A Proposal to Unify the IHO/OHI Publication C-55 Methodology for the United States and Canada's Hydrographic Surveying Adequacy Metrics

Background

International Hydrographic Organization (IHO) Publication C-55 provides the current global coverage of surveys and nautical charts to governments and international organizations to assist in identifying survey and chart inadequacies, foster collaboration between coastal regions, and contribute to the safety of navigation and protection of the marine environment.

The IHO assesses global survey and nautical chart coverage through a questionnaire that is provided to all coastal regions on a regular basis. This questionnaire is subdivided into three sections: (1) Hydrographic Surveying, (2) Nautical Charting, and (3) Provision of Maritime Safety Information. The hydrographic surveying portion of IHO Publication C-55 requests each coastal region characterize their survey data as (A) Adequately Surveyed, (B) Requires Resurvey at a larger scale or to modern standards, or (C) Not Systematically Surveyed within and outside the 200 m contour. This classification is completed using either the category zone of confidence (CATZOC) associated with each survey or an alternate systematic approach.

This proposal addresses the recommendations put forth by IHO's Capacity Building Sub-Committee.[1] The recommendations include:

a. Improving the consistency and documentation of C-55 hydrographic surveying adequacy assessments across member states and
b. Refining the purpose of the C-55 hydrographic surveying adequacy assessment to respond to safety of navigation concerns as well as reflect the state of global bathymetric knowledge in coastal State waters.

This proposal responds to these recommendations by proposing a consistent approach from which the United States and Canada will respond to the 2024 C-55 hydrographic survey adequacy assessment and recommends next steps to refine the use of the C-55 survey adequacy assessment for safety of navigation and global bathymetric knowledge purposes.

Proposal to Improve the Consistency and Documentation of C-55 Hydrographic Surveying Adequacy Assessments within US and Canadian waters for IHO/OHI Publication C-55

The United States and Canada propose a standardized, geographic information systems (GIS)-based approach for calculating the status of hydrographic surveying for the IHO/OHI Publication C-55. Until 2024, the United States and Canada followed different methodologies to update the hydrographic surveying adequacy portion of the IHO/OHI C-55 publication. The United States used water depth and survey year to assess the adequacy of surveys within each of the United States' international charting regions (A, B, K, L, and N). Conversely, Canada used CATZOC and water depth to inform the analysis within their international charting regions (A and N).

Moving forward, the US and Canada propose a collaboratively defined methodology that incorporates water depth, CATZOC, and recent survey footprints to assess the adequacy of surveys within each of the United States and Canada's international charting regions. The proposed methodology is summarized in Table 1. For the United States, it should be noted that surveys conducted since 2017 will also be considered "Adequately surveyed" to ensure all source data are appropriately represented in the analysis.

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[1] United Kingdom and France. (2016). Paper for Consideration by CBSC16 - Proposal for Review of C-55: Status of Hydrographic Surveying and Nautical Charting Worldwide. (CBSC16-08.3B) Available from: https://iho.int/uploads/user/Inter-Regional%20Coordination/CBSC/MISC/CBSC16-08.3B-Review_of_C-55_UK_FR.pdf

Table 1. 2024 hydrographic surveying C-55 methodology.

Classification	Description	CATZOC	Survey Footprint
Depth ≤ 200m			
A	Adequately surveyed	A1 A2 B where depth > 50m	Within collective hydrographic survey footprint **Surveys conducted after 2017*
B	Re-surveyed required	B where depth ≤ 50m C D U	Within collective hydrographic survey footprint
C	Never systematically surveyed	-	Outside collective hydrographic survey footprint
Depth > 200m			
A	Adequately surveyed	(A1) (A2) B C	Within collective hydrographic survey footprint **Surveys conducted after 2017*
B	Re-surveyed required	D U	Within collective hydrographic survey footprint
C	Never systematically surveyed	-	Outside collective hydrographic survey footprint

** For United States waters only*

Proposal to Refine the Purpose of the C-55 Hydrographic Surveying Adequacy Assessment to Respond to Safety of Navigation Concerns

Areas of navigational concern will be categorized as areas of navigational significance, based on the guidance from IHO's Capacity Building Sub-Committee.[2] Using results from the 2024 C-55 hydrographic survey adequacy assessment, the United States and Canada will further refine results to define areas of navigational concern within each country's Exclusive Economic Zone.

Canada will define areas of navigational concern using a specialized tool called the Canadian Hydrographic Service (CHS) Priority Planning Tool (CPPT)[3]. Given the size and complexity of Canada's waterways, especially those located in the remote and harsh Arctic environment, the Canadian Hydrographic Service (CHS) has engineered the CPPT to be able to focus on key navigational areas to ensure safe passage.

The CPPT is designed to identify and prioritize data gaps in crucial navigational areas. It uses a variety of navigational data to define and prioritize these gaps. The main geospatial layers used in the CPPT include water depth, adequate Category of Zone of Confidence (CATZOC) survey holdings, derived shipping corridors, seafloor complexity, port locations, anchorage areas, drift models, wind speed, ice concentration, risk of grounding, risk of collision, and tidal information. The main source of

[2] United Kingdom and France. (2016). Paper for Consideration by CBSC16 - Proposal for Review of C-55: Status of Hydrographic Surveying and Nautical Charting Worldwide. (CBSC16-08.3B) Available from: https://iho.int/uploads/user/Inter-Regional%20Coordination/CBSC/MISC/CBSC16-08.3B-Review_of_C-55_UK_FR.pdf

[3] Chénier, R.; Abado, L.; Martin, H. CHS Priority Planning Tool (CPPT)—A GIS Model for Defining Hydrographic Survey and Charting Priorities. ISPRS Int. J. Geo-Inf. 2018, 7, 240. https://doi.org/10.3390/ijgi7070240

information used to identify the CHS shipping corridors is derived from the automatic identification system (AIS)[4]

Using the CPPT to identify and target key navigational areas and analyze data gaps ensures the safety of navigation within Canada's waterways. Beyond the use of CPPT, CHS is also actively engaging in consultations with clients, communities, and other government groups to capture additional factors not currently incorporated into Canadian GIS. These factors may include additional environmentally and culturally sensitive areas and priorities or concerns driven by private and community feedback.

The United States will define areas of navigational concern using a hydrographic survey risk model, called the Hydrographic Health Model. Coast Survey developed the Hydrographic Health Model to prioritize areas for hydrographic survey based on the quality of hydrographic data needed to support safe passage, the quality of hydrographic survey data currently available, and the risk to surface navigation. The quality of hydrographic survey data needed to support surface navigation, referred to as the Desired Survey Score, will be used to identify areas of navigational concern from which the C-55 Hydrographic Surveying Adequacy Assessment can be refined to respond to safety of navigation concerns.

The Desired Survey Score uses a combination of under keel clearance, seafloor complexity, vessel traffic density, and water depth to estimate the quality of survey data required to support safe navigation. As such, areas of high navigational concern are characterized by locations where vessels are transiting close to the seafloor (i.e., low under keel clearance). To assess the status of hydrographic surveying adequacy within areas of navigational concern, the United States will complete the C-55 analysis for all US waters where vessels are transiting within 20 m of the seafloor or navigating in water depths less than 20 m. Similar to Canada, this designated region of navigational concern, as defined by the Desired Survey Score, will be further refined based on feedback from the local maritime community. This feedback will be used to address current and emerging needs not captured by the data-driven approach of the Desired Survey Score.

With the proposed approach, the hydrographic surveying adequacy analysis to support the IHO/OHI C-55 Publication will be consistently applied by all Member States within INT Region A and address the recommendations put forward by IHO's Capacity Building Sub-Committee regarding employing the C-55 hydrographic surveying adequacy assessment within regions of navigation concern.

[4] Chénier, R. ; Abado, L.; Sabourin, O.; Tardif, L. Northern marine transportation corridors: creation and analysis of northern marine traffic routes in Canadian waters. Trans. GIS, 21 (2017), pp. 1085-1097, 10.1111/tgis.12295. https://onlinelibrary.wiley.com/doi/full/10.1111/tgis.12295