

**Arctic Regional Hydrographic Commission (ARHC)
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Innovative data collection program delivery techniques in the Canadian Arctic

Submitted by:	Canada
Executive Summary:	The geography and environmental conditions within the Canadian Arctic present unique data acquisition challenges. Given limited budgets relative to the challenges, the Canadian Hydrographic Service (CHS) continues to explore various approaches to deliver the nation’s hydrographic program in Arctic waters. These recent practices are presented here for the interest of ARHC participants and IHO in general.
Related Documents:	ARHC4 Operational and Technical Working Group survey reports Canada
Related Projects:	

Introduction / Background

The challenge of the Canadian Arctic is the vast geography and the limited seasonal window in which to perform operations. This obliges CHS to consider all technologies both proven and emerging when planning hydrographic surveys in order to maximize results and gain efficiencies. Often the Arctic programs are utilizing what would be proven technology in the southern latitudes but because of the unique northern environment and the accompanying logistical challenges, the application of the technology is the issue.

CHS does not have dedicated survey platforms from which to work in Arctic waters. The Canadian Coast Guard (CCG) operates Canada’s civilian fleet of icebreakers on a seasonal basis in the Canadian Arctic. The current practice is to purchase time from CCG icebreakers, usually at an incremental rate and utilize them as floating bases of operation (accommodation and logistical support) for two survey launches. The CHS launches are deployed and recovered daily from the CCG icebreaker.

CHS attempts to align priorities set by an industry focused Advisory Board to plan CCG vessel availability to set the coming year’s surveys. Utilizing an icebreaker’s available time between primary program missions (mainly ice escort), CHS conducts hydrographic surveys that range from a few days to several weeks. Despite being reliant on the CCG’s fleet availability and respective vessel locations (operational zones), this opportunistic

approach has been relatively successful in addressing many of the identified priority areas. The difference in daily costs between opportunistic and dedicated ship survey can range in the tens of thousands of dollars. Recently however, requirements for SAR standby and ice escorts are diverging geographically from the prioritized hydrographic requirements. As a result, CHS continues to pursue other methods of acquiring bathymetric data and the following are recent examples.

Arctic Charting and Mapping Pilot Project (2011 and 2012) – This project was a multi-departmental initiative launched to focus and evaluate a multidisciplinary approach to mapping and charting in Canada’s Arctic. To suit the objectives of the various departments involved, a small portion of the North West Passage in Victoria and Alexandra Straits was selected. Here, expertise in hydrography, archaeology, ocean technology, space technology and environmental science was coordinated to capture, analyse and publish data from various, ocean-going, airborne and space borne platforms. The federal departments included (Fisheries and Oceans Canada - CHS & CCG, Parks Canada, Canadian Space Agency, Department of National Defence, and Environment Canada) as well as the University of Victoria and a private sector group, the Arctic Research Foundation. A key driver for selecting this particular area of the Arctic Ocean in addition to priority charting requirements was to search for the wrecks *HMS Terror* and *HMS Erebus* from the ill-fated Franklin expedition.

One of the overall objectives of this initiative was to assess the feasibility of collecting data for the production of official navigational charts in the Arctic as well as to support ecosystem and habitat management objectives through a multi-platform, multi-sensor and multi-organizational approach to surveying, data management and assimilation, and product generation. As anticipated, a multidisciplinary approach to data collection yielded an invaluable data base and products to support many other scientific activities in the Arctic. For example, data from this project now serves those seeking archaeological artefacts within a geographic area of known significance to Canada’s marine heritage; it serves to provide data to support scientific analysis for seabed classification and it also serves to provide a comprehensive description of an Arctic coastal zone area.

Aside from single and multi-beam sonar surveys, CHS contracted for an airborne LiDAR survey to delineate the coastline and the water depth in the near shore region.. The LiDAR survey was fairly successful considering the numerous obstacles faced that are particular to the Arctic - limited airport facilities, limited dynamic weather, partial ice cover and poorly understood turbidity/clarity. The use of this technology is something that needs to be ‘proven’ as a consistent viable option in the Arctic.

United Nations Convention on the Law of the Sea (UNCLOS) Borden Island 2010 - The bathymetry and gravity collected on this program will be used to augment and refine the historical information that will be used to establish and support Canada’s UNCLOS submission under Article 76. The project employed ‘through ice’ sounding techniques utilizing helicopters and an Autonomous Underwater Vehicle (AUV) to collect single beam and multibeam bathymetry.

Crowd Source Bathymetry/Collaborative Approaches

The concept of what has recently been referred to as ‘crowd sourced bathymetry’ (CSB) is not necessarily a new approach utilized by CHS. For many projects, CHS has been the recipient of data collected by public or private entities. The data received is reviewed for quality assurance and adherence to both IHO and CHS collection standards – and when accepted into the CHS holdings, the data is used to update nautical publications. What is unique about the Arctic application is the minimal volume of vessels compared to the Gulf of St. Lawrence, Baltic Sea or the Mediterranean Sea. The only commercial fishing vessels in the Canadian Arctic operate off the east side of Baffin Island and the predominant vessels within the archipelago are Government and community re-supply vessels – both of which follow surveyed track lines. However, CHS has acquired data from other sources through partnerships with other Government Departments and collaboration with Industry/Academia that is being applied to nautical products.

ArcticNet Program: CCGS Amundsen - 2003 – ongoing, RV Nuliajuk – 2012 - ongoing

One particular ongoing project is managed by the Ocean Mapping Group (OMG) of the University of New Brunswick. It is an annual mapping program utilizing a multibeam echo sounder (MBES) aboard the *CCGS Amundsen* and the *RV Nuliajuk* – data is collected during the vessel transits and is intended to expand current shipping corridors.

CFAV Quest – Olex Data Analysis 2012 –In this example a CHS installed and operated MBES system was utilized alongside a passive single beam data collection system that utilized the Olex data acquisition system. This allowed for a direct comparison between the two methods. While there is no substitution for a properly monitored and operated MBES, the passive Olex system has some merit in certain applications. However, increased monitoring and measurement of sound speed and the collection of raw sensor data would facilitate a more usable solution and allow post processed analysis.

Government of Nunavut vessel RV Nuliajuk – 2013

CHS funded time onboard the Territorial Government’s fisheries research vessel *RV Nuliajuk* for the acquisition of multibeam data in specific priority areas identified by the Arctic Marine Advisory Board. CHS also supported the surveys by providing tidal support to the project. Hydrographers from the OMG collected all data onboard *RV Nuliajuk*. A considerable amount of MBES data was collected for a focused area, in a very cost-effective manner as a result.

Conclusions

Canada has been successful in recent years with encouraging and cooperating with collaborations and new methods and technologies to advance the work to increase bathymetric and hydrographic knowledge in its’ Arctic region in the absence of a dedicated survey platforms.

Recommendations

That ARHC notes the Information paper

Justification and Impacts

The draft ARHC Strategic Plan supports the exploration of new and innovative methods to increase knowledge of bathymetry and hydrography in Arctic regions

Action Required of ARHC

The ARHC is invited to note the Information paper.