

ARHC National Report of Canada

September 2022



Executive Summary

This report gives a summary of the main activities and points of interest within the Canadian Hydrographic Service since the last report which was provided to the 11th ARHC in November 2021. Special thanks to the Canadian Hydrographic Service's Ontario and Prairie Region and Arctic Region who worked diligently to provide the bulk of information for this report.

1. Hydrographic Office / Service

1.1 Since 1883, the Canadian Hydrographic Service has studied Canadian waters to ensure their safe, sustainable, and navigable use. The Canadian Arctic stretches across northern Canada, from the Beaufort Sea east to Baffin Bay and southward to 60° north latitude. Canada's Arctic covers more than 4.4 million kilometres and contains more than 36,000 islands. About 47% is underwater with intricate coastlines characterized by inlets, channels, fjords and bays. Operating in the Arctic of course comes with several nuanced challenges which are unique to the region. Due to its size, its remoteness, and the intricacies present within the landscape, this region is unlike any other. Difficulties are further complicated by the onset of climate change, and the ever increasing marine activity present due to shortening of the ice season.



2. Surveys

2.1 CHS Management, Planners and our partners within the Canadian Coast Guard recognize the critical nature of the CHS/CCG navigational safety program and understand how it links directly to the essential services delivered by the broader Department and Government of Canada in the Arctic. The survey season in the Canadian Arctic is a short but extremely valuable window to improve the data holdings and ultimately improve navigational charting. A missed season would be a significant lost opportunity. Given the enormous geographic and challenges with data collection, the CHS continues a strategy which is focusing on Proposed Low Impact Shipping Corridors in the Canadian Arctic. These corridors are the "marine highways" where the majority of commercial vessels travel, and include "off ramps" into Arctic communities and commercial operations that rely on the annual Northern Sea Lift. As of April of 2022, the CHS have surveyed 42.6% of these corridors to a modern or adequate standard (see graph below). The Ocean Protection Plan (OPP) has seen important and targeted investments allowing the CHS to accelerate the work in the Arctic and to collect a larger volume of modern data.



Combined Modern and Adequate Bathymetric Coverage in the

2.2 For Arctic hydrography, the CHS requests access to up to five Canadian Coast Guard ice-breaking ships (CCGS Sir Wilfrid Laurier, CCGS Louis S. St Laurent, CCGS Des Groseilliers, CCGS Henry Larsen and CCGS Radisson) that are equipped with hull mounted multi-beam echo sounders. Work on these platforms allows the CHS to collect the bathymetric data necessary to chart the priority marine navigation corridors, and other areas identified by clients and stakeholders. For the 2022 survey season, the CHS will be working onboard 4 CCG icebreakers, one of which was equipped with a hydrographic launch. We will also benefit from opportunistic data collected by the dedicated science vessel CCGS Amundsen, which has been collecting modern bathymetry in the Arctic for nearly two decades.

2.3 The CHS makes use of Supply Arrangements for the procurement of both acoustic (MBES) and Bathymetric LiDAR hydrographic services. There are currently 11 companies on the MBES Supply

Arrangement that are qualified to work in the Ontario and Prairie/Arctic Regions and 5 companies that are qualified on the LiDAR Supply Arrangement. In 2022, the CHS has issued one contract in the Canadian Arctic via competitive RFP, with work focused in eastern Hudson Bay and Hudson Strait.

2.4 CHS Arctic Surveys leverage an important and privileged relationship we have with the Canadian Coast Guard. Arctic Surveys have the following common objectives:

- Collect multi-beam bathymetry to improve navigational charts and products, as per the CHS mandate;
- Detect, classify and report navigational hazards;
- Collect acoustic (backscatter) and other oceanographic data in support of scientific research;
- Contribute towards the goal of significantly increasing the percentage of modern and adequate hydrographic coverage on the Proposed Low Impact Shipping Corridors.
- Support the Tides, Currents and Water Levels Operations in the collection of tidal and geodetic data to enhance Continuous Vertical Datum (CVD) modelling.

2.5 The CHS continues to rely on five Canadian Coast Guard Icebreakers, as well as charted vessels for collecting survey data. *For more information on each vessel please reference the Annex 1. The figure below outlines the geographic areas where surveys are planned for 2022.*



2.6 The CHS has currently contracted out survey work, via a Hydrographic Survey Supply Arrangement, in South Eastern Hudson Bay & the Hudson Strait. This work will be undertaken by IIC Technologies, who was the successful bidder for this contract. Note that in additional to modern multibeam data collection, the contract includes shore-based GNSS occupations on predetermined benchmarks to update continuous vertical datum in Canadian waters and support Natural Resource Canada's geoid modelling for CGVD2013 the National Vertical reference system.



3. New Charts & Updates

3.1 The Nautical Publications division of CHS is meticulous in their work to update New Editions of ENCs, charts, publish reprints, and patches to ensure that important navigational information is available to the mariner in a timely manner. This work is complicated in part in the Arctic due to lack of modern bathymetric data, and requirement to integrate data from wide range of sources.

3.2 Since November 2021, the CHS has released 14 new ENCs and 22 new edition ENCs. See Annex 2



- **3.3** There are currently 6 Arctic area ENC's planned for 2022-2023. See Annex 2
- **3.4** Since November 2021, the CHS has released 31 new edition Paper Charts. *See Annex 2*



3.5 There are currently 9 Arctic area Paper Charts planned for 2022-2023. *See Annex 2*

4. New Publications & Updates

4.1 The Nautical Publications division of CHS is meticulous in their work to update New Editions of ENCs, charts, publish reprints, and patches to ensure that important navigational information is available to the mariner in a timely manner. In addition, new information that is significant to navigation is advertised immediately through the Canadian Coast Guard's websites for, 'Navigational Warning (NAVWARN)' or 'Notices to Mariners(NOTMAR)'.

4.2 As part of our current modernization initiative CHS Sailing Directions and CHS Tide Table will no longer be printed but will be available for download free of charge.

https://www.charts.gc.ca/publications/sailingdirections-instructionsnautiques-eng.html https://www.charts.gc.ca/publications/tables-eng.html

To access the catalogue of Nautical Charts and related products, please visit: www.charts.gc.ca

5. MSI: Existing infrastructure for MSI dissemination

5.1 Information on marine communications and traffic services (MCTS) in Canada is available at:

http://www.ccg-gcc.gc.ca/Marine-Communications/Home

5.2 Canadian Coast Guard (CCG) continues to operate the Navigational Warnings (NAVWARNs) web site and subscription service which replaced the domestic Notice to Shipping (NOTSHIP) services. For further information visit: <u>http://nis.ccg-gcc.gc.ca/</u>

6. C-55:

6.1 Canada is in the process of updating its C-55 information

7. Capacity Building

7.1 With an increasing presence in Canada's Arctic waters through the Government of Canada's Oceans Protection Plan (OPP) and other federal initiatives. The CHS is uniquely positioned to play a role in enhancing Canada's relationship with Indigenous peoples based on the recognition and implementation of rights, respect, cooperation and partnership in the context of mapping the depths of Canada's navigable waters. Over the past year, CHS has partnered with DFO Science and the Paulatuk Hunters and Trappers Association in Paulatuk, NWT. The work will see community members engaged directly in the collection in a range of scientific data (including bathymetry) from the Science vessel Frosti (chartered) along with smaller community boats equipped with "black-box" data loggers. Another project is a collaboration with the Canadian Coast Guard In-Shore Rescue Boat program in Rankin Inlet, NU. The CHS have integrated a logger into the on-board navigation system, allowing for passive data collection (lat/long/depth) while the vessel is operating in the waters of western Hudson Bay.

8. Oceanographic Activities

8.1 In addition to hydrographic surveys and chart production efforts, the CHS contribute to Ocean science priorities:

• CHS maintains a network of 5 permanent tide gauges in the Canadian Arctic (Refer map below).



- In addition to these permanent gauges, the CHS deploys temporary tide gauges in a seasonal/annual basis to improve tidal predictions. It is interesting to note that parts of the Eastern Arctic (Ungava Bay) have some of the world's largest tidal range exceeding 15 m.
- The generation of a new Continuous Vertical Datum (CVD) surface in Canadian Waters. This new CVD surface will include updated vertical reference data that has been collected and analysed to provide an updated surface for referencing bathymetric surveys and updated Chart Datum for navigational products.
- The maintenance of the new Integrated Water Level System (IWLS) (https://tides.gc.ca/tides/en) which will enhance data available to clients in real-time as well as feed into forecasts and provide tidal predictions from a centralized database.

9. Spatial data infrastructures

9.1 The Canadian Hydrographic Service's Marine Spatial Data Infrastructure is currently in it's fourth year of funding and is in the process of planning for the next five years. Since its inception, the MSDI has contributed over 500 datasets to the Canadian Open Data Initiative. There are currently 15 applications which have been released on the platform, with another 9 applications in development.

9.2 All data published through the MSDI adheres to the Government of Canada's Harmonized North American Profile (HNAP) – ISO 19115.

9.3 The MSDI has achieved departmental buy in by developing an infrastructure that relies on stakeholder expertise and adheres to set standards and security practices. The MSDI focuses on interoperability and data sharing.

9.4 The MSDI is helping to support ongoing Arctic research projects by leveraging new cloud technologies.

9.5 Through the Government of Canada's Open Data portal, the **CHS NONNA-10 and NONNA-100 Bathymetric Data products**, representing a consolidation of digital bathymetric sources managed by the CHS, have been made available. The « NONNA » refers to NON-Navigational. The « 10 » or « 100 » references the approximate resolution (in metres) of the data. For more information visit the Government of Canada Open Government NONNA page: https://open.canada.ca/data/en/dataset/d3881c4c-650d-4070-bf9b-1e00aabf0a1d

9.6 Arctic Voyage Planning Guide - The Arctic Voyage Planning Guide (AVPG) is intended as a strategic planning tool and a compilation of data and services for national and international vessels traveling in the Canadian Arctic. It has been publicly available for the past 10 years at the following location: <u>Arctic Voyage Planning Guide (charts.gc.ca)</u>



10. Innovation

10.1 The Canadian Hydrographic Service (CHS) is moving towards a digital transformation initiative over the next 10 years. CHS is shifting away from printed products to produce and distribute electronic nautical charts (ENC) and digital publications as well as new web services, which are quickly becoming the international standard (S100 suite of services). These new tools will better meet consumers' needs for e-navigation products that provide dynamic real time data.

10.2 CHS is leveraging the Government of Canada's Marine Spatial Infrastructure (MSDI) along with Oceanographic and Meteorological prediction systems to deliver dynamic surface currents for Canada's three coasts, including the Arctic Ocean. The service is delivered using the S111 standard for graphical depiction of surface currents (see image below).. While currently at a relatively low resolution in Arctic waters future plans will see higher resolution data provided where feasible. The data service can be accessed via: https://gisp.dfo-mpo.gc.ca/portal/home/item.html?id=be4ff7af23384fdbac2e6c8c165b6622



10.3 Arctic Telecommunications

With multiple survey assets working concurrently in Arctic waters, along with a desire for a smaller HR footprint onboard ships, CHS has a number of pilot projects underway with the CCG and private sector satellite communication providers to assess and test feasibility of ship-to-ship, and ship to shore (south) data links. Sharing of information which could even include large data files for processing, will allow CHS to optimize data collection, and aim to avoid the same ship working on a corridor already widened. Improved data links will also support tactical discussions between a ships commanding officer ,and the Hydrographer leading the project who may be located in the south, or perhaps on another vessel.

10.4 Deployment of USV for Arctic Survey

For the past 2 years, CHS has worked with IIC Technologies that has seen the deployment of a XOcean USV platform for multi-beam sonar bathymetric data collection. The initial work was undertaken on Lake Superior in the fall of 2020, and the project was completed in the fall of 2021, expanding bathymetric data collection while also carrying other scientific payloads. Additionally, 2021 a USV was deployed in the Arctic as a part of a contracted hydrographic survey. Unfortunately, there are no USVs being operationally deployed in the Canadian Arctic as part of CHS' 2022 survey operations. We are

planning on expanded use and further testing of technologies in the coming years as funding allows, and would welcome knowledge sharing and possible partnerships with ARHC member states to advance the use and capabilities of these systems.

10.5 Crowd Source Bathymetry and Trusted Sources

CHS continues to maximize the collection of high quality bathymetric data with a range of "trusted source" organizations. These include for example data collected by the USCG Healy (in 2021), which through collaboration with the University of New Hampshire (UNH) Science Mission lead, will see CHS receive data collected while the vessel transited the NWP this summer. The CCG Amundsen Research Icebreaker operated by the Amundsen Science also continues to collect and contribute high quality bathymetric data to CHS. We also worked to equip the RV Frosti with a portable MB system, and provided training to the DFO Science crew who were able to collect data in near-shore areas of the Beaufort Sea.

Pilot projects are also under way with the Canadian Coast Guard (CCG) community rescue boat program, which could see these vessels share any depth/sounder information collected while in transit. CHS is also collaborating with the Inuit Community near the Ottawa Islands of Hudson Bay. CHS provided a data logger for the Inuit operated research vessel based in Ivujivik, QC. This work is ongoing, but over 110 linear Km of single beam soundings have been collected in near shore areas. This data will be used to train analysis to produce Satellite Derived Bathymetry provided by CHS's Remote Sensing Centre of Expertise. Community data collection has also occurred near Arviat, Nu in collaboration with M2Ocean who provided data collection equipment and data processing under contract to the community.

The focus on these, and other Indigenous community projects, continues to be in a robust data lifecycle, and ensuring that those who contribute to the data collection are able to easily the data, often through non-traditional products (i.e not an official CHS chart).

10.6 Satellite Derived Bathymetry and Shoreline/Hazard Detection: SDB is one of the technique CHS has been assessing and applying to fill some of those gaps in data. Remote sensing data (optical and radar) has been used to extract accurate shorelines, assess low and high water line, and also to assess presence nearshore shoals that may be detected. CHS will continue to assess and apply these techniques as we work to expand ENC coverage as well as consider the development of other tools and products to communicate risk to navigators.



SDB analysis example for chart 7185



Shoreline and shoal detection-Chart 7665 Franklin and Darnley Bay

11. Conclusions

The past year has seen the CHS undertake a significant amount of work to advance hydrographic services in the waters of the Canadian Arctic. 2022 saw the end of the 5 year Ocean Protection Plan (OPP) project which accelerated CHS' work in the Arctic. We are very pleased to share that the Government of Canada has renewed the OPP, with targeted funding that will see the CHS receive \$84M over the next 9 years. The funding will be focused on modern Arctic Hydrography, as well as the development of a new community hydrography program that will benefit coastal communities across Canada. For more details please refer to: <u>New Oceans Protection Plan funding will bolster Canadian Coast Guard and Canadian Hydrographic Service in the Arctic - Canada.ca</u>

Annex 1

Survey Vessels Additional Information:

M/V Polar Prince



Locations: Hudson Bay and James Bay

Dates: July 30 to August 20

Description: Bathymetric data is to be collected to detect potential hazards to navigation and for incorporation in nautical products to enhance navigation safety. Data will be collected with M/V *Polar Prince* using multi-beam echo sounder (MBES). Data will be collected opportunistically by CHS as the ship transits during its pre-assigned duties.

Objectives:

- Collect multi-beam bathymetry to improve navigational charts and products, as per CHS mandate;
- Detect, classify and report subsurface navigational hazards;
- Collect acoustic data to support seabed analysis for navigation and scientific research;
- To contribute to the survey and charting of the Proposed Low Impact Shipping Corridors in the Canadian Arctic;

CCGS Sir Wilfrid Laurier



Locations: Western Arctic – Dolphin and Union Strait to Western King William Island, James Ross Strait and Bellot Strait

Dates: Legs 2/3 – August 16 to September 27, 2022

Description: Bathymetric data is to be collected to detect potential hazards to navigation and for incorporation in nautical products to enhance navigation safety. Data will be collected with CCGS *Sir Wilfrid Laurier* using a multi-beam echo sounder (MBES). Data will be collected opportunistically by CHS as the ship transits during its pre-assigned duties.

Objectives:

- Collect multi-beam bathymetry to improve navigational charts and products, as per CHS mandate;
- Detect, classify and report subsurface navigational hazards;

- Collect acoustic data to support seabed analysis for navigation and scientific research;
- To contribute to the survey and charting of the Proposed Low Impact Shipping Corridors in the Canadian Arctic;
- Assist CCG in their execution of Arctic duties, including the positioning and surveying of navigational aids.

CCGS Louis S. St. Laurent



Locations: Leg 1 & Leg 3 Baffin Basin and Davis Strait

Dates: Leg 1 – Aug 18 to September 15, 2022 Leg 3 – October 13 to November 4, 2022 **Description:** Bathymetric data is to be collected to detect potential hazards to navigation and for incorporation in nautical products to enhance navigation safety. Data will be collected with CCGS *Louis S St Laurent* using a multi-beam echo sounder (MBES). Data will be collected opportunistically by CHS as the ship transits during its pre-assigned duties.

Objectives:

- Collect multi-beam bathymetry to improve navigational charts and products, as per CHS mandate;
- Detect, classify and report subsurface navigational hazards;
- Collect acoustic data to support seabed analysis for navigation and scientific research;
- To contribute toward the 100% navigational charting of identified Low Impact Shipping Corridors in the Canadian Arctic;

CCGS Des Groseilliers



Locations: Lancaster Sound to Victoria Strait, Foxe basin to Hudson Strait **Dates:** Leg 3 – September 7 to October 20, 2022

Description: Bathymetric data is to be collected to detect potential hazards to navigation and for incorporation in nautical products to enhance navigation safety. Data will be collected with CCGS *Des Groseilliers* using a multi-beam echo sounder (MBES). Data will be collected opportunistically by CHS as the ship transits during its pre-assigned duties. In addition, primary tasking time will be utilized in priority areas within Low Impact Shipping Corridors, and other areas of interest.

A portable multibeam system will be deployed on the CCGS Des Groseilliers' barge when feasible. This will enable high resolution data to be collected within shallower, harder to reach areas.

Objectives:

- Collect multi-beam bathymetry to improve navigational charts and products, as per CHS mandate;
- Detect, classify and report subsurface navigational hazards;
- Collect acoustic data to support seabed analysis for navigation and scientific research;
- Assist CCG in their execution of Arctic duties, as required.

CCGS Henry Larsen



Locations: 2 Legs – Frobisher Bay, Salluit, Hudson Strait, Coral Harbour (Salliq), Nias Island & Naujaat. Dates: Leg 1 – August 24 to October 6, 2022 Leg 2 – October 6 to November 20 2022 Description of Sonar Operations: Bathymetric data is to be collected to detect potential hazards to navigation and for incorporation in nautical products to enhance navigation safety. Data will be collected with CCGS *Henry Larsen* and launch *Mercator* using a multi-beam echo sounder (MBES). While the majority of the data will be collected opportunistically by CHS as the ship transits during its preassigned duties – there will be some allotment of primary mapping at targeted areas – specifically the new port facility at Iqaluit and the approaches to Naujaat.

Description of Tidal Operations: Recovery of a subsea tide gauge currently deployed at Coral Harbour (1Yr) and the deployment of a new subsea tide gauge at Nias Island (1yr). The tide gauge deployment/recovery operations will require shore parties (2-3 persons via boat or helicopter) to visit existing survey control benchmarks over a period of two days at each site to measure stages of the tide. The shore observations are used to calibrate the subsea instruments. Any wildlife sightings (either aquatic or on land) will result in the shore visit being cancelled. These visits would be used to improve the tidal measurements in the area, which, in turn will improve the accuracy of the bathymetry collected. Work will consist of setting up GPS antennas and performing water level checks. A GPS antenna will be on location for 24 hours. At Nias Island, in addition to the subsea gauge, a small passive atmospheric pressure sensor will remain on shore securely hidden from wildlife interference for a period of 1yr and will be recovered along with the subsea gauge in 2023.

Annex 2

ENC Releases SINCE November 2021, the CHS has released 12 new ENCs and 18 new edition ENCs.

ENC #	ENC Title	New Edition (NE) or New ENC (N)
CA273257	Prince Regent Inlet	NE
CA273258	Committee Bay - Pelly Bay	NE
CA273274	Gulf of Boothia and Committee Bay	NE
CA273313	Lancaster Sound Eastern Approaches	NE
CA273329	M'Clintock Channel, Larsen Sound and Franklin Strait	NE
CA273422	Bylot Island and Adjacent Channels	NE
CA273511	Clyde Inlet to Cape Jameson	NE
CA273513	Cape Jameson to Cape Fanshawe	N
CA273527	Barrow Strait and Viscount Melville Sound	N
CA273551	Bylot Island and Adjacent Channels	N
CA273552	Bylot Island and Adjacent Channels	N
CA372007	Ikahuak (Sachs Harbour)	N
CA373262	Victoria Strait	NE
CA373482	Strathcona Sound and/et Adams Sound	N
CA373501	Beacon Island à/to Qikirtaaluk Islands	N
CA373504	Pelly Bay	N
CA373507	Parry Bay to/au Navy Channel	NE
CA373508	Navy Channel to/à Fury and Hecla Strait	NE
CA373509	Fury and Hecla Strait	NE
CA373512	Clyde Inlet	NE
CA373533	Tanquary Fjord	N
CA373534	Glacier Fjord	N
CA473365	Broughton Island and Approaches/et les Approches	NE
CA473467	Kangiqlugaapik (Erik Harbour)	NE
CA473505	Korvigdjuak Island Channels	N
CA473525	Sullukuluk (Albert Harbour)	NE
CA572008	Jenny Lind	N
CA573366	Broughton Harbour and Landing Beach	NE
CA573400	Hall Beach	NE
CA573421	Durban Harbour	NE

Arctic area ENC's planned for 2022-2023

ENC #	ENC Title	New Edition (NE) or
		New ENC (N)
CA473413	Hopes Advance Bay	N
CA473521	Wakeham Bay, Fisher Bay and Approaches	N
CA573522	Diana Bay (Partie Sud/Southern Portion)	N
CA373482	Strathcona and/et Adams Sound	N

CA273527	Barrow Strait and Viscount Melville Sound	Ν		
CA373262	Victoria Strait	NE		
New ENCs on eastern shore of Hudson Bay, created on S100 grid				

Paper Chart Releases since November 2021. CHS has released 22 new edition paper charts.

Chart #	Chart Title
5374	Beacon Island à/to Qikirtaaluk Islands
5375	Qikirtaaluk Islands à/to Point Qirniraujaq
6423	Askew Islands to/à Bryan Island Kilometre 1180 / Kilometre 1240
6424	Bryan Island to/à Travaillant River Kilometre 1240 / Kilomètre 1325
6425	Travaillant River to/à Adam Cabin Creek Kilometre 1325 / Kilomètre 1400
6427	Point Separation to/au Aklavik Channel Kilometre 1480 / Kilomètre 1540
7121	Cape Mills to/à Cape Rammelsberg
7122	Culbertson Island to/à Koojesse Inlet
7125	Pike-Resor Channel
7126	Culbertson Island to/à Frobisher's Farthest
7127	Approaches to/ Approches à Koojesse Inlet
7195	Kangok Fiord and Approaches/et les Approches
7485	Parry Bay to/au Navy Channel
7486	Navy Channel to/à Fury and Hecla Strait
7487	Fury and Hecla Strait
7565	Clyde Inlet to/à Cape Jameson
7566	Cape Jameson to/au Cape Fanshawe
7621	Amundsen Gulf
7621	Sachs Harbour
7750	Approaches to/Approches à Cambridge Bay
7778	Coronation Gulf Eastern Portion/Partie Est
7782	Queen Maud Gulf Western Portion/Partie Ouest

Arctic area Paper Charts planned for 2022-2023.

Chart #	Chart Title	New Edition (NE)
		or New Chart (N)
5349	Hopes Advance Bay	NE
5390	Wakeham Bay, Fisher Bay and Approaches	NE
5464	Diana Bay (Partie Sud/Southern Portion)	NE