

ANNEX C – IHO S-100 Sea Trial Report (ENGLISH)

NAME OF S-100 SEA TRIAL AREA

St. Lawrence River, Québec, Canada

TITLE – Trial name and primary focus

2025 Canada S-100 International Sea Trials

Primary focus: Operational readiness and interoperability of S-100 Phase 1 products and services in a live subscription environment

ORGANISATION(S)

Canadian Hydrographic Service (CHS), Fisheries and Oceans Canada

Canadian Coast Guard (CCG)

PRIMAR (Norwegian Hydrographic Service / Electronic Chart Centre)

Teledyne CARIS

Supporting contributors: CIOOS and participating system manufacturers

CONTACT DETAILS

Organization: Canadian Hydrographic Service

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PERIOD

Start date: 1 June 2025

End date: 30 November 2025

Dedicated web site and LinkedIn channel

A dedicated web site (www.canadas100.ca) for the Canada S-100 Sea Trials was set up, allowing the Team to organize and share valuable information about the trials. The web site proved to be a popular feature and was updated regularly, as new data or software offers became available. For example, after the first two months of the Trials, the web site had registered over 1300 visits.

A LinkedIn channel (<https://www.linkedin.com/groups/10012018/>) was open to allow everyone to share their discoveries and inquiries about the Trials and S-100 in general. That discussion group registered 850 active members (89 posts and 163 306 views) by the end

of the Trials. This communication channel was popular and used to remind participants about various Trials' highlights.

SCENARIO / USER STORY / USE CASE DESCRIPTION

The Canadian S-100 Sea Trials were conducted as open, public, nonscripted trials, allowing participants to freely experiment with S-100 data using their own systems, personnel and operational contexts.

The core user story focused on mariners, pilots, hydrographic offices, system manufacturers and regulators accessing and using multiple S-100 Phase 1 products concurrently through a live operational subscription service to support navigation, planning and decisionmaking.

Use cases included multilayer navigation, route monitoring, underkeel clearance assessment, dynamic navigational warnings, and evaluation of S-100 Part 15 implementation.

OBJECTIVES OF THE TRIAL

- Assess readiness for delivery of S-100 Phase 1 products (January 2026)
- Validate live S-100 data distribution via subscription services
- Evaluate interoperability and system behaviour
- Identify gaps in standards, data, systems and training
- Collect structured user and producer feedback

S-100 PRODUCTS AND SERVICES TESTED

S-101 Electronic Navigational Charts

S-102 Bathymetric Surface

S-104 Water Level Information

S-111 Surface Currents

S-124 Navigational Warnings

S-128 Catalogue of Navigational Products

S-129 Under Keel Clearance Management

More than 2100 S-100 Phase 1 data tiles were provided.

The Static Dataset

A ZIP file including several S-100 products (and the S-57 ENCs) was made available early on, before the Trials official start date. These S-100 datasets were our best effort at the time and early adopters quickly returned feedback, allowing us to fix several issues.

For those “beta” systems that came with default or hardwired User Permits, the subscription to the live subscription was not possible. The backup solution was to try the S-100 sample package, including **all** Phase 1 products, prepared by the Canadian Sea Trials team.

The datasets available in the sample kit covered a small geographic area, located near the Port of Québec. They included one or several tiles for the following products:

- S-57 Ed. 3.1 Electronic Navigational Chart
- S-101 Ed. 2.0 Electronic Navigational Chart
- S-102 Ed. 3.0 Bathymetric Surface
- S-104 Ed. 2.0 Water Level information for Surface Navigation
- S-111 Ed. 2.0 Surface Currents
- S-124 Ed. 2.0 Navigational Warnings
- S-128 Ed. 2.0 Catalogue of Nautical Products
- S-129 Ed. 2.0 Under Keel Clearance Management
- Sample route plans in RTZ format

The sample kit was refreshed regularly, as new products became available or as updated products were ready to be tested.

The latest package (ZIP file) of the sample S-100 datasets remains available to everyone and can be obtained here:

<https://charts.gc.ca/data-gestion/s-100/products-services-produits-eng.html>

SYSTEMS USED FOR THE TRIAL

ECDIS, ECS and PPU systems from multiple OEMs

- SEAiq
- Furuno
- Sperry Marine
- OSI

- Hexagon
- GMT Cybernetics Co (KHOA)
- ESRI
- Applied Research International
- Trelleborg
- CAIM ECDIS900
- Transas
- GeoNavigation Technologies
- CVoyager

PRIMAR subscription and update services

All the Canadian Sea Trials area data (S-57, S-101, S-102, S-104 and S-111) were made available in the PRIMAR Product Catalogue. The S-57, S-101 and S-102 were made available on regular basis to PRIMAR. The S-104 and S-111 datasets were delivered to PRIMAR 4 times a day. All S-102, S-104 and S-111 datasets were instantly released in the PRIMAR database after they passed the upload checks.

<https://primar.ecc.no/primar/portal/cc/mapClient.jsf>

All data (S-57, S-101, S-102, S-104 and S-111) used in the Canadian Sea Trials are now available to buy through the PRIMAR Product Catalogue

Canadian Coast Guard S-100 Testing Tool (CSTT)

Teledyne CARIS Cloud

SUMMARY OF OUTCOMES

Principal results

- First live operational S-100 subscription service demonstrated
- Confirmed readiness of CHS, PRIMAR and CCG for Phase 1 delivery
- Successful ingestion of S-100 data by multiple systems

Challenges

- To keep the CATALOG.XML updated and correct
- To make sure that the PRIMAR database is always equal to the CHS Database for the S-57, S-101, S-102, S-104 and S-111 products.
- Incomplete support for S-100 Part 15
- Variable OEM readiness
- Performance and data-volume issues
- Limited availability of complete S-100 viewers

Positive effects

- Improved producer–user collaboration
- Early identification of specification issues
- Increased S-100 awareness and maturity

RECOMMENDATIONS FOR STANDARDS IMPROVEMENT

- Clarify S-100 framework concepts
- Improve S101 metadata requirements
- Address ambiguities in S102 / S104 / S111
- Advance S129 toward dynamic UKCM
- Strengthen guidance for S-100 Part 15 implementation

Product	Summary	Impact	Corrected	Solution
User Systems	Missing or invalid User Permits; Not fully compliant with S-100 Part 15	Data subscription could not be activated	ongoing	Some systems did implement UP's (S-100 Part 15) during the trials
S-102 S-104 S-111	Mis-named CATALOG.XML	Product could not open	Yes	Renamed the file(s); improved packaging methods

S-104 S-111 S-128	Inverted coordinates in CATALOG.XML or GML-based products; CRS (assumed vs specified)	Data showing at wrong location	yes	Fixed in production system
S-101	Dataset title missing in the product metadata	No information about general location	No	gridded ENC's don't have curated extents. Obsolete concept for gridded data?
S-101	DatasetDiscovery Metadata missing the mandatory field "ProducerCode"	Validation fails	ongoing	
S-101	Exchange set catalogue dataCoverage defined with MultiSurface polygon	Validation fails	ongoing	
S-101	ProductSpecification.version is missing, Product.Specification.name is incorrect	Only some cells affected	ongoing	Being repaired at the packaging stage
S-101	Vertical Datum vs Sounding Datum; can the actual difference (in height) be	Wish for additional data		

	included in the ENC?			
S-101	Vertical clearance information: better explanations would be useful for cables or other cases. For paper charts, more details are provided in the CHS' Sailing Directions.	Uncertainty about "posted" clearances and built-in safety margins	ongoing	Discussions ongoing at the producing agency. Is there a need to add further clarifications in the product specifications? il y a une incohérence de codification entre la carte papier (S-4) et la ENC (S-57). Nous sommes à discuter de ceci à l'international au ENCWG et au NCWG à l'OHI pour rectifier et harmoniser ces 2 types de codifications.
S-101	Long bridge spans could be split so that each span would show its own vertical clearance.	Enhanced product		Being assessed at the producing agency. May require detailed structure plans from the responsible authority.
S-101	Will the tiling scheme adopted for S-101 ENCs	Price per tile or pricing per area		ENCs to be sold in bundles, so the overall prices should not change. S-100

	mean extra costs for the users?			will bring added value.
S-102	holes or gaps in the seafloor coverage; areas with sparse coverage.	Display clutter, artefacts / slow performance when safety contours are generated	no	Implement “Areas of useable coverage” metaobjects? Based on what criteria? Subject already raised with S-102 PT 22–26 septembre 2025, Denpasar, Bali
S-102	Coverage going beyond expected navigational areas	Extra data represents a burden on the navigation system	no	What defines “expected navigational areas”?
S-102	Validation of CATALOG.XML	PRIMAR could not import datasets	ongoing	More analysis is needed before a permanent solution is applied.
S-102	Exchange set catalogue missing mandatory fields	Validation fails	ongoing	Awaiting reply from S-102 product owner
S-102	Wish to see timestamp values for depths	Current info is about when the S-102 tile was produced	no	S-102 specs already allow for this. Production procedures & tools are under review to include that information. (QualityOfBathymetryCoverage)

S-57 / S-101 / S-102	New survey data not showing on CHS products	Outdated products	Ongoing	Data exchange protocols being improved between Ports and CHS
S-104	Management of “dry” tiles	Varying number of tiles can confuse the subscription system	yes	ALL S-104 tiles are generated, and the “dry” tiles are now marked as “No_Data “. The number of S-104 tiles remains the same from one run to the next.
S-104	Some misunderstandings on S-104 contents and how they should be used. Ex: forecast vs predictions, computed uncertainty, confidence level, etc.	Ex: Some users were expecting real-time “at-the-ship” water levels. Some confusion over how the data should be used.		Need better product descriptions and explain the use/purpose of water level forecasts. S-104 are designed to “fit” the S-102 , sharing the same water column. Note that S-102 L5 can be used with S-104 L6
S-104		In addition to the above, some users have inquired about getting 30 days' predictions for planning purposes.	Ongoing	Ongoing R&D at the producing agency.
S-104	How should the system apply water level forecasts.	Users expected the system to apply local water level adjustment. Instead, the same		ECDIS/PPU functionality to be enhanced? User settings?

		value, applied “at-the-ship”, was used over the entire display area.		
S-104 / S-111	No archiving of S-104 / S-111 data.	Can this represent a liability?	no	
S-104 / S-111	Can the data be prepared for 15 min intervals?	Improving the data offer.		Ongoing R&D at the producing agency.
S-104 / S-111	inconsistency in the definitions of the bounding boxes vs domain extents between the S-104, S-111 Ed. 2.0.0 and the S-100 Ed. 5.2 specs	Confusion	yes	R. Myltankar to submit an S-100 proposal to clarify that the b.box is not needed at the instance level if it is exactly the same as the root level b.box.
S-104 / S-111	How to manage tiles that are updated at a high frequency?	Producers are struggling with S-100 concepts of newDataset or newEdition, and the unclear specifications for dateTime information.	yes	CHS tilesnames do not include a timestamp. The entire sets of S-111 and S-104 tiles are refreshed with each production batch. The PRIMAR service only offers the latest. How to deal with the S-111 spec, which suggests the use of the dateTime string in the filename? Is it mandatory?

				Bring the question to the WG How is an ECDIS dealing with high rate of data refresh? How does it know which file to use? I have asked the question to Jordan Pratt.
S-104 / S-111	Can CHS share its expertise?	Inquiries made to CHS	yes	Technical exchanges are taking place.
S-104 / S-111	tag “<S100XC:navigationPurpose>” missing	Validation fail	yes	Fixed in production.
S-104 / S-111	<Comment> blocks were set with the string “None” - making them unnecessary.	Irrelevant info displayed to the user.	yes	Fixed in production.
S-111	S-111 2.0 products are not yet supported in some systems	Cannot load data	ongoing	OEMs implementing support for newer spec.
S-111	Extending geographic coverage for S-111	Areas lacking coverage	ongoing	Focus set on the creation of seamless, multi resolution S-111.

S-111	some systems cannot handle overlapping tiles	Information showing on incorrect geographic location	yes	Fixed in production; no more overlaps
S-111	Larger ships would benefit from 3D models, i.e. 3D profiling along a planned route.	Enhanced data offer		Ongoing R&D at producing agency. New version of the product specifications required?
S-124	Any statistics on the use of the S-124 http / SECOM service?	Improvements required?	no	Request will not be addressed.
S-124	Exchange set catalogue; DatasetDiscovery Metadata specificUsage field	Specs are not clear	ongoing	set to “Navigational Warning Service” as a string, until further clarifications are issued.
S-124	Missing references to paper charts	Is the reference really useful?	no	Relevance to navigation is to be proven. No action is required at this time.
S-128	Incorrect CSR reference	Some systems expect EPSG:4326	ongoing	
S-128 S-102	Exchange set catalogue dataCoverage defined with MultiSurface polygon	Validation fails	ongoing	
S-129	Underkeel clearance values			

	are still based on fixed tables (2013); when can we expect something more dynamic, vessel-specific?			
PRIMAR	Wish for regional data splits in the subscription service, ignoring products outside the planned route	Downloading large number of tiles can be a problem	no	Requirements to be gathered as more users deal with a live S-100 data service
System	Wish to control what products to download from subscription service	Downloading large number of tiles can be a problem		Can the system “predict” what products will be needed, and then take the steps to acquire/download them?
GML / XML	Adding line feeds and basic indentation would greatly help working with these files when investigating issues.	Files difficult to read	ongoing	In evaluation by production teams

RECOMMENDATIONS FOR DATA IMPROVEMENT INCLUDING DISTRIBUTION MECHANISMS

- Improve metadata consistency
- Enhance coverage strategies
- Support flexible subscription and download models
- Improve traceability from source to product

Digital Signatures

In March 2025, before the Trials' launch date, we had to admit that CHS' production units would not have official S-100 Ed. 5.2 (Part 15) digital signatures ready in time for the Trials. The data PRIMAR receives from CHS now includes some form of dummy digital signature and that is being addressed. A proper implementation of compliant digital signatures is being designed by the IT team of the Department of Fisheries and Oceans (Canada).

PRIMAR policy is to always add their signature to all datasets they distribute. The PRIMAR signatures and protection scheme will be compliant with IHO S-100 Ed. 5.2 Part 15. If a producer attempts to sign their own datasets, PRIMAR will always perform the following tests when the datasets are uploaded into the PRIMAR database:

- Verify that the producer is using S-100 Ed. 5.2 protection scheme (not possible to combine S-63/S-100 Ed. 4 dataset signatures into S-100 Ed. 5.2 compliant exchange set)
- Authenticate producer certificate is issued by IHO and with valid duration
- Authenticate producer dataset signature

If this authentication fails, a warning message will be displayed and the signatures will be disregarded and not stored with the datasets. These datasets will, upon export from PRIMAR, only have the PRIMAR signature.

Alternatively, if PRIMAR successfully authenticates the producer dataset signatures during upload, PRIMAR will store the producer signature with the dataset in their database. When these datasets are exported, they will include both the producer and PRIMAR signatures.

Adding a PRIMAR signature to the dataset does NOT in any way change the dataset. It is just a small piece of xml amended to the existing metadata encoded in the CATALOG.XML file.

With regards to the Canadian Coast Guard's production lines, the S-124 service deployed during the Sea Trials complies with S-100 Ed. 5.2 Part 15, while the S-129 service is still under development.

User Permits

Many participants in the S-100 sea trials were not familiar with the concepts tied to user permits and data subscription services. Several users who took advantage of the free SEAiq license offer had no prior exposure to such a system and how to set it up with the PRIMAR service.

This aspect needs to be part of user training when getting acquainted with a new ECDIS, PPU or ECS system. We noticed that each system has its own user interface (GUI), and the terminology used is not yet standardized across OEMs.

Several OEM's did not have the proper permit implementation in place in time for the Trials. For those systems that had a generic, factory hardwired key, the PRIMAR license could not be generated as that same key was in fact duplicated over several systems.

The project highlighted the need to communicate more clearly that both S-63 and S-100 User Permits are required to support the complete chart delivery value chain.

RECOMMENDATIONS FOR SYSTEM IMPROVEMENT

- Support all Phase 1 products in a single system
- Improve performance for large, dynamic datasets
- Enhance user control over downloads
- Reduce cognitive load through better filtering and portrayal

RECOMMENDATIONS FOR EDUCATION AND TRAINING

- Targeted S-100 training for users
- Focus on forecastbased product interpretation
- Provide operational case studies
- Integrate S-100 into navigation training programs

BENEFITS / CHALLENGES OF ADOPTING S-100

Benefits:

- Integrated data
- Enhanced awareness
- Future-ready navigation

Challenges:

- System readiness
- Training
- Data volume
- Clearer communication and guidance around encryption and User Permit handling

NEXT STEPS

Canada moves to operational deployment of S-100 Phase 1 products in 2026, expand coverage and engagement with OEMs and partners.

OTHER INFORMATION

Testimonies

British Columbia Ferry Services Inc.

"Thanks for the follow up. We could not use our SPERRY ECDIS as it does not yet have the S-100 capabilities. That is the reason we accepted the generous offer from SEAiQ to virtually borrow their software and run a version on a laptop here at the SIM Center.

The area that could use some better clarification and instructions is how to in fact to participate in real time remotely. We were limited to loading and viewing a static set of S-100 on the SEAiQ software.

As this was all very static no transcripts were imagined or attempted.

Respectfully,

Capt. Malcolm Rodger"

Manager, Simulation Training Center

Nautical Standards Group, Fleet Operations

British Columbia Ferry Services Inc.

Kyle R. Ward

NOAA Office of Coast Survey/Navigation Services Division

"The adoption of S-100 products is a paradigm shift for navigation, providing a wealth of integrated, intuitive, and actionable data. The ability to seamlessly combine high-resolution bathymetry (S-102) with dynamic water levels (S-104) and currents (S-111) allows for vastly enhanced decision-making in real-time. This enables safer anchorage selection, more accurate transit planning, and lays the groundwork for future "smart" route optimization systems.

The S-100 data suite is powerful, but the very richness introduces a significant risk of increased cognitive load and operator distraction. This is a potential safety concern, especially on a single-person bridge where managing complex new data layers could detract from core watchstanding duties. Conversely, on a multi-person bridge, this same data is invaluable for real-time, collaborative decision-making. In either case, to manage this new environment training is essential. This training should help mariners understand how to use their technology to access this information quickly and conceptually understand how the information will affect their transit.

Kyle R. Ward

NOAA Office of Coast Survey/Navigation Services Division”

WRSystems GeoNavigation Technologies (GNT)

“Our team at WR Systems GeoNavigation Technologies (GNT) Division, thanks you for pushing forward and executing the Canadian S-100 Sea Trials. Our team has been engaged in S-100 development as subject matter experts in support of U.S. NIWC and NGA for over 14 years. Attached is what we have found with respect to the products that were provided for these trials. In addition, I have provided a summary of what we have done in support of this effort.

Thank you for leading the way in support of the new S-100 hydrographic products, as well as, managing and executing these Sea Trials. It has been a great exercise for our team and hopefully our feedback provides additional value to your efforts.

Edward P Weaver, D.Eng. | PMP, CSDP

WRSystems GeoNavigation Technologies (GNT)

Carl Sarrazin, Corporation des Pilotes du Bas St-Laurent

« The S-100 products are improving the efficiency of navigation, by allowing the pilot to have better knowledge of his surroundings during the pilot’s training period. But it is critical to use those with caution as a lot of wrong input and settings can bring the data to an unsafe place. Especially if the training to use them is deficient. »

Simon Cooke, Technical Manager, Sperry Marine

“Sperry Marine intended to fully participate in the Canada S-100 Trials. Unfortunately, having followed IHO’s advice to use the generic M_ID and M_KEY codes provided in S-64 and S-164, these were rejected by Primar. We then applied to the IHO for a new S-100 M_ID and M_KEY, but these took several weeks to be issued and were only received today. As a result, we have not had time to assess the encrypted data. This week we learned of the availability of some unencrypted data but the S-101 cells failed to load. We are currently investigating the cause.

So, unfortunately, I have no material results to return.

Should the trials be extended or further opportunities arise, Sperry would be pleased to participate. “

Use Cases

The use cases in this section originate from either Production teams or Users. For those who intend to produce S-100 data, the information outlined here may assist in making proper plans.

Canadian Hydrographic Service (S-101 ENC Production Team)

Lessons learned so far :

Early feedback has shown a vertical datum inconsistency between S-101, S-102 and S-104 products. Vertical datums have been harmonized, with the boundary set to Trois-Rivières for the switch from LLWLT to LW.

S-101 Validation tools were not quite ready in time for the launch of the trials, subsequent software updates delivered validation for S-101 Ed. 2.0 ENC products.

There are still issues obtaining data from external sources. Communication protocols were established (or re-iterated) with those users inquiring why “their” data was not showing in the CHS’ S-100 products.

The pressure to release incoming data into ENC updates has not disappeared. This has been further demonstrated for the S-101 and S-102 product lines.

That highlights the need for resources dedicated to monitoring the data providers (regular and occasional). The Producing Agency must remain pro-active, keeping in touch with data suppliers, updating the exchange protocols as the needs arise.

There is an important distinction between the Product's release date and the age of the data in that same Product. Many S-102 users highlighted the importance of knowing “how old the data is” for the areas when sedimentation is a known issue.

Is the deployment of S-100 coming with better exchanges between users and the Producing Agency? Guidelines, report forms, and procedures may need to be refreshed to take S-100 into account, ensuring an efficient and reliable information transfer process.

The trials were an opportunity to establish good relationships with users (trusted users). Users felt they could approach CHS and be heard. Users realize their contributions have a real impact on the quality of the data and services.

A practical case took place in the Port of Québec – Sector Anse-au-Foulon :

Port authorities (after dredging operations took place) told the pilots that they could add an extra 50cm of draught to the ships' loads. That is more than what is shown on the published ENCs for the area. The Pilots have requested to see the S-102 and ENC products updated before they would proceed. Otherwise, this would require the publication of NAVWARNs, which is rather uncommon practice.

Canadian Coast Guard (S-129 Under Keel Clearance Management – Production Team)

Summary :

At the time of the Trials, the production of S-129 has not reached full operational status.

8 sample datasets (S-129 Ed. 5.2) have been prepared for distribution during the trials; those samples were created using the characteristics of a typical, commercial vessel often seen in that part of the St-Lawrence River.

Benefits of the Trials:

- The S-129 datasets produced by the CCG could be used on different platforms (ECDIS, PPU, GIS, etc.)
- We were able to use route plan data from RTZ, and S-421 datasets, as input for the generation of S-129 data.
- An efficient collaboration between several departments is paramount for a practical, realistic production of S-129.
- Several technical discussions with the “Corporation de pilotage du Saint-Laurent Central” have demonstrated the need for such exchanges (on S-129 and other topics) to continue on a regular basis, as S-100 is introduced and used in regular operations.
- The work on bringing S-129 to operational status in the St-Lawrence River is leading the CCG to put forward several improvement proposals to the IHO (and other related international committees). For example, the addition of passage (or restriction) windows and the use of PDF support files.

vi. Things to improve (prioritized) at the CCG:

- a.* Improve the management of the restriction periods, so that we can get complete coverage of the non-navigation windows over the next 24 hours.
- b.* Improve the PDF template, so that some errors are eliminated.
- c.* Improve the PDF template, so that it supports different transit speeds (Speed on water may vary between transit zones).
- d.* Merge some restriction areas.
- e.* Improve the RTZ files that are currently being prepared by the CCG (Improvement list was not provided).
- f.* Improve the application software so that the ship's destination is taken into account in the report.
- g.* Improve the GML encoding, to resolve an error related to the timestamp and filename.
- h.* Improve the links (traceability) between the input RTZ file(s) and the output S-129.
- i.* Consider the addition of “almost navigable” entities to the S-129 datasets.
- j.* Develop/Implement automation procedures for the packaging of S-129 products.

Suggested Improvements/Initiatives/Proposed experiments

- l.* Assess and document the accuracy of water level forecasts for the next 24 hours.
- m.* Assess and document how the sample S-129 datasets prepared for the trials compared to the observed water levels.
- n.* Build/deploy machine-to-machine datalinks that will work between land and ships.
- o.* Consider the use of uncertainty values from S-104 data in the S-129 computations.
- p.* Consider the use of the ship's SOG and S-111 for the S-129 computations.
- q.* Consider the use of S-111 when computing the ship's squat.

- r.* Consider the use of S-102 for the S-129 computations.
- s.* Consider the use of S-102 uncertainty values for the S-129 computations.
- t.* Consider the uncertainty in time during the computation of S-129.
- u.* Consider adding a sedimentation factor during S-129 computations.
- v.* Consider the use of real-time, dynamic squat during S-129 computations.

Identified Needs (Operational requirements not directly tied to S-129 production)

- Staff training in S-100, use of S-129 and UKCM concepts for the purpose of traffic management and safety.
- Build capacity to create S-129 datasets for a time in the past.
- Optimize the GUI for the S-129 web portal, adding a preview mode.
- Develop tools so that UKCM hypothesis can be easily altered for different ETA, speed, safety margins, squat conditions, water column conditions, etc.

Identified Needs (Operational requirements directly tied to S-129 production)

- Use of S-104 water levels and S-102 bathymetry for UKCM computations, taking into account the age of the data and its various uncertainty factors. Include local knowledge of sedimentation changes.
- Develop the functionality to predict the passage (ETA) of a ship at a given control point.
- Develop the tools to compute the squat values for a given ship in real-time, taking into account S-111 and SOW from AIS data.
- Add computation options for S-129 hypothesis for cases in later time windows.
- Develop the abilities to get UKCM updates in very short timelines (ex: the next 15 minutes).
- Build a better web GUI for the management of the ship's parameters, for planning purposes, or for the updating of the actual transit plan. Add functionality to query local environmental values.

- Incorporate data from the Collaborative Voyage Management System (CVMS) and the Vessel Traffic Management Information System (INNAV) during S-129 computations.

Canadian Coast Guard (S-124 Navigational Warnings - Production Team)

Versions of Production Specifications Used: Ed. 2.0.0, Ed. 1.5.0, Ed. 1.0.0

Summary:

As of June 1, 2025, our team was fully prepared to deliver S-124 Navigational Warning products for the Sea Trials. Our workflow begins with NAVWARN data sourced from the Canadian Coast Guard Navigational Warning Issuing Service (NIS). We process and validate the data in GML format according to the S-124 product specification, then package datasets into an S-100 exchange set using official IHO tools and internal scripts. Digital signatures and metadata are applied to ensure compliance and integrity. By June 1, multiple validated S-124 datasets were ready for integration and testing in the S-100 Testing Tool (STT)* and partner systems.

** The S-100 Testing Tool is an application developed by IIC Technologies under contract from the Canadian Coast Guard. This application was not meant for public distribution.*

Benefits from the Trials:

- The Trials confirmed that our S-124 datasets could be successfully ingested by multiple vendor systems.
- Identified and corrected gaps in metadata quality and completeness (e.g., issue dates, validity periods).
- Improved workflow for dynamic NAVWARN updates via SECOM, reducing latency.
- Gained clarity on portrayal requirements for S-124 features in ECDIS-like environments.
- Enhanced collaboration with other teams working on different S-100 products, and as a result, we agreed on the same Coordinate Reference System (CRS) and consistent encoding practices for data.
- Strengthened validation and error handling for request parameters.
- Improved developer documentation and user guidance for service adoption.

Outstanding Issues:

- Finalize portrayal rules for S-124 in operational systems.

- Improve automation for generating CATALOG.XML to reduce manual errors.
- Enhance validation tools for dynamic NAVWARN datasets.
- Continue staff training on S-100 standards and SECOM integration.
- Establish a robust distribution mechanism for real-time NAVWARN data beyond the test environment.
- Address metadata related to data quality in a consistent way.
- Stabilize production systems and reduce reliance on custom code.
- Secure a distributor offering a reliable download/payment platform.

Challenges

- Tight deadlines create pressure, particularly with dynamic data integration.
- Feedback was helpful but limited; additional guidance on portrayal and validation rules would have improved clarity.
- The heavy meeting schedule was challenging, though effective in aligning priorities and resolving technical issues.

Successes

Trials were successful, with excellent collaboration among CCG, CHS, vendors, and international partners.

Recommendations

- Increase the number of “on-the-water” testers to enhance real-world validation.
- Conduct additional trials as technology evolves on the OEM side and as new S-100 products are introduced.
- Include Arctic trials to address connectivity challenges for vessels operating in high latitudes.
- Provide more frequent and detailed feedback sessions to support implementation.
- Consider strategies to engage manufacturers and mariners who may not yet be ready to adopt these standards and services.