SCIENTIFIC REQUIREMENTS TO DETERMINE LIMITS of CANADA’S OUTER CONTINENTAL SHELF according to UNCLOS

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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
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”

- 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
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
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.
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.
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):**

given 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

*DFAIT/DFO/NRCan*
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.

DFAIT/DFO/NRCan
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

Deploying Air gun array (4400 pounds)

Louis S. St. Laurent
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

Greenland

Ellesmere Island

Alpha Ridge

Lomonosov Ridge

Morris Jesup Rise

Gakkel Ridge

Amundsen Basin
LORITA – Lomonosov Ridge Experiment (March 2006)
Seismic refraction to investigate deeper structures

In collaboration with Denmark

CFS ALERT
Deploying instruments and producing ‘sound’

150 seismic recorders

Pentolite
Measuring shape of Seafloor
Depth Soundings and Gravity
Alpha Ridge Experiment (March 2008)

Camp at Nansen Sound

Constructing Runway

Constructing camp
ARTA - Alpha Ridge Experiment
(March-April 2008)
WHAT HAS BEEN ACHIEVED?
Seismic Data before 2006

Russian Ice Island
US ship-borne
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)

Testing: March 2009

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

Field operations:
March 2010 and 2011
AUV Tent
The AUV operations
Cornerstone Remote Camp

Population: 12

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

INTERNATIONAL

USGS/NOAA/STATE (US)
GEUS (DENMARK)
VNIIO (RUSSIA)

DND (Aurora)
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


Louis S. St-Laurent and Healy

DFAIT/DFO/NRCan
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

YEAR

2005 2006 2007 2008 2009

# interviews

0 5 10 15 20 25 30 35 40 45

No major Arctic survey

Russian Flag