The Clock is Ticking --- The Journey for Canada’s Submission to the United Nations Commission on the Limits of the Continental Shelf

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SUMMARY

In 2003 Canada ratified the Law of the Sea (LOS) Convention. Given the timeline for Extended Continental Shelf (ECS) submissions to the United Nations Commission on the Limits of the Continental Shelf (CLCS), Canada’s submission is due December 2013.

Several years prior to ratification, Canada was preparing for the ECS submission to determine the current scientific data holdings, the regions requiring surveys and plan surveys to collect the additional scientific data necessary to support the submission. The submission will delineate the outer limits of the continental shelf using criteria determined by the United Nations Convention on the Law of the Sea (UNCLOS), Article 76. Post ratification in 2003, three Federal Government departments were assigned the responsibility to prepare Canada’s submission. The Department of Foreign Affairs and International Trade (DFAIT) is the lead department responsible for the preparation and presentation of the submission, Fisheries and Oceans Canada and Natural Resources Canada are tasked with the collection, analysis and presentation of the scientific data necessary to support the submission under Article 76.

Key words: Law of the Sea, Article 76, Atlantic, Arctic, Data Acquisition, Submission

1. Introduction

The data acquisition in the Arctic and Atlantic regions will be described and the use of innovative techniques and technology to acquire the scientific data in difficult and inhospitable regions will be presented. The collaboration among Canada’s Federal Departments and Agencies and the international cooperation with Arctic and Atlantic coastal states are also described. Canada’s submission status and what needs to be addressed to “beat the clock” before December 2013 will be discussed.

2. Background

Canada was a British colony prior to Confederation in 1867. Up to this time personnel of the British Royal Navy (British Admiralty) were the primary explorers and map makers for these holdings including the Arctic Regions. The Admiralty explorers were instructed to take possession in the name of the Crown of any newly discovered islands and territories. The Dominion of Canada was established by the British North America Act signed by the British monarch, Queen Victoria in 1867.

In 1870, the British proposed the transfer of the Arctic Islands to Canada and in 1880 an Imperial Order-in-Council was signed in London stating that “after September 1, 1880 all British territories and possessions and all islands adjacent to any such territories or possessions shall become and be annexed to and form part of the Dominion of Canada; and become and be subject to the laws for the time being in force in the said Dominion”. As a result of this transfer Canada has the longest coastline in the world and is endowed with continental shelves in the Arctic, Atlantic and Pacific regions.

The United Nations Convention on the Law of the Sea in more than 350 articles established the shared governance of the world’s oceans by all nations and also defines the principles and guidelines for the coastal states delimitation of sovereignty, jurisdiction and associated rights.

Canada became a signatory to UNCLOS in 1982. The convention currently has 162 states parties and is one of the most widely accepted world treaties. Every coastal state has a right to a 200 nm continental shelf and under certain circumstances an ECS. In November 2003 Canada ratified the convention and by ratifying, Canada made the commitment to the United Nations (UN) to provide a submission that delimited its ECS 10 years after ratification i.e. December 2013.

The following discussion will outline Canada’s progress in acquiring, analyzing, presenting data and preparing the submission for the Arctic and Atlantic regions. As the December 2013 approaches the “ticking clock” is becoming louder.

3. UNCLOS and Article 76

UNCLOS is frequently called the ‘constitution for the oceans’ since it provides a framework for the governance of the world’s oceans by dividing them into zones of national and international jurisdiction. The convention recognizes a coastal state’s rights to the water column and seabed up to 200 nm and to the seabed beyond 200 nm under special conditions as defined under Article 76.

Within its 200 nm wide Exclusive Economic Zone (EEZ) a state has exclusive sovereign rights over the seabed and the water column. For a continental shelf beyond 200 nm a state is required to delineate with precision the area over which it can exercise its sovereign rights. The state has exclusive rights over the natural resources on and under the seabed. However it does not include rights to the water column or migratory species therein beyond the 200 nm EEZ.

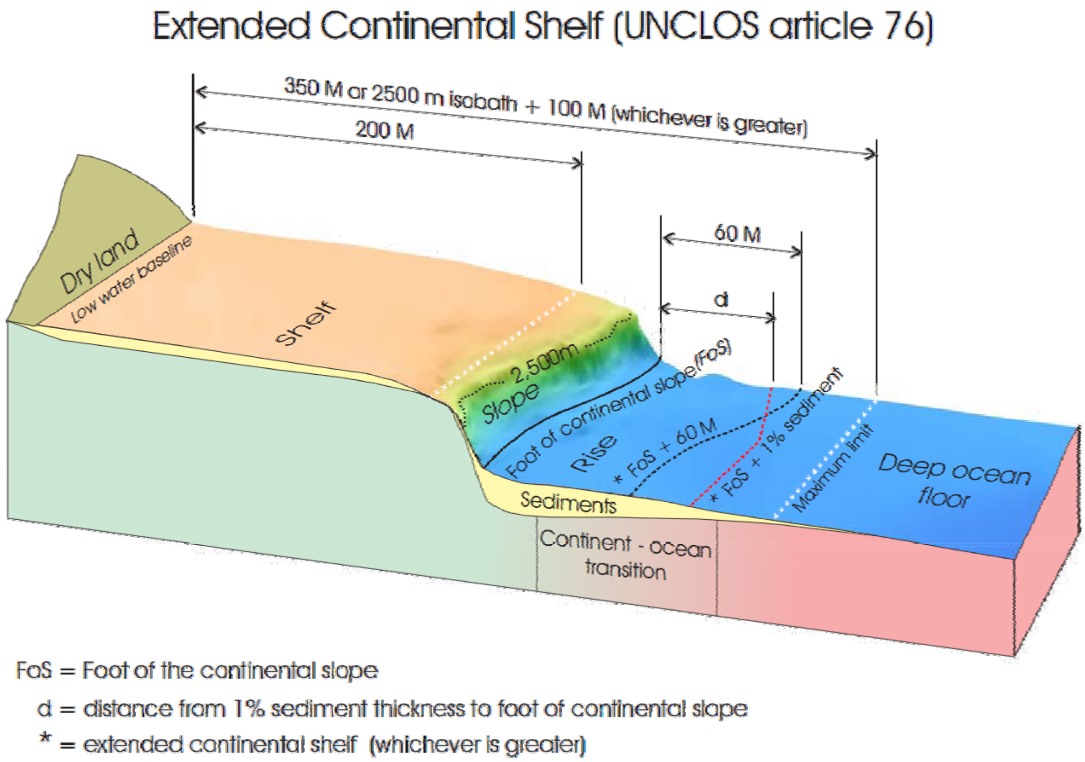

Figure 1 Foot of the Slope and Outer Limit

Article 76 utilizing scientific and legal terms defines the juridical continental shelf (Figure 1).

The definition of the continental shelf is: … *the natural prolongation of its land territory to the outer edge of the continental margin, or to a distance of 200 nautical mile* …(paragraph 1). The continental margin is defined as: …*the submerged prolongation of the land mass of the coastal State, and consists of the seabed and subsoil of the shelf, the slope and the rise. It does not include the deep ocean floor with its oceanic ridges or the subsoil thereof* (paragraph 3).

A coastal state must demonstrate that it meets the criteria of Article 76 for an ECS and must collect the hydrographic, geomorphological and geological information necessary to define its ECS. To delineate the ECS, Article 76 describes the formulae for measuring the continental shelf seaward (Figure 1). Determining the foot of the continental slope (FOS) is the first step in this process. It is defined as the point of maximum change in the gradient at its base. The outer limit can now be established as a distance of 60 nm from the FOS, or the distance to a point where the thickness of the sedimentary layer is at least 1% of the shortest distance from this defined point to the FOS (the line that is used to connect these two points is called the Gardiner line). The maximum extent of the continental shelf under Article 76 is constrained by two conditions. Firstly, the outer limit shall not exceed 350 nm from the baselines of the coastal state and the second constraint states it cannot extend beyond 100 nm from the 2500 m isobath. The coastal state is at liberty to use any combination of the above constraints to delineate its outer limits but the distance between points defining this limit can not exceed 60 nm.

4. UNCLOS Preparation

Canada began to prepare for the ratification of the Law of the Sea in the mid to late 1980's. Based on the requirement outlined in Article 76 for delimiting an ECS, it was prudent to determine the hydrographic, geomorphologic, seismic and geologic information that was currently available. Given this information it was possible to determine regions where additional data and analysis was needed to support Canada's ECS submission. All relevant literature in published research papers for the Atlantic, Arctic and Pacific were obtained and catalogued as supporting documents for the submission.

The Pacific Coast to date has had a lower priority because of its narrow continental shelf but a Pacific ECS submission has not been ruled out.

4.1 The Early Years

The planning of the surveys to acquire the scientific data necessary for the submission was pioneered by hydrographers and geomorphologists from the Canadian Hydrographic Service (CHS), Department of Fisheries and Oceans and geologists, geomorphologists and support staff from the Geological Survey of Canada (GSC) Department of Natural Resources (NRCan). The inventory of data and information created the foundation for determining resource requirements, priorities and infrastructure needed to augment data holdings, in support of Canada's submission. The early effort during this period was critical for preparing the financial and human resources documentation necessary to perform data acquisition and the substantial work required to prepare Canada's submission. This accelerated the processes for securing the funding and resources to support the UNCLOS project.

4.2 The Project

As noted in the summary the UNCLOS project is the responsibility of three federal departments.

4.3 Governance

Governance and oversight for the project is provided by the Assistant Deputy Minister's Steering Committee. The committee membership includes the ADM Earth Sciences Sector (ESS) NRCan, ADM DFO and the DFAIT Legal Advisor. Also included are the Director UNCLOS Project, NRCan, the Director LOS Project, DFO and a Director and Deputy Director, Continental Shelf Division, DFAIT. The committee generally meets twice a year and reviews the project status and progress through the performance reports and background material provided.

In addition a detailed evaluation audit of the project is performed twice during the project's duration i.e. 2003 to 2013. The evaluation is provided to the ADMs and the recommendation(s) are documented in the Management Review and Action Plan (MRAP) for implementation.

5. Atlantic Data

The inventory of data in the Atlantic from the Labrador Sea to the maritime boundary with the US indicated that potential field data, seismic data and bathymetry were systematically collected during the 1960's and 1970's. However the data coverage frequently did not reach the abyssal plain and therefore by itself was not sufficient for the ECS submission. Although the quality of data was good, the bathymetry was mostly single beam (SB) and did not provide the detailed bottom topography necessary to highlight slope processes and additional geomorphological evidence on and beyond the shelf.

To address this shortcoming, contract surveys were conducted for the Grand Banks in 2006, the Scotian Margin in 2007 and the Labrador Sea in 2009. These surveys extended the seismic and multi-beam sonar coverage further seaward to support Canada's submission. The seismic data collected in the Labrador Sea in 2009 were used to tie in existing seismic reflection and refraction data.

The data collected from 2006 – 2009 in the Atlantic are summarized in Table I.

Region	**Year**	**Joint**	**Bathymetry**	**Type**	**Multi-Channel Seismic**	**Type**	**Other Data**
Grand Banks	2006		18545 km	MB			
Scotian Margin	2007		12100 km	SB	6900 km	Reflection	
Labrador Margin	2009		4500 km	MB	3825 km	Reflection	
Labrador Sea	2009	**Denmark**			900 km	Refraction	

Table I Atlantic Data Collection 2006 – 2009

The additional multi-beam bathymetry (red) and seismic data (red) in the Atlantic acquired post 2006 is shown in Figure 2. The data holdings prior to 2006 are portrayed in black.

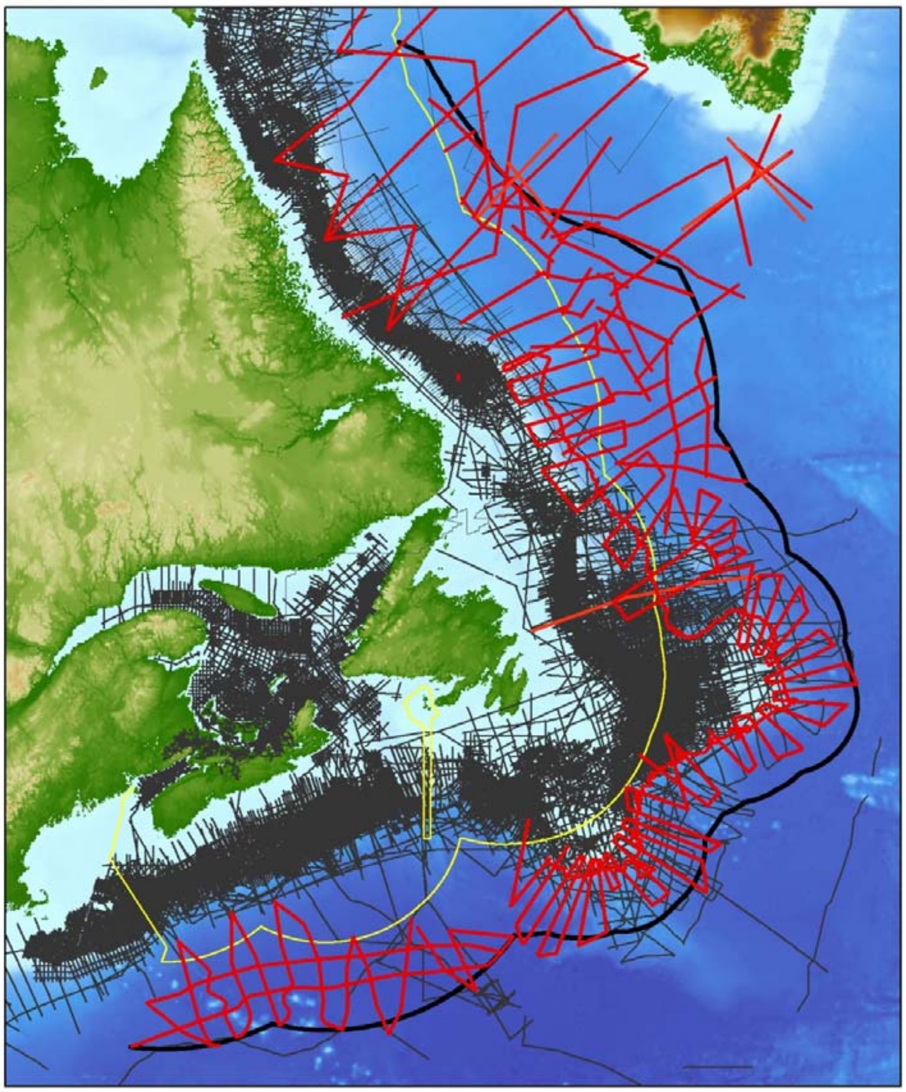

Figure 2 Multi-beam bathymetry and seismic data collected 2006 -2009

The Atlantic Region portion of the submission will be a combination of the foot of slope (FOS) plus 60 nm, 2500 m contour plus a 100 nm and sediment thickness (Gardiner) to maximize and delimit Canada's ECS outer limits.

6. Arctic Data

The Arctic presented a different challenge. Not only were existing seismic and bathymetric data sparse, the area has an inhospitable climate, short survey season, ice cover and is remote and largely unpopulated. These factors alone made it a costly and a high risk region to collect data.

6.1 Eastern Arctic

The Arctic in the region of the Lomonosov Ridge, Alpha Ridge and Sever Spur has historically been an area with heavy multi-year ice that prevented surveys being conducted by icebreakers. The approach in these areas was to construct ice camp(s) for the scientific and technical staff and to support data collection using helicopters and fixed wing aircraft.

Bathymetric measurements were obtained using an echo sounder and transducer coupled to the ice surface to obtain the depth. These measurements were made by a hydrographer to collect the position, time and depth information using a helicopter to transit from station to station.

Seismic information was obtained using seismic recorders in contact with the ice. The sound source for seismic measurements was pentolite explosive that was placed in holes drilled through the ice and detonated.

Potential field data i.e. gravity, were collected on the ice surface using gravity meters in specialized containers designed to provide power and maintain a consistent temperature.

The data acquired in the Eastern Arctic from 2006 to 2010 are summarized in Table II. Figures 3, 4 and 5 illustrate an ice camp and data collection in the Arctic.

Region	Year	Joint	Bathymetry	Type	Multi-Channel Seismic	Type	Other Data
LORITA Lomonosov Ridge	2006	**Denmark**	100 km	Spot 2 km spacing	540 km	Refraction	
ARTA	2008		678	Spot 1 - 5 km spacing	525 km	Refraction	250 gravity readings
Ward Hunt	2009	**Denmark**	1850 km	Spot			
Aero-Survey	2009	**Denmark**					75,000 km gravity & magnetics
Icebreaker Oden	2009	**Denmark**	320 km	MB	45 km	Reflection	
Borden Island	2010		326 km	Spot 2 - 5 km spacing			60 gravity readings
Borden Island	2010		500 km	AUV			

Table II Eastern Arctic Data Collection 2006 – 2010

Ward Hunt– April 2009

Figure 3 Ice camp in the Eastern Arctic

Figure 4 Collecting bathymetry and gravity to determine the shape of the seafloor

Figure 5 Seismic data collection in the Eastern Arctic

6.2 Western Arctic

In 2007, the CCGS Louis S St-Laurent conducted a hydrographic and seismic survey in the Western Arctic. Given the ice coverage and the necessity to collect data the following year in higher latitudes it was deemed too risky to survey with one icebreaker.

A Memorandum of Understanding was developed between the US and Canada that established a protocol for conducting joint survey(s) and data sharing in the Arctic that was mutually beneficial to both nations.

Canada utilized the icebreaker CCGS Louis S St-Laurent for the collection of seismic data, single beam bathymetry and spot soundings. The USCGC Healy was primarily utilized to collect multi-beam bathymetry and 3.5 kHz CHIRP sub-bottom profile data. There were four joint Canada – US surveys conducted in the Arctic from 2008 to 2011 utilizing these two icebreakers. Canada and the US planned the surveys in the winter and spring. The information, knowledge and experience acquired in the previous survey(s) were used to prioritize and improve data acquisition and operations for the upcoming survey season (summer and fall).

The two icebreakers complemented each other. When the data collection priority was seismic data the Healy led and broke ice for the Louis which resulted in excellent quality seismic data acquisition in heavy ice. When multi-beam bathymetry was the collection objective the Louis led the Healy and this facilitated the acquisition of high quality bathymetric data. Figure 6 shows the US and Canada icebreakers surveying in the Western Arctic and Table III summarizes the data acquisition in the Western Arctic 2006 – 2011.

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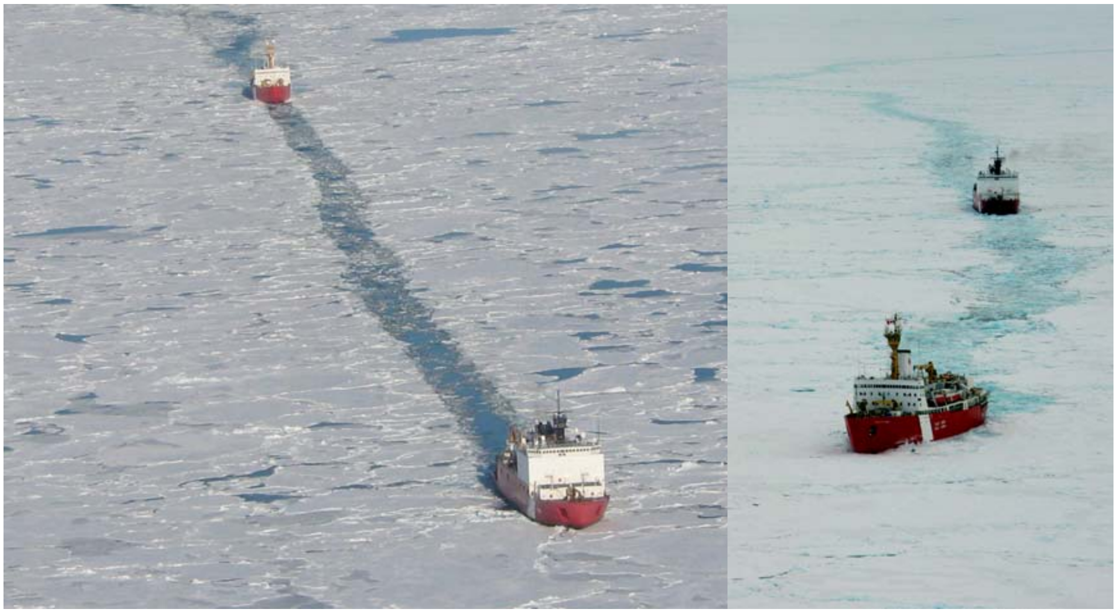

Figure 6 On left USCGC Healy leading (seismic data priority), on right CCGS Louis S. St. Laurent leading (multi-beam bathymetry priority)

Region	Year	Joint	Bathymetry	Type	Multi-Channel Seismic	Type	Other Data
Canada Basin	2007		4760 km (12 kHz) 180	SB Spot with helicopter	2987 km	Reflection	
Canada Basin	2008	**US** USCGC Healy	5500 km (12 kHz) 3000 km	SB MB	2817 km	Reflection	
Canada Basin	2009	**US** USCGC Healy	8000 km (12 kHz) 5000 km 177	SB MB Spot with helicopter	4045 km	Reflection	
Canada Basin	2010	**US** USCGC Healy	10,700 km (12 kHz) 5250 km 61	SB MB Spot with helicopter	3650 km	Reflection	
Canada Basin	2011	**US** USCGC Healy	6823 km (12 and 3.5 kHz) 4500 km 100 km 75	SB MB AUV Spot with helicopter	1440 km	Reflection	

Table III Western Arctic data collection 2007 – 2011

The fourth joint survey in 2011 was successful and the Canada's ECS data acquisition objective for the Arctic was met. This was Canada's final Arctic survey prior to the ECS submission date. There was no ice camp survey in the Arctic in the spring of 2011 because ice fracturing in the region of the 2010 ice camp required early removal of personnel and equipment. In 2011 it was decided that operating a camp far offshore in uncertain ice conditions was too risky and this method of data collection was ended.

6.3 Arctic Data Collection Summary

As noted, during the years 2006 to fall 2011, the project was successful in meeting objectives in the Arctic. Figure 7 is a view of the status of seismic data collection prior to 2006 in the Canada Basin. Figure 8 shows the data acquisition after 2006 including the 2011 survey. Although the overall data coverage in the Arctic is still sparse, the success of the data collection has been remarkable given the short time frame for conducting the surveys and the hostile environment.

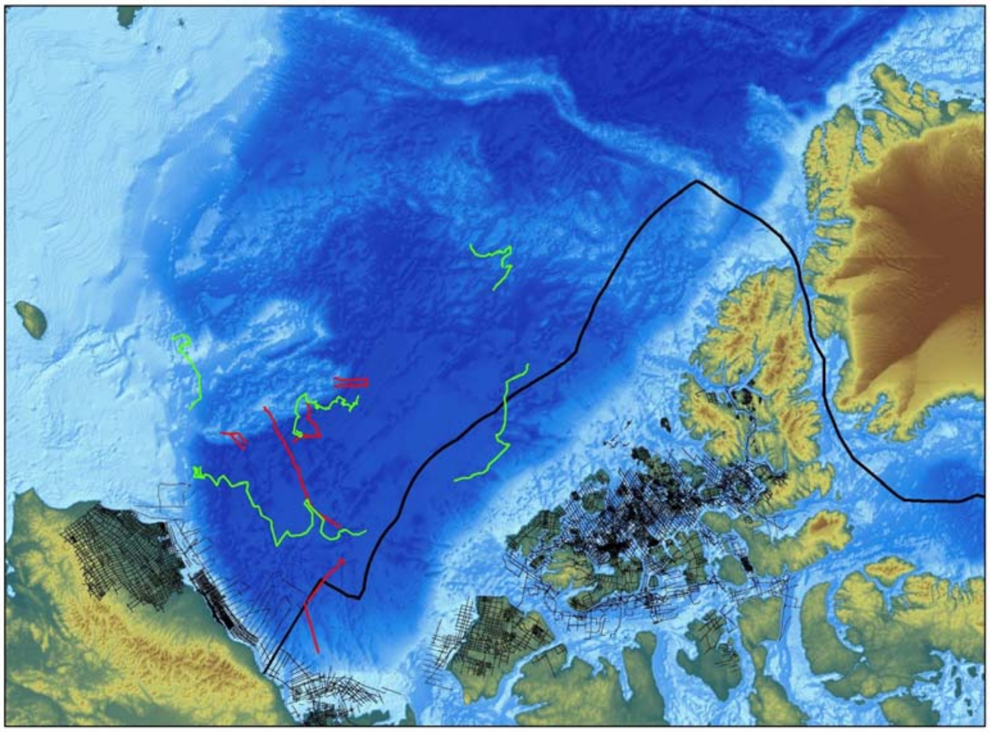

Figure 7 Seismic data holdings in Canada Basin prior to 2006 and the EEZ (black)

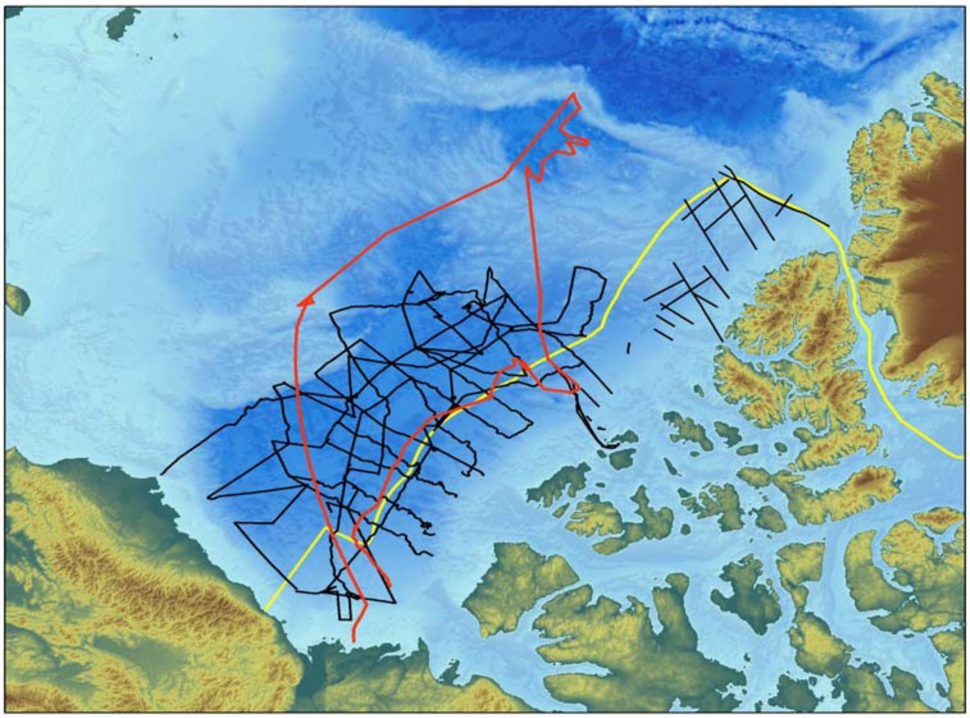

Figure 8 Seismic coverage in the Western Arctic including the fall joint survey in 2011 (red)

7. Technological Development and Innovation for Arctic Data Acquisition

It has been stated that "necessity is the mother of invention" and for conducting geological and hydrographic surveys in the Arctic this is a rule. Two significant developments that enhanced the data collection and data quality when surveying in thick multi-year ice contributed to the success of the Arctic data acquisition. A brief description of these developments follows.

7.1 Seismic Data Collection in Ice Infested Waters

The excellent quality of the seismic data collected in the Arctic under varying ice states including heavy ice was due to the engineering and technical development of a specialized module designed for housing the air guns. This development supported deployment of the air gun array and around the clock operation of the seismic gear. The streamer for acquiring the data was short due to operation in ice; however the entire system proved to be very reliable and resulted in collection of very high quality seismic data. Borden Chapman of the Geological Survey of Canada (GSC) and his technical staff at Bedford Institute of Oceanography (BIO) designed and implemented this system for the Arctic seismic acquisition. It was used successfully for five consecutive survey seasons. Considering the ice conditions that the system operated in, the endurance, reliability and the quality of data collected utilizing this innovation was remarkable.

7.2 Autonomous Underwater Vehicle(s)

International Submarine Engineering (ISE) in Vancouver, British Columbia manufactured an Autonomous Underwater Vehicle (AUV) for use under ice in Arctic waters. In the fall of 2009 the government of Canada took delivery of two of these vehicles which are Explorer class and were funded by the UNCLOS project and Defense Research and Development Canada (DRDC). The vehicles are meant to collect bathymetry under ice and are rated for 5000 metres depth. They are designed for 72 hour endurance and approximately 400 km range. Each vehicle is equipped with a Knudsen single beam echo sounder and Kongsberg EM 2000 multi-beam sonar (Figure 9).

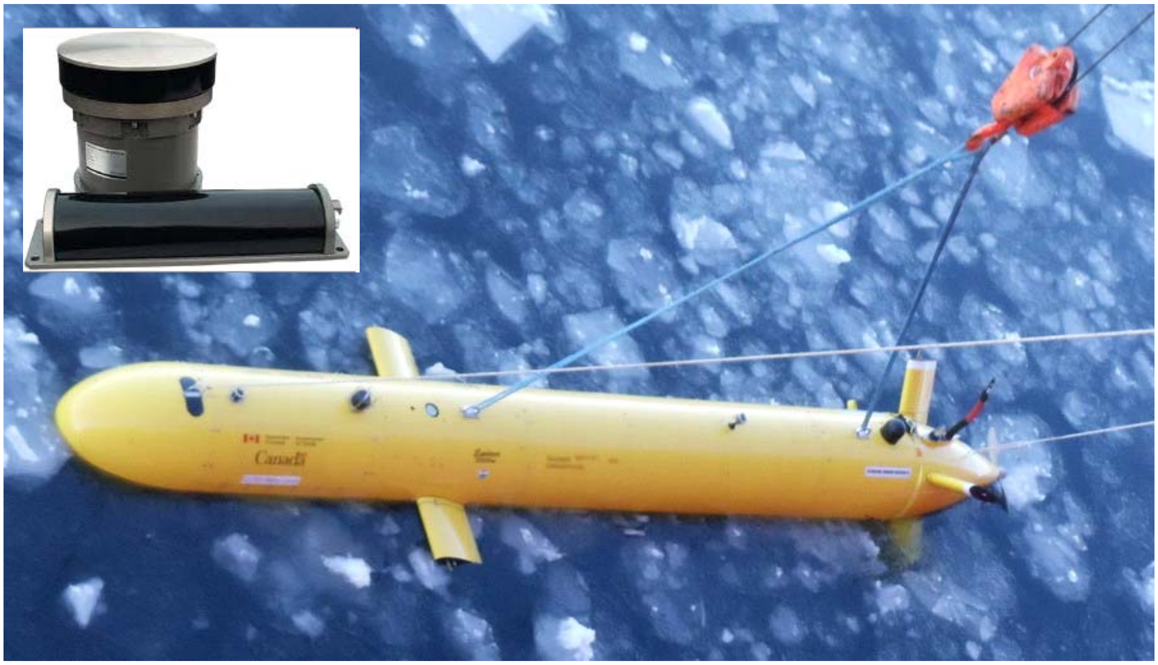

Figure 9 AUV with Knudsen and multi-beam transducers in upper left corner

DRDC, NRCan and DFO deployed the vehicle in the Arctic in the spring of 2009. The AUV was deployed from a camp based near Borden Island, transited to a remote camp 330 km from the deployment site and then returned to the Borden Island site. The AUV also conducted a 300 km survey mission to Sever Spur from the remote camp. All missions were conducted under ice, autonomously and approximately 1000 km of bathymetry was collected.

During the spring and summer of 2011, DRDC and the AUV implementation team for Project Cornerstone[1] tested the vehicle in southern waters prior to sending two AUVs north on the ice breaker CCGS Louis S St-Laurent for the 2011 high Arctic survey.

The deployment of the vehicle around Sever Spur, under heavy ice conditions, resulted in a successful survey mission and the vehicle collected 100 km of high quality multi-beam data.

Figure 10 shows the vehicle recovery in the Arctic by the CCGS Louis S St-Laurent.

Figure 10 Recovering the AUV in Arctic waters

7.3 Summary

[1] AUV Testing aboard Canadian Ice Breaker CCGS Louis S. St-Laurent, Sea Trial dates: 03 – 13 April, 2011, Chief Scientist: R.D. Pederson DRDC Project Atlantic Cornerstone, DRDC Project Plan, 2011, 53 p.

The seismic system development and the proof of concept missions carried out by the AUV in the high Arctic (2010 -2011) were instrumental in Canada being able to collect some of the required seismic and bathymetric data for support of Canada's submission.

8. International Cooperation and Collaboration

The following discussion will show the high level of international cooperation and collaboration that has taken place in the Arctic and other regions of mutual interest.

8.1 Arctic

During the past four years (2008 -2011) the United States and Canada conducted joint surveys in the Arctic using the Canadian icebreaker, CCGS Louis S St-Laurent and the United States icebreaker USCGC Healy. As previously noted, these joint surveys were conducted under an agreement and a Memorandum of Understanding (MOU) between the two nations regarding sharing of data collected.

This joint initiative with the US was beneficial to both nations by reducing the cost to Canada and the US to operate two icebreakers to survey in the high Arctic to meet their individual objectives. The vessels were complementary regarding their scientific infrastructure. Healy was equipped with Kongsberg EM122 12 kHz multi-beam sonar for detailed mapping of the ocean bottom and a 3.5 kHz CHIRP sonar for bottom penetration. The Louis had a single beam 12 kHz echo sounder and a customized air gun sled and streamer(s) for collecting seismic data.

In addition to the economic benefits for each country, the ships were a backup for each other if problems arose. There is no doubt that the successful acquisition of the required scientific data in the Arctic for Canada's ECS submission was due to this joint surveying approach. It was win-win for Canada and the US and the collaboration was commendable.

Canada also participated in joint projects with Denmark in 2006 and 2009. This included the LORITA project in 2006 on the Lomonosov Ridge. In 2009, Canada and Denmark collected spot soundings in the Ward Hunt area and conducted an aero survey for the acquisition of gravity and magnetic data. Denmark chartered the icebreaker Oden and Canada placed a CHS hydrographer on the vessel for multi-beam bathymetry acquisition. Bathymetry and seismic data were acquired on this survey and it also included a visit to the North Pole.

8.2 Labrador Sea

Canada has worked very closely with Denmark in the Labrador Sea. In 2009 Canada and Denmark acquired 900 km of seismic refraction data to support each nation's ECS submission in this region. In addition Canada has members on technical task forces with Denmark to address geodetic and other delimitation issues related to each nations ECS in the Labrador Sea. This relationship has been cooperative, collaborative and beneficial to both nations.

8.3 Arctic Meetings

To date the Arctic coastal states have participated in five Arctic meetings that included presentations by research scientists, hydrographers, geodesists, engineers and technical support staff to share their research and ECS related topics in a professional and congenial forum. These meetings foster knowledge sharing, collaboration in research and projects and an opportunity to share data where mutually beneficial. This is an important component given the lack of scientific data and knowledge in the Arctic.

A sixth Arctic meeting is planned for the fall of 2012 in the US.

8.4 Summary

In summary it is obvious there is significant collaboration and data sharing among the Arctic states and between Canada and Denmark in the Labrador Sea. It is to the benefit of all nations submitting ECS submissions to the CLCS to collaborate where possible without prejudice for their ECS submissions and particularly where there is a high probability of overlap.

9. Canada's Submission

Canada now has less than two years to complete the ECS submission. The current effort is to analyze the scientific data and prepare the submission. This is not a trivial task and it requires excellent coordination, communication and commitment by every member of the LOS team.

9.1 Developing the Submission, Supporting Documents and Scientific Data

The submission presents the scientific rationale and the scientific data required to support the delineation of Canada's ECS as outlined under Article 76. The submission also will reference many supporting documents including relevant published scientific research papers, information qualifying the scientific data (recently acquired as well as older data holdings) and description of all the data sets used to support the submission.

The written documents are accompanied by images depicting the FOS and outer delimitation based on the constraints as defined under Article 76. Each contributing FOS must be described and its relevance for determining the outer limit i.e. FOS + 60 nm, 2500 m contour + 100 nm, sediment thickness (Gardiner) and natural prolongation (natural prolongation of state's land territory as defined in Article 76). The overall delimitation may be maximized using the most advantageous of the choices listed, provided the data analysis supports the choice.

Images depicting the base points utilized as turning points for the baselines are included. The baselines are used to delineate the territorial sea, contiguous zone, the 200 nm EEZ and the constraints for the outer limits. The construction of these constraints (e.g. FOS + 350 nm), the EEZ and delimitation of the ECS will be submitted as maps, charts, etc. with the relevant supporting information and documentation.

To facilitate the review of Canada's submission it is planned to submit digital versions that have embedded links to supporting documents, images, data sets, etc. The intent is to simplify and accelerate the review of the submission by the CLCS commissioners.

9.2 Status of Canada's Extended Continental Shelf Submission

Canada has an extensive coastline in the Atlantic, Arctic and Pacific. As previously stated the Pacific is lower priority at this time and therefore the submission discussion will be divided into two areas, the Atlantic and the Arctic.

9.2.1 Atlantic

It was decided due to the large geographic extent, the sheer volume of information and the effort necessary to write a submission for the entire Atlantic continental shelf that the Atlantic portion of the submission would be produced initially in three parts i.e. the Labrador Sea, the Grand Banks and the Scotian Shelf.

The rationale of using individual components was advantageous for two reasons. Firstly the submission is not a scientific research paper and the objective is different. This means the organization, structure and presentation of the information is also different and as this was the first time that a Canadian submission had been written, it was thought prudent to begin with the Labrador Sea (considered the least complex area). The second reason was to use this initial effort as a test case to ensure we were on the right track. This was an important fact given the short timeframe remaining to complete the Atlantic and Arctic part of the submission.

The Labrador Sea preparation including supporting documents was begun in the summer of 2011 and Version 2.0 was completed in January 2012. This version was reviewed by a commissioner of the CLCS. The review comments were positive and the overall summary was;

"In summary, this is a very well prepared draft submission which presents a comprehensive and well documented basis for the outer limits." which is very encouraging.

The first draft for the Grand Banks and Scotian shelf is a work in progress and it is anticipated that this draft will be completed by the end of June 2012.

9.2.2 Arctic

In parallel with completing the Atlantic part of the submission, the analysis and development of the Arctic submission portion has begun. Initial tasks are to organize all relevant scientific data, supporting documents and analysis of the information for synthesis.

Analogous to the Atlantic, it is planned to initially write two submission portions for the Arctic i.e. the Eastern Arctic and the Western Arctic. Given the geographic extent and the different characteristics of the Western Arctic Beaufort Sea area where the primary approach will be sediment thickness and in the Eastern Arctic utilization of FOS + 60 nm, 2500 m contour + 100 nm and natural prolongation.

9.3 Tasks to Complete

It is obvious that the LOS team has a lot of work to complete prior to the submission date on December 6th, 2013 in New York.

Key milestones include;

a) Complete the Grand Banks and Scotian Shelf
b) Decide if the three Atlantic portions will be combined into one document for the Atlantic part of the submission
c) Complete the Atlantic work
d) Write the Eastern Arctic draft portion of the submission
e) Write the Western Arctic draft portion
f) Two review cycles for each of the Arctic drafts
g) Complete the Arctic submission part
h) One final review for the Atlantic and Arctic submission parts
i) Complete the final submission

There are several sub tasks associated with the above milestones and it is clear that there is not a surplus of time to meet the deadline.

9.4 Will We "Beat the Clock" and Present Canada's ECS Submission on Time?

The LOS team is confident that the submission deadline will be met and will present the best scenario for delineating Canada's ECS outer limits. Therefore Canada will submit on time and honour its UNCLOS commitment.

10. Conclusions

To recap, Canada intends to submit the ECS submission for the Atlantic and the Arctic on December 6th 2013, ten years after ratifying UNCLOS.

Canada's inter-departmental collaboration and support have been instrumental for the success of the project and this cooperation has been evident from the beginning of the project.

The successful surveys and data acquisition in the Arctic could not have been achieved in the timeframe necessary for meeting Canada's ECS deadline without the collaboration and joint surveys carried out with the Danish in the Eastern Arctic and the contribution of the US in the four joint Western Arctic surveys. In addition cooperation and collaboration with the Danish in the Labrador Sea facilitated the necessary data acquisition and confirmation of each nation's baselines in Labrador for Canada and in Greenland for Denmark.

In conclusion this project would not have been possible or successful without the foresight of persons employed at NRCan and DFO in the 1980's and 1990's who were responsible for preparing the inventory of scientific research, data and hydrography necessary to plan and support Canada's ECS initiative in the 21st century.

Acknowledgements

The authors thank the science party, support staff and the ship's complement of *USCGC Healy* and *CCGS Louis S. St-Laurent*. In addition we thank the collaboration and cooperation that Canada has received from the Danish research scientists, hydrographers and support staff who participated in joint programs in the Eastern Arctic and sharing of scientific data in the Labrador Sea.

Finally we would be remiss not to acknowledge the dedicated effort from the Canadian LOS team including the research scientists, geologists, geomorphologists, hydrographers, geodesists and DFO and NRCan technical support staff. We also thank the DFAIT personnel who have provided valuable legal advice and direction regarding the aspects of the project that deal with boundaries, legal issues and the legal interpretation of UNCLOS including Article 76. They have also provided advice when dealing with the governments of foreign nations.

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BIOGRAPHICAL NOTES

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