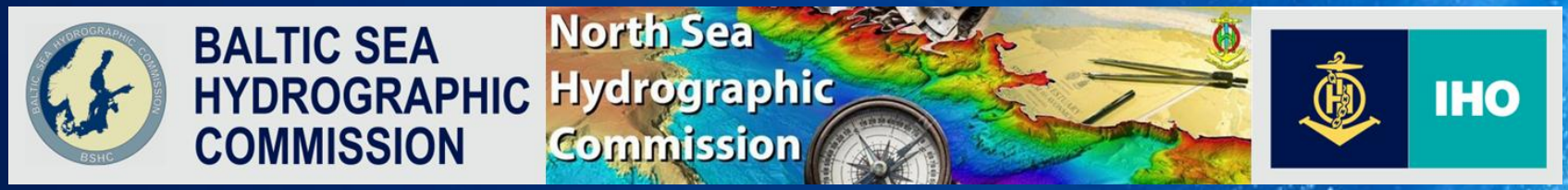


Regional product harmonisation guidelines for S-104 and S-111 in the Baltic Sea and North Sea

11th TWCWG Meeting
10-13 November 2026
Helsinki, Finland

Thomas Hammarklint

BSHC Chart Datum, Water level and Currents Working Group (CDWCWG)

"To implement a common reference system, S-104 and S-111 in the Baltic Sea"

Photo: Chart Datum, Water level and Currents Working Group 3rd meeting, 24-25 March 2026, Riga, Latvia

https://www.bshc.pro/working-groups/cdwcwg

Members of CDWCWG:

Denmark	Mr Kristian Villadsen Kristmar
Estonia	Mrs Gabriela Kotsulim
Finland	Mr Jyrki Mononen
Finland	Mrs Anni Jokiniemi
Germany	Dr Patrick Westfeld
Latvia	Mr Bruno Špēls
Lithuania	Mr Mindaugas Zakarauskas
Poland	Mr Bartosz Zembrzuski
Poland	Mrs Alicja Olszewska
Russia	Mr Leonid Shalnov
Russia	Dr Sergey V. Reshetniak
Sweden	Mr Thomas Hammarklint (Chair)
Sweden	Mr Henrik Tengbert

Observers and Experts:

Estonia	Prof. Artu Ellmann
Estonia	Dr Sander Varbla
Estonia	Dr Nicole Camille Delpeche-Ellmann
Estonia	Mr Aleksei Kupavõh
Finland	Dr Jani Särkkä
Finland	Dr Mirjam Bilker-Koivula
Finland	Dr Timo Saari
Germany	Dr Xaver Lange
Germany	Mr Thorben Knoop
Germany	Dr Gunter Liebsch
Germany	Dr Joachim Schwabe
Latvia	Mr Armands Murans
Latvia	Mr Krists Dzenis
Lithuania	Mr Emilis Tertelis
Lithuania	Mr Romuald Obuchovski
Norway	Mr Aksel Voldsund
Poland	Mr Krzysztof Pyrchla
Poland	Dr Monika Wilde-Piórko
Poland	Dr Malgorzata Szelachowska
Sweden	Dr Jonas Ågren
Sweden	Dr Per-Anders Olsson
Sweden	Mrs Anna Geidne
Sweden	Prof Luciana Fenoglio

SWEDISH MARITIME ADMINISTRATION

BALTIC SEA HYDROGRAPHIC COMMISSION IHO

NSHC Tidal Working Group (TWG)

"To provide technical advice and promote co-ordination on tidal issues"

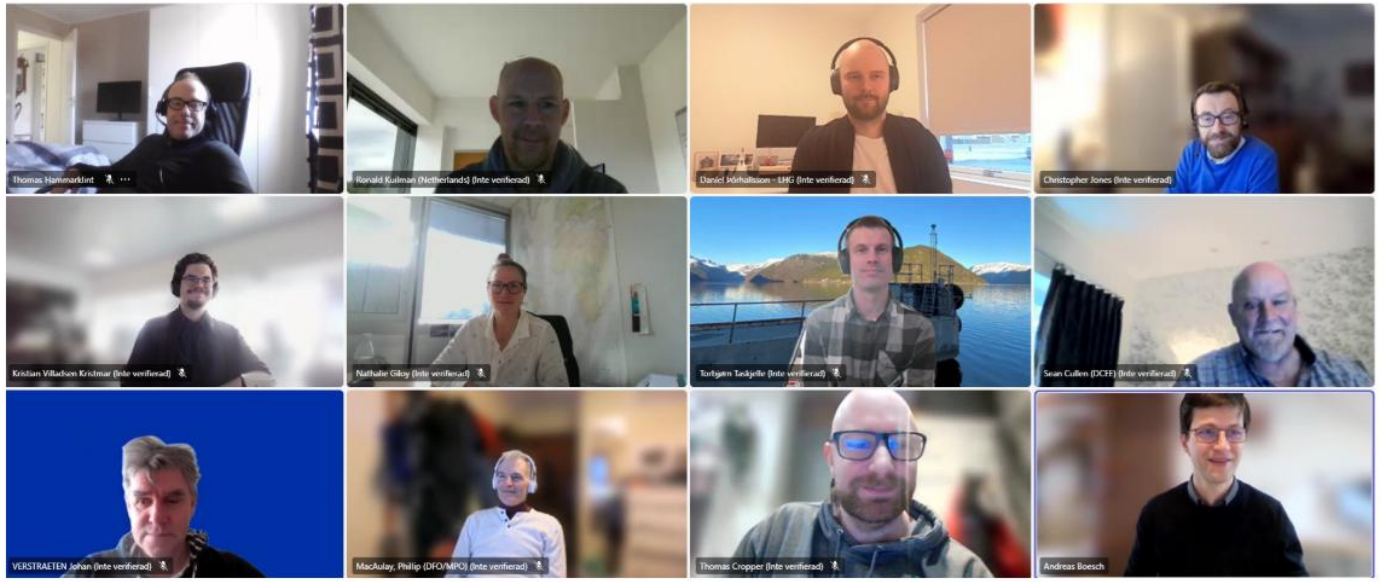


Photo: Tidal Working Group 28th meeting, 3 February 2026, VTC

Members of TWG:

Belgium	Mr Johan Verstraeten
Denmark	Mr Nicki Riber Andreasen
Denmark	Mr Kristian Villadsen Kristmar
France	Ms Nathalie Giloy
Germany	Mr Andreas Boesch (Chair)
Iceland	Mr Daníel Þórhallsson
Ireland	Mr Sean Cullen
Netherlands	Mr Ronald Kuilman
Norway	Mr Torbjørn Taskjelle
Sweden	Mr Thomas Hammarklint
United Kingdom	Mr Chris Jones

https://www.bshc.pro/working-groups/twg

SWEDISH MARITIME ADMINISTRATION

North Sea Hydrographic Commission

Baltic Sea Chart Datum 2000 (BSCD2000)

➢ **Registration:**
BSCD2000 have been registered as Vertical Datum number 44 in IHO Geospatial Information Registry.

➢ **Definition:**
The datum refers to each Baltic country´s realization of the European Vertical Reference System (EVRS) with land-uplift epoch 2000, which is connected to the Normaal Amsterdams Peil (NAP).

➢ **Justification:**
The Baltic Sea is an international shallow, non-tidal area in the northern part of Europe with dense traffic. IHO BSHC has approved the name and the adoption of the Baltic Sea Chart Datum 2000 (Specification).

➢ **Height systems used as national realization of BSCD2000 (EVRS-based):**

Sweden RH2000	Denmark DVR90	Germany DHHN2016
Poland PL-EVRF2007-NH	Lithuania LAS07	Latvia LAS2000,5
Estonia EH2000	Finland N2000	Norway NN2000

➢ **Chart datum name to be shown in paper charts:**
Mean Sea Level (Baltic Sea Chart Datum 2000$^{\text{national realization name}}$)
or
Mean Sea Level (Baltic Sea Chart Datum 2000)

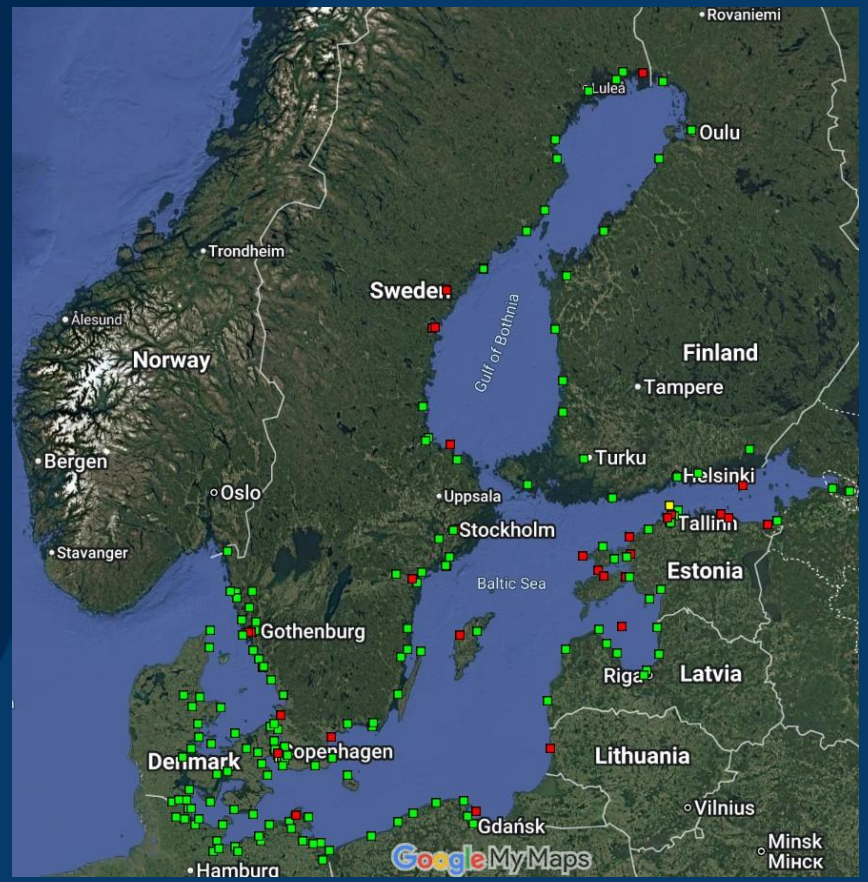


CHART DATUM: Mean Sea Level (Baltic Sea Chart Datum 2000$^{\text{RH2000}}$)
REFERENSNIVÅ: Medelvattenyta (Baltic Sea Chart Datum 2000$^{\text{RH2000}}$)
SYMBOLS and ABBREVIATIONS: see INT 1
BETECKNINGAR och FÖRKORTNINGAR: se KORT 1

Referensnivå

SWEDISH MARITIME ADMINISTRATION

CDWCWG´s Historical account

The key contexts surrounding the decisions taken by the BSHC, which were subsequently coordinated and implemented by the CDWCWG:

2005: BSHC recognized the issue of the incompatible chart datum and established the Chart Datum Working Group (CDWG), to develop a concept of a harmonised chart datum

2013: at BSHC18 (Minutes, Photo), the first decision to use a common reference level, based on European Vertical Reference System (EVRS), was taken. The decision was based on a survey sent to the member states, in which all unanimously agreed. For various reasons, the use of other reference levels, primarily for water levels, will continue to exist in parallel.

2014: a Memorandum of Understanding (MoU) was signed between BSHC and the Baltic Oceanographic Operational System (BOOS)

2015: at BSHC20 (Minutes, Photo), the member states agreed to use “Baltic Sea Chart Datum 2000”, as the name for the common reference system

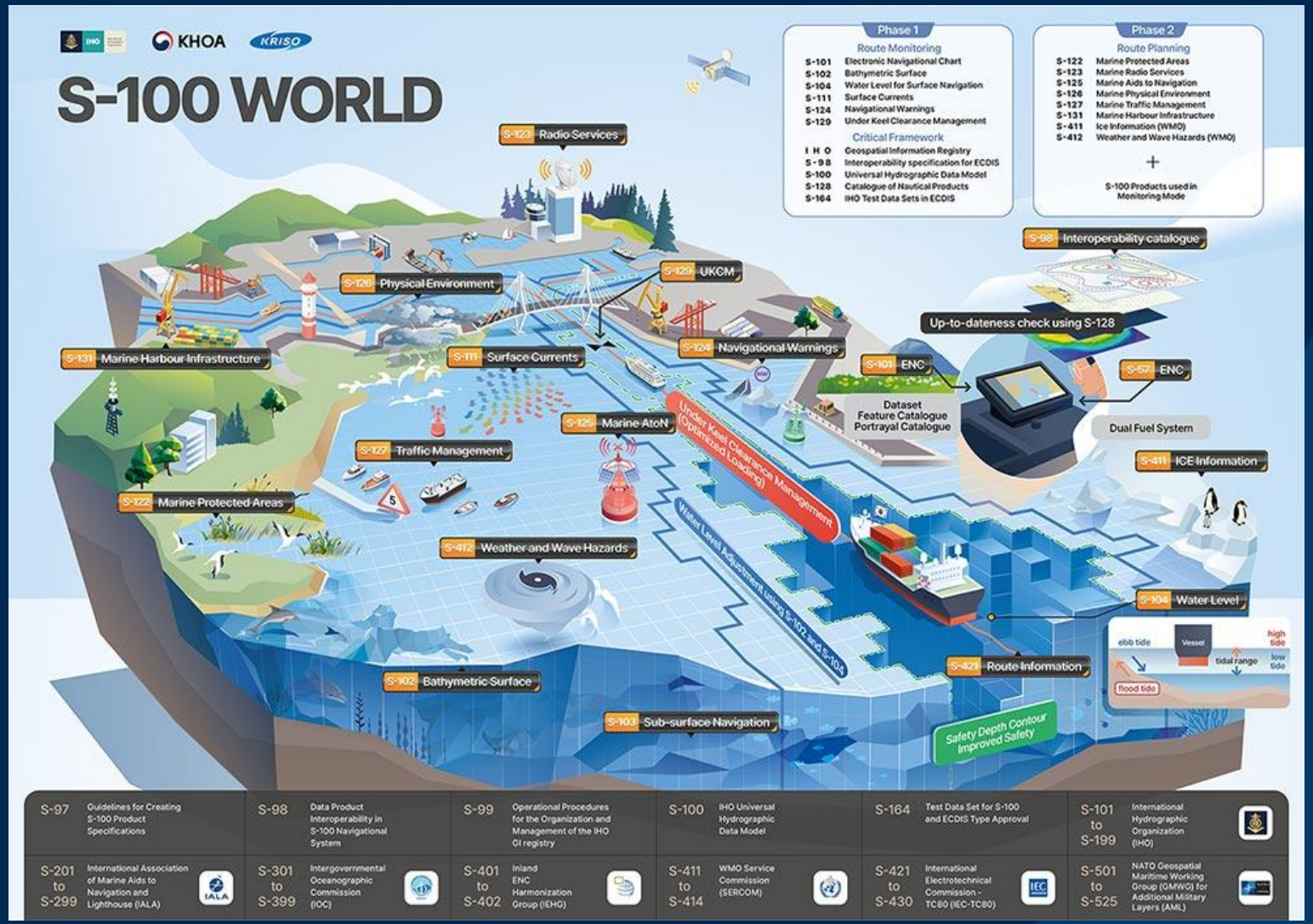
2018: at BSHC23 (Minutes, Photo), it was agreed to use the abbreviation “BSCD2000”. BSCD2000 was registered as Vertical Datum #44 in IHO GI Registry

2023: at BSHC28 (Minutes, Photo), the group was tasked to also coordinate the implementation of S-104 Water level information for surface navigation and S-111 Surface currents in the Baltic Sea and at the same time the group changed its name to Chart Datum, Water level and Currents Working Group (CDWCWG). In November 2023, the first version of the BSCD2000 height transformation grid (DOI) was computed and released to the public, as part of the CDWCWG´s activities.

2025: water level data from approximately 200 tide gauges accessible through the BOOS, Marine Copernicus, and EMODNET systems was converted to the BSCD2000 reference system. This demonstrates the strong collaboration with BOOS and other international organizations.

2026: at BSHC31 (Minutes, Photo), the Regional product harmonisation guidelines for S-104 and S-111 in the Baltic Sea were approved and adopted.

Future Maritime Services S-100



SWEDISH MARITIME ADMINISTRATION

Real Time Hydrographic and Environmental Information Service

Infrastructure

Co-financed by the Connecting Europe Facility of the European Union

Gravity surveys

Hydrographic surveys

Geoid model

Baltic Sea Chart Datum 2000

Bathymetry database

Oceanographic observations

Oceanographic model

COPERNICUS
MARINE ENVIRONMENT MONITORING SERVICE
Providing PRODUCTS and SERVICES for all marine applications

S-100 products

Bathymetry

S-101 ENC
S-102 Bathymetric Surface

Water Level

S-104 Water Level Information for Surface Navigation

Surface Currents

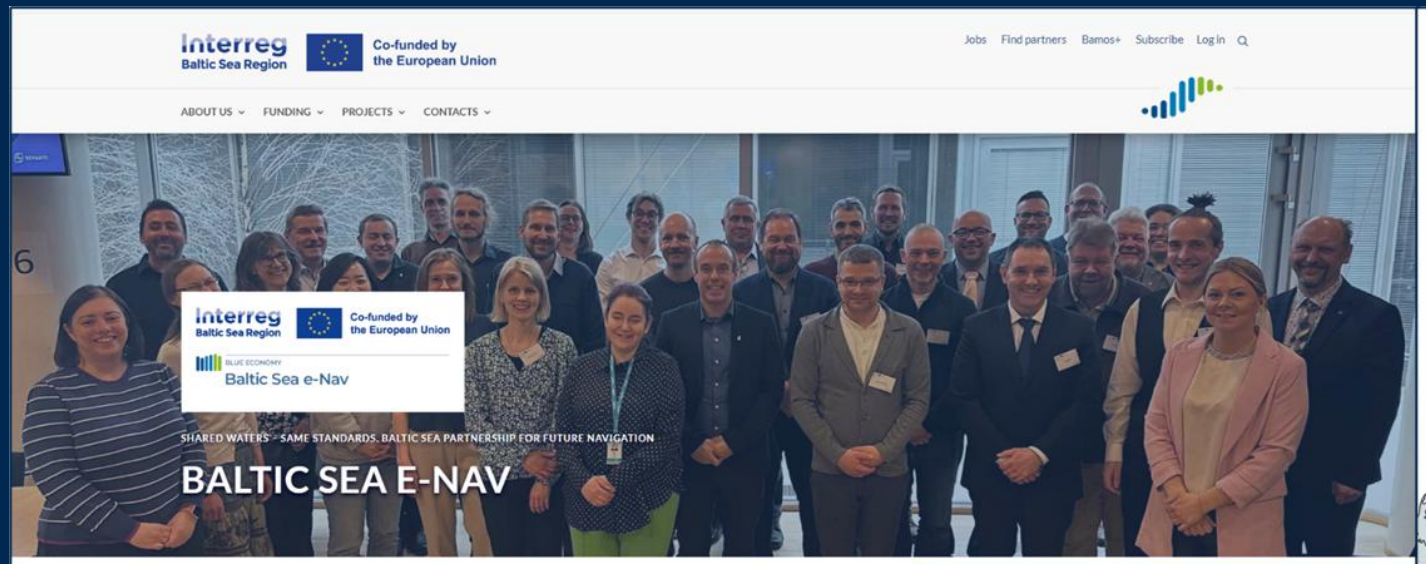
S-111 Surface Currents

Under Keel Clearance

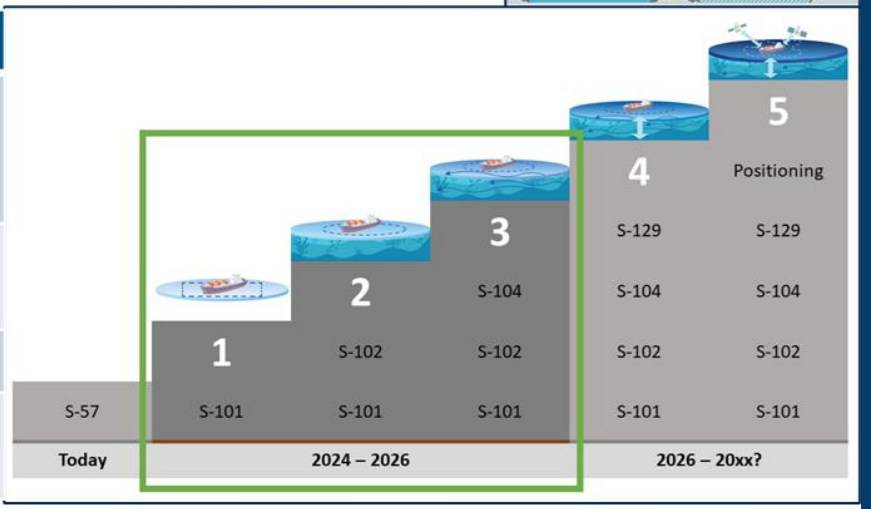
S-129 Under Keel Clearance Management (UKCM)

SWEDISH MARITIME ADMINISTRATION

Baltic Sea e-Nav Interreg project 2023-2026



Goal	Period
Develop production capabilities for S-101 ENC, S-102 bathymetry and to some extent S-104 water level	2023-2025
Establish **harmonization rules** for S-10x-products, under the BSHC umbrella	2024-2026
Test, evaluate and refine the S-10x products	2025
Commercial rollout for S-101 and S-102 in the Baltic Sea. S-104 in parts of FI.	2026



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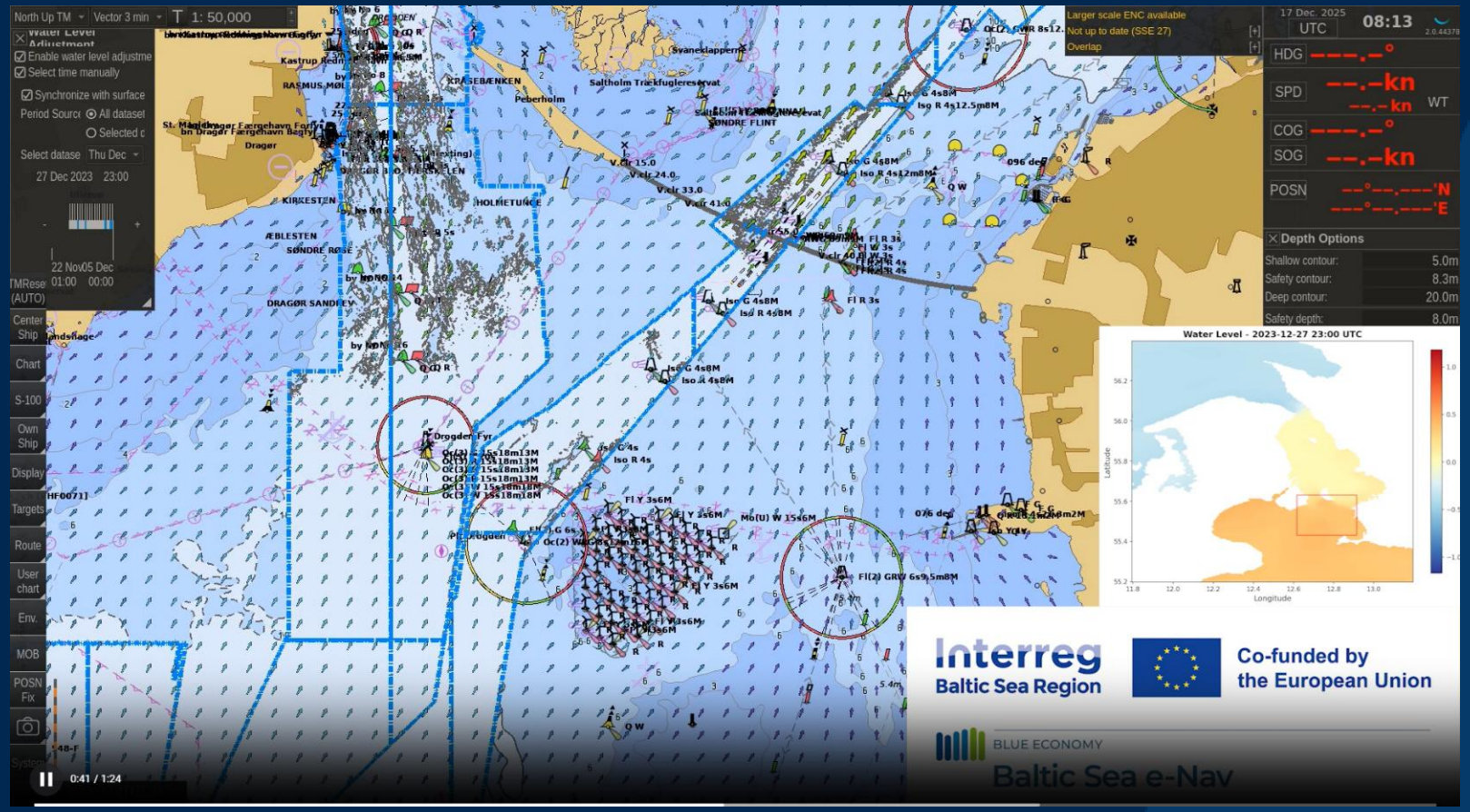
Interreg Baltic Sea Region Co-funded by the European Union
BLUE ECONOMY Baltic Sea e-Nav

Baltic Sea e-Nav Testbed Öresund

Combined S-102 Bathymetric surface, S-104 Water level and S-111 Surface currents:



Animations of S-102, S-104 and S-111:

- Öresund 2023-11-22–2023-11-23 | observations
- Öresund 2023-12-21–2024-01-03 | observations
- Öresund 2024-09-30 | observations

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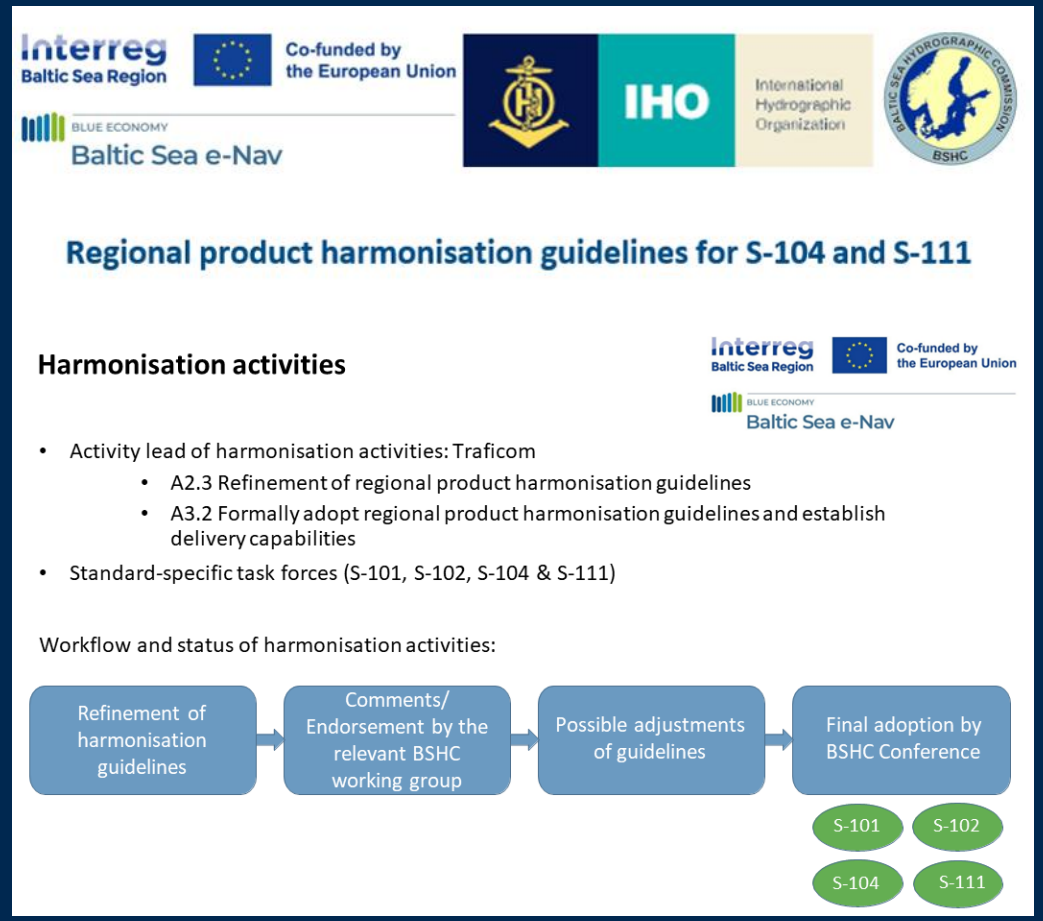
BSHC Regional product harmonisation guidelines for S-104 and S-111



1. Recommendation: Baltic Sea Chart Datum 2000 (BSCD2000) should be used as vertical reference system for water level information in S-104.
2. Recommendation: For S-111, the current values should be presented either at a given depth or as a depth-averaged value from the sea surface down to a specified depth.
3. Recommendation: S-104 should use the same horizontal reference system as the underlying standards S-101 and/or S-102.
4. Recommendation: It is recommended to provide a S-104 water level and S-111 surface currents products based on sufficient resolution and reliable quality required to resolve the oceanographic conditions in the area.
5. Recommendation: The data producers or Hydrographic Offices are responsible for the production and delivery of S-104 water level and S-111 surface currents within their area of responsibility for the production of ENCs.
6. Recommendation: Neighbouring countries should agree on harmonisation of data coverage and reduce differences of S-104 water level and S-111 surface currents products meeting at borders of areas of responsibility. No data overlap should occur across borders.
7. Recommendation: It is recommended that data should be produced and delivered to the end users according to a fixed time schedule (typical every six hours, extending at least five days into the future). If a model run is very delayed or incorrect, a cancellation of the products should be considered.
8. Recommendation: It is recommended that the quality of products S-104 (water level) and S-111 (surface currents) be monitored and validated to ensure their usability and trust.
9. Recommendation: Set uncertainty values in the metadata of the S-104 water level and S-111 surface currents products, to provide mariners with valuable information, enabling them to determine which data is more reliable or up to date for safe navigation.
10. Recommendation: The data producer or the Hydrographic Office should perform a technical validation according to S-158 of the produced S-104 and S-111 data files (HDF5-format), put a signature, i.e. create and attach a signature file (xml-format) to the data set.
11. Recommendation: The Hydrographic Offices and data producers aim to have continuous S-104 water level and S-111 surface current products, especially in areas where S-102 bathymetric surface is available. Therefore, the Hydrographic Offices and data producers are recommended to implement methods to assure continuous surface, ensuring usability for mariners.
12. Recommendation: The naming of HDF5-files for S-104 and S-111 data should follow the IHO S-100 Dataset naming standard.
13. Recommendation: Use names for sub-areas in the Baltic Sea as geographic identifier.

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Conclusions

These regional guidelines or recommendations established by the Chart Datum, Water level and Currents Working Group (CDWCWG) ensures a harmonized framework for producing and distributing S-104 Water level information for surface navigation and S-111 Surface currents data to enhance operational reliability and cross-border consistency regarding data overlap, resolution, and reference systems etc. to ensure safer real-time maritime navigation across the Baltic Sea. The guidelines ensure the long-term development of the products and the consistent user experience. The recommendations supplement the main guidelines in the product specifications.

If these recommendations conflict with the product specifications, the product specifications should be obeyed.

Through this collaboration, three major advances have been made:

- **Seamless Integration:** Standardizes data packaging for a consistent display on modern Electronic Chart Display and Information Systems (ECDIS).
- **Unified Reference Infrastructure:** Mandates the Baltic Sea Chart Datum 2000 (BSCD2000), resolving old chart discrepancies by linking marine data directly to land-based height systems (land-survey datums).
- **Institutional Collaboration:** Highlights decades of cooperation (via BSHC and BOOS), which successfully transitioned roughly 200 tide gauges to the new BSCD2000 standard.

CDWCWG will continue its efforts to collaborate on developing and improving the guidelines in the future, particularly in connection with the operational implementation of S-104 and S-111 in the Baltic Sea.

Our findings will be disseminated within the NSHC and the North Sea region, and will be further developed within the TWG and the Dynamic Navigation project. An article or technical note will be published in IHR in November 2026.

Dynamic Navigation ÖKS Interreg project 2026-2029

- EU-Application submitted mid-February 2026 to Interreg Öresund-Kattegat-Skagerrak.
- Partners:
  - SE: SMA (lead), Chalmers University, RiSE
  - DK: DGA, DEMA (Emergency Management Agency), DMC (Danish Maritime Consultancy), Port of Aalborg
  - NO: NHS, NCA (Coastal Administration)
  - FI: Furuno Finland
  - Associated partners: IC-ENC, PRIMAR, Intertanko, Port of Gothenburg, SMHI (SE Met/Oceanographic Authority)
- Scope: Implementation S-104, S-111 and S-124 including distribution methods (SECOM and MCP). Further development and requirements S-102. Route exchange S-421 in Norway (NCA).
- Budget 5,4 MEUR (60 % co-funding). Project period Aug 2026 – Jul 2029. **Approved June 2026.**

Interreg
Medfinansieras av Europeiska unionen
Öresund-Kattegat-Skagerrak

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SMHI
Interreg
Co-funded by the European Union
Öresund-Kattegat-Skagerrak
Dynamic Navigation ÖKS

Dynamic Navigation ÖKS Interreg project 2026-2029

The Swedish, Danish and Norwegian Hydrographic Offices with other partners have been awarded grants for Dynamic Navigation ÖKS (Öresund-Kattegat-Skagerrak), an EU Interreg-project (2026-2029) designed to provide operational S-100 services that contribute to safer and more environmentally sustainable shipping. The project will develop the next-generation navigation warning service (S-124) and further develop services for water levels (S-104) and surface currents (S-111), as well as high-resolution depth data in the new S-100 formats (S-102). The project will continue the work begun within the Baltic Sea e-Nav project to develop the service for sharing water level and current forecasts in the S-100 format, which will take place in close collaboration with, amongst other, the Swedish Meteorological and Hydrological Institute (SMHI).

IHO International Hydrographic Organization

IHO S-100 Sea Trial Area

A designated maritime zone where S-100-based products and systems are tested under real-world conditions or an equivalent virtual environment. It is initiated by a Hydrographic Office or Member State and endorsed by the HSSC to evaluate S-100 products and services, system performance and user experience. The results contribute to refining S-100 standards, improving maritime safety and efficiency, and supporting the transition from S-57 to S-100-based navigation. Progress is overseen by the Council.

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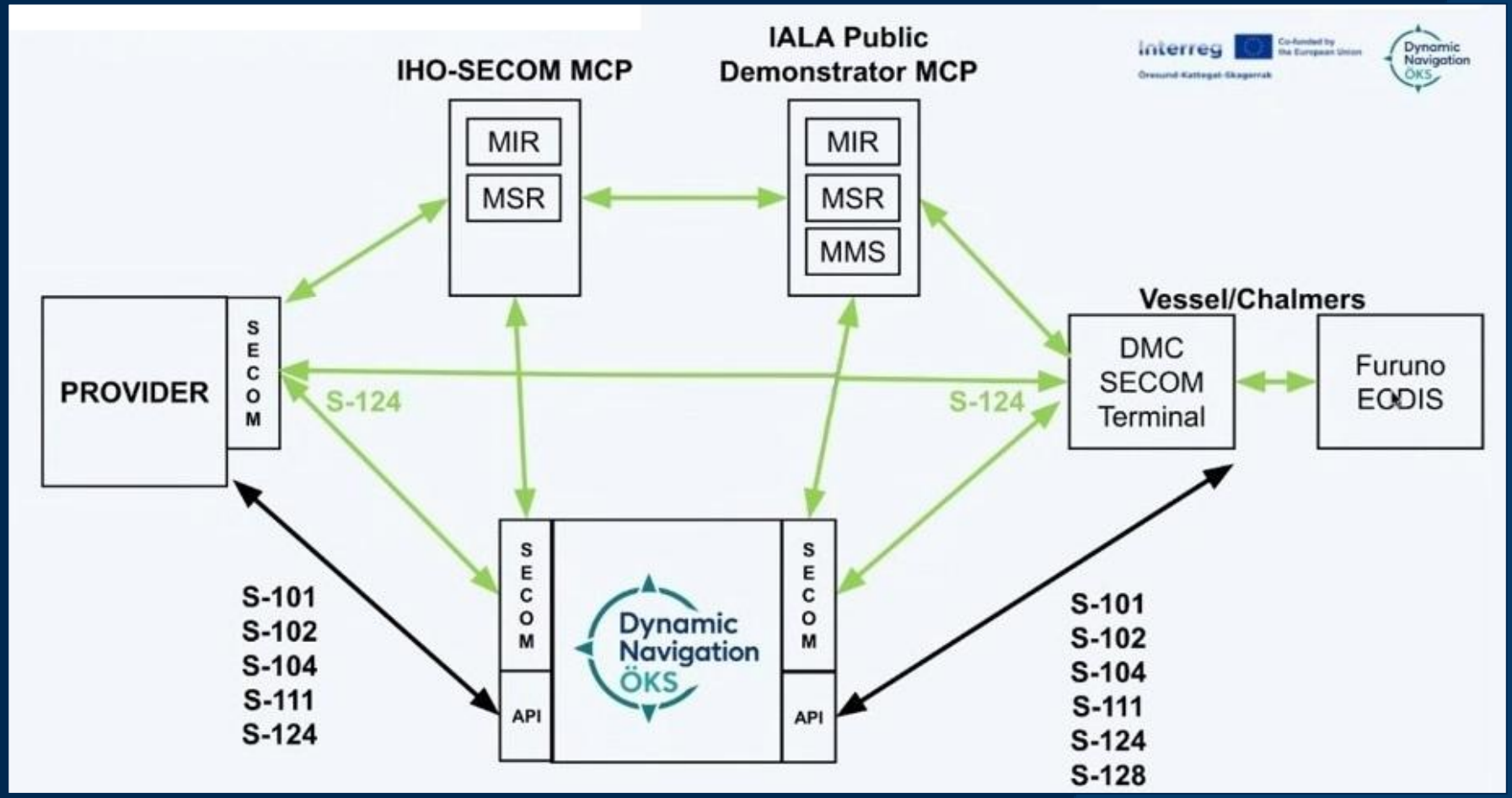
Dynamic Navigation ÖKS

Dynamic Navigation ÖKS Data Exchange



In order to distribute data via SECOM, a data provider must be registered as an S-100 producer with the IHO

This involves a formal process in which the Swedish Maritime Administration is involved, since we have the national mandate to represent Sweden in the IHO

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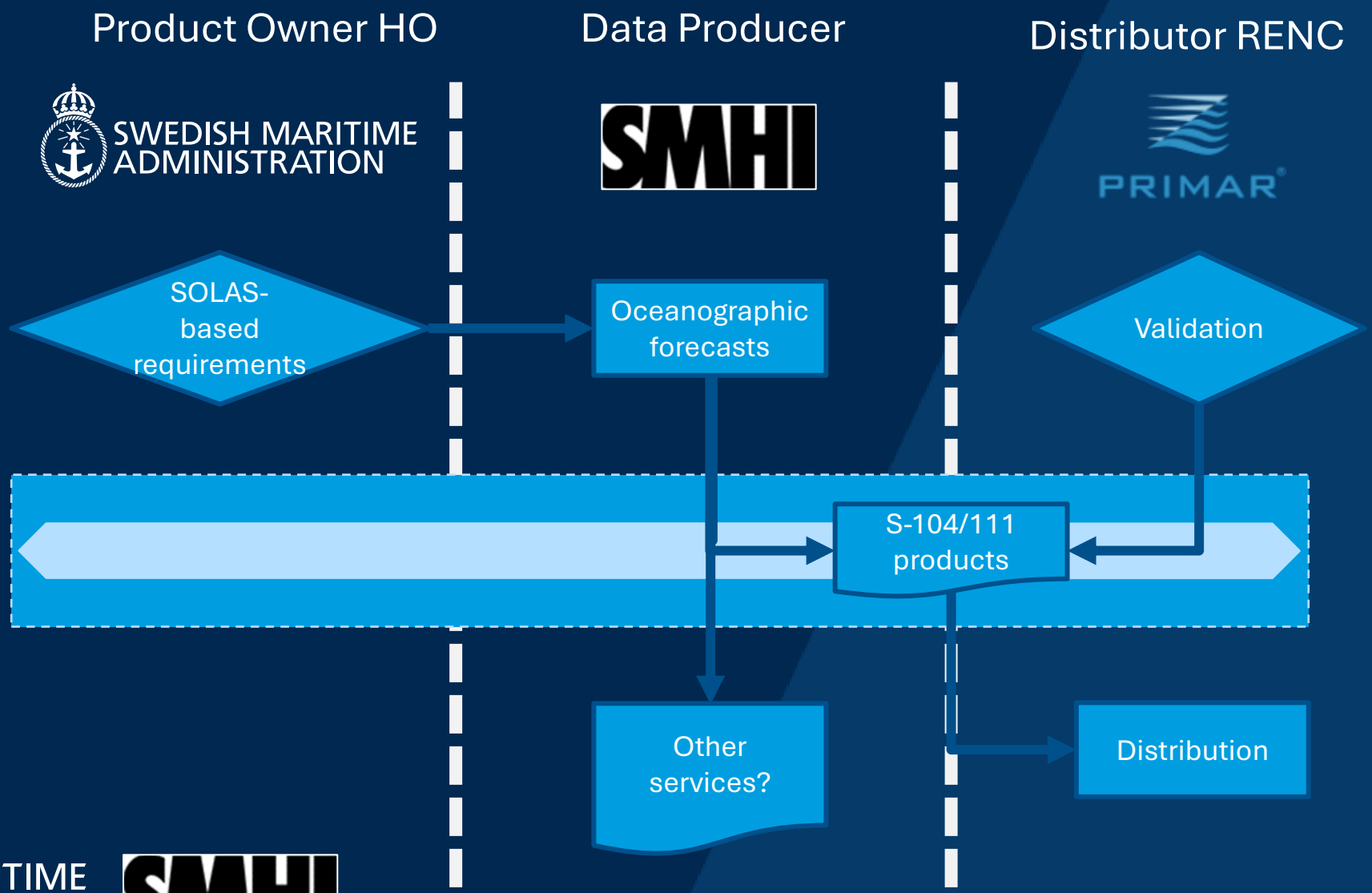
Dynamic Navigation ÖKS

S-104/S-111 service



SWEDISH MARITIME ADMINISTRATION

SMHI

S-104/S-111 service

Organisation

Product Owner
SMA

Hydrographic Office
SMA

Data Producer
SMHI

Stearing Group
Dynamic Navigation

Controller
SMA

Project Leader
Dynamic Navigation

Controller
SMHI

Work Stream Leader
Dynamic Navigation

Activities

1. Requirements
SMA

3. Development
SMHI

5. Test
SMHI

7. Production
SMHI

9. Validation
SMHI

11. Delivery
SMHI

13. Distribution
PRIMAR

15. Demonstration
SMA

2. Organisation
SMA/SMHI

4. Harmonisation
SMA/SMHI

6. Simulation
Chalmers

8. Monitoring
SMHI

10. Signing
SMHI

12. Follow-up
SMA/SMHI

14. Productisation
SMA

16. Marketing
SMA

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Dynamic Navigation ÖKS

Thanks!

Thomas Hammarklint

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thomas.hammarklint@sjofartsverket.se

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