



ARHC National Report of Canada

November 2021



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 10th ARHC Conference and Arctic Virtual Science Forum on August 11, 2020.

1. Hydrographic Office

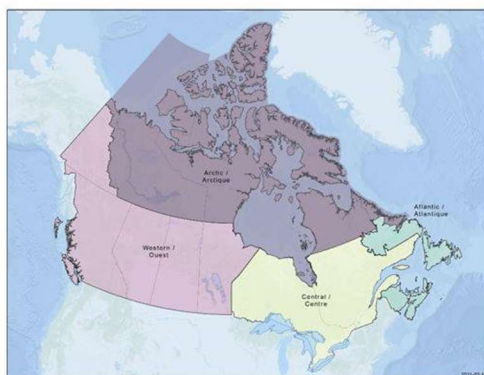
The Canadian Hydrographic Service (CHS) maintains the responsibility of conducting hydrographic surveys and charting throughout some of the most intricate set of waterways in the world. With roughly one third of Canadian territory under water, with a large proportion in the Arctic, the CHS faces challenges unlike many other Hydrographic Offices. With the Onset of climate change, and an ever shortening ice season, the CHS has looked to bolster its efforts as it continues to improve on its work in the Arctic.

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.

With an emphasis on safety and a maintained vision of being a world class authority and supplier of hydrographic geospatial information, the Canadian Hydrographic Service continues in its efforts to produce navigational charts (both paper and ENC), publications and data driven services.

In order to better accommodate the Arctic region, on March 5, 2021, the Minister of Fisheries, Oceans (DFO) and the Canadian Coast Guard (CCG), the Honorable Bernadette Jordan announced the geographical boundaries for the DFO and CCG Arctic regions. The boundaries are inclusive of the Yukon North Slope, Northwest Territories, Nunavut, Nunavik, Nunatsiavut, Hudson Bay, James Bay and all of Inuit Nunangat.

CCG Arctic Region



DFO Arctic Region



The new Arctic regions consist of the Yukon North Slope, Northwest Territories, Nunavut, Nunavik, Nunatsiavut, Hudson Bay, and James Bay. This boundary includes the Inuit Nunangat (the Inuit regions of Canada).

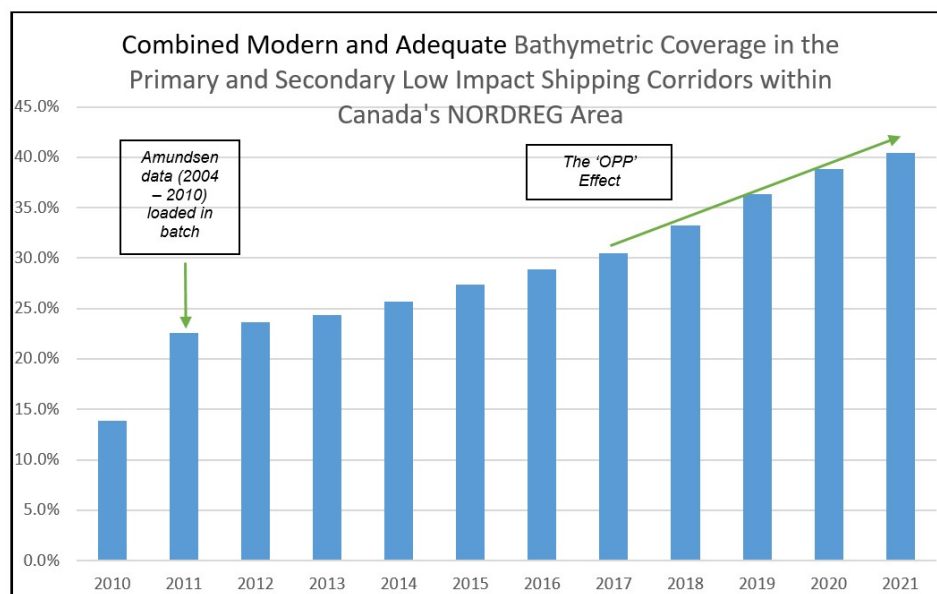
After four years of funding from the Ocean Protection Plan, the Canadian Hydrographic Service has seen an improvement in navigation products and services for mariners in important coastal areas, including the Arctic and high traffic commercial ports and waterways. This includes increasing modern hydrographic coverage in the Arctic primary and secondary low impact shipping corridors to approximately 40% (as of March 2021). Note that data collected this past Arctic field season is still being processed, and our metrics will be updated in March 2022.

The Canadian Hydrographic Service underwent significant changes in its daily operations in response to the COVID-19 challenge. Deemed critical, essential field work was accomplished with the implementation of strict protocols to ensure the safety and well-being of staff. A work from home model was successfully implemented in order to keep all other aspects of the organization in motion, and service delivery has been largely via remote work for the past 19 months.

The Canadian Hydrographic Service has taken many steps in order to bring about positive changes in its workforce and culture. This has involved *Change Management*, bringing about new mindsets and behaviors, resiliency, employee engagement and empowerment of leaders at all levels. A *Training Plan*, for new skillsets at the individual and team levels, and new capabilities at the organization level. A *Human Resources Plan*, for new strategies to attract, retain and develop top talent and human expertise. Most importantly, *Gender and Inclusion*, to promote a better understanding of the diverse human experiences, foster respect, provide space spaces and limit biases. And finally, *Culture and Innovation*, which allows for flexible governance, lean business processes and an agile way of working to adapt quickly to changing demands.

2. Surveys

2.1 From 2017 – 2021 (4 year span) coverage went from 30.5% to 40.4%. This is double the amount of coverage that was obtained from 2011 to 2016



2.2 The 2021 Arctic operational survey program saw CHS plan and execute an ambitious program. Funding from the Ocean Projection Plan (OPP) enabled a plan to have CHS Hydrographers onboard 5 Canadian Coast Guard (CCG) icebreakers along with request for proposal to private industry for data collection in 3 priority area of the Arctic. Data collection is prioritized to both increase coverage of the Primary and Secondary Shipping Corridors, to meet marine transport and community requirements, and finally to support chart production.

As of November 2021, Arctic survey operations are wrapping up for the year. CHS able to operate from 3 of the planned CCG icebreakers, as 2 were dealing with mechanical issues and delays with refit. Cooperation with CCG was excellent, and CHS was able to secure additional primary tasking on both the CCGS Des Groseilliers and the CCGS Louis St. Laurent. Nearly **32,000 Km²** of modern multi-beam data was collected from CCG vessels this year.

2.3 CHS contracted data collection in priority regions of Hudson Strait, Ungava Bay, and Hudson Bay in 2021 (see images to follow). These contracts were tendered via public request for proposals, and IIC Technologies was the winning bidder. The contract surveys collected ~1900 Km² of modern multi-beam data was collected (project still underway mid-November 2021), and for the first time included the operational use of an Uncrewed Survey Vessel (USV) working together with a vessel “mother ship” that also contributed to data collection. They contractor worked for over 90 days in the Eastern Arctic, with data collection continuing into the middle of November. The polygons completed increase coverage of the primary and secondary shipping corridors, and in some cases include “off-ramps” from main corridor into one or more of the Arctic communities which were surveyed in previous years.

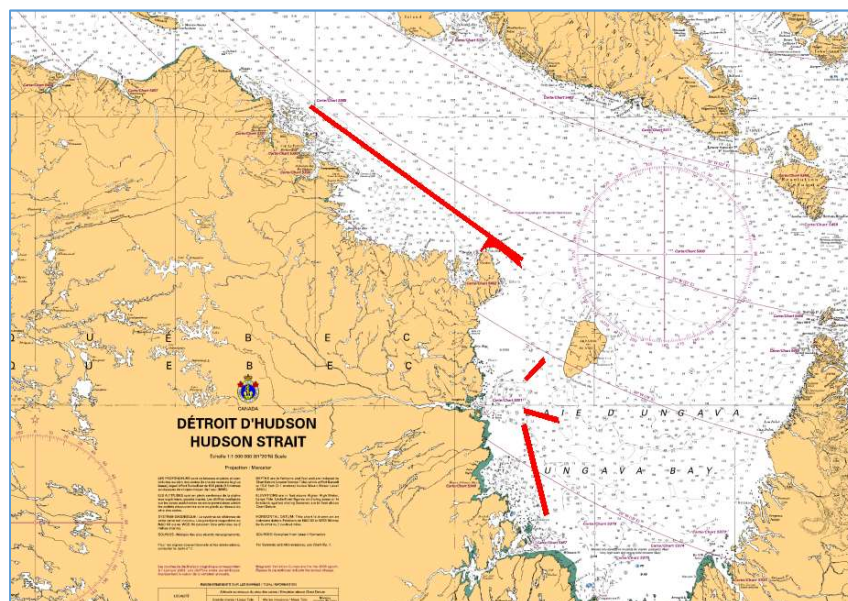


Figure 1: Chart section of Ungava Bay

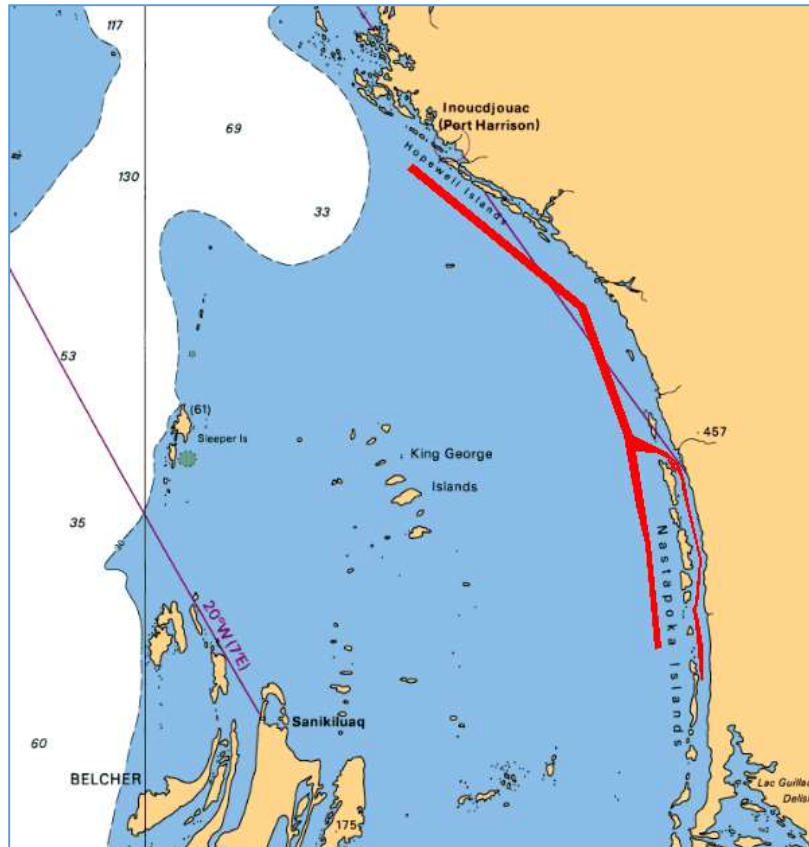


Figure 2: Chart section of Hudson Bay

2.4 Modern (CATZOC A1 and A2) survey coverage in Canada’s overall Northern Canada Vessel Traffic Services Zone (NORDREG) area in the Canadian Arctic has increased from 9.3% in March 2020 to 9.7% in March 2021. Data collected in 2021 is being processed, and these metrics will be updated in March of 2022.

2.5 Modern (CATZOC A1 and A2) and Adequate (CATZOC B) survey coverage in Canada’s primary and secondary potential Low Impact Shipping Corridors (LISC) in the Canadian Arctic has increased from 38.8% in March 2020 to 40.4% in March 2021. Data collected in 2021 is being processed, and these metrics will be updated in March of 2022.

2.6 The CHS has been moving towards making the survey and charting plan public. The CHS has developed an online tracking application entitled *the CHS Operational Plan (CHS-OP) application*. The public will soon be able to track the status of the CHS’s updates from planning to dissemination of navigational products to keep better informed.

2.7 Figure 3. is a CHS Survey plan showcasing a national two year plan (2021 – 2022). Figures 4, 5 and 6 further illustrate that plan. There are currently 25 planned surveys in the Arctic region (however, this number is subject to change).

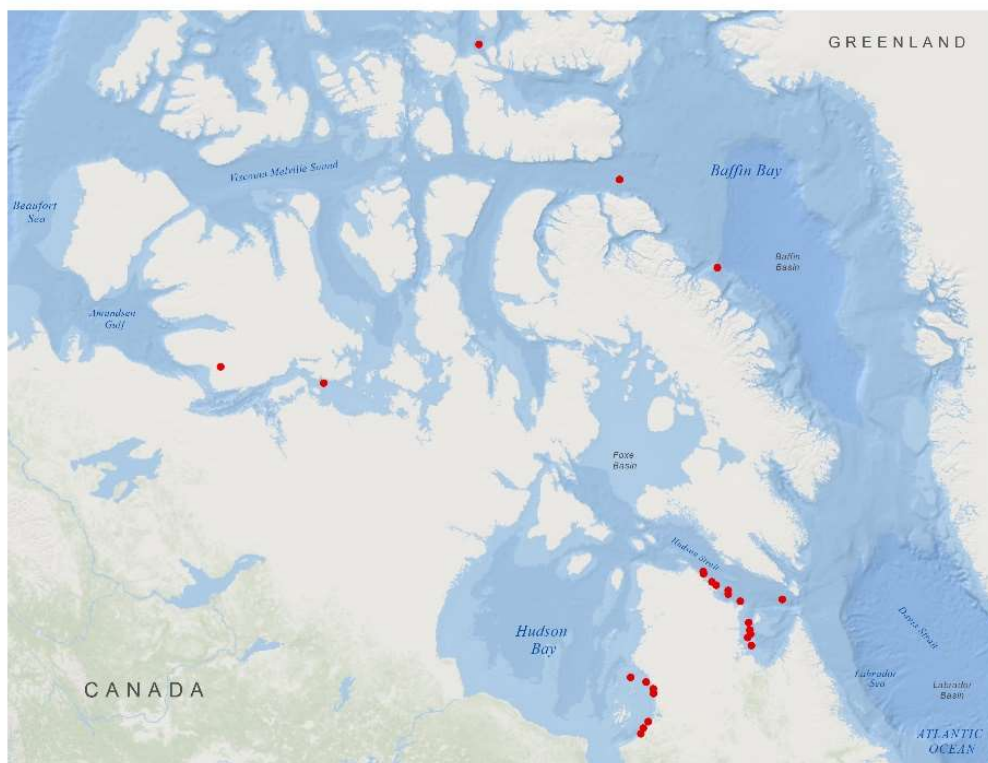


Figure 3: CHS Survey plan point locations showcasing a national two year plan (2021 – 2022)



Figure 4: CHS Survey plan for Western Arctic (2021-2022)



Figure 5: CHS Survey plan for High Arctic (2021-2022)



Figure 6: CHS Survey plan for East Arctic (2021-2022)

Survey Vessels

There are currently five multi-beam sonar equipped icebreakers at the disposal of the CHS, the CCGS Amundsen, CCGS Des Groseilliers, CCGS Louis S. St. Laurent, CCGS Pierre Radisson, and the CCGS Sir Wilfred Laurier and the. A sixth icebreaker, the CCGS Henry Larsen will also soon be equipped.



3. New Charts and Updates

3.1 So far this year (2021), CHS have released 9 new ENC's in the Arctic and 3 new edition ENC's. Our strategy in the Arctic continues to be filling ENC "gaps" on the primary and secondary shipping corridors, with the goal of enabling modern navigation in these priority areas. We continue to apply a phased approach which is to first product an ENC using the legacy Paper Chart boundaries and scale, digitizing legacy data sources, applying modern shoreline (from remote sensing). With this Phase 1 ENC in place, new data can more easily be incorporated, and CHS is preparing to move to grid based ENC's (south of 76 N), providing better scales, and incorporating all available bathymetric data. It is important to note that while CHS's Ontario & Prairie and Arctic Region has the lead for Arctic Hydrography, staff from all of our regional offices in Pacific, Quebec, and Atlantic Regions are all supporting Arctic data integration and chart production efforts as part of the OPP program.

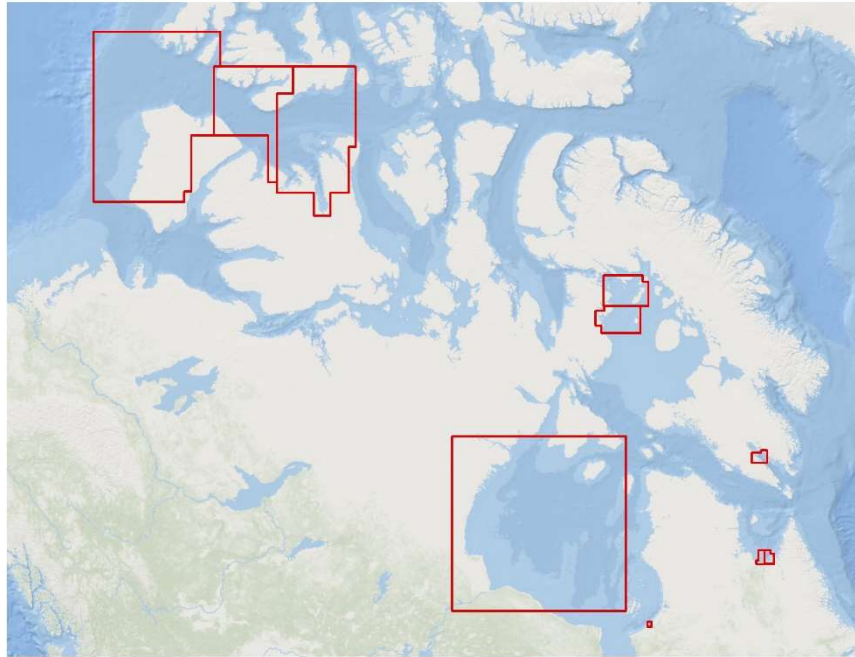


Figure 7: New ENC's released since September 1, 2020.

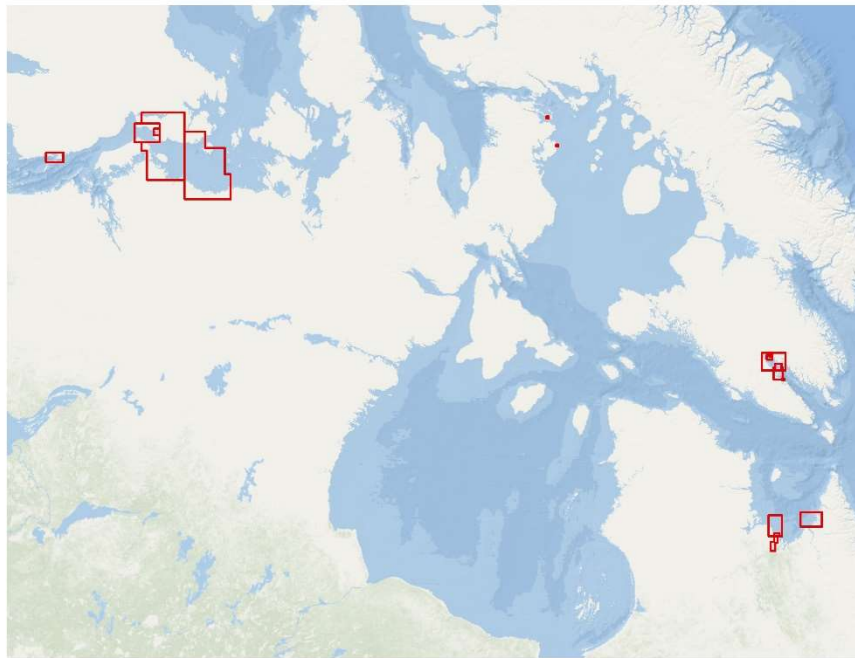


Figure 8: New Edition ENC's released since September 1, 2020.

3.2 Canada's Transportation Safety Board Releases Report on Grounding of Akademik Ioffe. Following the grounding of the Akademik Ioffe in the Canadian Arctic on August 24th, 2018 near Kugaaruk, NU. The Transportation Safety Board (TSB) completed an investigation, and released their final report and recommendations earlier this year. The report provided a summary of the factors which contributed to the grounding, along with a number of recommendations. The recommendations include

a number of proposed actions to improve the safety and risk mitigation measures in place for passenger vessels travelling in the Canadian Arctic. The report is available online at: <https://www.bst-tsb.gc.ca/eng/enquetes-investigations/marine/2018/m18c0225/m18c0225.html>

4. Technology and Innovation

4.1 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.

4.2 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 a project is presently underway in the fall of 2021 to expand bathymetric data collection while also carrying other scientific payloads. IIC Technologies has also partnered with XOcean to deploy that USV in the Eastern Arctic, supporting 24/7 data collection (see details in section 3 of this report).

4.3 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, 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 Ivuglvik, 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).

5. Maritime Safety Information (MSI)

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

<https://www.ccg-gcc.gc.ca/mcts-sctm/index-eng.html>

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:

<http://nis.ccg-gcc.gc.ca/>

6. C-55 for INT Region – N; Country – Canada – Arctic Region

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

7. Capacity Building

7.1 Due to the COVID-19 pandemic, the CHS has unfortunately had to put on hold all exchanges with the NOAA Office of Coast Survey (OCS)

7.2 As the lead for the development and implementation of marine spatial data infrastructure (MSDI) for the Department of Fisheries and Oceans, CHS continues to conduct education and outreach both within the Department and to other agencies. The rollout of the MSDI was a significant milestone that has been recognized across the Government of Canada (GoC) as improving and accelerating science data management, discovery, and access.

7.3 The CHS has taken many active steps towards upholding and strengthening respect in the workplace. This includes celebrating diversity and inclusiveness as well as shedding light on LHBTQ2+ issues by raising awareness. The CHS has recently established a National Network for Women at CHS.

7.4 Upon a successful application from the IHO Secretariat, Canada is supporting the IHO Empowering Women in Hydrography Project whose objectives are to encourage diversity, equality, and wider access to leadership roles in the hydrographic community. Canada has committed approximately 100K CAD per year for three years to the project and encourages other Member States to consider contributing, as well.

7.5 The Multi-Disciplinary Hydrographer training has recently undergone changes as a result of a national team (Training and Human Resources Working Group) evaluation of the Acquisition and Transformation courses. The CHS will look to contract out the entirety of the courses, and make them modular. One subject matter expert will be hired nationally for each of the Acquisition and Transformation courses with the intent of re-writing the course materials and to “train the trainers” (essentially train the contractors). The intent was to have a few sessions of each course, however due to the pandemic only one offering occurred. The courses were adjusted to be delivered virtually. A deck on lessons learned after the virtual offerings is in the works.

8. Oceanographic Activities

8.1 The CHS recently released NONNA-10. The CHS NONNA-10 is a consolidation of digital bathymetric sources managed by the CHS. With its 10-metre resolution data, the CHS NONNA-10 products are a ten-fold improvement over its data predecessor, CHS NONNA-100. Beyond the higher resolution, a new web based portal to host the data has been developed to facilitate finding datasets for non-navigational needs. The NONNA portal and data service includes access to Canadian bathymetric data in the Arctic. The application can be accessed at: <https://data.chs-shc.ca/login>. The NONNA service is providing access to CHS's bathymetric data holdings, helping to meet the growing demands and interest in this data uses other than marine navigation.

8.2 CHS Integrated Water Level System (IWLS):

CHS released a new Integrated Water Level System (IWLS) as part of the transformation and modernization initiative. The new system integrated roughly 15 legacy applications and has allowed CHS to provide a single robust source for tide and water level information, including access to real-time and temporary tide gauges in Arctic waters. It looks to help CHS by consolidating maintenance and support, and improving performance. It is available to the public via the progressive web application for mobile, the newly released tides website, and via the new REST API for applications (machine-to-machine communication). For more information please visit www.tides.gc.ca.

8.3 Surface Current Data Service in S111 standard format

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. 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>

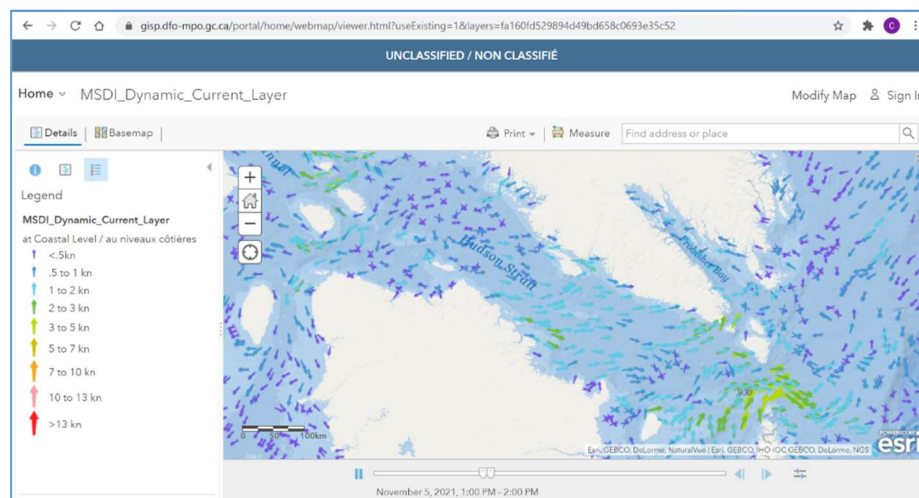


Figure 9: Screen shot of surface current application hosted on the MSDI