National Research Council of Canada

U.S./Canada S&T Cooperation - Improving Arctic Operations by Leveraging Our Strengths

May 2018

Presentation Overview

- ***Overview of NRC***
- ***Examples of Key Capabilities***
- ***Leveraging International Research Opportunities***

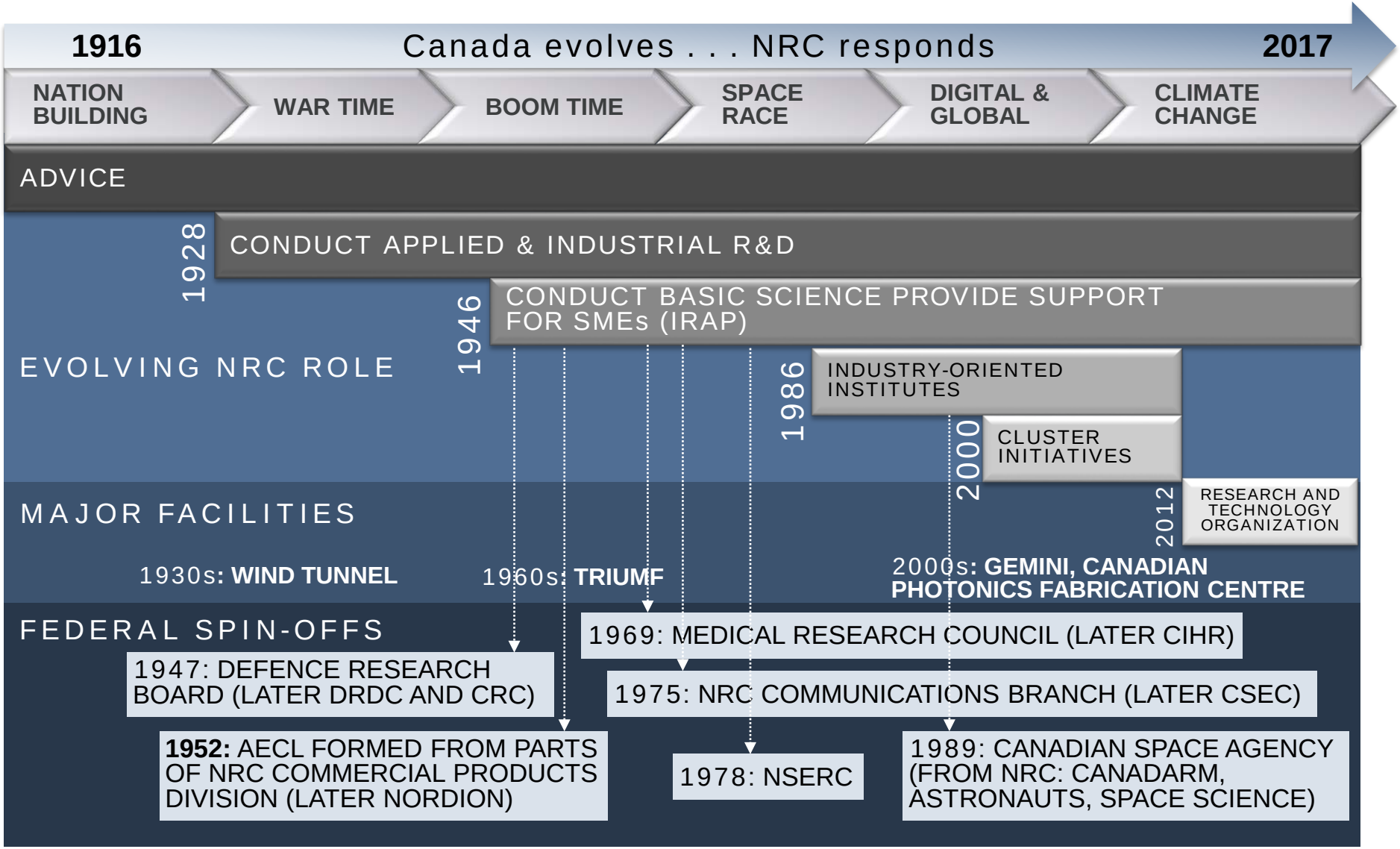
The NRC at a glance

Key Roles

- Business innovation
- Federal policy mandates
- Advancing knowledge

The NRC has evolved to meet the research needs of Canada

Helping build Canada's innovation system



The NRC at a glance

A national organization with regional presence & global reach

100-YEAR TRACK RECORD
Science and Innovation Leadership for Canada

3,700 people

$1B Budget

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NRC Divisions and Research Centres

- Emerging Technologies
  - Information & Communications Technologies
  - Measurement Science and Standards
  - National Science Infrastructure
  - Security and Disruptive Technologies
- Engineering
  - Construction
  - Energy, Mining & Environment
  - Ocean, Coastal & River Engineering
- Transportation & Manufacturing
  - Aerospace
  - Automotive & Surface Transportation
- Life Sciences
  - Aquatic and Crop Resource Development
  - Human Health Therapeutics
  - Medical Devices

Our Laboratories: A Few Examples

Victoria and Penticton, BC
- Optical and radio telescopes
- Adaptive optics

Saskatoon, SK
- Small-scale fermentation and bioprocessing
- Plant biotechnologies and plant-growth facilities

Ottawa, ON
- Aerospace, vaccines, construction, quantum, photonics, machine vision, big data analytics, metrology, materials characterization and testing

Halifax, NS
- Photobioreactors, bioprocessing
- Natural product chemistry, bioactive characterization

Vancouver, BC
- Batteries, fuel cells and industrial tribology

Mississauga, ON (*in process*)
- Advanced materials for digital manufacturing, printed electronics, smart objects, devices, sensors

Saguenay, QC
- Aluminium and multi-materials assembly
- Hybrid manufacturing (extrusions, forgings, castings)

Charlottetown, PE
- Natural product and functional ingredient development
- Analysis and characterization

Edmonton, AB
- Nanotechnology, electron microscopy

London, ON
- Additive manufacturing, product development, laser consolidation, micro-machining

Montreal/Boucherville/ Royalmount, QC
- Intelligent machining, robotics, advanced materials
- Medical devices, advanced biologics analytics, biomanufacturing pilot plant

Winnipeg, MB
- Advanced manufacturing, process design, systems engineering, pilot laboratory

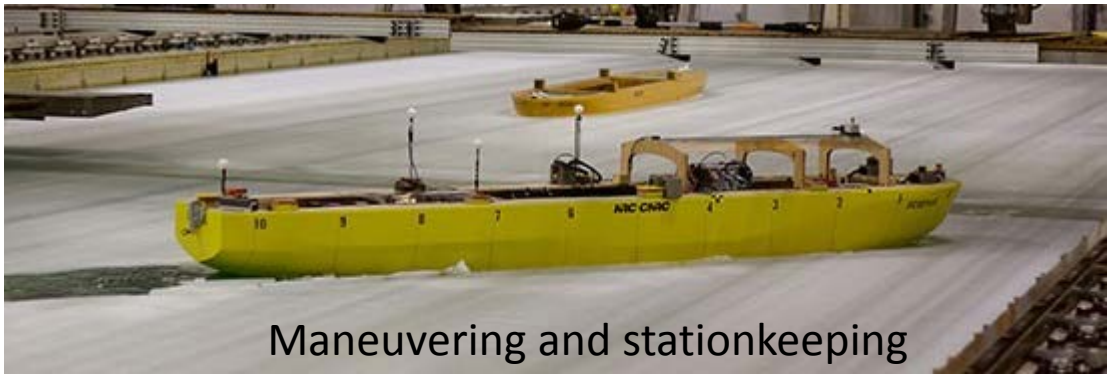
St. John's, NFL
- Ocean engineering
- Ice and vessel management

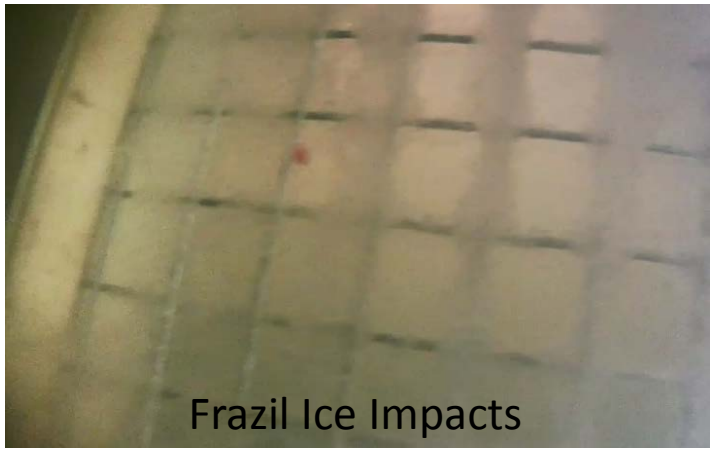
NRC Arctic R&D Partnerships

NRC supports a wide spectrum of collaborative research of relevance to Arctic operations.

Our partners include, for example, Canada's Department of National Defence, Canadian Coast Guard, marine and infrastructure industries and northern communities.

Laboratory Test Programmes





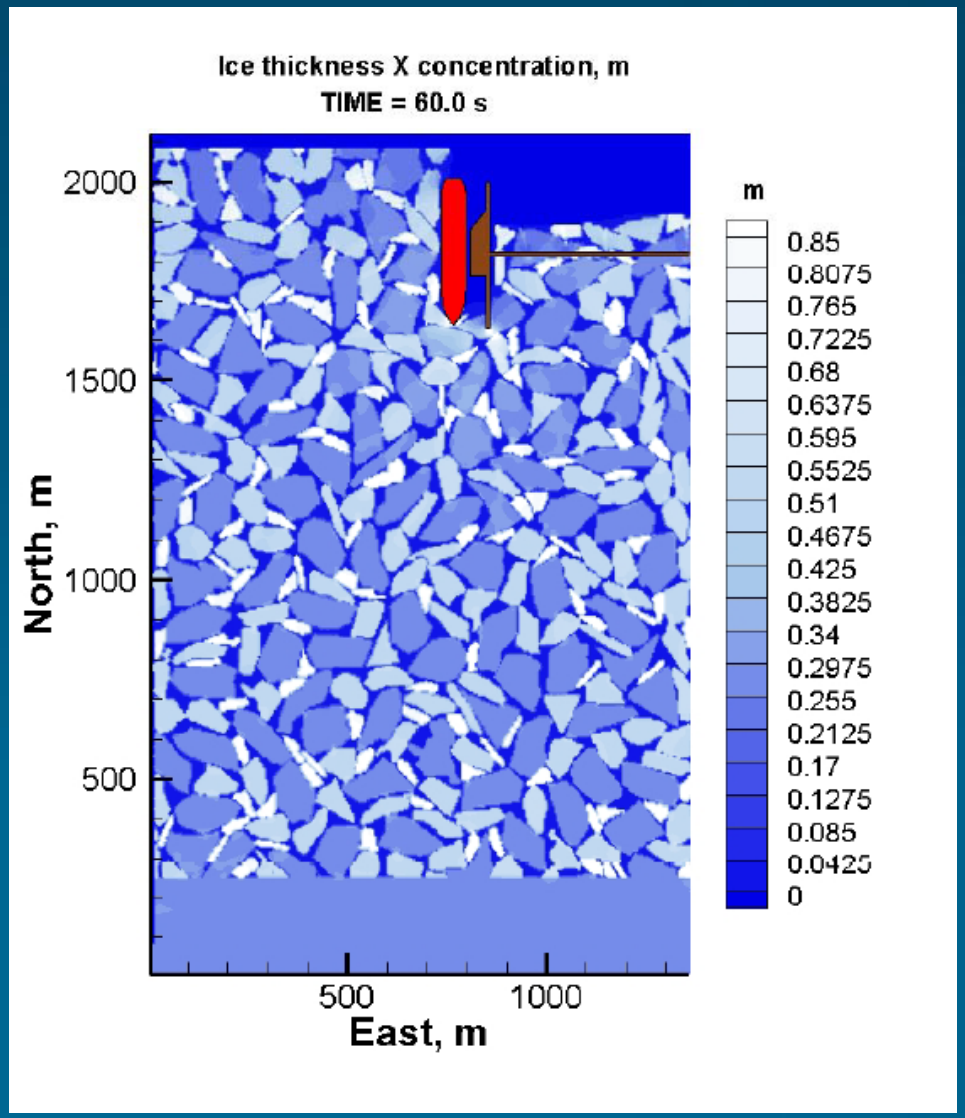
USCG Icebreaker Testing Programme

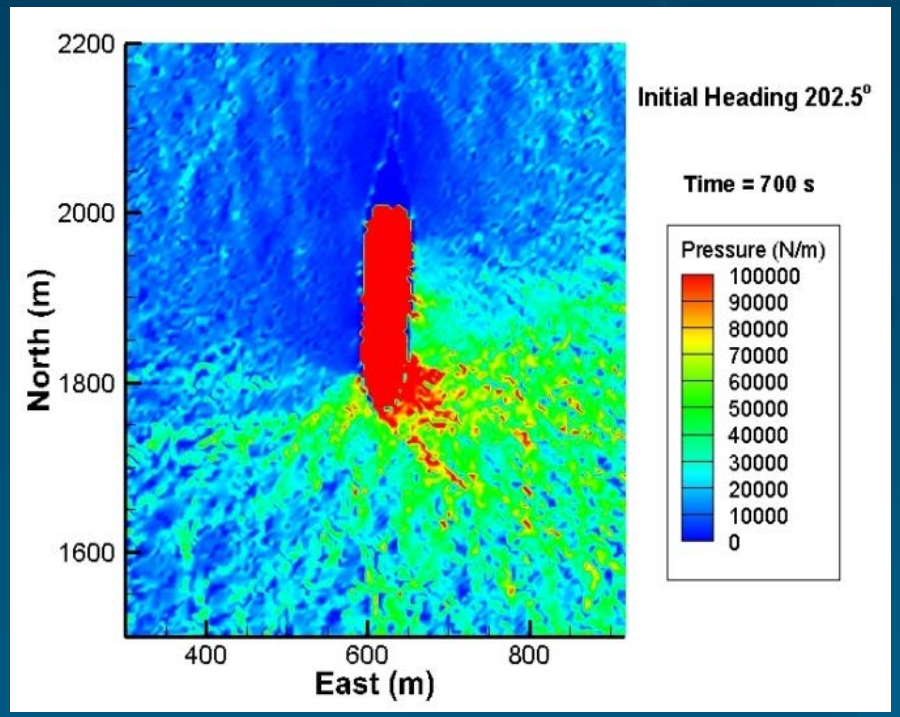
Photos: CBC

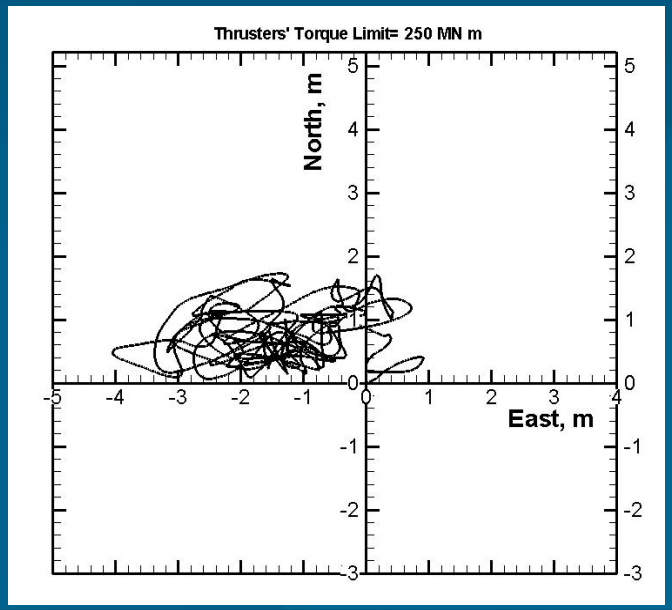
Performance Limits - PPE

Environmental and Regulatory SO_2 Abatement on Vessels

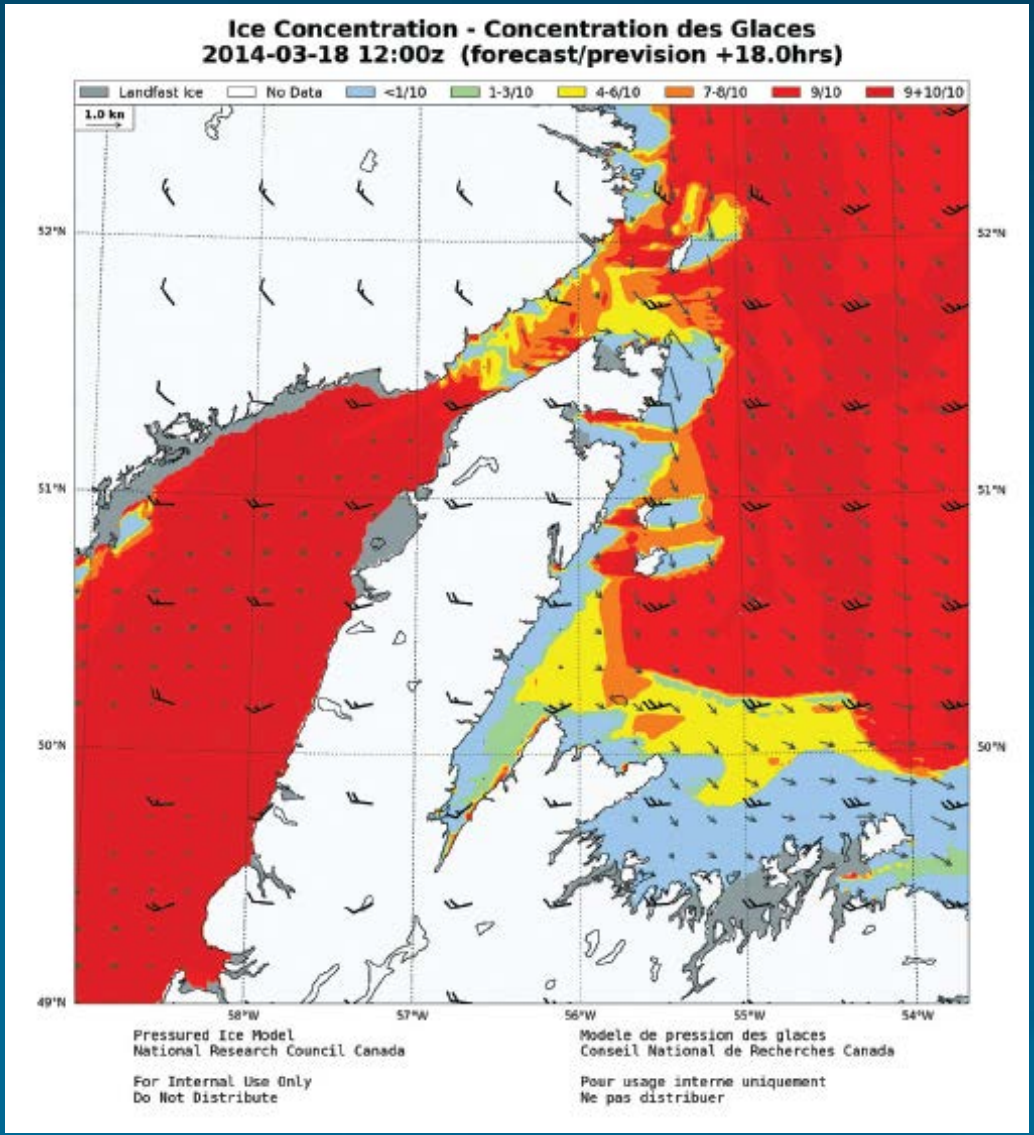
Ice Interaction Modelling





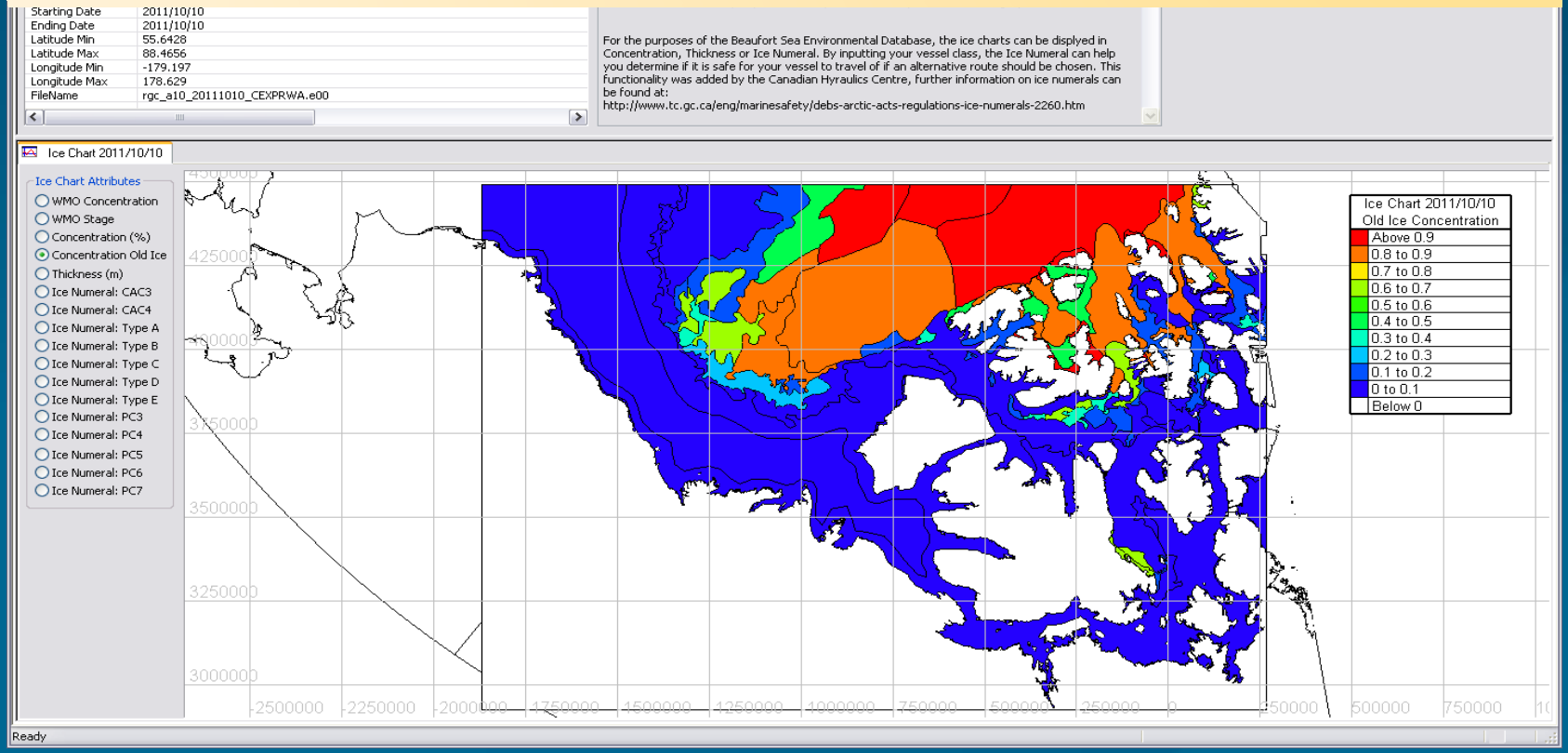


Operational Pack Ice Forecasting

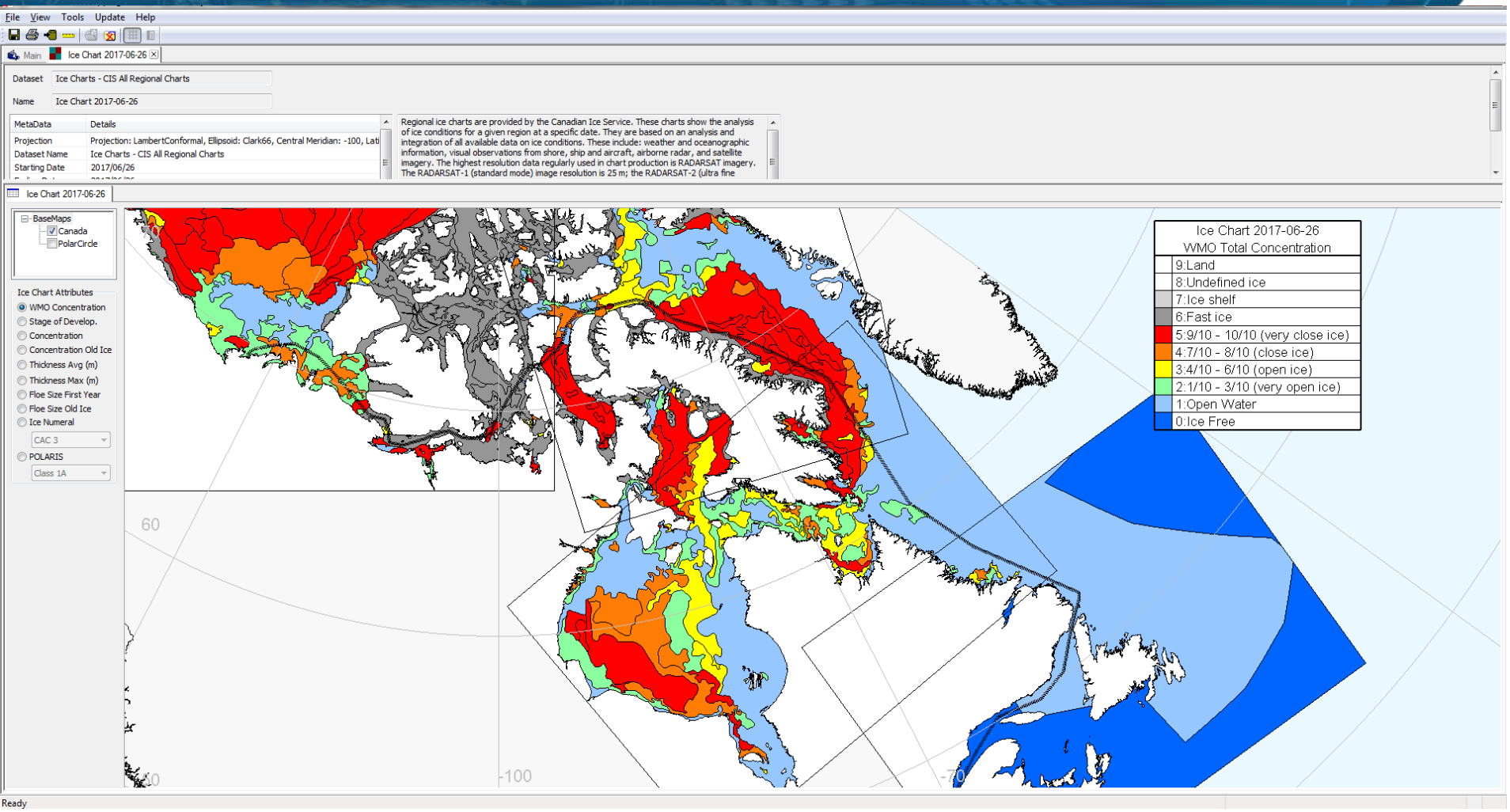


Beaufort Sea Engineering Database

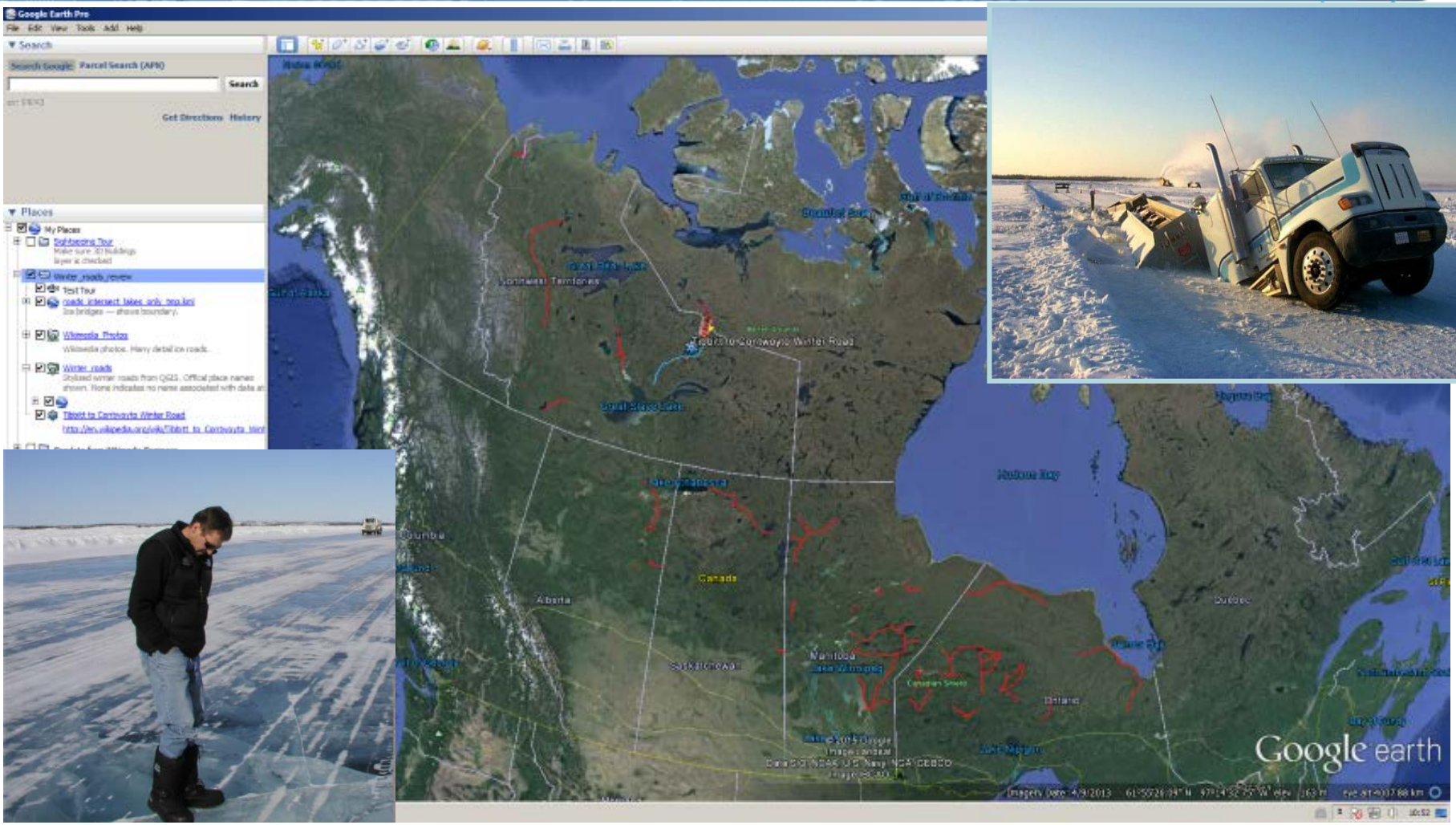
- Collaborative project: NRC, BP, Imperial Oil Canada, ExxonMobil URC, ConocoPhillips Canada, Indigenous and Northern Affairs Canada (now CIRNA), Environment Canada - Canadian Ice Service



Canadian Arctic Shipping Risk Assessment System



Seasonal, Ice and All-Season Roads



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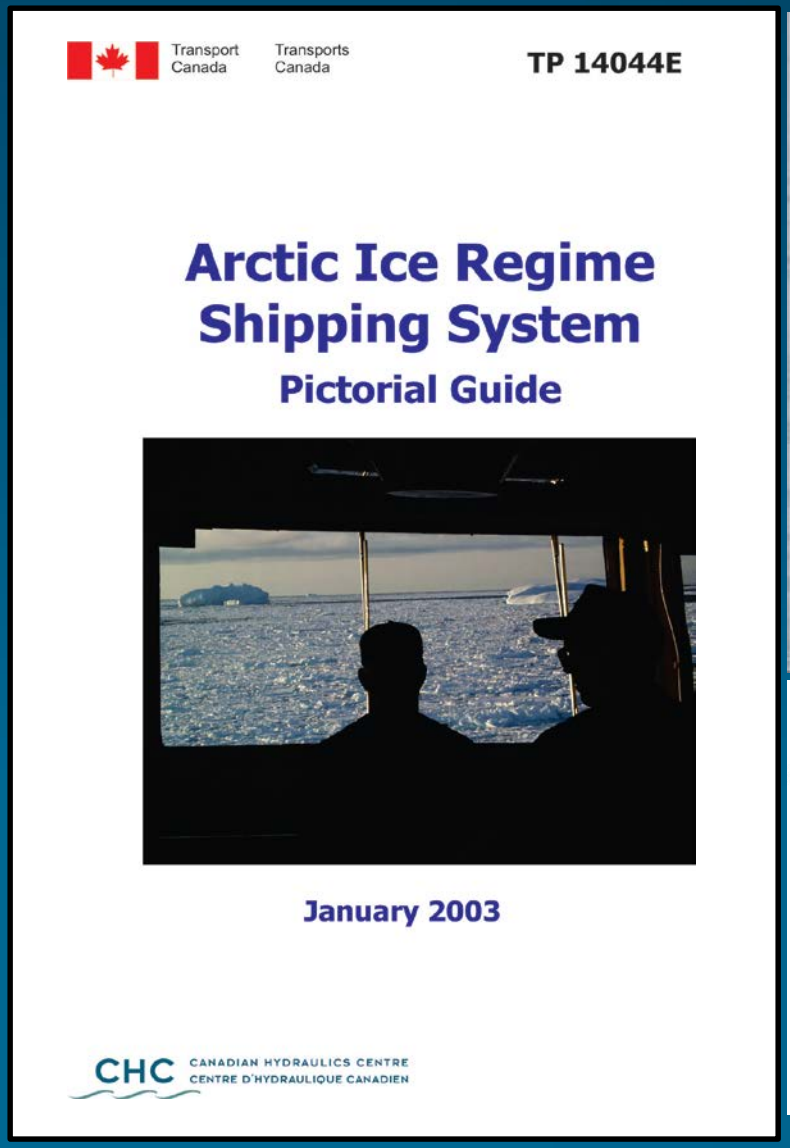
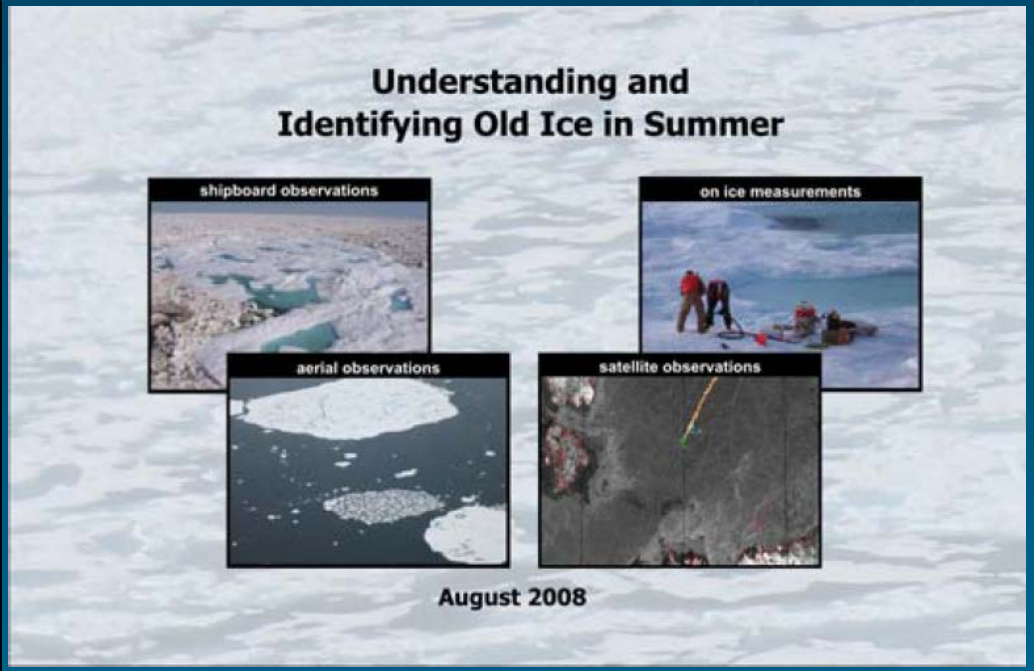
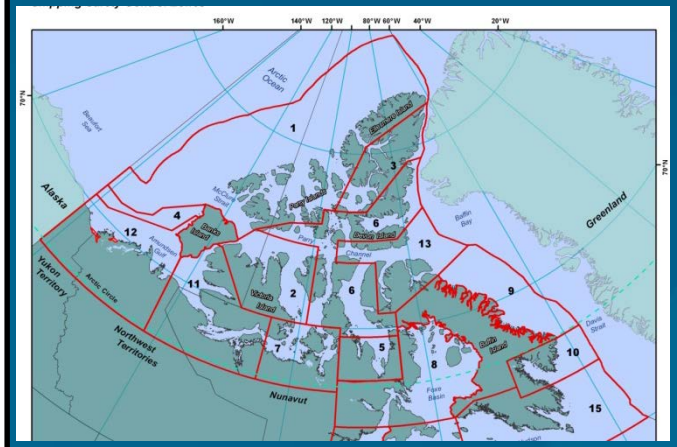
Safe Shipping and Guidance for Mariners





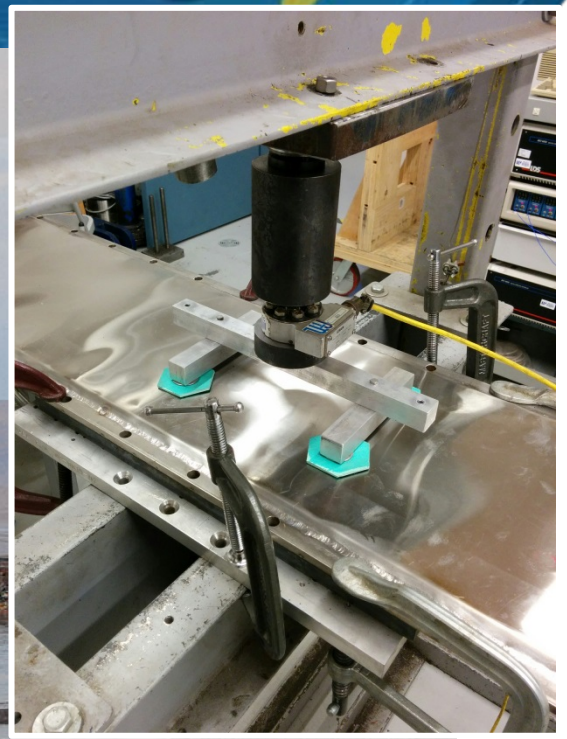


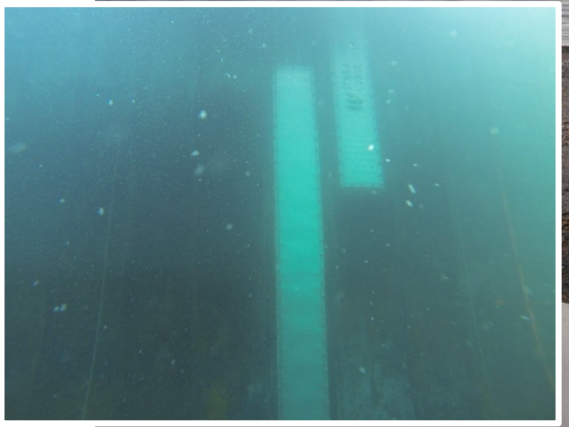
Navigation, Design and Performance

Vessel Performance in Ice

- Field trials
- Ice loads monitoring
- Ice observations

Ice Load Monitoring – Nanisivik Wharf





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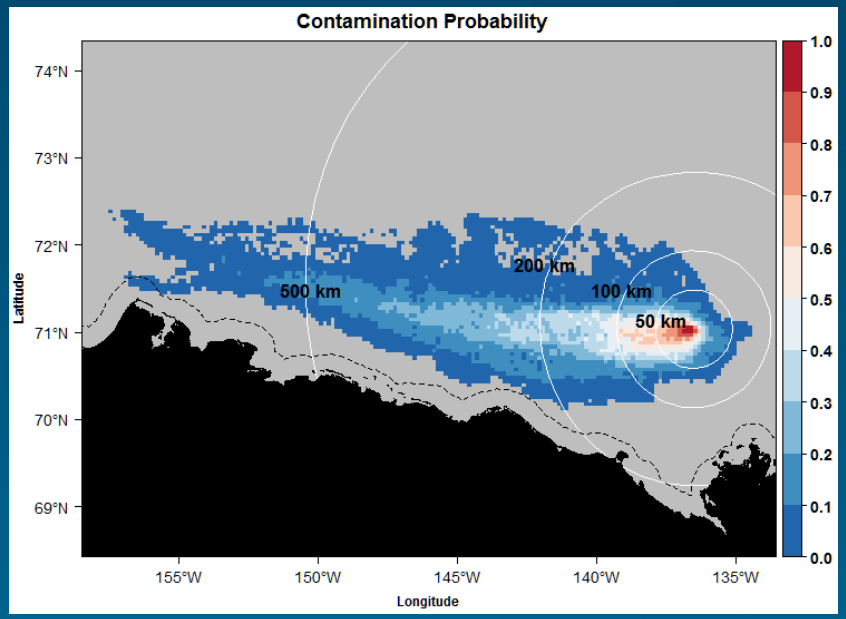
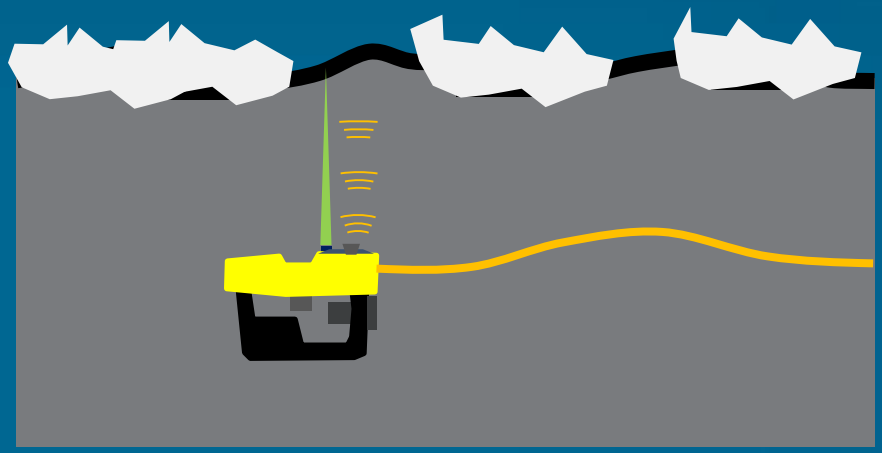
Lighting: Energy Efficiency and Well-Being

Sewage Treatment for Remote Applications

Oil Spill R&D - Bioremediation Technologies, Oil Spill Detection and Forecasting in Sea Ice





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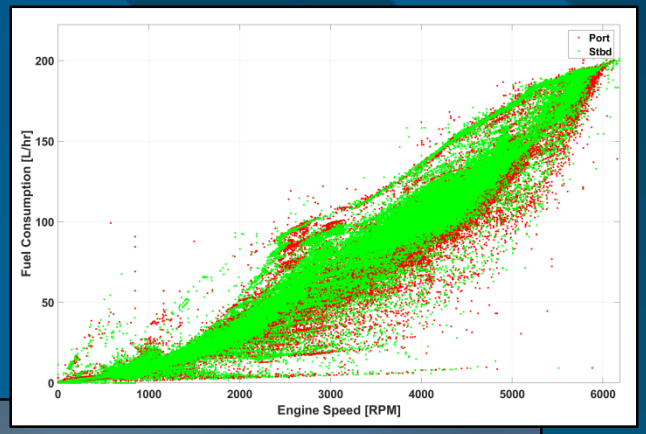
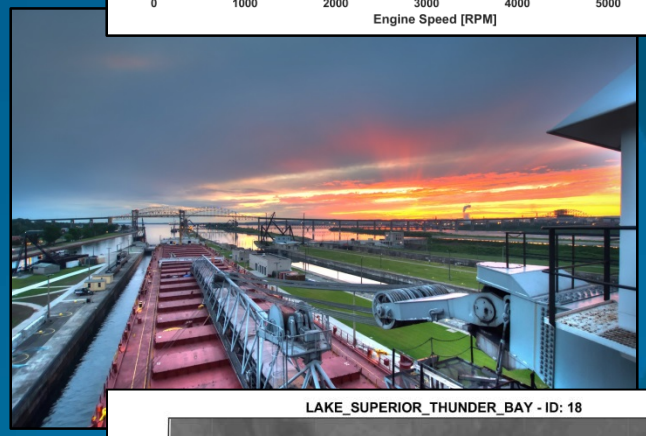
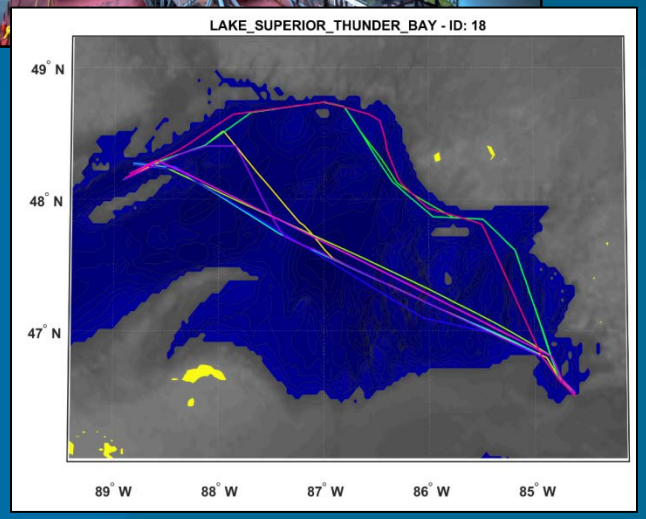
Vessel Performance Evaluation

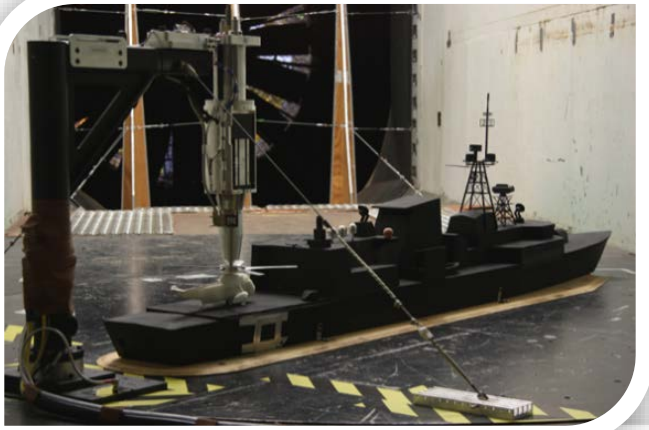
- Vessel performance monitoring systems for wide deployment
- Goals:
  - Continuous evaluation of vessel performance
  - Baseline data for future design or equipment changes
  - Quantification of effect of significant factors on fuel efficiency
  - Investigation into efficiency optimization in terms of fuel, emissions, energy balance, safety, and comfort
  - Effects of maintenance or system alterations on fuel efficiency (e.g. hull and propeller cleaning, engine maintenance)







Aerospace



Bioenergy, Fuel Flexibility and Energy Storage

Materials and storage technologies, cleaner combustion, biomass conversion, low carbon fuels, materials storage, techno-economic analysis

Automotive and Surface Transportation

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Leveraging International Research

- Canada – U.S. co-operation in S&T is facilitated under the Critical Infrastructure Protection and Border Security (CIPABS) agreement
  - U.S. Department of Homeland Security's Science and Technology Branch and Defence Research and Development Canada
  - Enables federal departments and agencies to establish collaborative arrangements for joint activities and information sharing between the two countries, including the transfer of funds and the exchange of personnel

Looking ahead

- Gaps for potential collaborative Arctic R&D:
  - Environmental characterization at operational scales for forecasting
  - Technologies that are optimized for remote applications – materials, base operations…
    - Life-saving appliances that are functional in their expected operating environment
    - Large-scale infrastructure design and performance for changing climatic conditions
    - Vessel performance and optimization for energy efficiency and environmental security

A Cooperative Approach

- Fostering an increase in collaborative research between these two Arctic nations leverages complimentary data, technologies, expertise and facilities, for the development of cost-effective, responsive and successful Arctic operations.

- Collaborative S&T will be essential to make the rapid technological advances necessary to meet challenges posed by increased activity in the Arctic in coming years.

For further discussion on collaboration opportunities with NRC contact:

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