

	<p align="center">NHC 66th Meeting Aalborg, Denmark 21 + 22 Mars 2023</p>	<p align="center">NHC National Report NORWAY</p>
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***NATIONAL REPORT
NORWAY***

Executive Summery

This report gives the summary of the activities and events that have taken place within the Norwegian Mapping Authority, Hydrographic Service (NHS) since the last report given at the NHC65 Conference, April 2022 in Stavanger Norway.

1. Hydrographic Office

Norwegian Mapping Authority 250 years

This year the Norwegian Mapping Authority (NMA) celebrates its 250th anniversary. This will be marked by several smaller local arrangements all over Norway through 2023 and will culminate on 14 December with a large event gathering all 800 NMA employees from all NMA district offices. At the hydrographic office in Stavanger, we will arrange two events this summer. Firstly, we will host a family barbecue for local staff, and then we will have a stand in Stavanger harbor at the annual Stavanger harbor festival.

Marine Base Maps

The pilot project has now been concluded and has been deemed a success. The different datasets produced and distributed through the project have proved very valuable to several different users ranging from private users and companies to marine spatial planners. We have not yet been able to launch a national program, so together with our pilot partners and politicians from coastal municipalities and counties, we continue to work on this.

Status S-100 implementation

A S-102 production line is set in operation. NHS have started production of S-102 data for some selected harbours and ports, and we will be releasing these over the coming 18-month period. Distribution of publicly available S-102 datasets will be done through PRIMAR RENC.

NHS also produces restricted and not publicly available S-102 data for use by VTS stations and pilots, mainly covering selected anchorage areas and narrow passages.

S-101 work is still in an early phase, focusing on competence and capacity building as well as production planning.

Office location / constellation

The rental agreement for our current office location, expires in spring 2025. We have now started a process of studying what type of office solution would fit our future HO work and organization best.

2. Hydrographic Surveys

2.1 Internal conducted surveying 2021

During 2022, R/V Hydrograf and its two survey launches have been working in the coastal waters of Norway.

Norwegian coast

The primary survey areas in 2022 have been fairway surveys in the northern parts of Norway and at Hustadvika between Molde and Kristiansund.

Many smaller areas along the entire coast were surveyed for coastal development or construction purposes.

Additionally, the areas near Fredrikstad were surveyed for nautical charting purposes.

The total area surveyed within the territorial waters of Norway in 2022 was 463 km² (see figure next page)

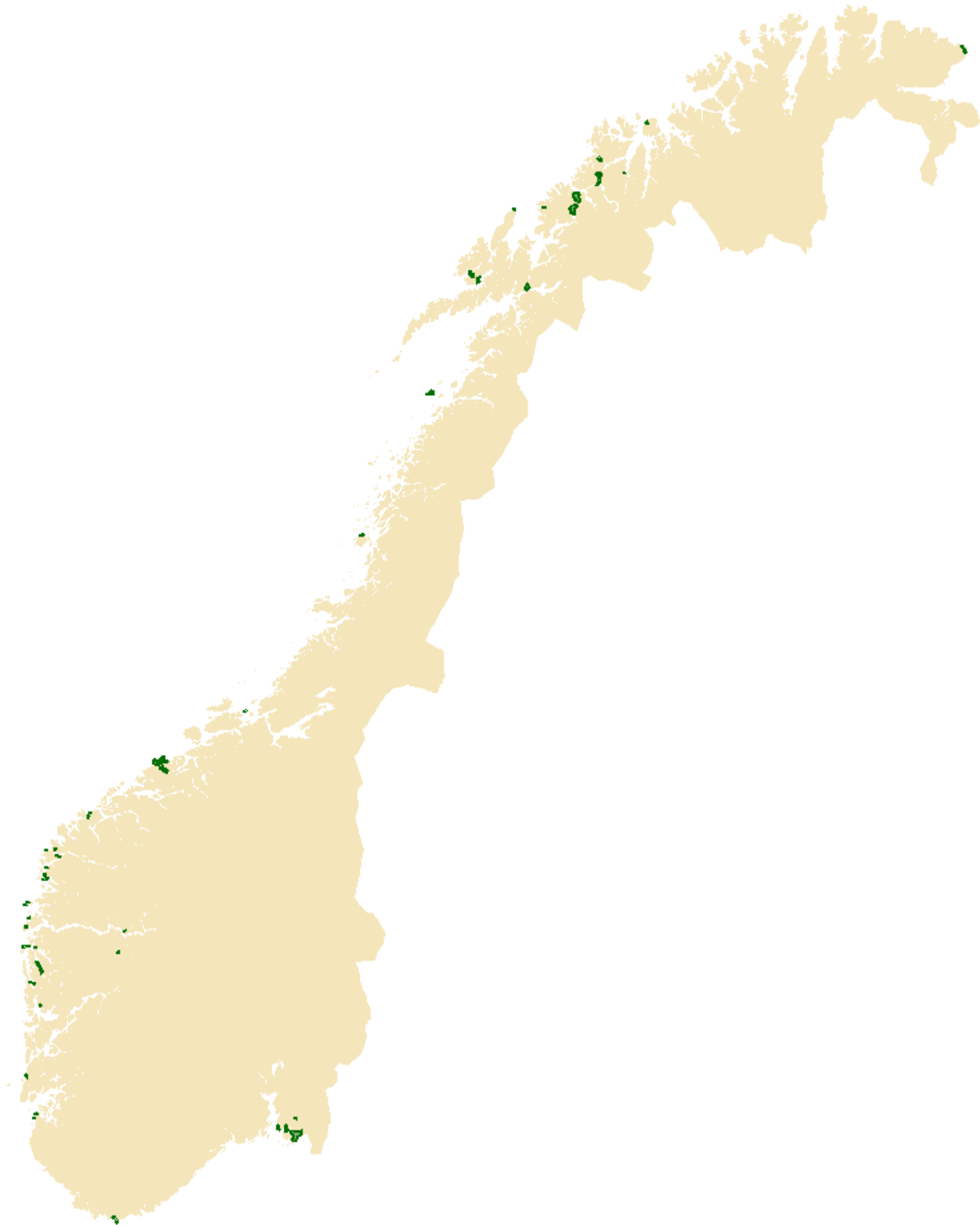


Figure 1 Area surveyed in territorial waters of Norway during 2022. Please note that the area sizes are exaggerated to make the smaller areas visible on the plot

Svalbard

In 2022 there was very little sea-ice at Svalbard, and we used this opportunity to survey a transect around the North-East part of the archipelago. Parts of this transect still needs more surveying to be useful. In addition to this, some areas close to the glaciers in Kongsfjorden and Bjørnsundet in Hinlopen was surveyed.

The total area surveyed within the territorial waters of Svalbard in 2022 was 2536 km² (see figure below).

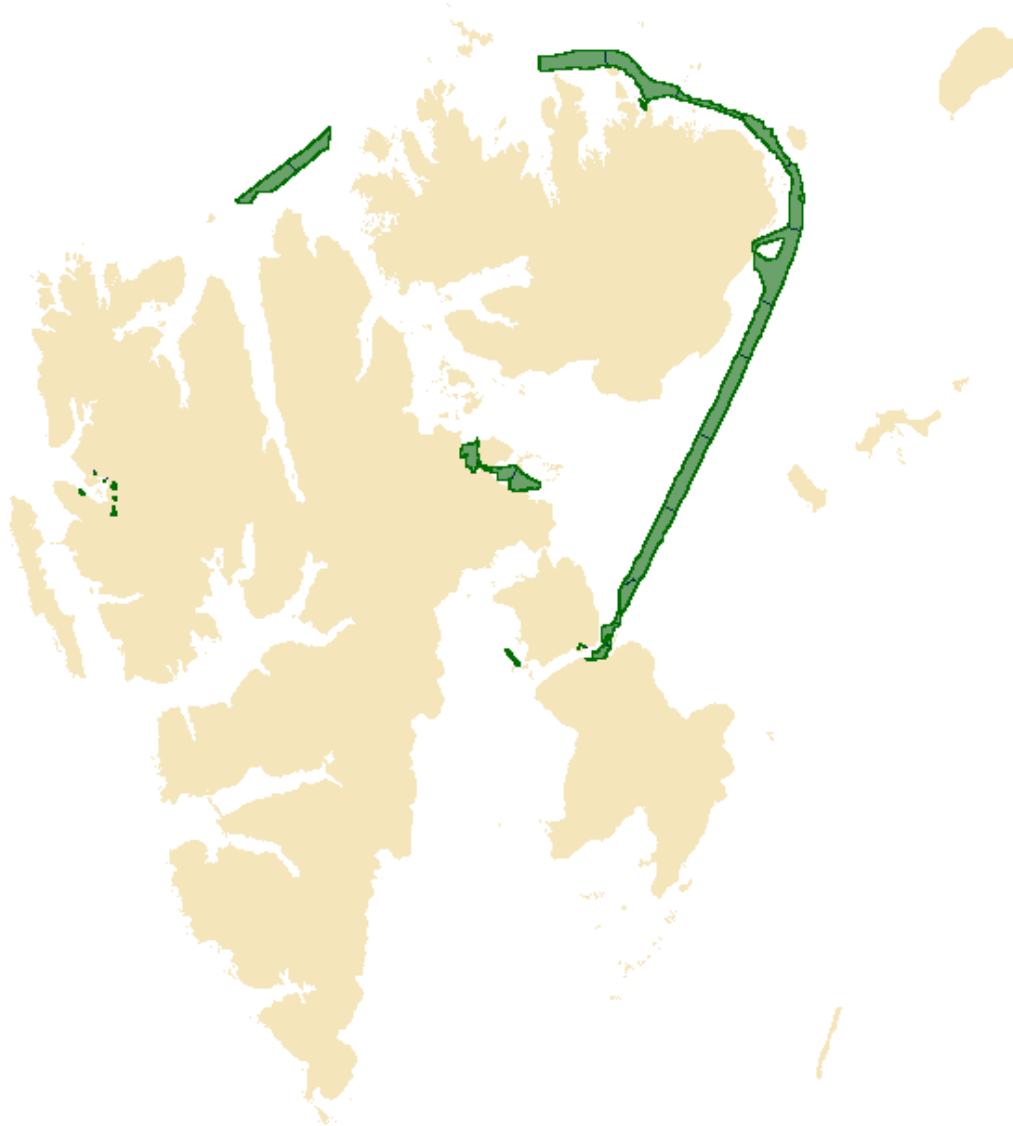


Figure 2 Areas surveyed in the territorial waters of Svalbard in 2022

2.2 External conducted surveying 2021

Only surveys within the MAREANO program were contracted to external companies. The 2022 MAREANO surveys were conducted by Clinton Marine Survey AB in the Norwegian Sea.

2.3 The Mareano Programme

Background: MAREANO is a multidisciplinary marine mapping and documentation programme aiming at providing the foundation for ecosystem based sustainable management of the Norwegian coastal and sea areas. The primary focus has been The Management plan for the Barents Sea and the management plan for the Norwegian Sea (see figure 3 below). The aim is to bridge the knowledge gap in poorly mapped areas. High quality multibeam bathymetry is regarded as a premise for further geological, biological and chemical investigations. The NHS is responsible for bathymetric data acquisition (including backscatter and water column data), and effective data management and distribution of survey data, derived products and services. An important facet of the programme is the web-based geodata distribution, and distributed data management as part of a National Spatial Geodata Infrastructure (NSDI)

Organization: The NHS is a program partner in the MAREANO Executive Group with the Institute of Marine Research (IMR, program management) and the Geological Survey of Norway (NGU).

Results 2022: The MAREANO program received NOK 99,53 mill in total through earmarked funding. 3 362 km² MBES (multi beam echo sounder data) were surveyed in 2022. In 2022 MAREANO included surveying in transit to contribute to crowd sourcing bathymetry.

Data distribution: The multibeam data has been modeled in digital terrain models with grids of various resolutions. The terrain is visualized through shaded relief maps as a Web Map Service included in the map services on the MAREANO webpage www.mareano.no.

NSDI: According to the MAREANO data policy all geodata from the MAREANO program will be published in the Norwegian spatial data infrastructure; *Geonorge* www.geonorge.no and www.dybdedata.no .

MAREANO will be a major undertaking for the NHS in the years to come, and is mainly aimed at non-navigational purposes.

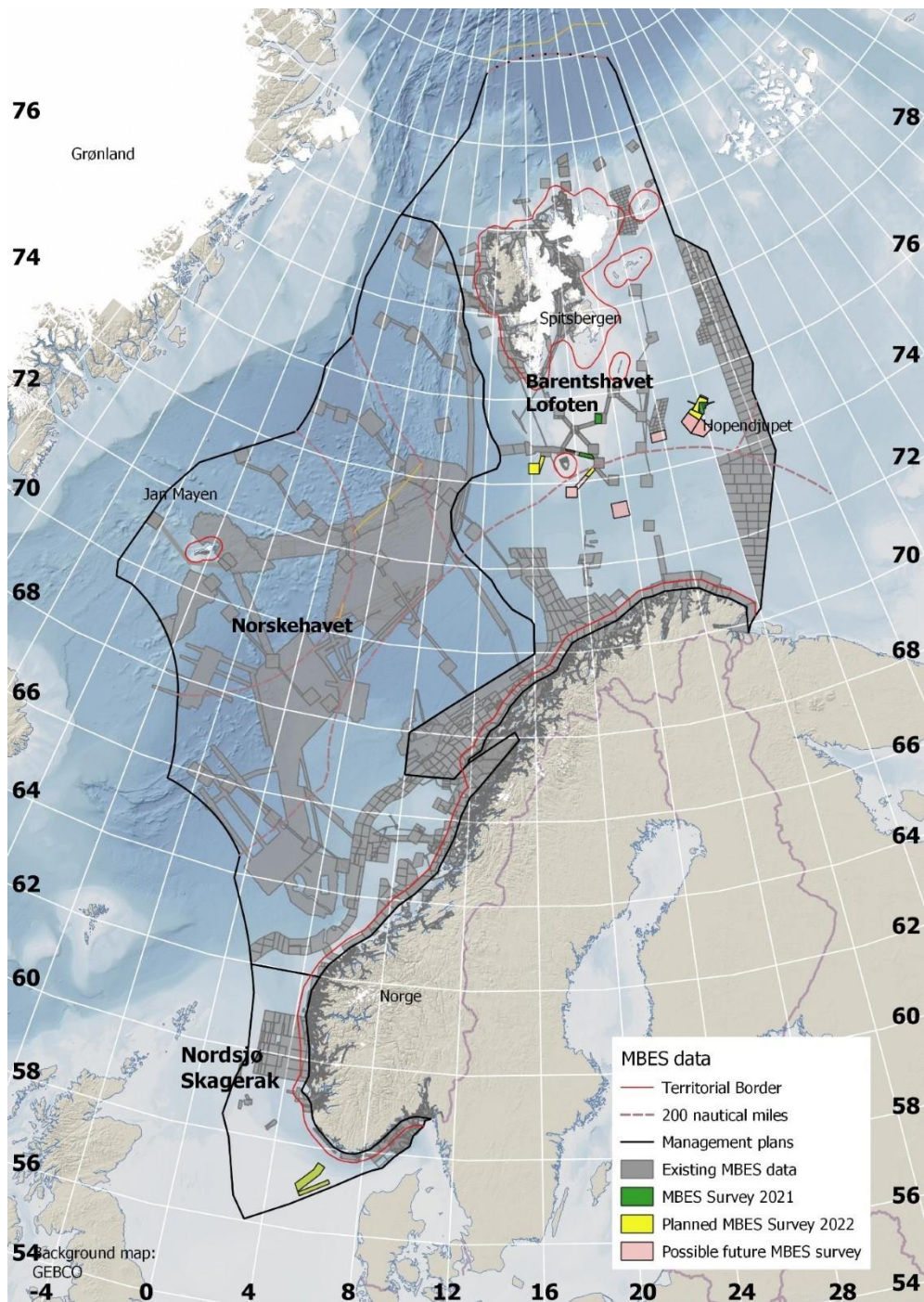


Figure 3. The Management plan areas and coverage of multi beam echo sounder data.

2.4 Marine Base Maps in Norway

Marine base maps in Norway is all about gathering detailed information and boosting the knowledge of the seabed and marine coastal systems along Norway's coast. The aim is to provide new business opportunities, stimulating and/or optimizing the growth of industries, better public administration, and effective coastal zone management. Marine base maps in Norway (i) maps on a large scale the seabed's physical, biological and chemical

environments (ii) analyses the data and (iii) distributes a set of standardized products. The products can be combined with other datasets.

It is a cooperation project with 3 partners; The Norwegian Mapping Authority, Hydrographic Service (leading the project), Geological Survey of Norway and the Institute of Marine Research. This cooperation allows for a streamlined process from data collection to distribution. It also has the added advantage of better coordination and management of resources.

The pilot project was finished in 2022. The project team has staff from the NHS, the Geological Survey of Norway and Institute of Marine Resarch. Mapping, both bathymetrical, geological and biological for the 3 project areas according to plan. A proposal to government for a national marine base map program has been delivered. We have analyzed data collected with new technology, for example airborne lidar. We will continue to document user cases from the 3 pilot areas.

3. Nautical Charts

NHS has covered the Norwegian coast with ENC's and modernised paper charts. In the Arctic and Antarctic waters, there are still areas without any coverage. The NHS production department has been concentrating on replacing areas with old survey data with new data. NHS prioritize these areas based on safety of navigation and economic benefit to society.

ENC coverage, gaps and overlaps

The total number of Norwegian ENC's was 1218 at the end of 2022.

	Usage Band	Compilation scale	No of ENC's
1	Overview	< 1:1 499 999	3
2	General	1:350 000 – 1:1 499 999	70
3	Coastal	1:90 000 – 1:349 999	84
4	Approach	1:22 000 – 1:89 999	765
5	Harbour	1:4 000 – 1:21 999	221
6	Berthing	> 1: 4 000	75

Table above: Number of ENC's in each usage band per 31 Dec. 2022.

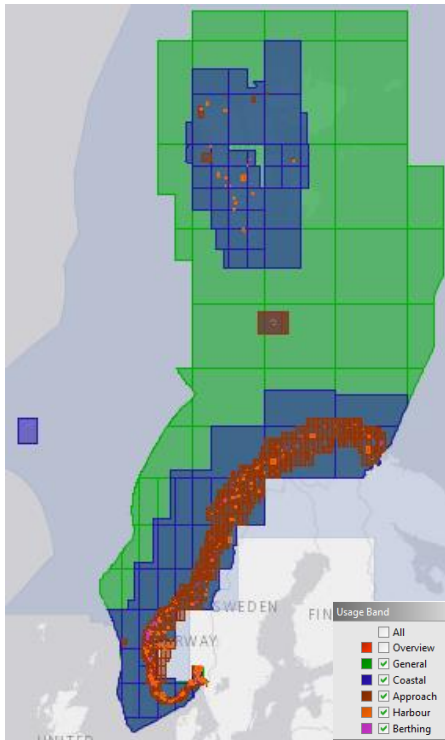


Figure 4. ENC coverage for the Norwegian coastal waters (ENCs in User Bands 2-6).

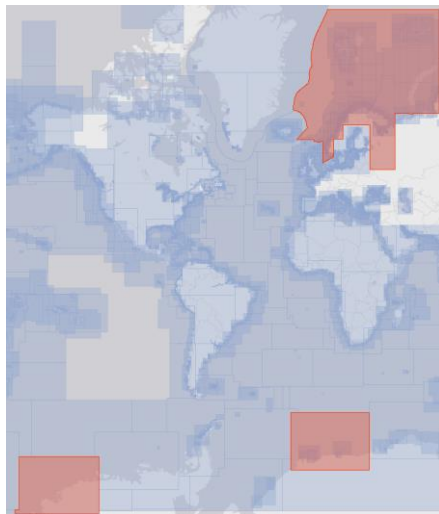


Figure 5. ENC coverage in User Bands 1.

In 2022, existing ENC's in several major- and most important fairways from Vestland to Nordland are updated with multibeam survey (Stokksund, Fanafjorden-Raunefjorden, Sotra-Askøy-Hauglandsosen, Sørfjorden Hamarsneset, Sørfjorden-Kvisti, Radfjorden, Osterfjorden, Lerstadholmen-Stokkholmen, Snekkevika-Tangene-Lepsøya, Hareidlandet, Vikan, Harstad).

The ENC's NO4M1309 og NO4E1309 are released as new editions completely covered with new surveys. In addition, other small parts of existing ENC's along the Norwegian coast have

been updated with new surveys based on request from users. In total 71 cells. 9 of these are new ENC's (ed 1) produced in small areas where users needed a larger scale.

In Svalbard, surveys from 2021 were released in the ENC's (Storfjorden and Borebukta).



Figure 6. Surveys within the green polygons were released in the ENC's in 2022.

In 2022 a total of 2668 ER files and NE were issued as part of the continuous maintenance of the ENC's. All reported corrections are processed consecutively based on priority and deadlines. Important updates are released within 7 days. Included Temporary (T) and Preliminary (P) notices.

In 2022, NHS has established a new production line for high density ENC (HD ENC). New HD ENC's were created for the ports of Stavanger, Bergen, Kristiansand and Mandal.

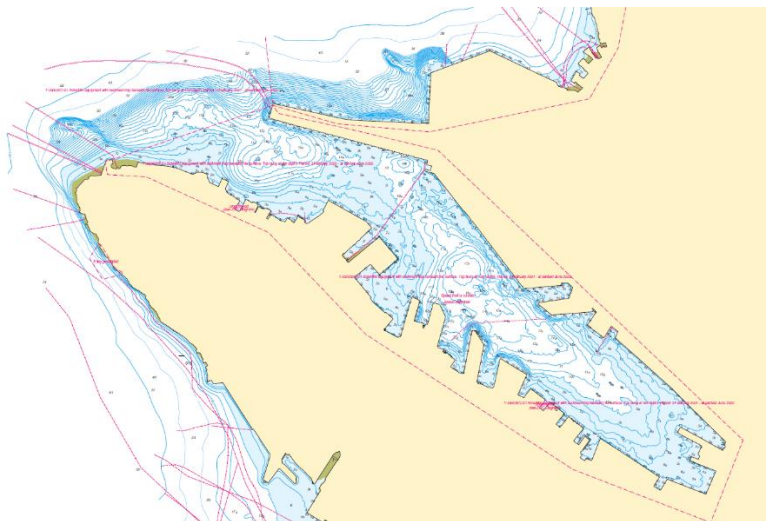


Figure 7. HD ENC for the port of Bergen.

RNCs

The Norwegian Mapping Authority, Hydrographic Service is not producing Raster navigational charts.

INT Charts

Norway has 23 INT-charts in the chart portfolio. Most of them are small-scale charts (general and coastal charts). No New Charts in 2022. 2 New Editions. This was:

Chart No.	Title	Scale
1. 505	INT 9311 / Svalbard	1:700 000
2. 507	INT 9313 / Svalbard. Nord svalbard	1:700 000

National Paper Charts

Norway has 209 National Paper Charts. A total of 29 new editions of national charts were issued in 2022 due to updates from new surveys. 10 harbour charts, 15 main charts and 4 charts for Svalbard.

National charts, new editions with new survey data published 2022

Chart No.	Title	Scale
1. 4	Oslo – Rødtangen – Drammen	1:50 000
2. 5	Svenner – Porsgrunn – Jomfruland	1:50 000
3. 9	Lillesand – Ny-Hellesund	1:50 000
4. 10	Ny-Hellesund – Lindesnes	1:50 000
5. 19	Ryvarden – Selbjørnsfjorden	1:50 000
6. 21	Selbjørnsfjorden – Bergen	1:50 000
7. 23	Bergen – Fedje	1:50 000
8. 26	Håsteinen – Batalden	1:50 000
9. 30	Haugsholmen – Ålesund	1:50 000
10. 31	Breidsundet – Fjørtoft	1:50 000
11. 31	Breidsundet – Fjørtoft	1:50 000
12. 32	Steinshamn – Hustadvika	1:50 000
13. 119	Osterfjorden og Sørfjorden	1:50 000
14. 120	Hjeltefjorden. Stureterminalen – Mongstad	1:50 000
15. 126	Storfjorden. Ytre del med Hjørundfjorden	1:50 000
16. 456	Ålesund havn	1:20 000
17. 459	Kristiansand havn	1:10 000
18. 460	Bergen havn	1:10 000
19. 460	Bergen havn	1:10 000
20. 467	Egersund, Sirevåg og Hellvik med innseilinger	1:20 000
21. 472	Drammen havn	1:10 000
22. 473	Langesund – Herøya	1:20 000
23. 474	Porsgrunn – Skien	1:20 000
24. 478	Flekkefjord havn med innseilinger	1:20 000
25. 490	Ulvesundet med Måløy hamn	1:10 000
26. 527	Sørkapp	1:100 000
27. 528	Storfjorden Sør. Isbukta – Kvalpynten	1:100 000
28. 532	Storfjorden. Kvalpynten – Agardhbukta	1:100 000
29. 533	Storfjorden Nord. Freemansundet – Heleysundet – Sørporten	1:100 000

Other charts, e.g. for pleasure craft

NHS does not produce any other charts than the official paper charts and ENC's for navigation, but are distributing S-57-cells (derived from the official ENC's) for use in charts and maps e.g. for the leisure boat marked.

S-102

In 2022 we established a production line for S-102 and started producing the first S-102 products. NHS is planning S-102 coverage in areas where there is a particular need for precise navigation, such as ports, harbours, particularly narrow or shallow waters, anchorage areas etc.

The S-102 coverage prioritization is an assessment made based on reported user needs. The NHS sends a request to the Norwegian Armed Forces for permits to publish detailed terrain data for navigation (S-102).

As of 21st of December the following ports has S-102 coverage:

- Port of Tromsø
- Port of Bergen
- Port of Stavanger
- Mekjarvik
- Risavika

Challenges and achievements

In 2022, NHS began producing S-102 products for distribution through Primar.

Major- and most important fairways from Vestland to Norland Norway have been updated with multibeam surveys. On Svalbard, existing corridors in Storfjorden were expanded.

In 2022, NHS established a new production line for high density ENC's (HD ENC's).

A major challenge in working with high-density bathymetry is the current Norwegian grading regime. We are still waiting for a change of this regime. The indications are a release of detailed depth information inside the 0-30m depth area, but no date has been set.

4. Nautical Publications

By digitizing the Norwegian pilot we had to develop a new national port data standard. In 2020 the standard was used to collect port data from 17 ports in Norway. The digital port data is stored in a common map database. A registration document has been prepared in Norwegian, so that all ports can register data themselves. The standard is available in Norwegian and English. The registration document is currently only in Norwegian, but will be translated into English in 2023.

Efforts are being made to get more ports to register the data themselves. The goal is that the ports keep their port data updated and quality check their data. This can be done through

plug-in developed for the open source GIS-application QGIS, for easy access directly in the database hosted by the Norwegian Mapping Authority.

The data will be displayed in the Norwegian pilot guide, but can also be downloaded as a dataset in our national geoportal, Geonorge. By compiling the data into a common map database based on port information, we will have all the information in one place, which means that all information is correct and continuously updated. It is also desirable to expand the database with more port data from several more ports in Norway.

During 2021 and 2022, several ports have collaborated in a project (with the Norwegian Mapping Authority as project leader) to develop software tools that utilizes port data, for more efficient port administration tasks and easier planning of the daily operations in the port.

5. MSI

The Norwegian Maritime Directorate is the responsible body for MSI in Norway.

6. C-55

The last update of C-55 was sent to IHB in January 2020

7. Capacity building

Norway participated in and chaired both the annual (May 2022) and intersessional (March 2023) meeting of the IHO Capacity Building Sub-Committee. The IRCC and the CBSC encourage Member States from the most developed regions to be involved in capacity building by assisting CBSC activities or by other means.

8. Oceanographic activities

During 2022 the technological infrastructure at all permanent tide gauges were upgraded. In addition, three new stations were installed and have now been added to the network. This was done as a part of our initiative to improve the basis of existing and future products and services. This will be achieved through an increase of the number of permanent tide gauges, a modernized solution for short-term water level measurements and collaboration with private companies and governmental institutions that perform water level measurements. The new tide gauges consist of radar sensors for water level monitoring and geodetic sensors for land movement monitoring and is installed in close collaboration with the Geodetic institute. The project runs on and the aim for 2023 is to install three new stations.

The oceanography department is also contributing to a new report, Sea Level Change for Norway, downscaling the global results for sea level change given by IPCC AR6 to regional conditions

We have delegates in the IHO-working groups "North Sea Hydrographic Commission Tidal Working Group (NSHC-TWG)", "Tides, Water Level and Current Working Group (TWCWG)" and an observer in "Baltic Sea Hydrographic Commission - Chart Datum Working Group" (BSHC CDWG). In addition we participate in the GLOSS Group of Experts and the EuroGOOS Tide gauge task team.

9. Spatial Data Infrastructures

MSDI is an integrated component of the [national SDI in Norway](#). The cooperation [Norway digital](#) counts for more than 600 organizations, where over 50% are involved in coastal and/or offshore activities. NHS is a key player in the development of relevant collaboration arenas between data owners, service providers and end-users to improve the user-value of marine and maritime geospatial services to society.

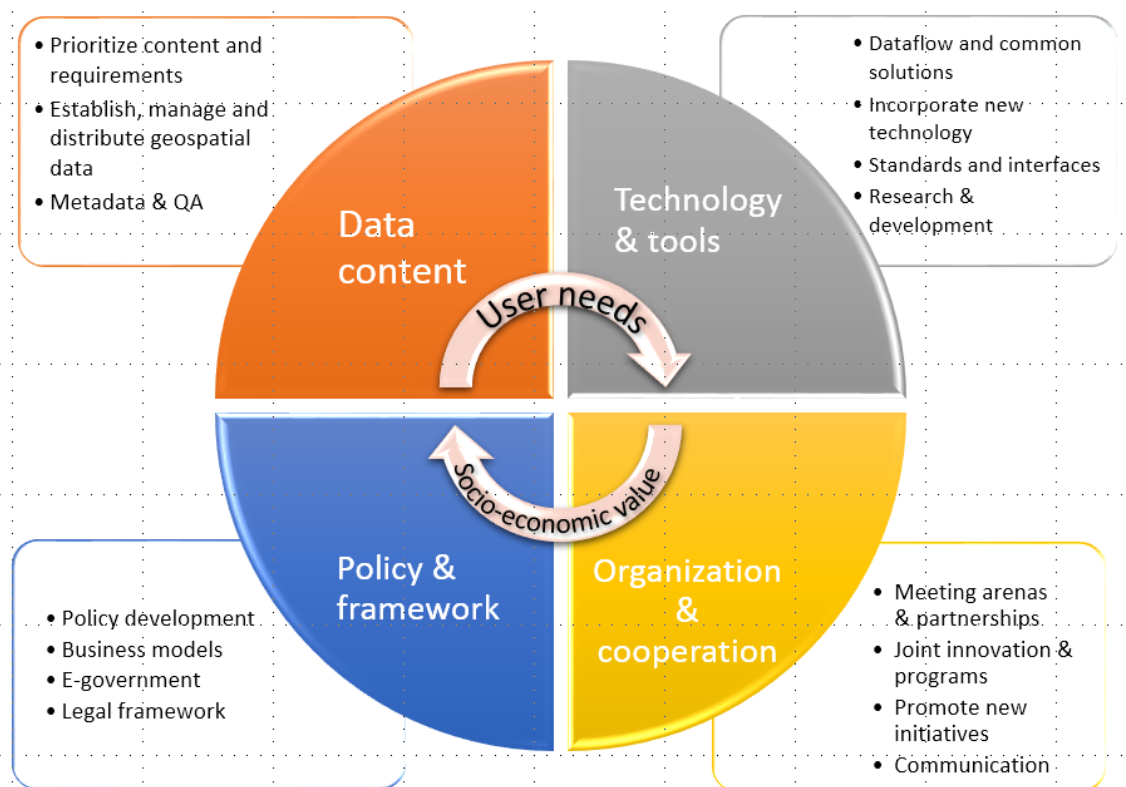


Fig.9 Norwegian SDI approach

A national governmental geospatial strategy, "[Everything happens somewhere](#)", has the ambition to improve the value of geospatial information and its usefulness to society in Norway. The primary objectives for this strategy is to:

- Offer a national knowledge base of geospatial information that meets important societal needs and user-priorities
- Incorporate technological tools and improve interoperability to increase interaction, efficiency and innovation

- Improve and further develop cross-sectorial cooperation and collaboration arenas between both public and private sector
- Adapt policies and framework conditions to meet the challenges within geospatial infrastructure, e-governmental services and the digital society in general

A yearly revised national action plan supports this strategy with more detailed descriptions on where and how to improve the national SDI.

The national SDI of Norway is continuously seeking connections to other relevant infrastructure platforms to enhance the usefulness of geospatial data within a larger ecosystem of digital governance and digital economy. The NMA's involvement in the [Gaia-X](#) initiative is an example of a starting point of a maturing journey in this direction.

FAIR

The FAIR-principles provide guidelines to improve the Findability, Accessibility, Interoperability, and Reuse of digital assets

The Norwegian Mapping Authority is leading the FAIR working group of MAREANO which aims to enhance the FAIRness of MAREANO data to the benefit of the users. A key approach is to implement the FAIR-indicators on top of the existing components of the NSDI-arrangements to make them operational in an SDI-context.

FAIR implementation by using geospatial infrastructure standards, technologies and routines

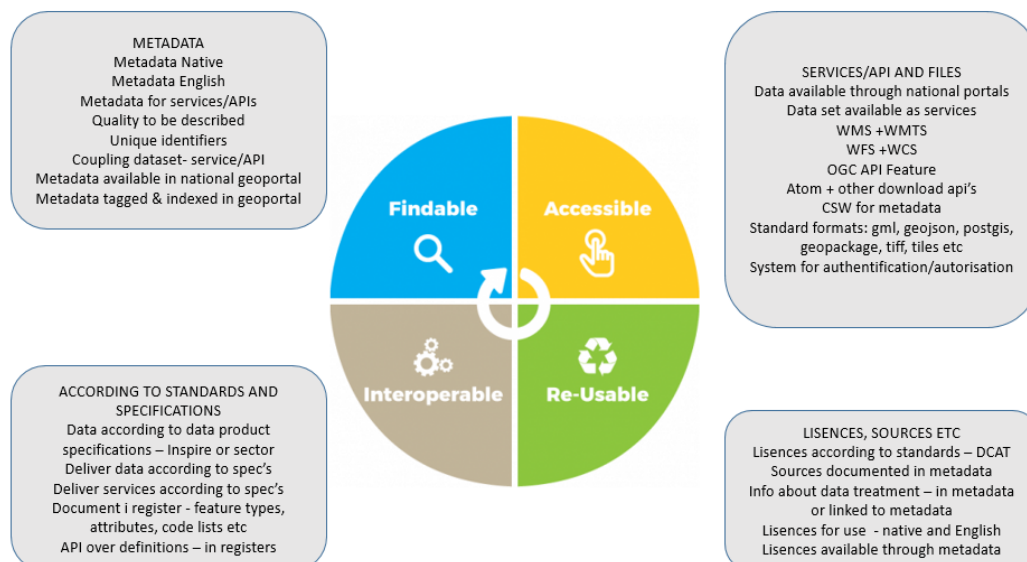


Fig. 10 FAIR implementation

The project has established a [status registry](#) in the national geoportal (Geonorge) containing an FAIRness assessment of all datasets collected through the MAREANO-programme. The assessment process is handled automatically, based on the implemented FAIR-indicators. This first version of the FAIR-system is undergoing an evaluation for further improvements.

10. Innovation

HYDRIS - Hydrographic Information System (earlier NAUTILUS - New Hydrographic Infrastructure)

NHS needs to renew its management, storage and processing system for bathymetric and miscellaneous marine geo data in order to:

- more effectively serve existing and future users
- support new data formats, standards and products
- meet future requirements for automation, machine learning, quality and lead time

NHS have therefore established a new product organization Hydrographic Information System (HYDRIS) with a Product Development Team that is working on renewing existing Hydrographic management systems/solution.

Our annual Ministry governance document letter, prioritizes digitalization and efficiency improvement. HYDRIS responds to this, with its aligned goals for modernization and automation to meet society expectations for efficient Marine Geodata dissemination.

HYDRIS is a part of the digital transformation strategy that is being implemented within Norwegian Mapping Authority. A number of cross-functional product development teams are established across the divisions with the aim for collaboration that is supported by a Digital Leadership Team. In addition, the focus is set on standardization and common infrastructure where possible for maximizing the benefits.

The new system is expected to be an integrated and complete data management solution supporting effective preparation and dissemination of a broad range of marine geodata, including bathymetric and derived bathymetric products. The solution will ensure an effective production of authorized nautical products.

The new solution will be based on a modern technological platform that supports:

- FAIR principles emphasizing machine-actionability
- support a more efficient nautical production
- multiple digitization and data sharing solutions
- fast data access and effective bathymetric production (short processing time / increased automation)
- layered services and functional structure (allowing algorithmic, AI/ML, production etc. processes to run on top off the data)
- an integrated metadata management
- management of complete and original data (no or minimum generalization required)
- integrated product and data sharing solutions (machine-to-machine, APIs, etc.).

HYDRIS achieved a critical milestone at the end of 2022 setting into production a new management system for the closed environment where classified data are maintained and processed. The core of the solution is based on Teledyne Caris COTS software/components. The system is under further development according to the specific requirements and focusing on automation as well as increase of efficiency. In addition, implemented infrastructure fulfilling FAIR principles that emphasize machine-actionability. The system is being tested for migration of the data from the old system that will be sunset after the migration process is completed.

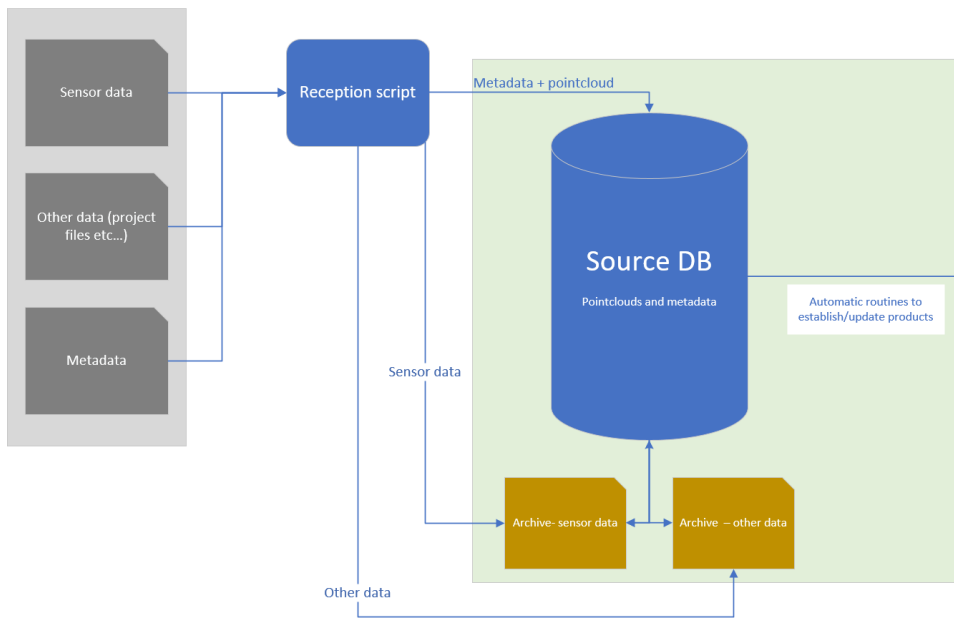


Figure9. New data management solution

Another milestone achieved by HYDRIS was successful completion of a 6 months pilot that resulted in fully automatic and effective production of digital elevation models (DEMs) from raw datasets. The Pilot showed possibilities in data orchestration tools based on open source and is cloud ready. Analysis Ready Data - ARD that were produced are a response to the need of an important and prioritized group of users. The pilot laid the foundation for further development based on open source that is going to give NHS a technological boost.

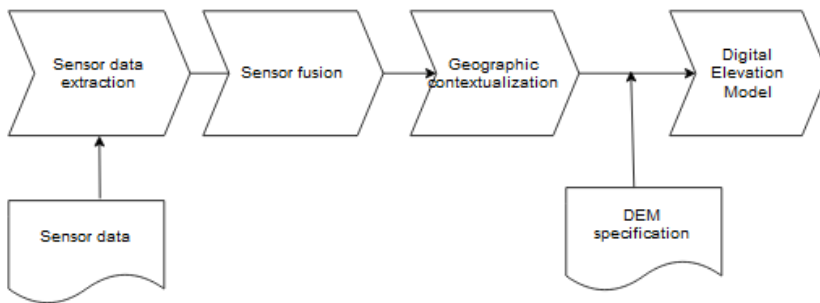


Figure 10. General processing pipeline for automated bathymetry processing.

The development (as scoped) is planned to take 5 years to complete (period 2022 – 2026), has an estimated total cost of appr. €13.5 Mill. EUR and has received full funding over the national budget from 2022. The implementation will include organizational as well as technological changes. HYDRIS is very much interested in any opportunities for collaboration.

11. Other activities

International activities

The NHS is involved in several Working Groups, Committees and Commissions related to IHO. Norway chairs the IHO CBSC and the IOC IHO GEBCO Guiding Committee and has representatives in the following Sub-Committees and Working Groups: IHO Council, S-100, DQ, ENC, NC, NIP, TWC, IEN, MSDI, CSB and WEND. We have participated in the HSSC and the IRCC meetings in 2022. Norway is actively participating in 5 Hydrographic Commissions: ARHC, HCA, NHC, NSHC and SAIHC.

The NHS is a member of the UN-GGIM Working Group on Marine Geospatial Information, chairs the GEBCO Guidance Committee and actively contributes to the Seabed 2030 project.

As operator of Primar we participate in all related meetings.

NHS is an active partner in EMODNet.