I’m using my past experience. What I got from Stewart is how to move forward and think about in 40 years what sorts of other actions will happen and be happening that will shape the scenarios. *Yes, the big takeaway from Stewart was that you need to think about the context of the rest of the world.*
- Comment to the question of “winners in the Arctic” – I agree with both comments. But I think it’s also important to recognize that there are actors out there that are looking at climate change as a positive.
- We might have been a bit too dismissive of the Arctic as a potential corollary to the Antarctic that might mimic the regulation in the Antarctic. There are really no items in there that address regulation and fall-out after a major disaster. With the focus and attention is not toward shipping, but toward closing parts of the region off.

- I think we underestimate the strength of the Arctic sovereign states; especially Russia if it reverts back to is closed borders and state-led systems. We might have collectives, IMO involvement.
- To briefly respond—If you take the polar bear issue, Canada, in theory, could create a very far ranging refuge to allow whales and other species to live life undisturbed, and that might be a plausible scenario.
- I think in the equation when we draw the analogy to Antarctica, We need to keep in mind that the two places are very different.
- I was in a meeting not long ago where very senior officials from Canada and USA were talking about jurisdictional issues. The tenor of voice was surprising, they were yelling at each other about borders and precedence. I think we need to keep in mind that level of intensity.
- I think we're all being far too rationale. The countries and actors in the region might not react rationally to things like sovereignty and politics. A second factor: all in all we have to make a decision about what we think of human nature. It's a matter if we're more collaborative as a species or more opportunistic.
- Almost every science conference I go to, water is a commodity. When we talk natural resources (timber, gas, etc.) but water is something we should include on that list. Water as commodity.

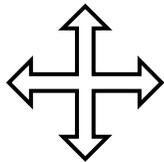
## Process-Related Reflections

- What if we're missing key points in the brainstorm list? Will that have broader implications? *It's often the case that there are topics that some feel are not included in the list of uncertainties. What usually happens is that those topics are woven back into the scenario during the creation of the narrative.*
- The comments here this morning are interesting, but I think we're underestimating our collective global view and collective wisdom. A lot of the topical threats (polar bear, Arctic treaty, etc.) are all underlying the higher-level view that we have fleshed out in the uncertainties.
- To respond, I would say I agree, with the exception that collectively in the room we have a mid-latitude mindset. Everyone expressed interest in the North Pole perspective map, but if you go to St. Petersburg and at the Arctic museum. There are people in the north that have been living that world for generations, and I'm concerned that we haven't captured that perspective.
- Would it be valuable to have a simple forum to picture how each person in this room sees the Arctic in 40 years after this workshop is over? *It would be easy to do, but I think we might run the risk of turning to forecasting where the Arctic is going.*
- There seems to be a little bit of slippage between forecasting and scenario thinking. I think some of what Stewart was doing was forecasting which could be contestable. From the outside there are some larger rationalities that could be included. During the Cold War there was a great deal of forecasting that was wrong. But there is a certain amount of meta-framing that could be done to consider the higher level issues. There are implicit worldview scenarios that slip into forecasting, and that's what you want to disrupt.

## Discussion and Refinement of Matrices

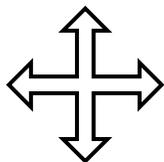
Workshop participants broke into small groups to create potential matrices for framing the set of scenarios. They did so by choosing and crossing pairs of critical uncertainties taken from the final list above. Each of the groups generated 3-4 matrices, and then selected one to present to the group as a whole. These six were then discussed in plenary and the whole group then selected the final matrix shown below. Criteria for choosing the matrix included plausibility, divergence, relevance, and challenge—as well as the “right” level of external forces.

### Candidate Matrices



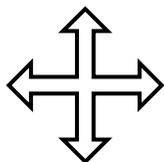
**Indigenous Welfare (lower / higher priority)**  
crossed with  
**Resource Exploitation (uncertain / certain)**

- *Northern Saga* (higher & certain) – Common good and shared exploitation can contribute to indigenous people and northern ecology typified by resilience.
- *White Out* (lower & certain) – Indigenous welfare low and exploitation is certain resulting indirectly in ethnocide and destruction of culture.
- *Vacated Tundra* (lower & uncertain) – Low indigenous welfare and uncertain resource exploitation makes for a lose-lose scenario with accidents and catastrophes.
- *Icy Stovepipes* (higher & uncertain) – Pockets of traditionalist development in which a fair amount of culture and folklore are preserved, with some but not much development.



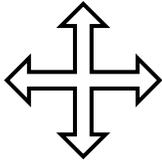
**New Resource Development (strong / weak demand)**  
crossed with  
**Maritime Disasters (min / max impact)**

- *Arctic Park* (weak & max) – total banning of activities
- *Rough (Calm?) Waters* (strong & max) – strong regulatory environment that arises out of disasters, but development continues.
- *Free for All* (strong & min) – all players are in the game, lots of activity, large and small.
- *Status Quo* (weak & min) – things are as they are today
  - I'd add that sometimes in a large maritime disaster, the impact remains 40-50 years
  - Impact on waters is long-term, pervasive, and not regional



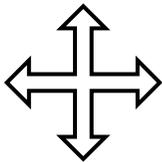
**Climate change (cool / hot)**  
crossed with  
**Level of Trade (min / max)**

- *Resurgence* (hot & max)
- *Technology Renaissance* (cool & max)
- *Regression* (cool & min)
- *Persistence?* (hot & min)



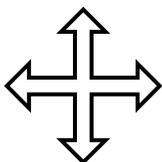
**Indigenous People (embrace dev / resist dev)**  
crossed with  
**Rise of Asia (hard military power / soft commercial)**

- *Indigenous Multilateralism* (embrace dev & hard power) – Embrace development, but also strong presence of Asian hard power
  - *Casino* (embrace dev & soft power)
  - *Strange Bedfellows* (resist dev & soft power) – Protectionism and preservation
  - *Tiananmen Tankers* (resist dev & hard power) – Gunboat diplomacy from East Asian power(s), with military fleet(s) cresting the horizon
- “Development” is a highly-charged word, perhaps “expansion”? Or “management”?



**Legal Regime (unstable, unresolved / stable, resolved)**  
crossed with  
**Value of Natural Resources (low, volatile / high, stable)**

- *Arctic High* (stable & high) – Development, people working in harmony
  - *Arctic Dreams* (stable & low) – people thinking about how to develop the Arctic, but not value
  - *Arctic Meltdown* (unstable & low)
  - *Arctic Conflict* (unstable & high) – Rogue states and companies exploiting the area.
- We noticed that some of the other groups had indigenous people as an axis, but decided that it would be important to consider other peoples and stakeholders too. Therefore we used legal regime as a proxy to incorporate the interests of many different groups.
- When we talk about a legal regime, we have many meanings in the axis there. Utopia is a world where everyone is happy. If you back off from there, these parallel systems don’t advance at the same rate.
- Legal might be a little to restricted for what you’re trying to get at. What I’m talking about is modes of governance, of which legal regimes are only a part.



**New Resource Development (weak, restricted / strong, regulated)**  
crossed with  
**Legal Regimes (unilateral / international)**

- *Balkanization* (weak, unilateral) – Fragmentation, domination by the coastal states each acting in their own interest, no viable Arctic shipping, no resources to develop it. Primary actors are countries because you have no large companies pushing development. Potential positive: greater chance of indigenous self-determination, but no stable regime...
  - *Gold Rush* (weak, international) – lots of opportunity for conflict
  - *Arctic Express* (strong, international)
  - *No-Go Zones* (strong, unilateral)
- We ran the indigenous filter in each. We could also run the climate filter on these.
- What about regulations that drive development v. regulations that restrict development?

## Choosing a Matrix

- I'm not sure how climate fits into these. There are about 26 scenarios that drove our analysis (Arctic/IPCC) the only difference between the low and the high is the speed at which the Arctic Ocean opens. We can marry that range in here because it's the difference between 2040-2100. For instance, Arctic Express – we could have development and such, but how does climate work into them? It seems that climate change visibility is low. I worry about assuming that there will be an open ocean in 40 years, is because that's what we say is likely.
- I think another way to look at it is to go back and look at the way that Arctic marine technology has evolved in the last 20-30 years. I wouldn't say that climate change is a red herring, but I'm not sure it has to be a driving factor. Shipping levels may change regardless of climate change.
- To be provocative. In the model "Arctic Express" that is here today in Russia, it's not Trans-Arctic, and not containers, but the routes and technology are there today.
- That goes together with what I've been thinking about – a 2x2 matrix is very simplistic. I struggle a little but to find out how to make a matrix that puts them all together. There is also an issue of that each of the axis is not quite precise.
- Been trying to play this through the filter. There are so many factors that played in the development of container shipping. It is so difficult to work it through that with all the different factors out there. I don't know that we're capturing all the different issues.
- The second comment is I really like the idea of the Asia perspective because it opens up our perspective in ways that I know I didn't think of earlier. And a changed economic perspective needs to be we consider. A different set of power structures is something that could play out.
- We're capturing trade but not transit and transport of goods.
- It's basically about people and stuff.
- I think the fundamental thing is that we have an Arctic Council, and they have found the trends. There is a huge range and there are uncertainties around them. The mode and multiple uses of the Arctic is what we're talking about and it is a huge issue.
- Shipping categories of Regional Transit, Oil & Gas, Fisheries, Tourism, Minerals. If we have our frame that separates the four worlds, and some of the higher level uncertainties as themes, we can then think through how these categories play out in each of the worlds.
- If you add conditional variable, would you want these groups to push the edge of what is plausible so that you end up with stories pushed to the corners of these axes? *Yes.*
- We within the oil industry, from the shipping perspective, shipping oil and gas across the Arctic is plausible today. There is more work that needs to be done around the technologies for getting the oil out of the ground (more than getting it on the ships), but those challenges are not seen as insurmountable. So viability is something to keep in perspective.
- Many elements of oil development are relatively insensitive to climate change. Exploration is sensitive to climate change, but year-round production operations are relatively insensitive.
- Political development issue is something I feel is getting lost. It's a central issue in all of the issues we're discussion. Where does the politics fit in this?
- My question is not how will this room define the scenario, but how others will interpret the scenarios. Therefore I'm supportive of natural resources being included.
- Could we talk about natural resource development and levels of trade activity? Legal regime – governance regimes is broad enough to capture the suite of issues that are associated with that.

## The Final Matrix

By crossing the two framing uncertainties detailed below, participants formed the scenario matrix shown here. Those at the workshop saw these two factors as the most important and uncertain in shaping the Future of Arctic Marine Navigation in Mid-Century. This framework also allows the incorporation of many of the other uncertainties explored earlier, while creating scenario spaces that are plausible, relevant and diverse. Workshop participants went on to describe in detail each of the four scenario quadrants, as captured in the following section.

### Governance

This axis describes the degree of relative stability both within the Arctic region and internationally.

Less stability implies shortfalls in transparency and legal structure, as well as a propensity for actors and stakeholders to work on a more unilateral basis rather than by collaborating in a cooperative, international regime.

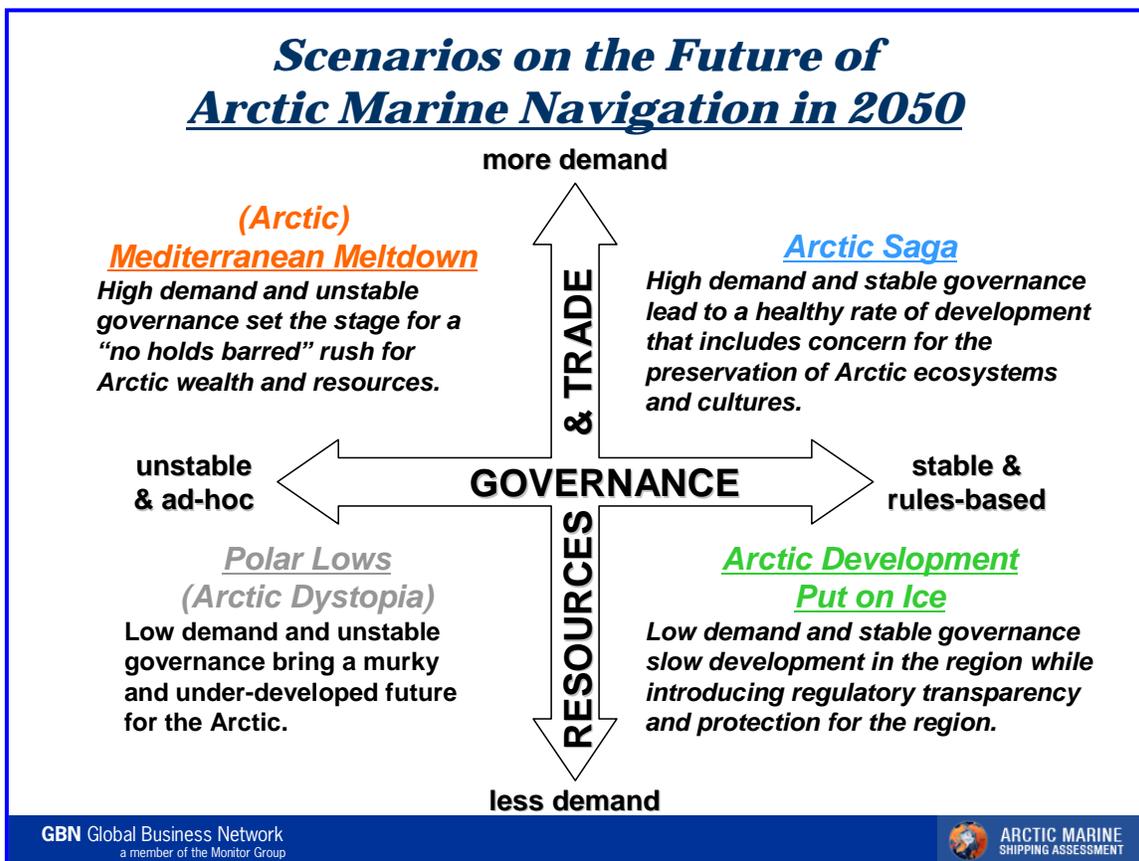
More stability implies not only efficiently operating legal and regulatory structures, but an international atmosphere more conducive to collaborative and cooperative development.

### Resources and Trade

This axis describes the level of demand for Arctic Resources and Trade. Framing this in a global context exposes the scenarios to a broader range of potential market developments, such as the rise of Asia and political instability in the Middle East.

More demand implies exactly that: higher demand from more players and markets around the world for resources in the Arctic, including open water for trade through the Arctic.

Less demand is also straightforward, with fewer players interested in fewer Arctic resources.



## ***Developing the Scenarios***

*Workshop participants broke into four groups, each discussing and describing one quadrant of the previously agreed matrix. Groups walked through templates prompting them to describe deep causes which would be behind this world, what the end-state of this world would look like, a storyline for how this world could develop, and a few early indicators to show when this world might emerge. The groups also discussed what the interim implications of this world might be in 2020 (along the way to endstates in 2050).*

### **“Polar Lows”**

(formerly “Arctic Dystopia”)

↓ **Less Demand**

← **Unstable Governance**

#### *Deep Causes*

- Armed conflict due to national security concerns
- Break-up of federated states leads to smaller nations
- Global religious conflict
- Increase of protectionism (economic)
- Regional outbreak of generation x of Avian flu
- Easy access to new sources of natural resources
- Arctic cooling
- Obstruction of resource development by Arctic residents
- Geopolitical stalemate & strife

#### *Early Signs*

- Have occurred
  - Russian unilateralism
  - Avian flu shown in bird to bird to human transmission
  - North slope borough sues Department of Interior over Oil & Gas issues
  - Inuit sues U.S. Government over loss of life-style
  - Mid-East conflicts
  - Global terrorism
- Indicative if they DID occur
  - Cruise ships end trans-oceanic crossings
  - Global governments legislate reduced use of fossil fuels
  - Reduction in ship production – freight, cruise, supply, etc.
  - Level of investment
  - Gulf-stream slows down/temporarily stops

#### *2020 Snapshot*

- 2-3 characteristics of Arctic Marine Navigation
  - Developments initiated in 2010 reduces and or winding down
  - Stagflation
  - Reduced R&D
  - Periodic disruption of marine traffic

- 2-3 issues **more** important in 2020 than 2050
  - Shipping ops in icy waters
  - IMO Arctic regulations
  - Who is investing?
  - Governance uncertainty
- 2-3 issues **less** important in 2020 than 2050
  - Dominant presence of military vessels
  - Consequences of dramatic lifestyle changes
  - Cumulative impacts of climate change
- 2-3 issues points of decision to be made in this time?
  - Investment in marine infrastructure
  - Maritime governance

### End State

- By 2050 we would see...
  - Decreased movement of trade
  - Decrease in tourism
  - Increase in terrorism – conflict between established states
  - Skating on the canals of Amsterdam (cooling??)
  - Rise in nationalism
  - Increased isolation due to homebound labor force due to technology, health issues
- In 2050, Arctic Marine Navigation would be categorized as...
  - Minimal Arctic marine traffic dominated by government re-supply, military, research
  - Ratio between traditional lifestyle and immigrants will decrease
  - Unsafe local maritime operations
  - Low Safety/Low enforcement of maritime regulations

### Key Issues

- Adjustment of regulations to address uncertainty and discrepancy in Arctic governance
- Transition to 2050 is problematic: still have Arctic operations for a time without appropriate regulations
- Incorporating both end points of climate range = same scenario.

## **Report Out**

### Deep Causes

- Geopolitical stalemate globally, access to new sources for energy/decreased demand. Obstruction of resource dev by Arctic residents.
- Arctic whaling stops Shell from drilling, 2011 permanent participants dominate Arctic Council, 2015 US imposes new tariffs on Asian imports, massive riots in China in response. 2030 – Sakhalin gas project in Russia abandoned. 2030 Russia dry docks their ice-breakers 2050 International Polar Year cancelled

### End State

- Reduced global trade
- Minimal Arctic marine traffic

2020

- Ships still operating in icy waters, but no regulations to govern
- Who is investing in the future development of the Arctic?
- Dominant presence of military vessels in the Arctic Ocean

*Key Issues*

- Adjustment of regulations to address uncertainty and discrepancy. We go through the same scenario – we’ve still got stuff going on, but no regulations and it’s all petering out and stagnating. Increased ice in the Arctic mid-scenario, but no increasing activity. Get to the same end-point, but the path is different.
- This scenario has very interesting historical analogs (1907) huge wave of global integration, expansion of trade and econ, increasing communication & tech, tech driven growth, Norman Angel “The End of War”. The roll of international institutions is captured here. It was their failure in the early part of the century that led to trade wars and eventually the world wars. If you look at the recent trends in protectionism (tariffs on china) and the lost of faith in institutions (UN, NATO, etc.) it presents a world where current events put us at great risk of returning to the state of the early 20<sup>th</sup> century. Resource wealthy unilateralism is on the move.

## “Arctic Development Put On Ice”

(formerly “Mixed Bag”)

↓ **Less Demand**

→ **Stable Governance**

### Deep Causes

- Grave public concern about climate change (impacts to Arctic)
- Get resources in other places?
- Conservation and alternative energy viable alternatives to oil and gas
- Key stakeholders (e.g. corporate / indigenous peoples) demand harmonized governance
- Low demand creates less contentious political space
- Arctic oil & gas reserves disappointing
- India and Africa link-up

### Early Signs

- Have occurred
  - Supreme Court allows states to set fuel standards
  - Nuclear power revisited – next generation reactors safer
  - Climate change becomes major political issue
  - Africa/Indonesia as sources/resources
  - Polar bear proposed for ESA listing
  - Russia has applied for continental shelf under Article 76 of UNCLOS
  - Panama Canal being enlarged
  - IMO developing guidelines for Arctic ships
  - Increasing Russian nationalization
  - Selendang AYO/ Cougar Ace/ Salica Frigo
- Indicative if they DID occur
  - Large scale alternative energy development
  - Chinese hiccup in development
  - Production from Russian Arctic off-shore
  - Global interest in Arctic continuing to grow

### 2020 Snapshot

- 2-3 characteristics of Arctic Marine Navigation
  - Harmonized polar rules for ship design and pollution prevention
  - Oil and gas development increases in Russia but limited in Canada/US
  - Established Arctic shipping corridors
- 2-3 issues **more** important in 2020 than 2050
  - Arctic oil dependency
  - Arctic fisheries
  - Climate change
- 2-3 issues **less** important in 2020 than 2050
  - Alternative sources of conventional oil and gas
  - Maintaining vigilance in the face of fewer accidents
  - Staying focused on Arctic issues
- 2-3 issues points of decision to be made in this time?
  - Decision to launch Arctic planning process

- Move to alternative fuels

### *End State*

- By 2050 we would see...
  - Jurisdictional disputes resolved
  - Indigenous self-determination and strong government
  - Alternative energy sources used worldwide for transport and electricity generation
  - International conventions implemented widely
  - Integrated ecosystem-based planning (Large Marine Ecosystem)
  - Clearly defined Arctic protected areas
  - Depressed Arctic economy with few employment opportunities
  - Arctic limited to elite/rich tourists (high-end)
- In 2050, Arctic Marine Navigation would be categorized as...
  - Infrastructure in place for safe shipping
  - Ship standards agreement
  - Clearly defined shipping lanes
  - “Balanced use regime” includes “exclusion zones”
  - Bureaucracy now dampening new developments

### *Key Issues*

- Planning process
- Need to anticipate changes in “demand” on Arctic
- Sensitivity of Arctic future to external economic drivers

## **Report Out**

### *Deep Causes*

- More resources available in other places
- conservation and resource management developed

### *Headlines*

- Arctic accidents alarm the world
- Arctic agreement protect environment and the people (states set up powerful rules in governing the exploitation of oil and movement of ships)
- Oil dependence has been reduced (+15), (+40) trade patterns change
- Don’t see the routing of ships and sourcing of materials we have today

### *End State*

- Integrated eco-system planning framework – rules for ships, defined protected areas, depressed Arctic economies, few opportunities for residents

### *2020*

- More important – Arctic oil dependency, climate change (bigger driver in policy development), Arctic fishery

### *Key Decisions*

- Need to launch Arctic planning process, adoption of technology to support alternative fuel sources

*Key Issues*

- Balanced planning process for regulations (addressing needs of all parties) aimed achieving certain objectives
- Need to anticipate changes in demand on the Arctic
- Arctic is sensitive to external demands and drivers, doesn't have it's own destiny in it's hands

*New trade routes?*

- Indian-African cooperation, a different type of distribution of routes.
- Fisheries – first they move north and then they collapse. Early factors are driven by documentation about changes in the Arctic. That drives certain policies early on that will lead to motivation from communities for planning. Early on there is a great demand for oil and gas. The worry for climate and environment is right up against the need for energy. In the long-run, it's a reduced marine usage scenario.

## “Mediterranean Meltdown”

↑ **More Demand**

← **Less Stable Governance**

### Deep Causes

- Middle East implosion
- Radical climate change
- The “Asian Century”
- Cold War, Part II
- Water (human right vs. commodity)

### Early Signs

- Shell kicked out of Sakhalin
- Gazprom decides to develop Shtokman alone
- Chinese ice-breaking ship in the Arctic
- Growing Article 76 disputes

### 2020 Snapshot

- 2-3 characteristics of Arctic Marine Navigation
  - Regional
  - Unilateral
  - Increasing
  - Uneven increase in maritime activity – by region – NW Russia, US Beaufort, Greenland cruise
- 2-3 issues **more** important in 2020 than 2050
  - International regulatory framework
  - Supply of hydrocarbons
  - How we handle boundary disputes (UNCLOS Art. 76, International Straits)
- 2-3 issues **less** important in 2020 than 2050
  - Water
  - Nature of Asian power
  - Change in sea ice (timing of “ice-free” window)
- 2-3 issues points of decision to be made in this time?
  - Try to reach a peaceful settlement of Arctic disputes
  - How do we manage rising Asian power?
  - Development of Arctic international maritime framework

### End State

- By 2050 we would see...
  - Breakdown = increasing hostility
  - Arctic countries becoming the new Singapore/Hong Kong
  - Water as a political dispute point
  - An increase in worldwide nuclear power (ships)
  - “Free for all” mentality for resource extraction/exploitation
  - Arctic Council disappears
- In 2050, Arctic Marine Navigation would be categorized as...
  - High military presence

- Indo-China maritime presence in the Arctic
- Unregulated fishing
- Whaling obsolete
- Localized tourism
- Unilateral governance
- Poor infrastructure
- “Prestige” – rogue ships and increasing environmental impacts
- Indigenous people adapt and flourish OR fail to adapt and are distressed
- Poor infrastructure

### *Key Issues*

- Where is geopolitical security, navy “stuff” going?
- A less stable governance with a high demand in resources could lead to open conflict

### **Report Out**

#### *Deep Causes*

- Asian Century – recognition of the rise of the Asian countries and how they will impact the Arctic in resources and L-T geopolitical developments.
- Water as a resource – is it a human right?
- Cold War, part II – geopolitical situation given the combo of resources and poor regulations will impact global dynamics

#### *Headlines*

- Arctic shipping on the rise – not necessarily regulated, not in the means we may be hoping for
- First water shipment sales from Canada to Middle East
- East Asian power warship exercises right of navy/passage in Bering Strait
- Two nuclear tankers collide in central Arctic Ocean
- 1<sup>st</sup> trans-polar oil shipment occurs in the trans-polar route

#### *End State*

- Explosion in terms of Arctic activity at the unilateral level: increased building, resource development, etc.
- Disputes begin to escalate (article 76, US, Canada, etc.)
- Internationally – see increasingly destabilized international system, ongoing Middle East implosion – sowing the seeds for further international distrust. “Every man for themselves” escalation of unilateral interest.
- As the resources in the Arctic begin to increase, we continue to see increasing military capabilities of both Chinese and Indians. “Ice Capable” battle group into the region. Chinese RMB becomes base currency.

#### *2020*

- Uneven increase in maritime activity. Unilateral, up and down. Most important – how to avoid worst decisions? Head off worst disputes now and reach peaceful settlement (boundary, maritime, Article 76).
- Development of international maritime framework. Changing soft-law into hard-law.

- How do you start managing a rising Asian sea power that will be interested in these specific resources? Meet head-on? Build confidence?

*Key Issues*

- Where is the geopolitical navy stuff going?
- A less stable governance system, married to an increase (perception of reality) of resource development, will inevitably lead to increased conflict in that region.
- Reason we chose the Mediterranean is that these themes seem to mirror the development of the Mediterranean – trade and conflict.
- Two observations – in some ways this is the worst feared scenario. In some ways the scenarios of less demand are less frightening because the pressure is reduced. This scenario captures well what people are afraid of. One small observation, I think before this project is done, it will be possible to have access that the navy and coast guard thoughts on this topic – still being drafted, but should be available.
- The framework works very well, we're getting interesting similar scenarios.
- This last scenario reminds me of what we're seeing in Africa – great opportunities, and little structure for relations. But, for some businesses, it's an undeniable great opportunity.
- Arctic Council – this regime seems very comfortable, but there will be need a bit more far thinking and reaching to make it workable – it's not all rosy and happy.

## “Arctic Saga”

↑ **More Demand**

→ **More Stable governance**

### Deep Causes

- Warmer faster
- Middle East conflict causing motive for governance
- Expanded global economic prosperity
- Shared economic interest of Arctic states [Arctic Bloc]
- Interruption of global trade routes

### Early Signs

- Have occurred
  - [none listed]
- Indicative if they DID occur
  - Warming disrupts Canadian Seal Hunt
  - Iranian act of war (capture of naval & commando personnel)

### 2020 Snapshot

- 2-3 characteristics of Arctic Marine Navigation
  - New propulsion and ice breaking technology enables 50% increase in tonnage, faster
  - Building infrastructure increases shipping
  - IMO adopts mandatory Arctic Shipping guidelines
- 2-3 issues **more** important in 2020 than 2050
  - Adopt “rules”
  - Infrastructure
  - Need proven oil production technology
- 2-3 issues **less** important in 2020 than 2050
  - Need for trans-shipping strategies
  - Less social with which to deal
- 2-3 issues points of decision to be made in this time?
  - Start creating regulatory framework
  - Resolve OCS claims

### End State

- By 2050 we would see...
  - More indigenous peoples
  - Change in economic balance of power
  - Terrorist acts?
  - Growth of population
  - More wealthy people
  - Expanded intra-regional trade
  - Significant infrastructure in and out of the Arctic
  - Social change – increased disease, pollution, and crime
  - Homogenization of Indigenous Peoples
  - Viable cities
- In 2050, Arctic Marine Navigation would be categorized as...

- Stable maritime environment
- Navigational aids expanded
- In harmony with world trade
- Safer and more efficient
- Governance resolved
- Fee structure stable
- Based on new technologies
- Emergences of trans-shipment ports related to A.S.

### *Key Issues*

- Does demand materialize?
- Are climate projections realized?

### **Report Out**

#### *Deep Causes*

- Warming is faster than predicted
- Expanded global prosperity
- Emerges shared Arctic state interests – promoting Arctic shipping to economic benefit

#### *Headlines*

- Resolution of Arctic Continental shelf
- IMO rule adoption with retard to shipping
- Build out of infrastructure required
- Cities evolve and indigenous people are fully integrated and voice recognized
- Summer ice gone by 2050

#### *End State*

- Social change, increased disease, pollution and crime

#### *2020*

- Adoption of rules, construction of infrastructure. (For 2050 but not 2020, the need for shipping companies to come up with trans-shipment strategies.)
- This sounds like a scenario where all the hard questions have been answered “Yes”. I can think of one example where that is true (Post WWII – Europe) All those States did everything in their power to incorporate and collaborate to stop themselves from killing each other. Question – what plays the analogous role to the history of conflict that motivates the magnitude of collaboration in Europe that engenders the collaboration in this scenario?
- Middle East conflict, Panama joins the Venezuela block, growing economic powers in other parts of the world putting competitive pressure on the Arctic states.
- The other variable in your example is the Marshall plan. That could be a factor here as well – another geopolitical actor bringing influence.

### **Day 3 — What about Wild-Cards?**

*To start the third day of the workshop, participants were asked about “Wild Card” events that could impact the Future of Arctic Marine Navigation. They were asked, What isn’t captured in the scenario set so far? What about unpredictable events that may have very low probabilities, but very large impacts? The group had many ideas, all of which are captured below. It is worth noting that a number of these already came through in some of the scenarios, and a number of others would fit coherently as catalyzing events in one or more of the scenarios.*

- Alaska and Russia are in the Earthquake zone...a large earthquake could cause a large environmental disaster
- Role of Japan as a maritime country in need of natural resources
- Chinese nuclear sub-surfaces in the North Pole and kicks-off a new nuclear arms race
- Major bio-engineering discovery in the Arctic Ocean
- Major breakthrough in technology that allows access of hydrates
- Break-up of Russia
- China invades Russia
- Charismatic leader champions Arctic
- Global War on Terror with spill over into the region
- Global economic collapse / the reverse of globalization
- Arctic turns out to only be half-full (in terms of resources)
- Severe summer weather generated by melting ice
- Ice melts even faster than expected
- Ice melts and it’s “just another ocean”
- What if the science is wrong? And the ice doesn’t melt?
- Peace breaks out in the Middle East
- Arctic traffic jam
- Destabilization of the US
- Terrorist takes out the Trans-Alaskan pipeline
- Realignment of the Northwest Territories
- Agreement amongst Arctic States (due to climate change) to an aqua-culture fish farm
- Acidification of oceans and the food chain collapses
- Bering Sea Tunnel (“Bunnel”) – coupled with increased rail traffic displaces shipping
- Federation of States of the Inuit
- Panama/Suez Canals become unavailable
- Cold fusion
- Abrupt climate change
- “Ring of Fire” becomes much more active
- US leads Kyoto 2 Protocol
- Sooner than expected (2020) technology allows year-round shipping (Ultra-Arctic Ice Breaker)
- Science changes the freezing point of water
- Extra-terrestrial events (meteor strike)
- Volcanic activity, ala Krakatoa
- US, Canada, Russia lead a new tri-lateral arrangement in the region
- North Korea plays a role in the Arctic
- Shortage of ice (shipping) crews

- Accelerated melting of the Greenland Ice Sheet
- Dirigible transportation
- What if half of Bangladesh is underwater because of climate change? That would have profound ripple effect around the world as displaced population migrates to other places...



## **Regional Implications**

Workshop participants then formed small groups to focus on the regional implications of the four scenarios. Each group was asked to identify which scenario would be “best” and “worst” for their region, as well as to identify key decisions facing that region in the coming decades. The four regions were: Northern Canada and Greenland; Bering Strait, Beaufort and Chukchi Seas; Barents and Kara Seas, and Iceland; and the Central Arctic Ocean.

### **Northern Canada and Greenland**

*Issues unique PER scenario?*

- “Polar Lows”
  - Canada and Greenland – forming own rules
  - Conflict between traditional and modern Indigenous lifestyle
  - Isolated sporadic vessel traffic
  - No incentives for regulations
  - Low probably, but increasing totally
  - Economic downturn
- “Arctic Development Put on Ice”
  - Local economic depression
  - Over regulated – hampering development
  - Prepared for a different future
  - Regulatory regime a barrier to entry for industry
- “Mediterranean Meltdown”
  - Indigenous concerns
  - High risk of marine accident (environmental disaster, loss of human life)
- “Arctic Saga”
  - Surveillance and enforcement
  - Multi-lateral agreements / coordinated support
  - Infrastructure – navigation aids, ports, search and rescue, communications, charts, ice information, salvage, satellite surveillance, Ports, VTS, traffic laws, vessel repair

*Why is the **Best** scenario best?*

- “Arctic Saga”
  - Economic benefits to Arctic residents
  - Safe operations / environmental protection

*Why is the **Worst** scenario best?*

- “Mediterranean Meltdown”
  - Environmental threats
  - Conflict potential

*Key Choices in the next...*

- ...10 years
  - Regulatory development (yes or no?)
  - “Arctic Bridge”
  - How will each Arctic State engage with indigenous peoples

- Seek multi-lateral agreements
- Infrastructure investment
- UNCLOS Article 76
- Military presence?
- ...40 years
  - Protect certain areas? Ocean parks?
  - Cross-border resources policy – fish/oil
  - Regular trans-shipping vessels
  - Status of straits
  - Reinforce tri-lateral alliance

#### *Other important insights?*

- Arguably more biological sensitivity here
- Gradual transition from destination traffic to transit traffic
- Good likelihood of national cooperation
- Compared to other regions, this region is generally stable
- American isolationism
- This area will not be an oil and gas exploration area
- Not tanker focused in this area?

#### **Report Out**

- Best – Arctic Saga – infrastructure, development
- Worst – Med Meltdown - military build-up, disasters, loss of life – increase of tourism, not enough rules.
- Polar Lows –challenge for indigenous between traditional and modern lifestyles
- Key choices – How will sovereign nations deal with indigenous concerns, UNCLOS 76, infrastructure dev, multi-lateral agreements, Arctic bridge Churchill to Murmansk
- In 10 years – surges of activity, mainly destination shipping, infrastructure beginning in 10 years continuing, regional protection.
- In 40 years – reinforce trilateral alliance
- Important Insights - American isolation? This region generally stable
- Model of stability – can you make a buck?
- The concept of tanker traffic to move commodities back and forth for this region are very small, much more likely to use pipelines/rail.
- A huge insight for this region—not huge potential for oil and gas development in the near-term

## Bering Strait, Beaufort and Chukchi Seas

### Issues unique PER scenario?

- “Polar Lows”
  - Role of indigenous peoples as driver but no commitment to shared wealth
  - Siberian republics gain autonomy/influence
  - Bering Strait becomes regionally controlled, militarized commercial zones
- “Arctic Development Put on Ice”
  - Better cooperation on environmental/oil spill response
  - Better Chukotka/Alaska/Canada
  - Effective regional planning at all levels
  - Existing Beluga/Polar Bear agreements become model for planning
  - Continued government angst about lack of economic development
- “Mediterranean Meltdown”
  - Border disputes lead to conflict in the Bering Strait, as well as piracy
  - Armed conflict over Chukchi & Beaufort oil and gas fields
  - Northern cities grow as base for shipping, off-shore operations and military (Barrow, Anadyr, Whitehorse)
  - Offshore oil & gas developed unilaterally in Chukchi and Beaufort
- “Arctic Saga”
  - Coexistence of hi-value fisheries and industry
  - Strong existing indigenous culture in Canada/Alaska/Russia disappear
  - Environmentally friendly development due to united governance and Canadian/US public interest
  - Shared pipelines
  - Lots more infrastructure support for indigenous people health, social, and other issues
  - Major infrastructure to support ports and shipping

### Why is the **Best** scenario best?

- “Arctic Development Put on Ice”
  - Good international planning to deal with negative impacts
  - Environment good
  - Good response capacity
  - Low threat levels

### Why is the **Worst** scenario best?

- “Mediterranean Meltdown”
  - Configuration of borders results in conflict
  - Unregulated development destroys most productive ecosystem

### Key Choices in the next....

- ...10 years
  - Management of Resources
  - Resolution UNCLOS Article 76 and border disputes
  - Resolution of jurisdictional disputes
- ...40 years
  - Amount of international and regional cooperation and planning

*Other important insights?*

- Indigenous people exposed for more time to development – better positioned to address development issues
- Indigenous peoples all have established subsistence economies
- Most diverse and productive ecosystem impacted by change
- Challenging navigation and traffic density greater
- Climate change impacts greatest and most variable

**Report Out**

- Best – Lower right quadrant (Arctic Development Put on Ice) – great international planning that mitigates potential negative effects. Good response capacity to dangers, disruptions and difficulties. Based on good cooperation.
- Worst – Mediterranean Meltdown – Unique geography provides potential for conflict (Russians and US go at it) – real wars. Unregulated development leads to the pollution with negative fall out locally and globally.
- Key Elements – this region is a key indicator (it's the canary of the canaries): 1. Indigenous opportunities have already have opportunity to develop the issues, and the US and Canadian government have given the indigenous people to develop and adapt to changing conditions. The framework is already in place. 2. Most diverse ecosystem in the Arctic 3. This area will be most radically affected by climate change and the most radical variability. 4. Challenges to navigation will be greatest because it will have the highest concentration of traffic
- Where is business in this region? *In the worst, business is everywhere and growing. In the best, it begins by being driven by business, but then energy falls off. Business still participates, but it falls off/ goes to other regions, but still strong governance to pursue governance in an eco-friendly manner.*

## Barents and Kara Seas, and Iceland

### Issues unique PER scenario?

- “Polar Lows”
  - Russian Ice-breaker fleet fully decommissioned
  - Unregulated high risk shipping (old hulls)
  - Decaying on-land pipelines lead to spills – ad hoc tanker alternative
  - North Sea oil and gas down – Norway economy threatened
  - Iceland comes out on top
  - Russian boat project goes - destabilizing
- “Arctic Development Put on Ice”
  - Initial strong growth of oil and gas associated shipping (out to 2020)
  - Indigenous peoples self-government not an issue
  - Prescriptive shipping navigation routes
  - IMO Arctic code multi-laterally
  - Abandonment of oil and gas assets 2040-2050
  - Decline in marine activity
  - Depressed local Arctic economy
- “Mediterranean Meltdown”
  - Russia imposes mandatory ice-breaking convoying and increases fees
  - Property and indemnity insurance increases to reflect tension and risks
  - Norwegian fisherman demonstrate
  - Major oil spill causes tension between Norway and Russia
  - NGO disruption of cargo shipments (Ice Class Rainbow Warrior)
- “Arctic Saga”
  - Energy demand continues in the East Coast and Europe (Oil and LNG)
  - Expanding traffic still destinational
  - Norwegian-Russian vessel management system
  - Boundary dispute between Norway and Russia resolved by 2020
  - Iceland implements projection regime
  - No convoying, independently operated ice-breaking ships, commercial ships
  - New oil and gas finds in Barents & Kara seas
  - No multi-year ice – floating production system feasible in development of Kara

### Why is the **Best** scenario best?

- “Arctic Saga”
  - Geopolitical harmony between Russian and Norway
  - Well-regulated shipping
  - Environmental safeguards
  - Healthy local economies
  - Well-managed regional development

### Why is the **Worst** scenario best?

- “Mediterranean Meltdown”
  - Depressed regional economy
  - High environmental risk

*Key Choices in the next....*

- ...10 years
  - Joint traffic management system
  - Russia resolves sub-soil/ sea-bed legal regime
  - Protected marine area & restrictions on navigation (safety and environmental)
  - Resolve Russia and Norway boundary dispute
- ...40 years
  - Managing explosive development

*Other important insights?*

- Sea ice change climate not a major issue
- Geo-political decisions by Russia (sell oil & gas to US/Asia) change regional pipeline/ship mix
- Prototype for other Arctic regions (robust/opportunities)
- Indigenous people do not play an important role in the future development scenarios

**Report Out**

- Development of shipping lanes within this region are happening today – shipping, fishing, resource development, etc. It's the hope of the Northern Sea Route.
- The lower left could lead to “Los Angeles” in our region.
- **Worst** – Upper Left – conflict between strong demand (for oil & gas, fishing, etc.) and unstable governance. Russian's make ice-breaking a mandatory issue, but sufficient supply becomes an issue. If they want to start 2015 to have new ships come on line, they're already late to the game. Another issue was over tensions over Russian/Norwegian boundary over the Barents. Norwegian fisherman could end up getting militant over tankers transiting fishing grounds. NGO already designated large portions of the Kara Sea as areas of scientific interest. O&G exploration there might die off, local economies threatened, very marginal traffic.
- **Best** - Upper Right – stable, high – expanding traffic, boundary disputes resolved, also puts in place vessel traffic management system, including SAR and training of ice pilots – a holistic safety management system. No convoy - We can do the work independently.
- Lower Right - Low-Stable – strong demand in O&G until 2020 – prescriptive shipping routes defined by NGOs and other stakeholders. After 2020 activity drops off due to lack of demand. At some point you might end up abandoning oil and gas projects (a company write-off).
- Indigenous don't play big roll in this region – this region is a proto-type for all other regions because it's more advanced in terms of O&G development.
- What is the nature/severity of jurisdictional disputes relative to other regions? There are regions with potential hydrocarbon resources in this area that are currently quiet but could flare up...
- If there was anyway to get a bunch of ships up to the Arctic for tourism, they would do it. It has important consequences for safety issues.
- I'm still concerned that we may not be able to project realistic scenarios if we don't incorporate Arctic interests exerted by other countries who want to close borders and use it as a preserve.
- The question on best and worst really forces us into a corner because of the implicit value judgments—“best” and “worst” for whom? *Exactly the point.*
- What do we have control over in this framework? It appears to me that the Arctic Council has very little control over the resources and trade axis, but on the other hand, it would seem to have more/some control over the governance axis.
- It's tough to look at the scenarios without the veil of today's politics. In a 2050 environment, the engine driving trade maybe an engine driving environmental protection, etc.

## Central Arctic Ocean

### *Issues unique PER scenario?*

- “Polar Lows”
  - No Viable Arctic Express
- “Arctic Development Put on Ice”
  - No Viable Arctic Express
- “Mediterranean Meltdown”
  - “Rogue” vessels
  - Environmental risk
  - Risk of disrupted trade due to conflict
- “Arctic Saga”
  - Less uncertainty increase profit opportunities
  - Market Stability
  - Environmental Issues are solved

### *Why is the **Best** scenario best?*

- “Arctic Saga”
  - Certainty

### *Why is the **Worst** scenario best?*

- “Polar Lows”
  - No demand

### *Key Choices in the next....*

- ...10 years
  - Ice breaker support
  - Politage
  - Fees
  - Article 234
  - IACS Consensus
  - Shore based-infrastructure
  - Territorial Delineation (Article 76)
  - Politics, esp. around crewing
  - Stack emissions
  - Northern resident implications
- ...40 years
  - ATON (Aids to Navigation)
  - Communication AIS
  - SAR (Search and Rescue)
  - VTS (Vessel tracking system)
  - VSL traffic lanes

### *Other important insights?*

- Shipping super cycles
- Ice surveillance abilities
- Tolls/fees – Panama, Suez, Arctic

- Stable governance system key for Trans-Arctic shipping
- Technological development critical
- Actual rate of climate change
- Human implications to Arctic residents
- Charter rates
- Marine Insurance
- Tran-shipment hubs?
- Most important of regions – ice tracking, international rules, mineral and oil extraction
- Only region with international water potential
- Huge variability in freight rates?

### **Report Out**

- **Worst** – Polar Lows – No viable Arctic transit because of no demand
- **Best** – Arctic Saga – less uncertainty increases profit potential. Gov structure solves environmental risks
- 10 years – ice breaker problem needs to be solved now, and ice capable crews, article 234, IACS issues, shore-based infrastructure – building for something that might never happen, who pays? Fee discussions need to start, Article 76 – territorial delineation. Crewing. Remaining culturally sensitive to northern residents
- 40 years – aids to navigation, communication issues, Search and Rescue, Vessel traffic system, Vessel tracking links
- Insights – tolls and fees, stable governance system, future Arctic vessels, shipping super cycles (boom and bust)
- What is different in the Arctic versus the Pacific/Atlantic if it's ice free? It will never be 100% ice free as such. The uncertainty of that happening without sufficient tracking is something that will be of concern.
- The only one that has the potential for a trans-Arctic shipping route outside of national boundaries. But will they change the rest of their shipping structure for only 2-weeks to 2-months?
- Just within this region, look at Russian regulation within the Northern Sea Routes – internal waters have an extended zone of control.
- Another – no transit shipping, but destination shipping. Ship Management schemes.
- I think we're being far too conservative for our 40 year picture, particularly in terms of ship technologies and the ways they'll interact with changes in the ice (disappearance of multi-year ice). I think trans-Arctic shipping is a real scenario.
- I'm not sure about the ice-less window, but that would depend on the cargo you'd be considering – bananas, Toyotas, minerals, fish?
- High variability of freight rates that are very cyclical (up to \$100k for an LNG) but a huge glut in shipping could cause rates to bottom out.
- What about the notion of a rogue ships, unqualified ships? If demand remains high, anything can happen...
- Season and navigation will also be affected by whaling and other regional considerations – multi-faceted.

## ***Recommendations and Learning***

*For the final closing session of the workshop, participants made recommendations — based upon their own experience and understanding of the scenarios — for “Issues to Address” and “Research Agenda Items.” They also reflected on what they’d learned together over the course of two-and-a-half days.*

### **Issues to Address**

- Mandatory Arctic shipping regulations
- Arctic shipping regulations: construction, manning/crewing, operation, pollution
- Transition from voluntary to mandatory International Arctic Shipping Standards
- Need for the development of a polar shipping regime
  
- Create regional Arctic “ICS” – incident command system
- Maximizing emergency preparedness & response in Arctic Environment
- Increased circumpolar communication links
  
- Regional approach to jurisdictional dispute resolution
- Innovative mechanisms for Arctic dispute resolution
- How to respect indigenous rights and needs and permit sharing of the Arctic gold rush
- How do all of the various stakeholders communicate?
  
- Attitude of Arctic states towards cooperation and international governance structure
- Evolution of protected areas – unilateral vs. collaborative?
- Spearhead evolution of integrated ocean management in the Arctic
- Creation of new Arctic institution? (e.g. abolish Arctic Council [soft] and form a new capable Arctic institution [hard])
- Enable the Arctic Council to consider naval shipping
  
- Connections to International Polar Year, National Science Foundation (Arctic Ocean observing system), Ocean research priority plan - CEQ website (Committee on Ocean Policy).
  
- Need for national ice-breaking capability
- Standardization of ice management techniques
- Improve the science of navigating in ice: detection and interpretation
  
- Who will control the Bering Strait?
- Right of “Innocent” Passage
  
- How the Russian Federation’s policies develop and play-out?
  
- Lack of trained & experienced marine personnel
  
- IP’s acceptance or otherwise of hydrocarbon, minerals extraction (US, Canada, Russia?)
  
- Funding for further research!

## Research Agenda Items

- What's going on in the Arctic **Now**? Need a complete picture of the present state
- Examination of near-Arctic shipping, e.g. TAPS
- Improve circumpolar vessel data capturing capabilities
  
- New hull materials for economic Arctic ice operations
- Assessment of Ship Technology in 2050
- “White” ships – Environmentally friendly Arctic ship – ballast water, stack gasses
- Status of sub-sea production R&D for Arctic basin deep water drilling
  
- Infrastructure requirements (level of activity – this much infrastructure required)
- SAR requirements – scenario: transport and logistics, region: Arctic ocean
  
- Collation and understanding of Arctic maritime legislation, regulation, and policy
- Assessment of Pan Arctic legal and maritime regimes
  
- Reducing uncertainty in rate of climate change
- Improved regional understanding of climate change
- Regionally-specific Arctic sea ice/ climate models
- Integrated ice environment monitoring system (CIS on steroids)
- Long-term continuous observations of AO characteristics
  
- Address socio-economic impacts of increased marine access
- Impacts (social, economic, environmental) of multiple users of Arctic waterways
- Impacts on non-Arctic areas of increased Arctic shipping
  
- International relations (i.e. What are the non-Arctic countries (transit states) thinking/planning?)
- Interdisciplinary study of Asia and the Arctic
  
- Indigenous cultural adaptation to impact of Arctic ecosystem & environmental changes
- Understanding and assessing cultural and economic impact of increased marine activity on indigenous peoples
  
- Ecosystem research, particularly relative to climate change as a basis for planning
- Nature and change of large marine Arctic eco-systems/fisheries
- Identify biological sensitive areas
- Further research on noise pollution impacts of shipping, oil & gas development, fishing, marine mammals, and other biota
- Impact of tourist activity on wildlife
- Impact study on loss of permafrost

**Discussion about Issues to Address & Research Agenda Items**

- Pleasure and stimulation in a working environment. The AMSA Team has a lot of work to do. Arctic states have a lot of work to do. Should the assessment of existing structures of governance have been in this assessment?
- IMO derived standards is one thing, coastal state governance is another thing, this didn't cover security.
- PAME was going to something similar for oil and gas, but haven't gotten to it yet.
- Probably we'll do it from an IMO perspective, internationally derived. We have no right to analyze the Arctic coastal state thing.
- It is something that several groups have suggested be done, but understandable the limitations of why it can't be done now.
- A need for more research into the technological details – technology around navigation in ice, building ships, etc. Perhaps not enough initiatives in these areas.
- A lot of people will try and make the information proprietary so they can make money off it. It might constrain that. Perhaps we need something higher level to drive it.
- Seems that there are certain types of research that are drivers and leaders, and other that are followers. Whether or not we do this research might influence the directions we drive in, where as other types of research are just cleaning up the mess afterwards. There are types of research that, if they happen, will have that type of impact.
- I think there are several issues in there that converge towards how unsafe is Arctic navigation if you think about the technological means you might have by 2040. There's always open water in the Arctic, it's just a matter of how you find it. (Computing power combined with drones and sensors to predict where ice concentrations would be lowest.)
- It strikes me that we still have a dearth of economic data that underpins all of the considerations exploration and development. We don't know at what level it becomes viable. I understand there are proprietary issues to consider, but there are also some general parameters that could become drivers, but we don't even have those.
- Embedded assumption that we don't know what is going on, but when we do learn what's going on that there will be lots of problems we'll need to fix.