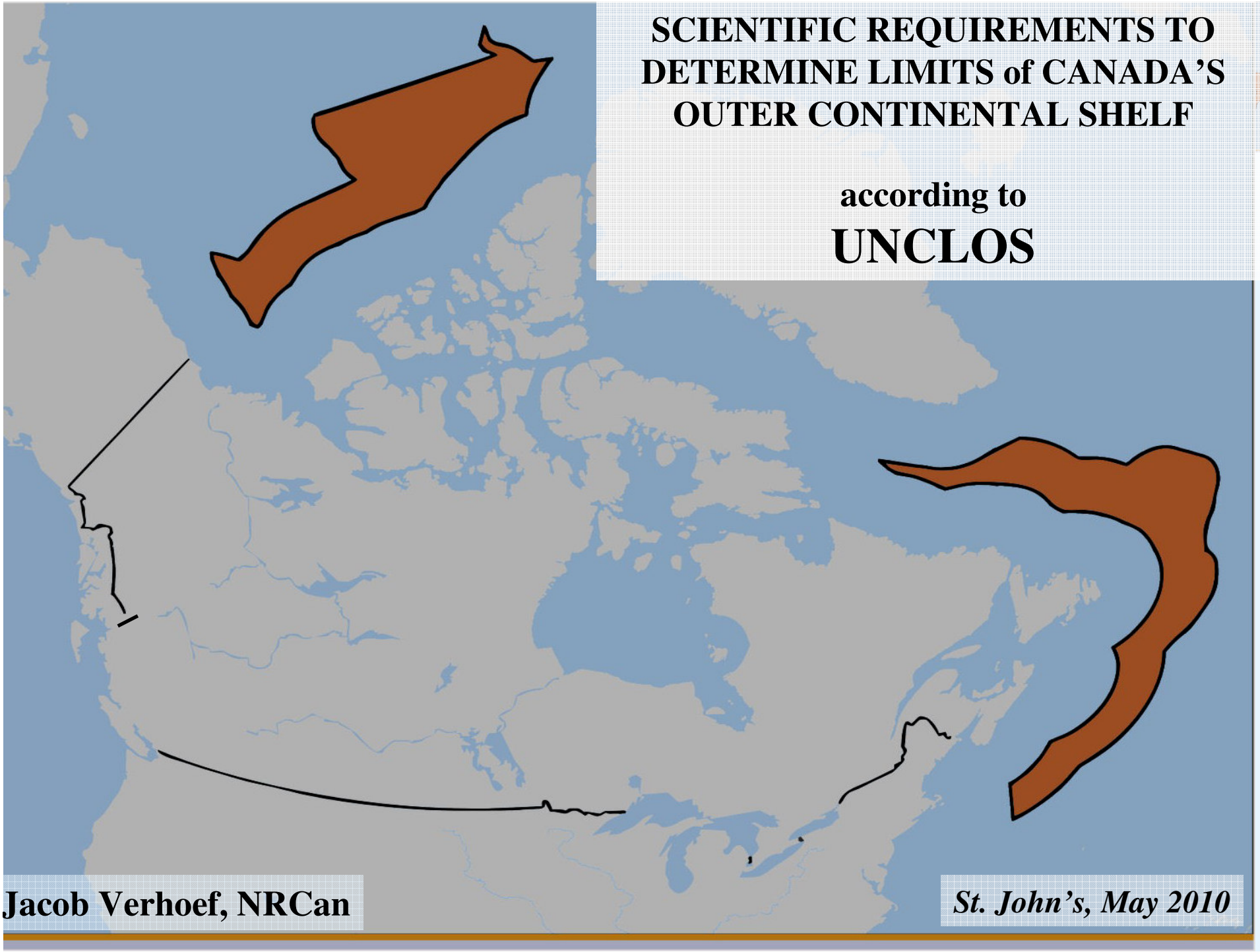
SCIENTIFIC REQUIREMENTS TO DETERMINE LIMITS of CANADA'S OUTER CONTINENTAL SHELF

according to

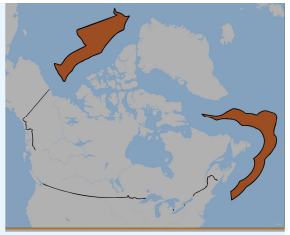
UNCLOS



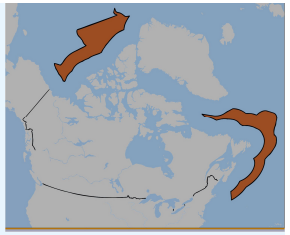
Jacob Verhoef, NRCan

St. John's, May 2010

WHAT IS UNCLOS?



- Often called 'constitution for the oceans' and divides the sea into zones of national and international jurisdiction
- Recognizes Coastal State's rights to the water column and seabed up to 200 nm and to the seabed beyond under special circumstances (Extended Shelf: Article 76)
- Red areas are under the jurisdiction of the Coastal State
- Outer limits of the Continental Shelf over which a Coastal State has sovereign rights beyond 200 nm has to be actively defined (within 10 years of ratification).
- Proposed limits must be submitted for review to Commission on the Limits of the Continental Shelf (CLCS)

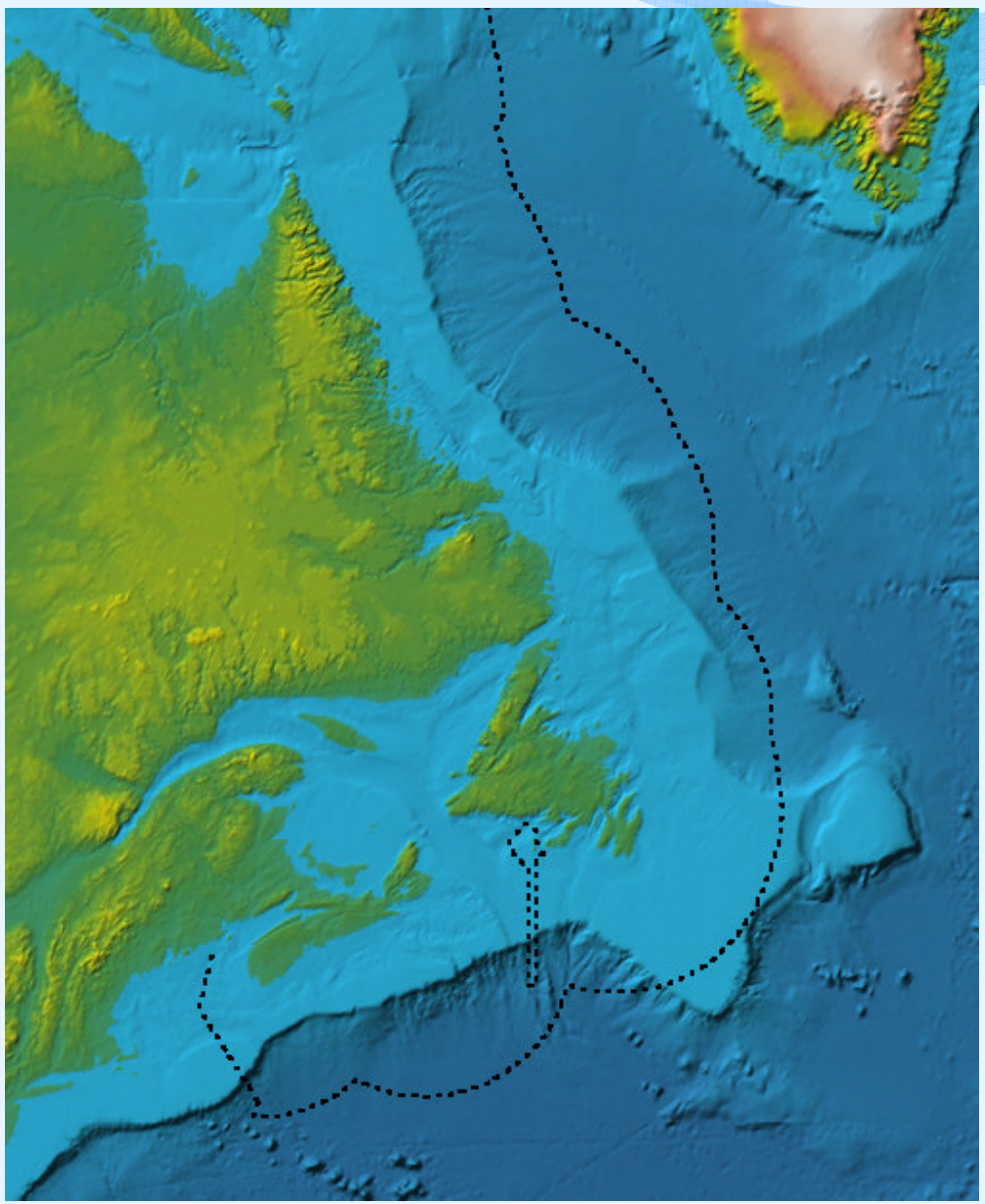


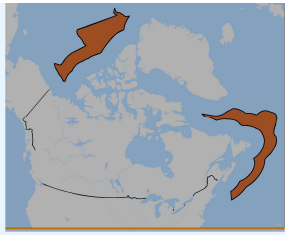
ARTICLE 76

provides scientific requirements for defining an extended continental shelf beyond 200 nm

How does it work

ARTICLE 76 : DESK-TOP STUDY

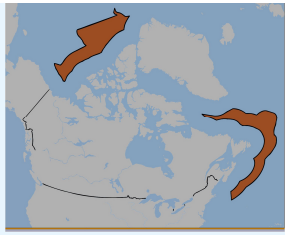




Atlantic Canada

Exclusive Economic Zone
(200 nautical mile limit).

Foot of the Slope and Outer Limit

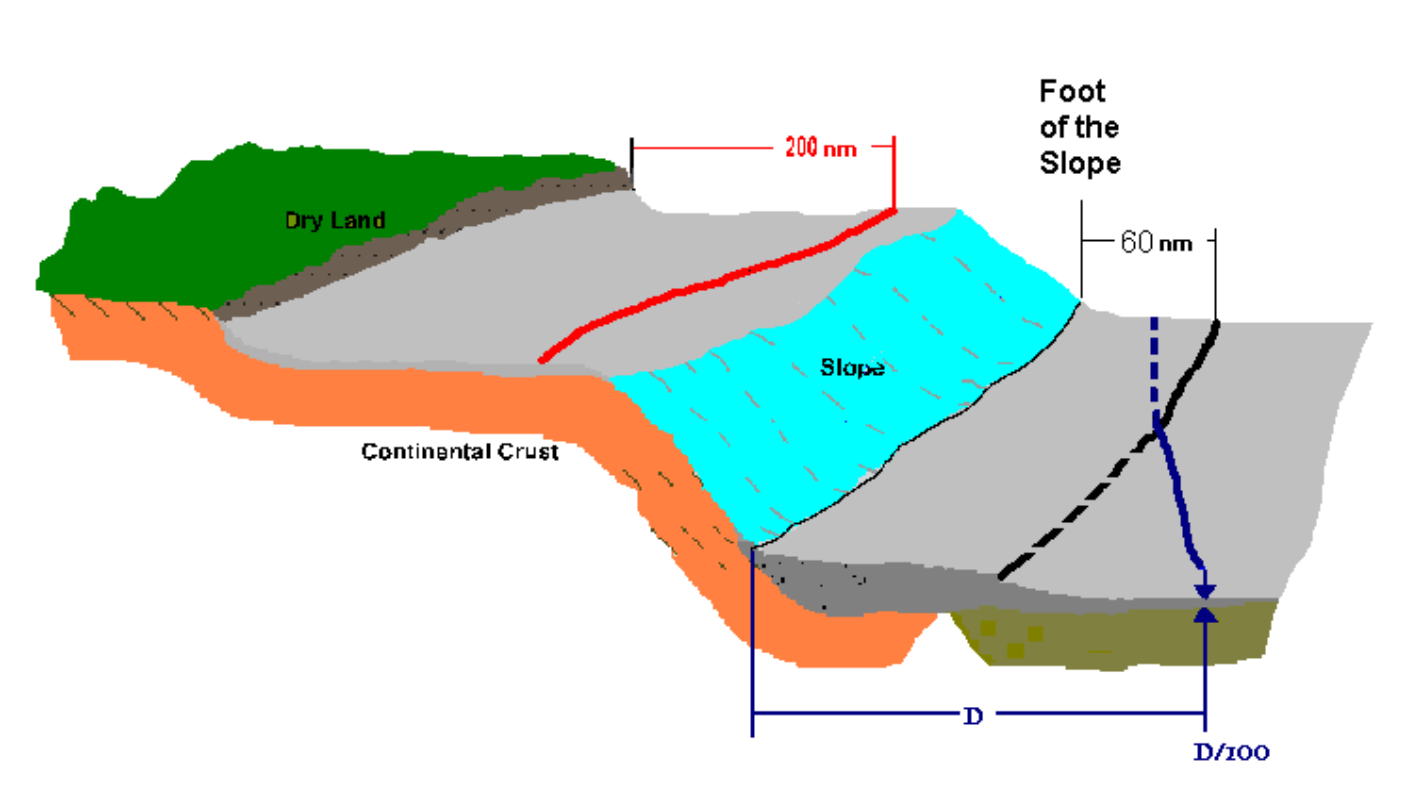


Outer Limit is measured from the "Foot of the Slope"

options: a) distance of 60nm, or

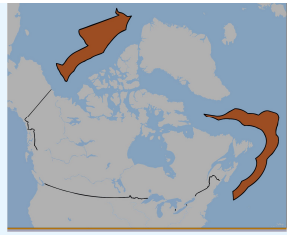
b) to a point where thickness of sedimentary rocks is 1% of the distance to the foot of the slope (Gardiner line)

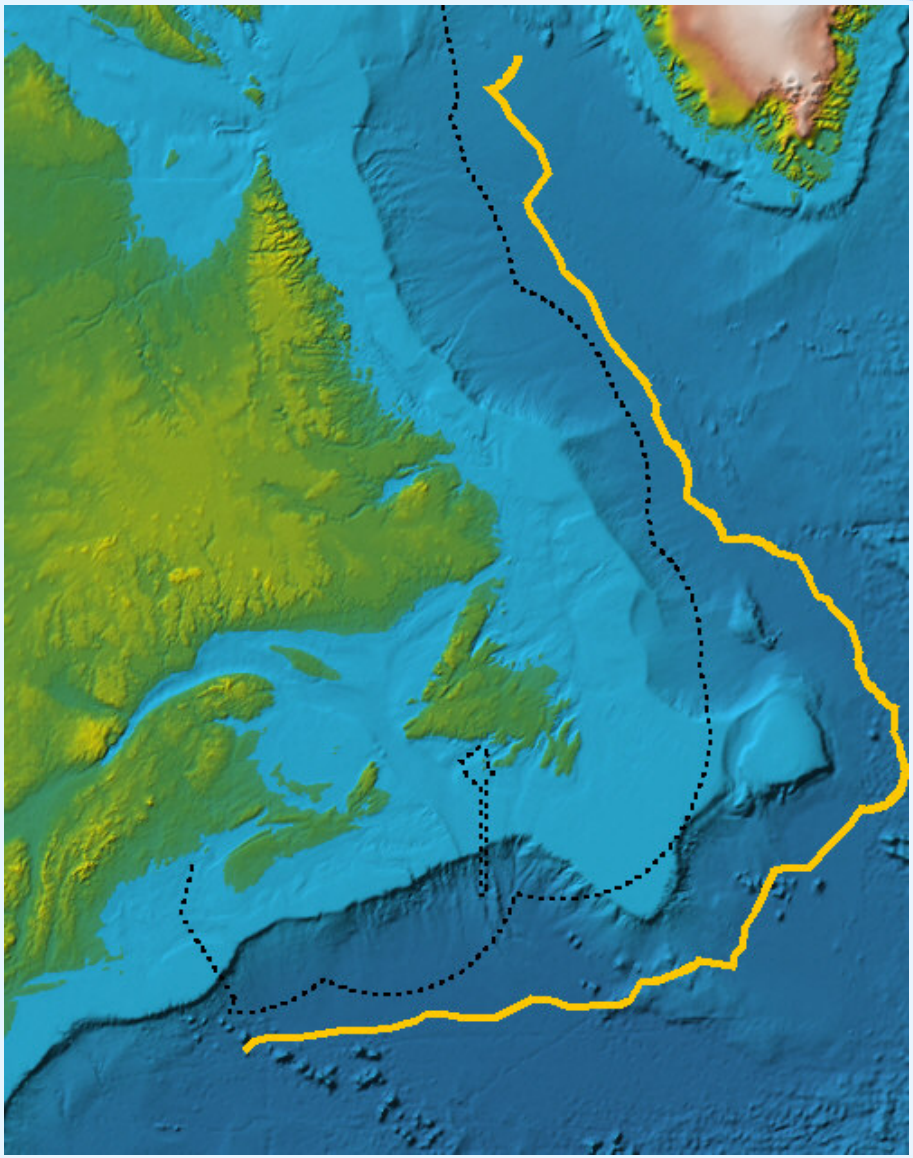
OUTER LIMIT to be DEFINED by points less than 60 nm apart



Canada

Combined Formula





This shows:

the 200-mile limit (dashed)

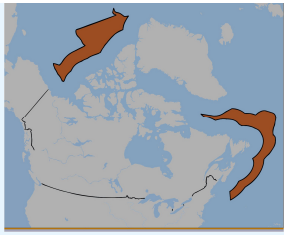
the combined formula line (yellow)

The combined formulae line is the seaward-most of
- the Gardiner and
the Distance formulae

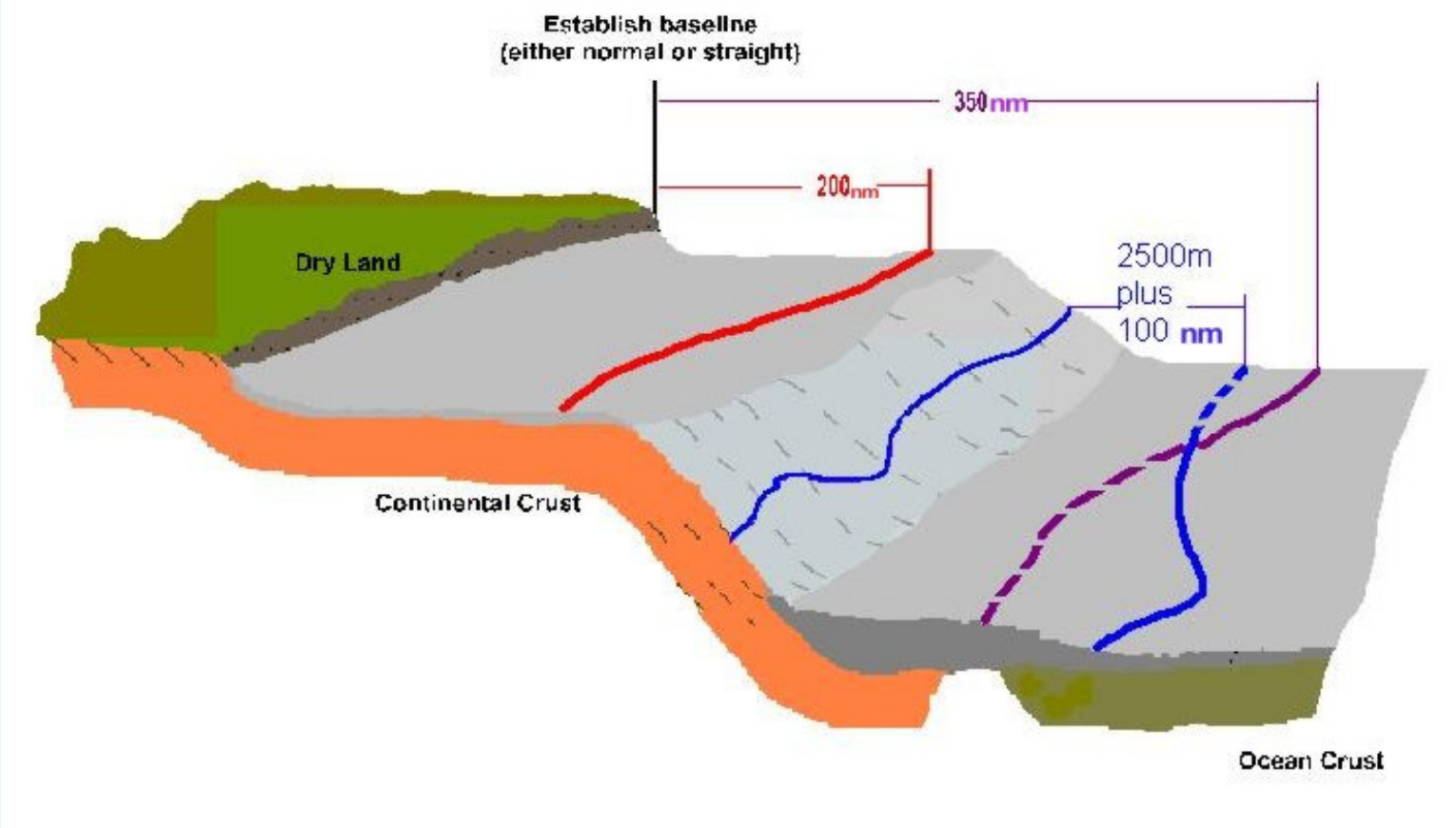
DFAIT/DFO/NRCan

Canada

Extended Continental Shelves

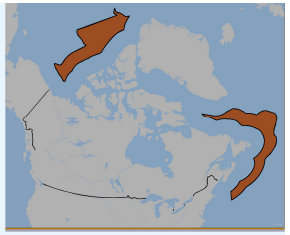


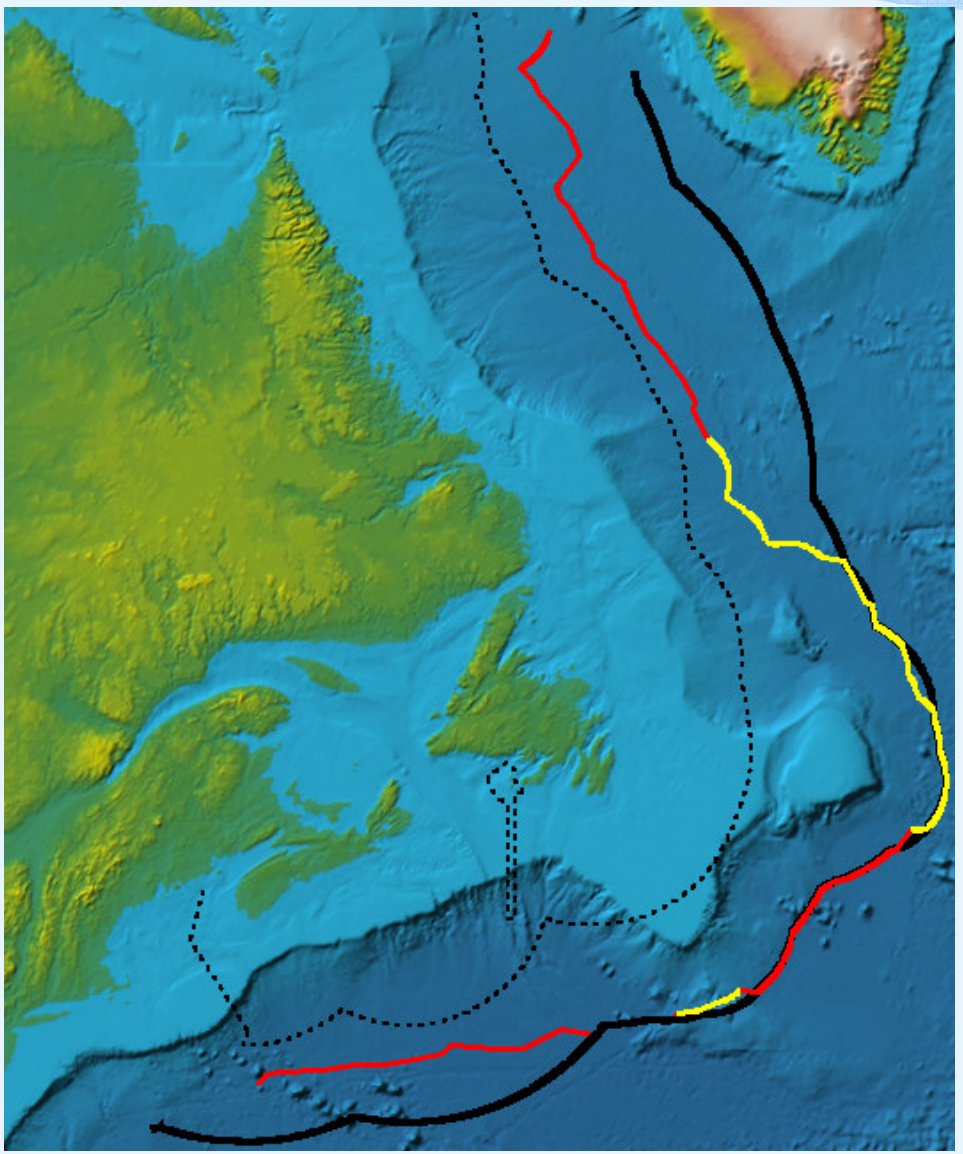
are constrained by the most seaward of a line 350nm from the baselines or a line 100nm seawards of the 2500m depth contour



Canada

Final Outer Limit





the **Outer Limit** is coloured by the component that defined the limit:

RED for sediment thickness

YELLOW for distance/bathymetry.

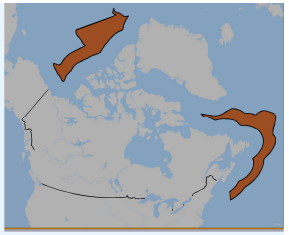
Heavy black line: **Outer Cut-off**.

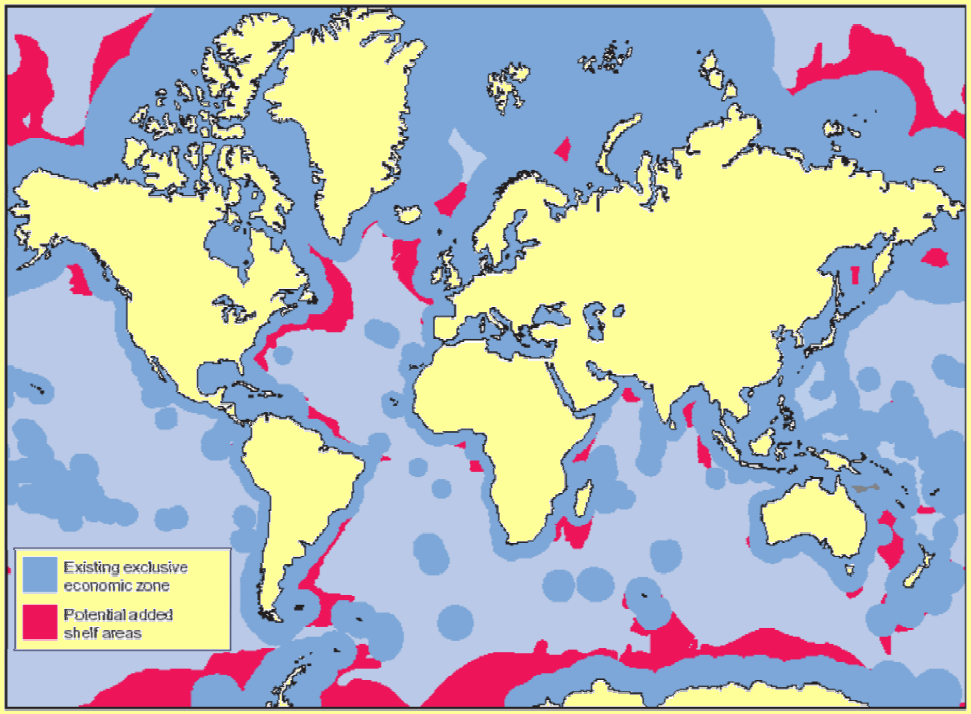
Places where the Outer Limit and the Outer Cut-off coincide indicate areas where the extended shelf is maximal

DFAIT/DFO/NRCan

Canada

Extended Continental Shelves





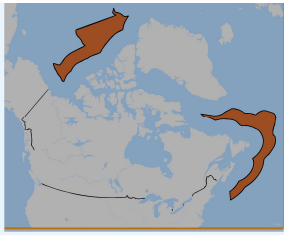
- **Light blue: the AREA**
  (area: about 260 million sq km)
- **Dark Blue: EEZ**
  (area: about 85 million sq km)
- **Red: ECS beyond 200 nm**
  (area: about 15 million sq km)
- **Up to 50 nations may have an extended continental shelf**

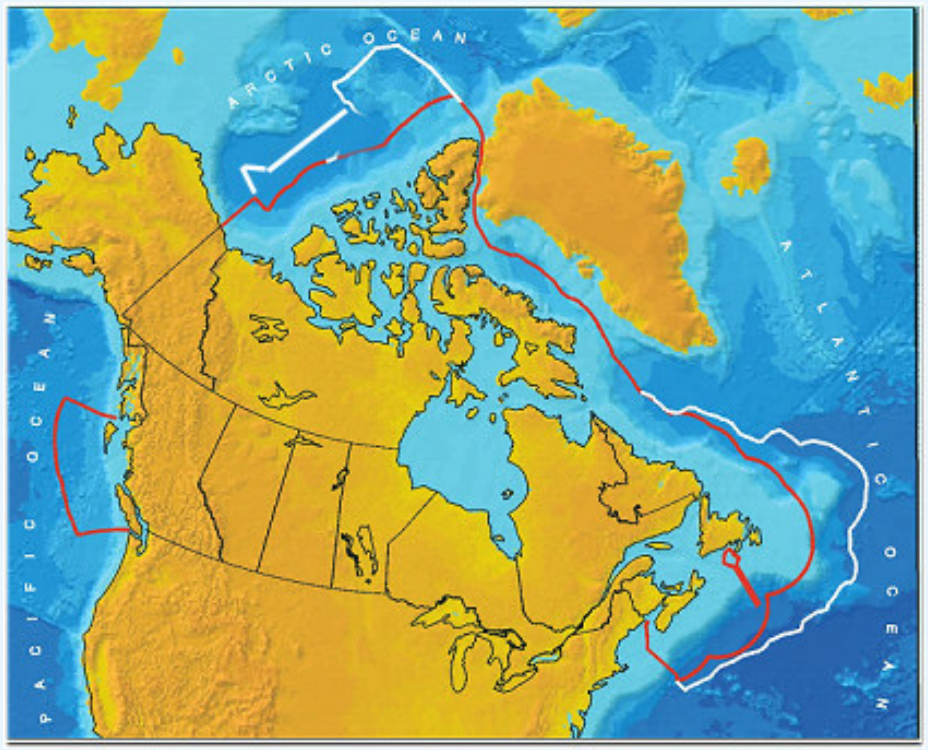
(modified from Preston, 2001)

Commission on the Limits of the Continental Shelf (CLCS)

- **51 submissions since 2001 (area: about 23 million sq km)**
- **13 subcommittees established**
- **9 recommendations done**
- **41 preliminary information**

Canada's case for an extended shelf focuses on the Atlantic and Arctic Ocean





National Initiative

to establish outer limits of the continental to maximum possible

Three Federal Departments

DFAIT	lead, legal advice
NRCan/DFO	mapping, technical/ scientific advice

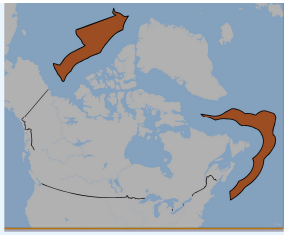
Exclusive Economic Zone (red line):

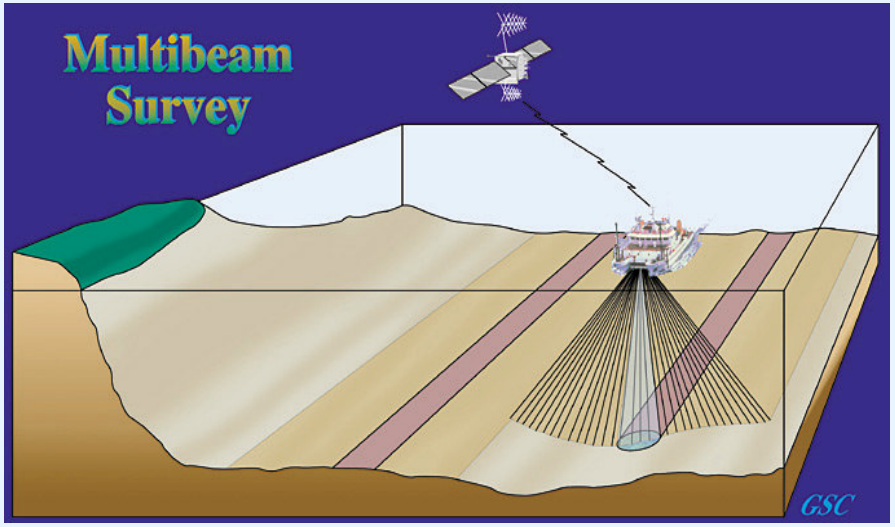
granted automatically; sovereign rights over 'all' resources

Shelf outside 200 nm (white line):

requires submission (within 10 years of ratification; **for Canada: December 2013**)
sovereign rights over resources of seabed and subsoil only

Canada's case for an extended shelf depends on two conditions of the seafloor





Bathymetry: shape of seafloor

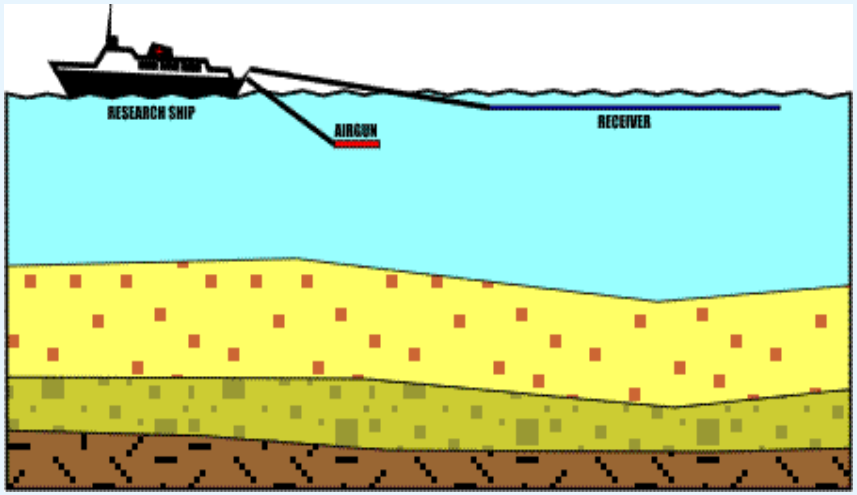
- Foot of Slope – the starting point
- 2500 metre depth contour

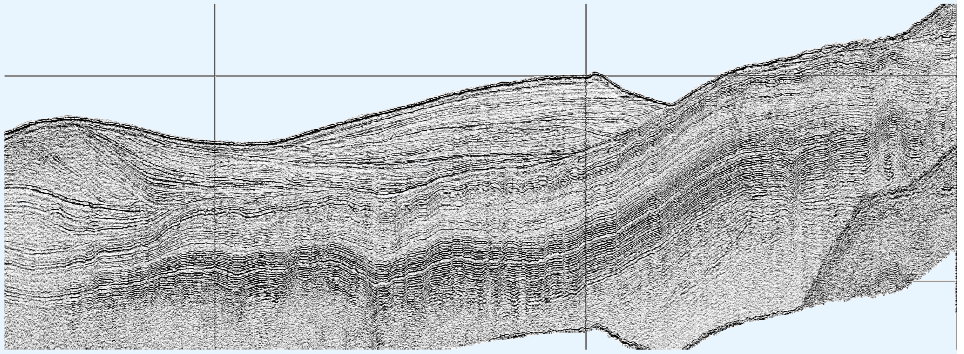
Seismic - thickness of sediments

Sound produced by the source, travels through the water

•Some is reflected from the seafloor

•Some penetrates the sediments and gets reflected from changes within the sediments





THE ARCTIC OCEAN

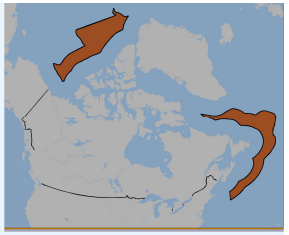
Exclusive Economic Zones
(EEZ: black line)
and
Extended Continental Shelves (ECS)

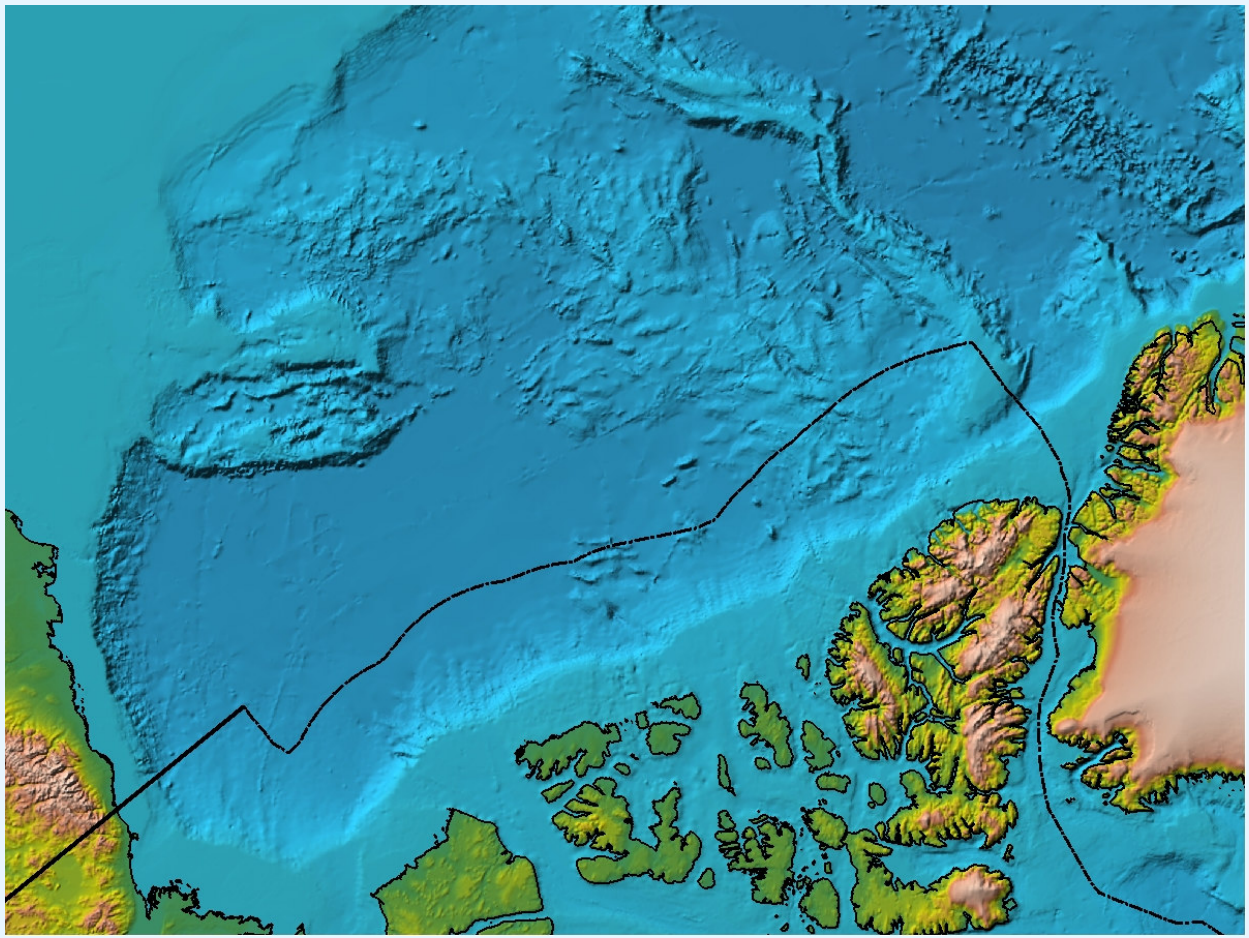
Notes:

Russian ECS submitted in 2001
not recommended by the UN Commission (CLCS)

Norwegian ECS (white arrow) submitted in 2006
recommended by CLCS in 2009
'accepted' by Norwegian government in 2009.

Data acquisition in the Arctic Ocean is difficult





Lack of existing data

Complicated geology

Western Arctic (start in 2006)
- **Sediment thickness**?

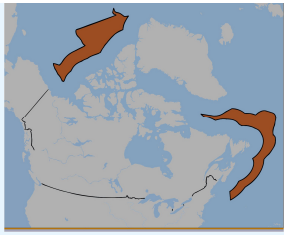
Eastern Arctic (start in 2006)
- **Submarine ridges attached?**

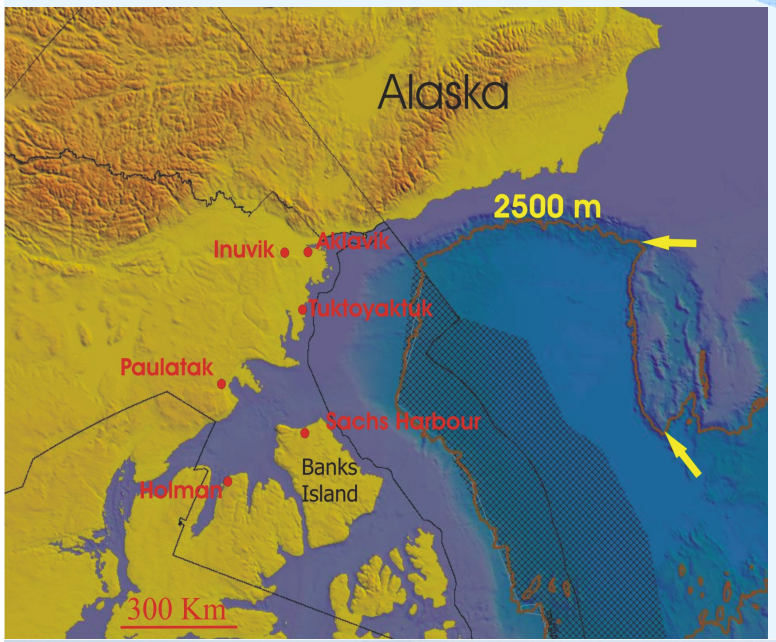
Program requires 5 field seasons:
- **Spring survey in the east**
- **Fall survey in the west**

Concerns:
- **Remoteness of area**
- **icebreaker capability/availability**

- **Concern: variability in weather and ice conditions**

WESTERN ARCTIC: Seismic surveys





Require seismic profiles:

- every 60 nm
- at least 1-2 km of sediment needed

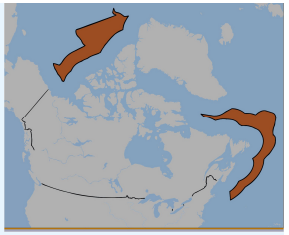
Community consultation

- (Feb. 2006 + repeat annually)
- Marine mammal observers

Louis S. St. Laurent

Deploying Air gun array (4400 pounds)

2008 and 2009 Surveys: jointly with the US

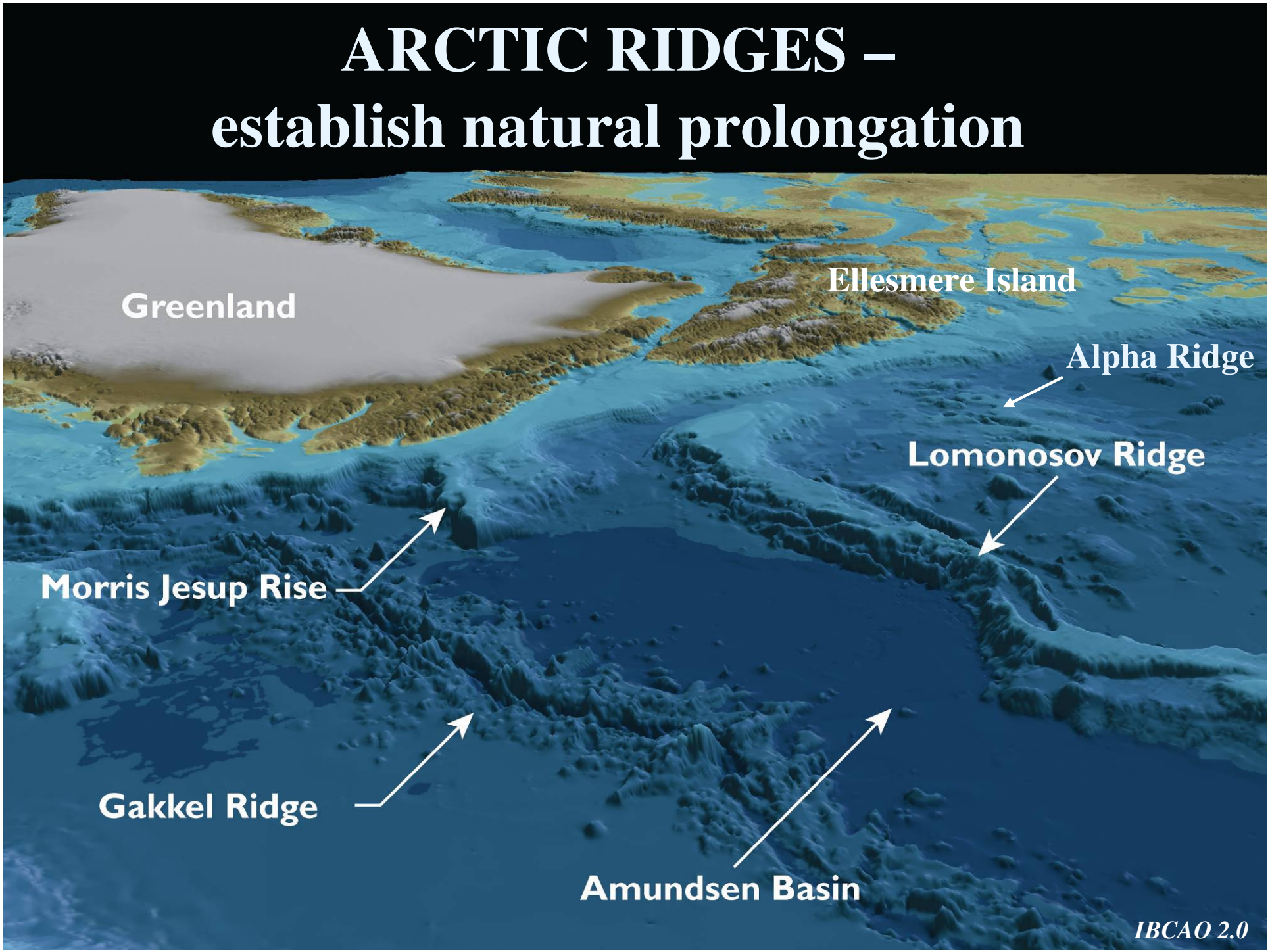


US vessel Healy:
breaking ice

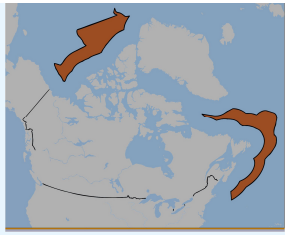
Louis S. St. Laurent:
following with
scientific equipment

DFAIT/DFO/NRCan

ARCTIC RIDGES – establish natural prolongation



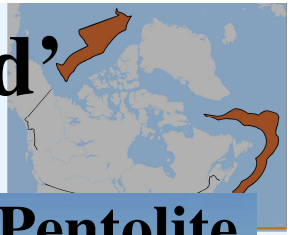
LORITA – Lomonosov Ridge Experiment (March 2006)



Seismic refraction to investigate deeper structures

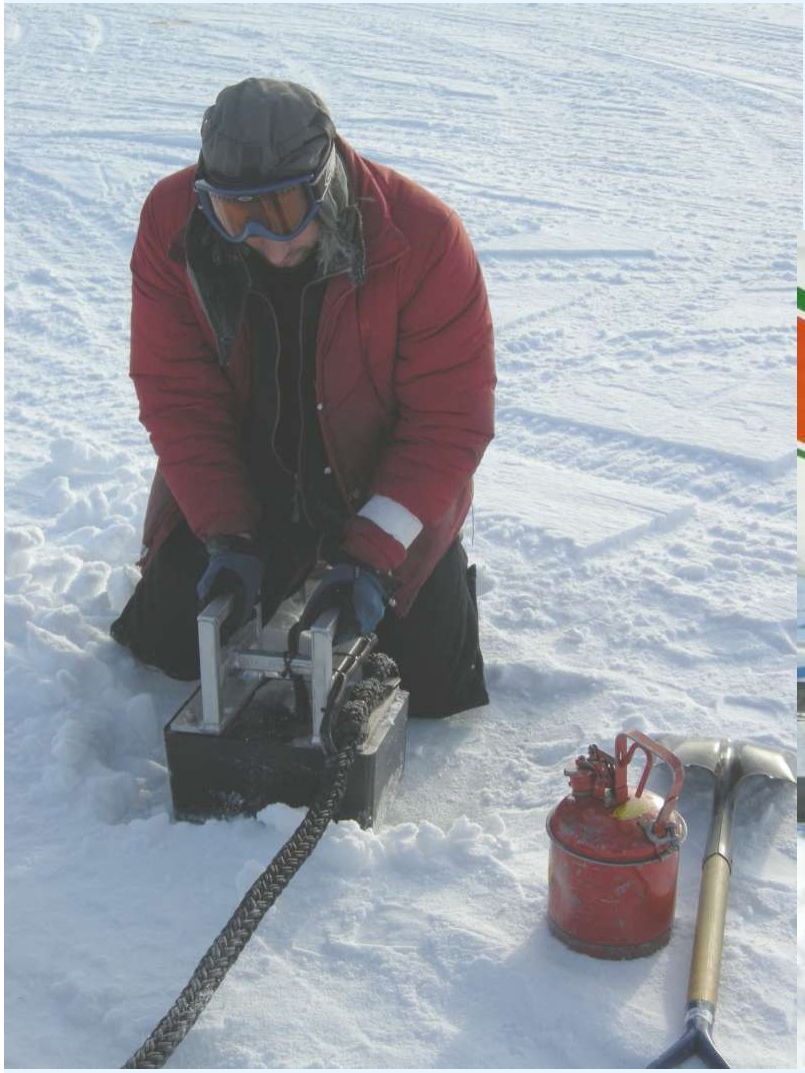
In collaboration with Denmark

Deploying instruments and producing ‘sound’

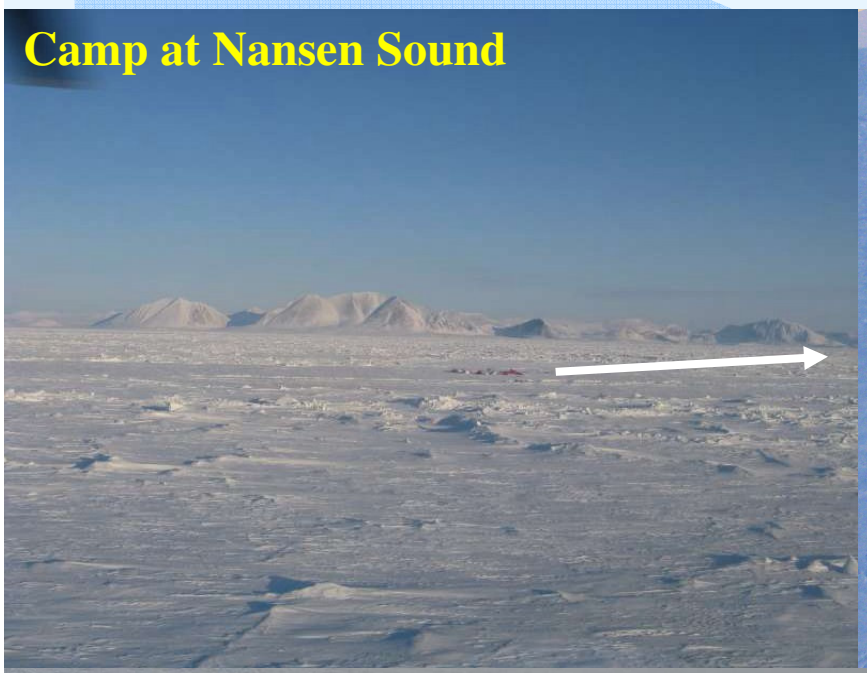


Measuring shape of Seafloor

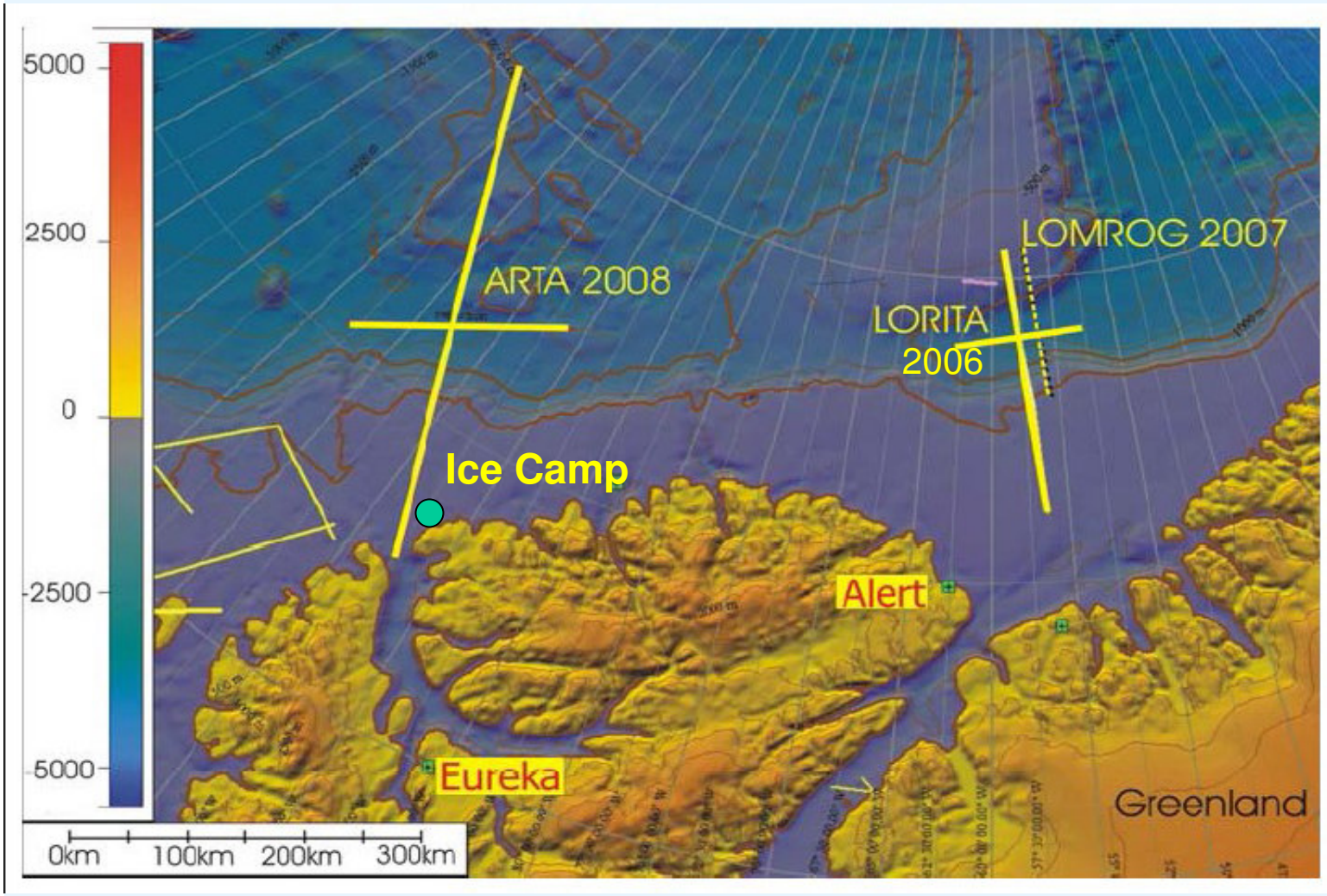
Depth Soundings and Gravity



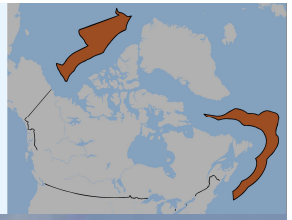
Alpha Ridge Experiment (March 2008)



ARTA - Alpha Ridge Experiment
(March-April 2008)

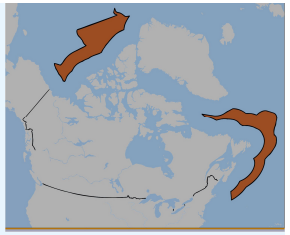


Ward Hunt survey (2009) Jointly with Denmark

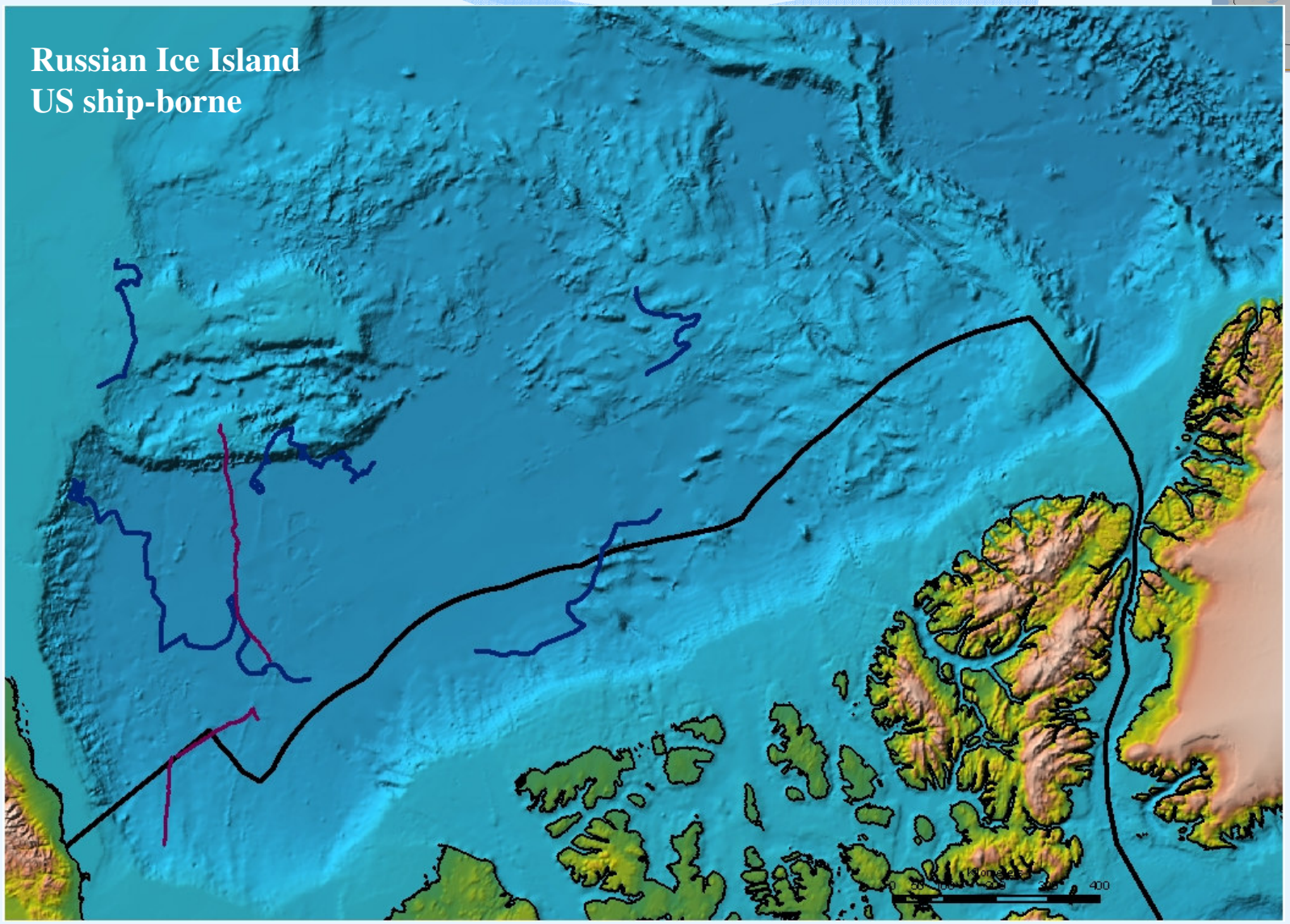


Canada

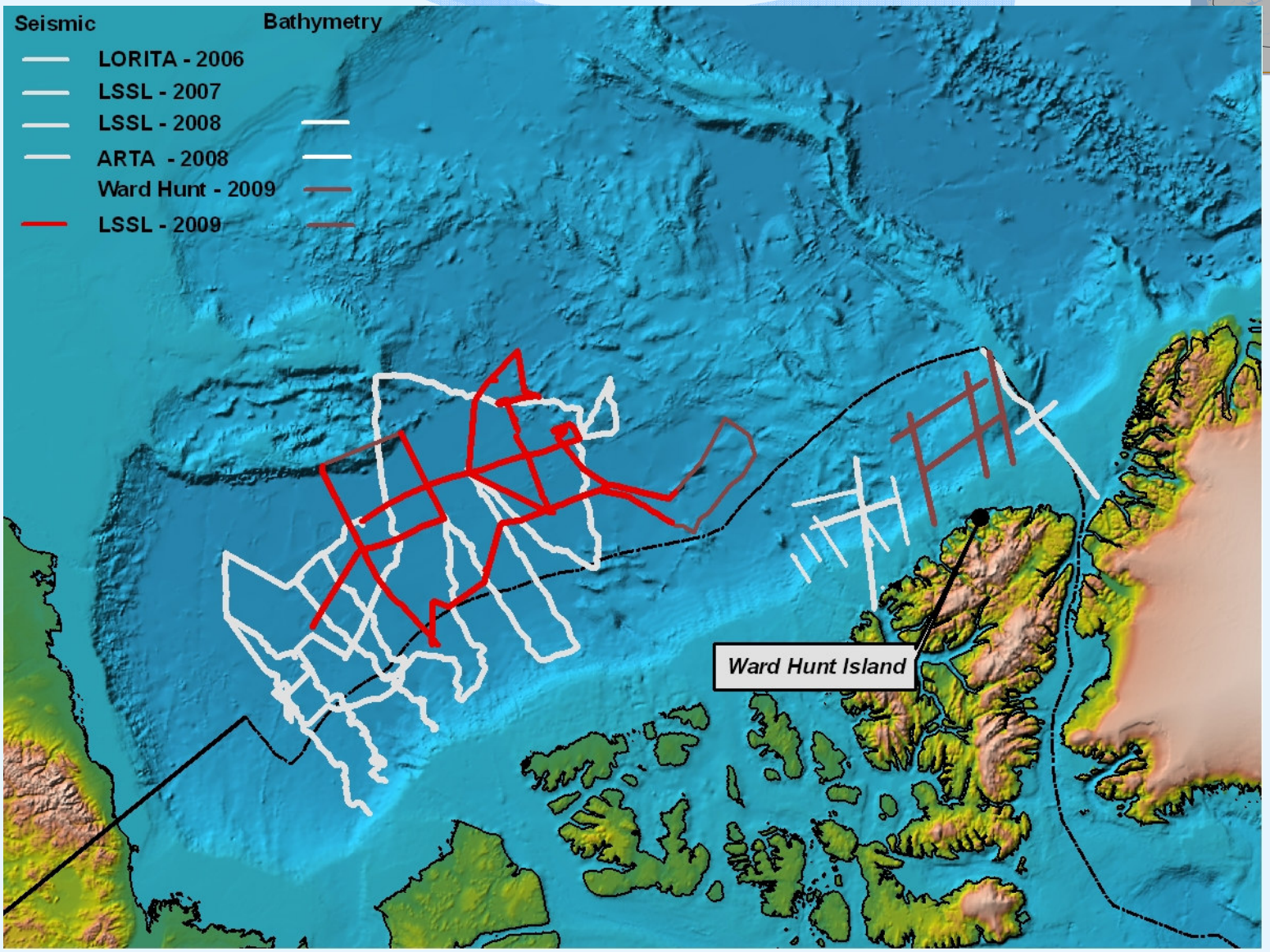
WHAT HAS BEEN ACHIEVED?



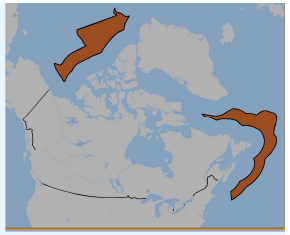
Seismic Data before 2006



Data collection 2006-2009



The Western Arctic program has collected high quality seismic data

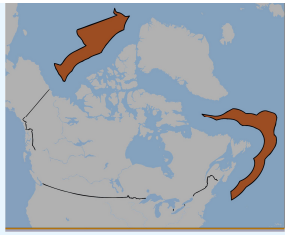


- **Successful seismic surveys in 2007, 2008 and 2009**
  - Collected 10,000 km of seismic data (quality above expectation)
  - Covered most of the extended area

- **Joint operation with US in 2008 and 2009 (Louis/ Healy)**
  - excellent collaboration between 2 ice breakers
  - able to collect seismic under heavy ice conditions (up to 84 N)
  - first seismic data ever collected in northern Beaufort Sea

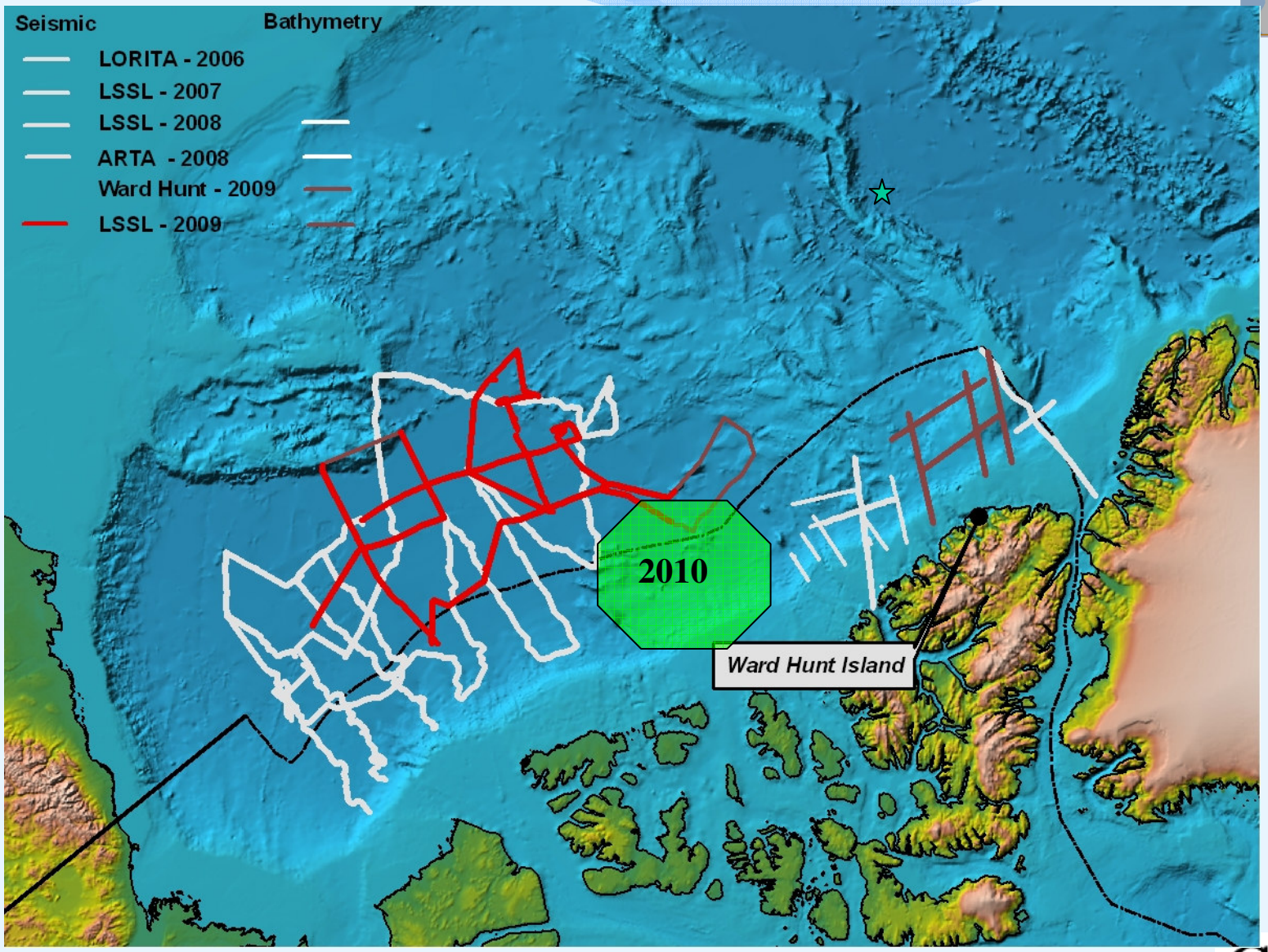
- **Initial results**:
  - Large quantities of sediments in entire Beaufort Sea
  - Likely significant extended continental shelf
  - Planning for third joint survey with US in 2010

The Eastern Arctic program focuses on Submarine Ridges

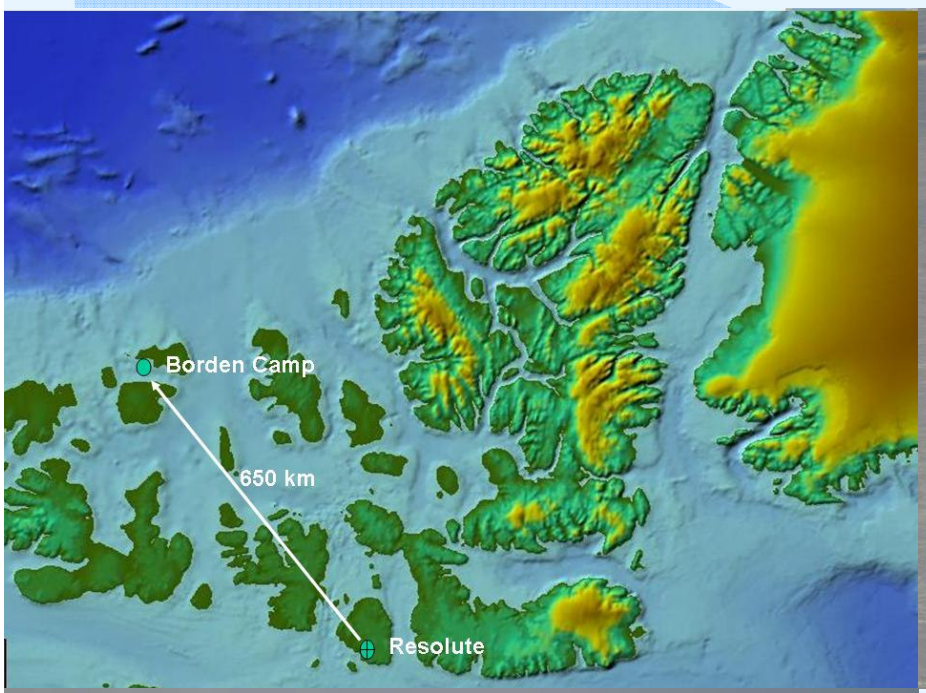


- **Overall Status**
  - **Collected high quality data**
  - **99% of instrument deployments successful**
- **Lomonosov survey (LORITA experiment, 2007, with Denmark)**
  - Scientific results presented at IGC (Oslo, August 2008):
  - results pick up by newspapers, NRCan press release
- **Alpha Ridge survey (ARTA, 2008)**
  - Logistically complicated:
    - Ice camp location: rough ice conditions, runway construction
    - 5 helicopters, 2-3 Twin Otters
    - Involvement of many organizations (75 people in field)
- **Ward Hunt survey (2009: with Denmark)**
  - successful data collection
  - Excellent cooperation with Danes
- **Scientific results are being presented and published for peer review**
- **Concern: variability in weather and ice conditions**

Next steps in data collection (2010)



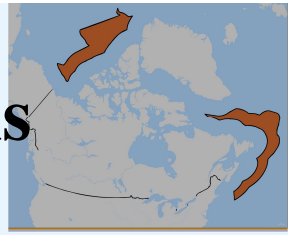
Borden Island Main Camp (2010)



Main camp:

- 17 tents
- Population of 40 or more
- Constructed 2500 ft runway

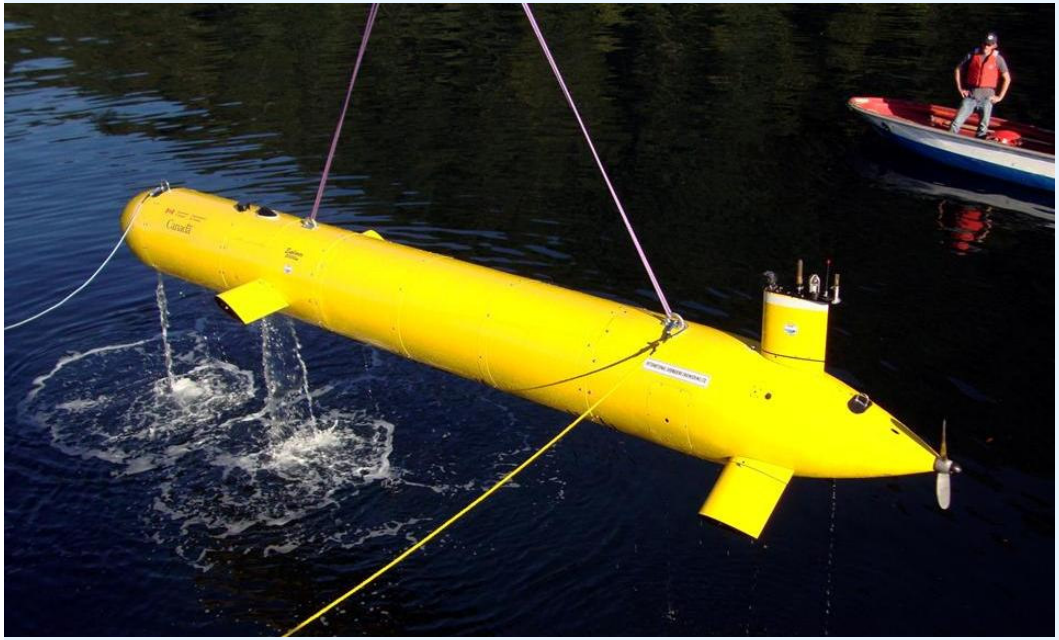
To reduce dependability on weather/ ice conditions



use world-leading Canadian technology to map the Arctic seabed:

Autonomous Underwater Vehicles (AUV) (delivered: September 2009)

Collaboration with DRDC (ISE and MUN: development program)

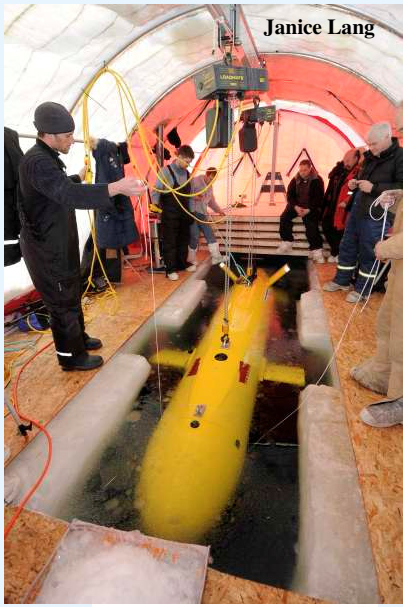


AUV

Length: 7 m
Range: 400 km
Max. depth: 5000m

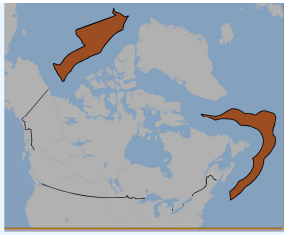
Field operations:
March 2010 and 2011

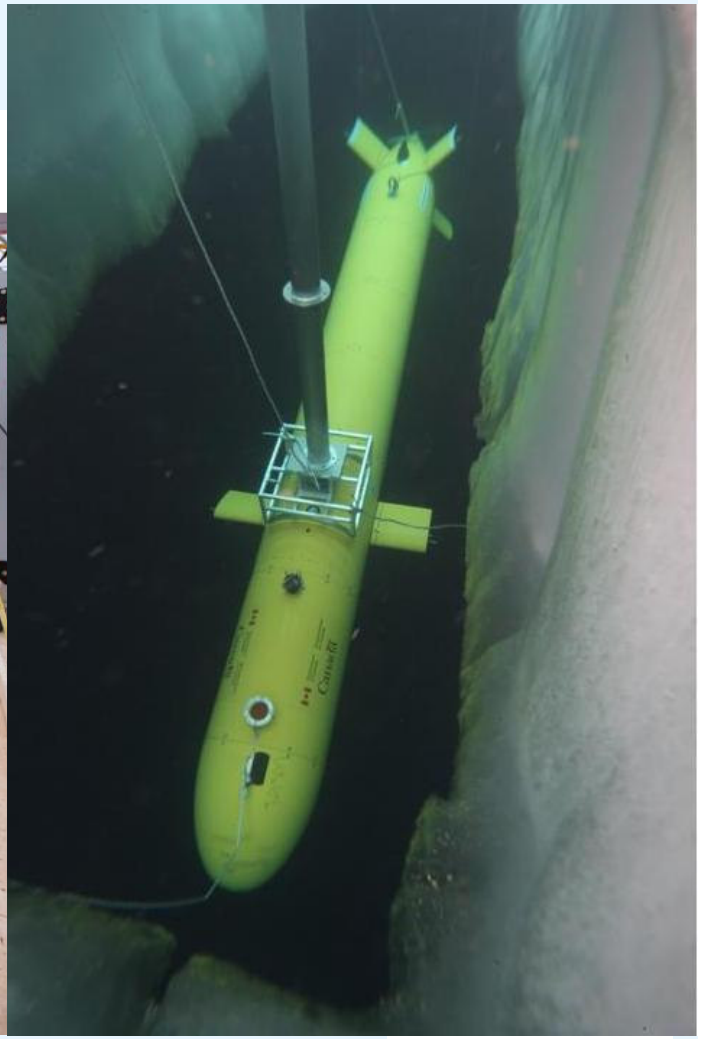
Testing: March 2009



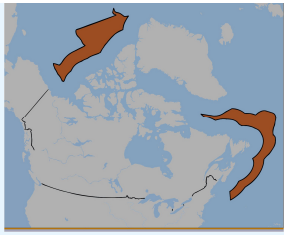
AUV Tent

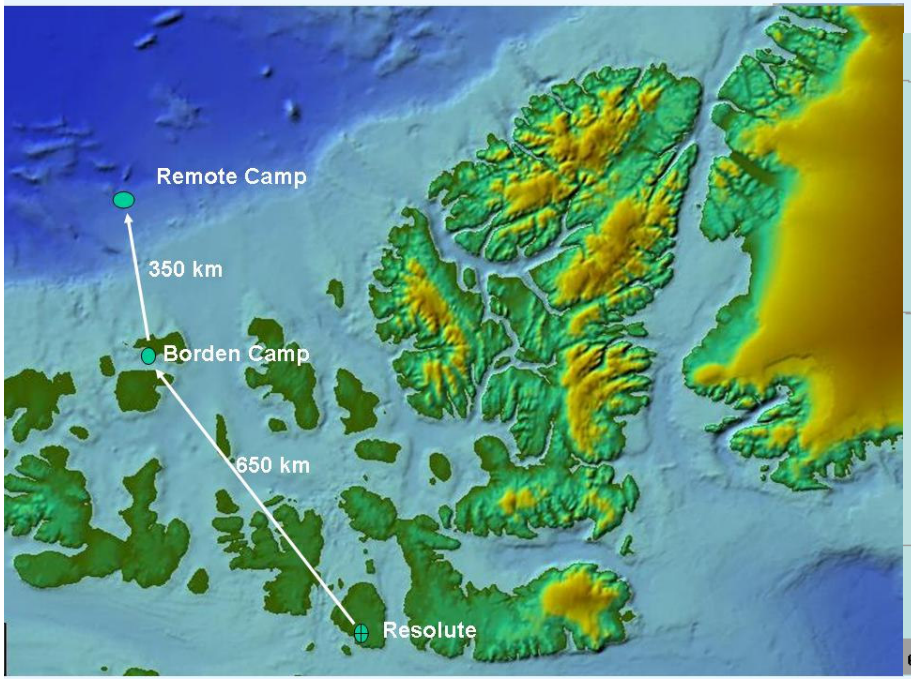
The AUV operations

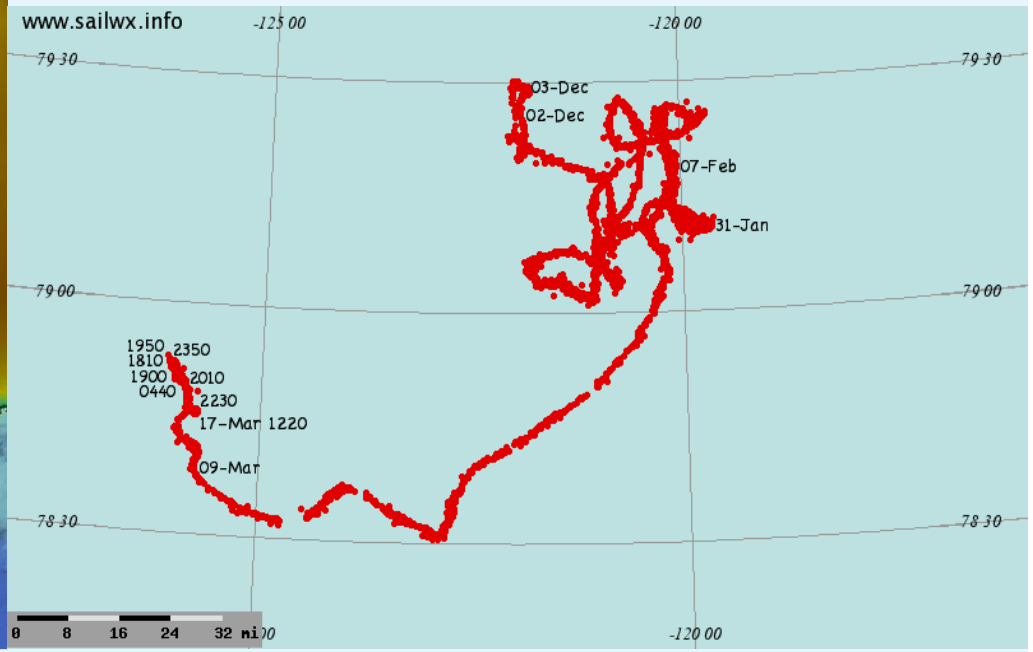




Cornerstone Remote Camp

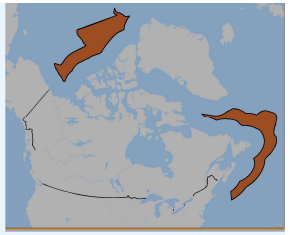






Movement of ice floes (Dec-March)

2010 Program



Borden Survey:

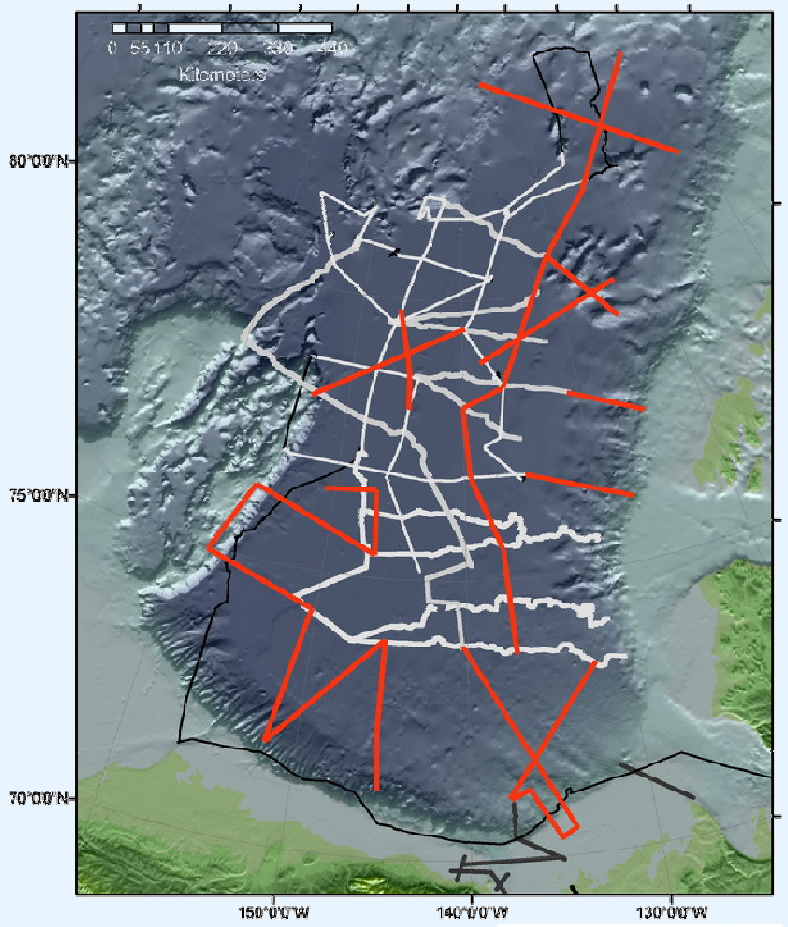
camps are being dismantled

due to weather delays not all planned data collected

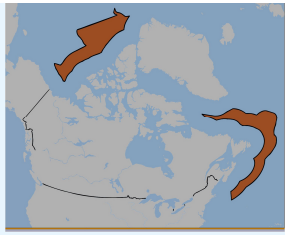
Fall-2010:

Joint Seismic Survey with US

(LSSL (seismic) and Healy (multi-beam)



What the Program has achieved…



- **Establishing the outer limits of the continental shelf in the Atlantic and Arctic is a high priority for Canada**

Accomplished to Date

- **Excellent collaboration among 3 Departments**
- **Excellent Support – Internal and External**
- **Successful data collection in Atlantic and Arctic**
- **International collaboration:**
  - **MOU with Denmark – 6 cooperative surveys (2007 - 2009)**
  - **MOU with USA (joint surveys in 2008 and 2009; plans for 2010)**
  - **discussions with Russia re Arctic data**

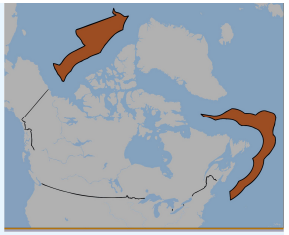
Challenges

- **Rising costs of surveys (Fuel, Vessel Charters, Aircraft)**
- **Increasing unpredictability of ice and weather conditions in Arctic**

Final Statement:

On track to complete data collection by 2011

Many federal Departments and Agencies contribute



CCG
(icebreakers)

EC / CIS
(ice-weather)

DRDC/ISE/MUN
(AUV)

EC (Eureka)
DND (Alert)
Parks (Ward Hunt)
PCSP

DFAIT
NRCan/DFO

DND
(Aurora)

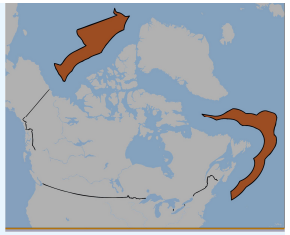
INTERNATIONAL

USGS/NOAA/STATE
(US)

GEUS
(DENMARK)

VNIIO
(RUSSIA)

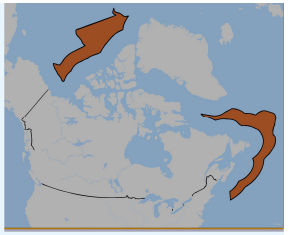
What the Program has left to do…



- Finish data collection
- Finish data interpretation
- Prepare submission to CLCS

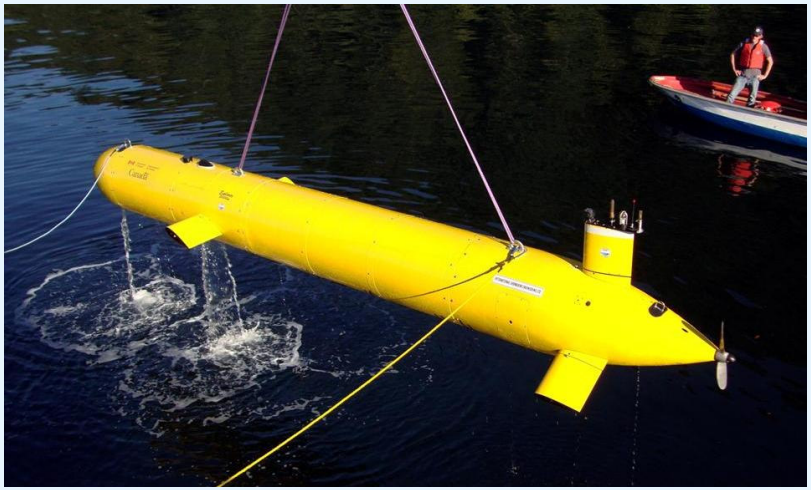
CLCS = United Nations Commission on the Limits of the Continental Shelf

THANK YOU



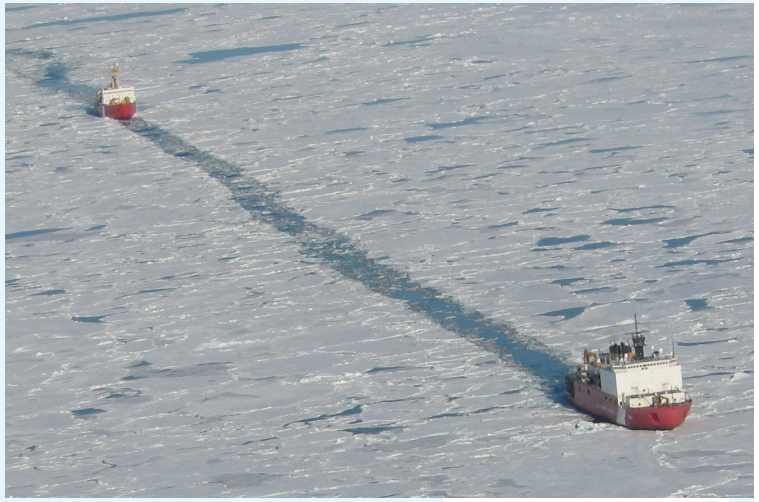
Ward Hunt ice camp (March-May 2009)

AUV testing – September 2009

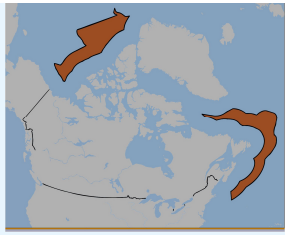


Joint Canada – U.S. survey 2008/2009

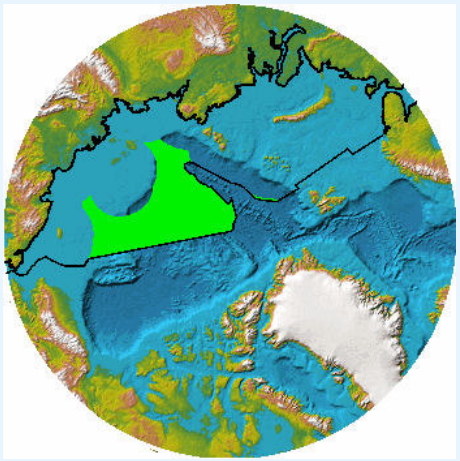
Louis S. St-Laurent and Healy



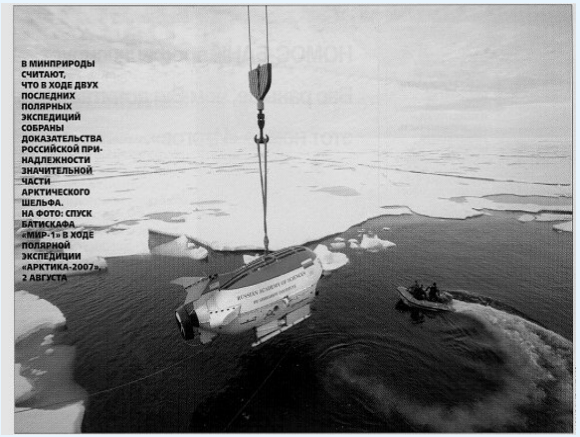
The Arctic component has received a lot of media attention



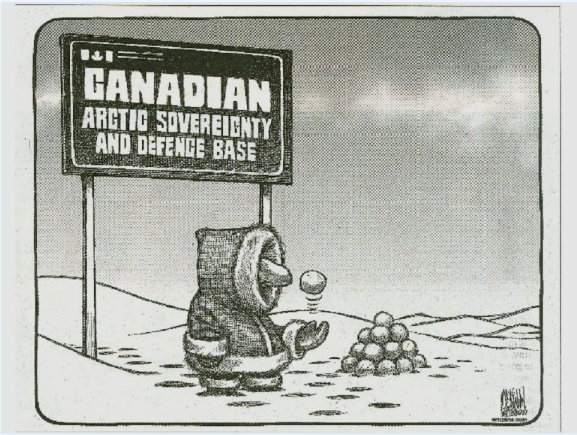
Russian Claim (December 2001)



Planting the flag on the North Pole



Cartoons in Canadian Newspapers



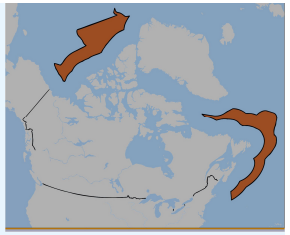
LSSL-Healy survey:

- Press releases (DFAIT and State Department)

- Press briefing before survey (12 journalists)
- Press briefing during survey (29 journalists)

- Videographer on LSSL (about 34 hours of HD-video)

Communication challenges



Increased program profile: MEDIA INTERVIEWS