Shipping and the Marine Environment
Panel Members

- Oliver Curran
- Mike Zurowski
- Bevin LeDrew
- Rolph Davis
- Val Moulton
- Tim Keane
- Fernand Beaulac
Marine Shipping Regulations

Principle pieces of legislation protecting arctic waters:

- Arctic Waters Pollution Prevention Act - provides measures to prevent pollution from ships

- Canada Shipping Act – makes the owners and/or operators of vessels responsible and liable for their vessels and the consequences of its operations
Marine Assessments

The Panel will address:

- Shipping Operations (FEIS Volume 3)
- Marine Environment (FEIS Volume 8):
  - Sea Ice
  - Water and Sediment Quality
  - Marine Habitat and Biota
  - Marine Mammals
- Monitoring Plans and Adaptive Management (FEIS Volume 10)
Key NIRB Issues

- This Panel will also address:
  - Issue (a) – Alternatives analyses associated with the marine shipping route and proposed frequency, seasonal duration and potential need for periodic suspension of shipping activities
Key NIRB Issues

- Issue (f) – Adequacy of marine baseline information and proposed monitoring and adaptive management plans
- Issue (g) – Management of ballast water, including regulatory role in oversight/enforcement, potential for introduction of invasive species, and potential cumulative impacts to marine water quality, habitat and food chain/web dynamics
Key NIRB Issues

- Issue (h) – Potential impacts to marine mammals and Inuit harvesting, including movement through the marine environment, resulting from proposed year-round shipping and associated ice breaking, noise and wake effects

- Issue (i) – Potential for transboundary impacts associated with proposed shipping activities
Shipping Operations

- 10 to 12 ore carriers completing 102 round trips every year
- Equates to a vessel passing in the shipping lane on average every 1.8 days
- Vessels will be approximately 330 meters long, 50 meters wide and 20 meters below water surface when loaded
- Vessels can travel at 14.5 knots and 7 knots in open water and ice cover respectively
Ship Design

**Current Design**  
**MV Arctic**

<table>
<thead>
<tr>
<th></th>
<th>Current Design</th>
<th>MV Arctic</th>
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<tbody>
<tr>
<td>Capacity</td>
<td>185,000 DWT</td>
<td>28,400 DWT</td>
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<tr>
<td>Length</td>
<td>330m</td>
<td>220m</td>
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<td>Width</td>
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<td>Draft</td>
<td>20m</td>
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<tr>
<td>Horsepower</td>
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Typical of Ship Design

- Fuel tanks positioned 2 meters from outside edge of ship – greater than regulatory standard
- Fuel tanks will be double lined
- Diesel engines - superior efficiency
- Noise minimized to improve efficiency and reduce damage to propeller
- Ballast treatment – will meet International and Canadian regulatory standards
Route Selection

- Comprehensive Inuit knowledge studies influenced route selection
- Designed to avoid traditional resource use areas
- Designed taking bathymetry and ice conditions into account
- Fednav engaged to develop shipping options, decades of experience in operating ice-breaking bulk carriers in Arctic
- Bathymetry program ensures adequate depth for safety
Technical Advantage – Steensby Port

- Distance from Deposit No 1 to Steensby is 150km, less than half the distance to Nuvuit
- Several alternate rail routes to Steensby considered
Technical Disadvantage – Nuvuit

Construction challenges:
- unstable ground
- Additional facilities and airstrip mid rail
- stream crossings
- rock cuts, bridges, tunnels
- 2 more years to construct – safety, cost
- Shallow water (government depth readings)
Shipping and Inuit Marine Harvesting

Reported Harvest Locations
From:
Nunavut Wildlife Harvest Study
(1996-2001)

LEGEND:
- Existing Tote Road
- Proposed Transportation Alignment
- Nominal Shipping Route Community
- Whale
- Polar Bear
- Walrus
- Arctic Bay Harvest Location
- Clyde River Harvest Location
- Hall Beach Harvest Location
- Iqaluit Harvest Location
- Pond Inlet Harvest Location
- Repulse Bay
Inuit Knowledge - Walrus

- Based on the IQ study, the eastern route avoids a number of important walrus calving areas, and other areas where walrus were identified to be found and harvested.
Scale of Ship and Proposed Route
MV Arctic heading towards Deception Bay
(March 2007)
Figure 20: Marine transportation routes, major port locations and ballast water exchange zones in the Canadian Arctic.
Shipping Schedule

- The viability of the Project depends on the constant supply of iron ore to overseas markets requiring shipping on a 12 month/per year basis
- FEIS concludes year round shipping will not have significant effects (see below)
- Tiered approach to adaptive management
- Potential for route alteration, vessel speed, periodic shipping suspensions
Ballast Water Management

- BIMC committed to exceeding standards required by Ballast Water Control and Management Regulations
- Will conduct both a mid-ocean exchange and use an IMO and Transport Canada approved Ballast Water Treatment System (BWTS)
- Ballast water to be exchanged in mid-North Atlantic Ocean, part of same ocean regime as Steensby Port
- Exchanged ballast water will then be treated onboard the vessel. Treatment will involve.
Ballast Water Management

- In response to QIA Technical Review Comments, a comprehensive Ballast Water Dispersal Modelling report for Steensby Port was commissioned in December 2011
  - Ballast water will be almost entirely flushed out of Steensby every open water season
  - Ballast water concentrations are low throughout the port, even where discharge rates doubled

- Ballast water monitoring plan will be developed and incorporated into Environmental Monitoring Program
  - Water surrounding ports: monitor non-native organisms, water chemistry data, phytoplankton analysis
  - Onboard sampling of residual sediment in ballast tanks
Ballast Water in Steensby

- Steensby Inlet: $141 \times 10^9$ m$^3$
- Freshwater Input per year: $8 \times 10^9$ m$^3$
- Ballast water per year: $0.02 \times 10^9$ m$^3$

- 75 gallons; 340 litres
- 4 gallons; 19 litres
- 1.5 ounces; 40 millilitres
Ship Wakes

- Conservative estimate
- Outer edge of line indicates wake height of less than 10cm
- Far less than natural wave and tidal variation
NIRB Environmental Assessment Process

- NIRB guidelines were a result of scoping with communities and agencies
- 3+ year process
- DEIS, 2 opportunities for IR’s and technical meetings
- Communications and workshops
- Final Environmental Impact Statement is the result of years of baseline studies, assessments and detailed predcations.
<table>
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<tr>
<th>Sea Ice (2.0)</th>
<th>Water &amp; Sediment Quality (3.0)</th>
<th>Habitat &amp; Biota (4.0)</th>
<th>Marine Mammals (5.0)</th>
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<td>Landfast ice in Steensby Inlet</td>
<td>Suspended Solids</td>
<td>Habitat</td>
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Marine Baseline
Marine Baseline

- Sea Ice
- Oceanography
- Water & Sediment Quality
- Marine Habitat & Biota
- Marine Mammals
Marine Knowledge

A strong foundation for:

– Project Design
– Environmental Assessment
Marine Mammal Knowledge

- 3 year Traditional Knowledge Study
- Comprehensive Review of Scientific Baseline Data (Appendix 8A-2)
- More than 3 years of field studies
- Comprehensive Review of Literature on Marine Mammal Response to Shipping
- Modelling
Marine Baseline Studies

Marine Mammal Key Indicators

- Ringed Seal
- Walrus
- Beluga Whale
- Narwhal
- Bowhead Whale
- Polar Bear
- Bearded Seal
Commitments for Further Studies

- Baffinland has committed to supplemental data collection for the purpose of Marine Environmental Effects Monitoring
- Discussed in more detail below in monitoring
Assessment Tools

Noise Modeling
- In Air
- In Water
- Construction
- Shipping
Assessment Tools

- Ballast Water
- Sewage
- Ship Wakes
## Effects Predictions - Marine

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<th>VEC/KI</th>
<th>Modelling Results</th>
<th>Data Analysis</th>
<th>Literature Review</th>
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Noise

- Approach to assessment included:
  - Ship Noise and Propagation
  - Hearing
  - Species Distribution
  - Known Effects of Noise
  - Prediction of Project Effects
  - Mitigation
  - Residual Effects
Predicted Ship Noise

Source level (dB re $\mu$Pa at 1m)

Frequency (Hz)

Ore Carrier - open water
Ship Noise Propagation
Known and Potential Effects of Noise

Range of Responses with Distance

- Detect distant shipping – no effect
- Minor behavioural changes
- Masking – noise may reduce hearing
- Disturbance begins – avoidance
- Temporary hearing loss – not likely
- Permanent hearing loss – not possible
Summary of Predictions

- Routine shipping will not have significant negative effects on populations of marine mammals.
- The project will not have significant transboundary effects in Nunavik or in Davis Strait (FEIS Volume 9, Section 4.0).
- The project will not have significant cumulative effects (FEIS Volume 9, Section 1.4.4).
- Predictions to be verified by monitoring research (discussed later).
What does Experience Tell Us?

This is not a novel situation. Marine mammals are exposed to shipping all over the world. Some examples

- Bowheads and belugas in the Beaufort Sea
- Gray whales along W Coast of North America
- Humpback whales off Australia
Beaufort Sea
Industrial Activity 1980-1986 in Canadian Beaufort Sea

- As many as 5 drilling vessels per year
- Up to 71 vessels (including icebreakers)
- Up to 8 dredges (noisiest vessels)
- As many as 5 seismic vessels
- As many as 11 offshore helicopters
- 200-275 vessel passages per week
- 300 helicopter flights per week

(Source: Brouwer et al. 1988)
Industry Activity - 1 Aug - 10 Sep - 1985
Beaufort Sea
Whale Populations – 1980-1986

- Bowhead population increased at the rate of 3.4% per year from 1978 to 2001 (Zeh and Punt 2005)
- Beluga population stable or probably increasing (Hill and DeMaster 1998)
Gray Whale
Gray Whale Migration Routes

Eastern North Pacific Gray Whale Migration Routes
Gray Whale Population and Shipping

- 18,000 km round-trip migration
- During spring migration, northbound females accompanied by 1-3 month-old calves
- During the peak migration periods, approximately 3,000 ships enter and leave ports along route
- Population increasing at rate of 2.5%/yr
Humpback Whale
Humpback Populations in Australia
Industry vs. Whale Population Growth

**West Population**
- Seismic – 250,000 km
- Offshore Wells - 291
- Offshore Platforms – 49
- Shipping – 5,578 port calls
- Whale Watching PAX = 46,717
- Population Growth = ~12% per year

**East Population**
- Seismic – 0
- Wells – 0
- Platforms – 0
- Shipping – 10,850 port calls
- Whale Watching PAX = 548,974
- Population Growth = ~11% per year
Risk of Ship Strikes (1)

- The FEIS predicts that there is a very low risk of the ships striking marine mammals.
- The low risk of a ship strike is because the species of marine mammals in the arctic are known to avoid moving vessels.
- Beaufort Sea experience.
Risk of Ship Strikes (2)

- DFO conducted an analysis of the numbers of whales that could be struck if they took no evasive action when a ship approached.
- However, all evidence indicates that marine mammals move out of the way of approaching vessels.
- There is only one situation where there may be a risk of a ship strike.
- Socializing bowhead whales.
Bowhead Whale Study
Proposed Monitoring Studies

- Hudson Strait Winter Surveys
- Foxe Basin Winter Surveys
- Surveys for Bowhead Concentrations
- Mammal Response to Shipping
- Walrus Calving Surveys
Winter Surveys of Hudson Strait
Winter Surveys of Foxe Basin - 2013

Figure 1. Proposed Aerial Survey Grid for Winter Surveys of Foxe Basin
Mammal Response to Shipping

Figure 1. Possible Winter Study Areas
Possible Study Area in Foxe Basin
Study Techniques

- Aerial Surveys to document changes in mammal numbers and distribution
- Hydrophones to document ship noise
- Directional Arrays to document and locate mammal calls as ships approach
- UAVs (unmanned aerial vehicles) to quietly circle mammals and watch behaviour as ships approach and pass
Techniques - continued

- Program to continue for several years to examine long-term effects and to determine whether habituation will occur.
- Appropriate statistics will be applied and developed, as necessary.
- Three season/area/species combinations will be selected for study.
Environmental Management

The Cycle

- Project Design
- Mitigation
- Monitoring
- Adaptive Management
<table>
<thead>
<tr>
<th>Project Activity</th>
<th>Mitigation Measure</th>
<th>Species</th>
</tr>
</thead>
</table>
| Vessel traffic to/from Steensby Port, including ice management at the dock       | • Reduce vessel idling  
• Minimize footprint of ice disturbance  
• Reduce vessel speed in ice  
• Markers along shipping lane in landfast ice  
• Vessel designed to limit noise output  
• Marine mammal observers to be on select vessels to identify response and behaviours from shipping activities by marine mammals | Ringed Seal, Bearded Seal, Walrus, Beluga, Narwhal, Bowhead Whale                                  |
| Commence ice breaking activity prior to period of lair and breathing hole creation |                                                                                                                                  | Ringed Seal, Bearded Seal                                                                            |
| Maintain constant course and speed when possible                                  |                                                                                                                                  | Ringed Seal, Bearded Seal, Walrus, Beluga, Narwhal, Bowhead Whale, Polar Bear                      |
Monitoring and Adaptive Management

- Shipping and Marine Wildlife Management Plan
- Environmental Effects Monitoring Plan
- Marine Environment Working Group
Marine Environment Working Group

- Purpose
- Terms of Reference
Going Forward

- Baffinland commitments
- Response to recommendations in Written Submissions