

 Kartverket	<b>NHC 65<sup>th</sup> Meeting</b> <b>Stavanger, Norway</b> <b>26 + 27 April 2022</b>	<b>NHC</b> <b>National Report</b> <b>NORWAY</b>
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## ***NATIONAL REPORT*** ***NORWAY***

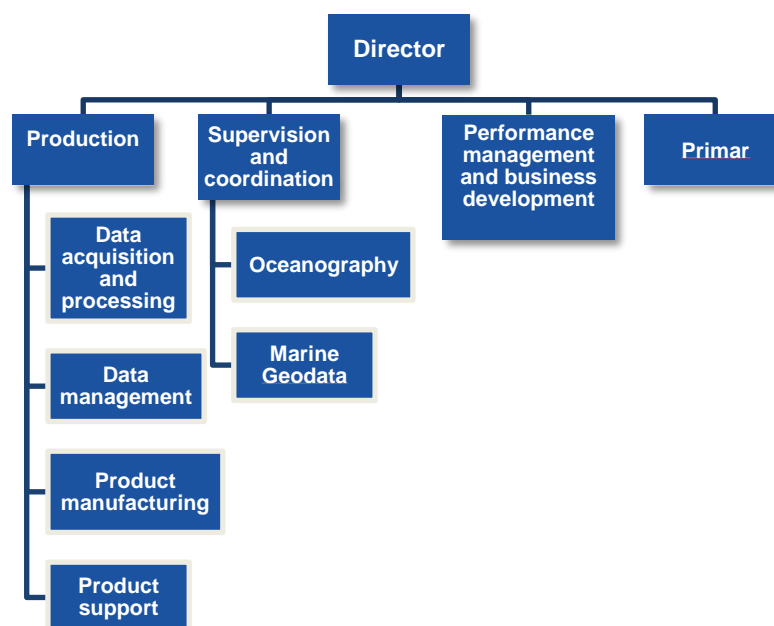
### **Executive Summery**

This report gives the summary of the activities and events that have taken place within the Norwegian Hydrographic Service (NHS) since the last report given at the virtual NHC64 Conference, April 2021.

### **1. Hydrographic Office**

- **Organizational changes**

As of 01.01.22, the Norwegian Hydrographic Service no longer runs its own survey vessel. The NHS is still the ship owner, but all maritime personnel has been transferred to the Institute of Marine research (HI). The hydrographers remain NHS employees and are responsible for the hydrographic surveys, but the actual running of the ship is now the responsibility of HI. After a short overlap period with the HI ship management department, the NHS ship management department was closed. Shown below is our updated organizational chart.



**Figure 1 Organizational structure Norwegian Hydrographic Service**

- **Marine Base Maps**

The pilot project is in the third and last year. The project team has staff from the HNS, the Geological Survey of Norway and Institute of Marine Research. 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. The focus in 2022, is to finish the production in the third project area. We will analyse data collected with new technology, for example airborne lidar. We will also continue to document user cases from the 3 pilot areas.

- **Ellipsoid Referenced Surveying and Processing**

We have fully moved to ellipsoid referenced surveying and processing but some refinements in the processes are still needed. In order to be able to make the change we had to link Chart Datum to the Ellipsoid everywhere along the long and complex Norwegian coastline. A gridded model giving the vertical separation between CD and the ellipsoid for Norwegian territorial waters has been published, but improving this model through, in particular, sea level measurements will be an ongoing process in the coming years.

## **2. Hydrographic Surveys**

### **2.1 Internal conducted surveying 2021**

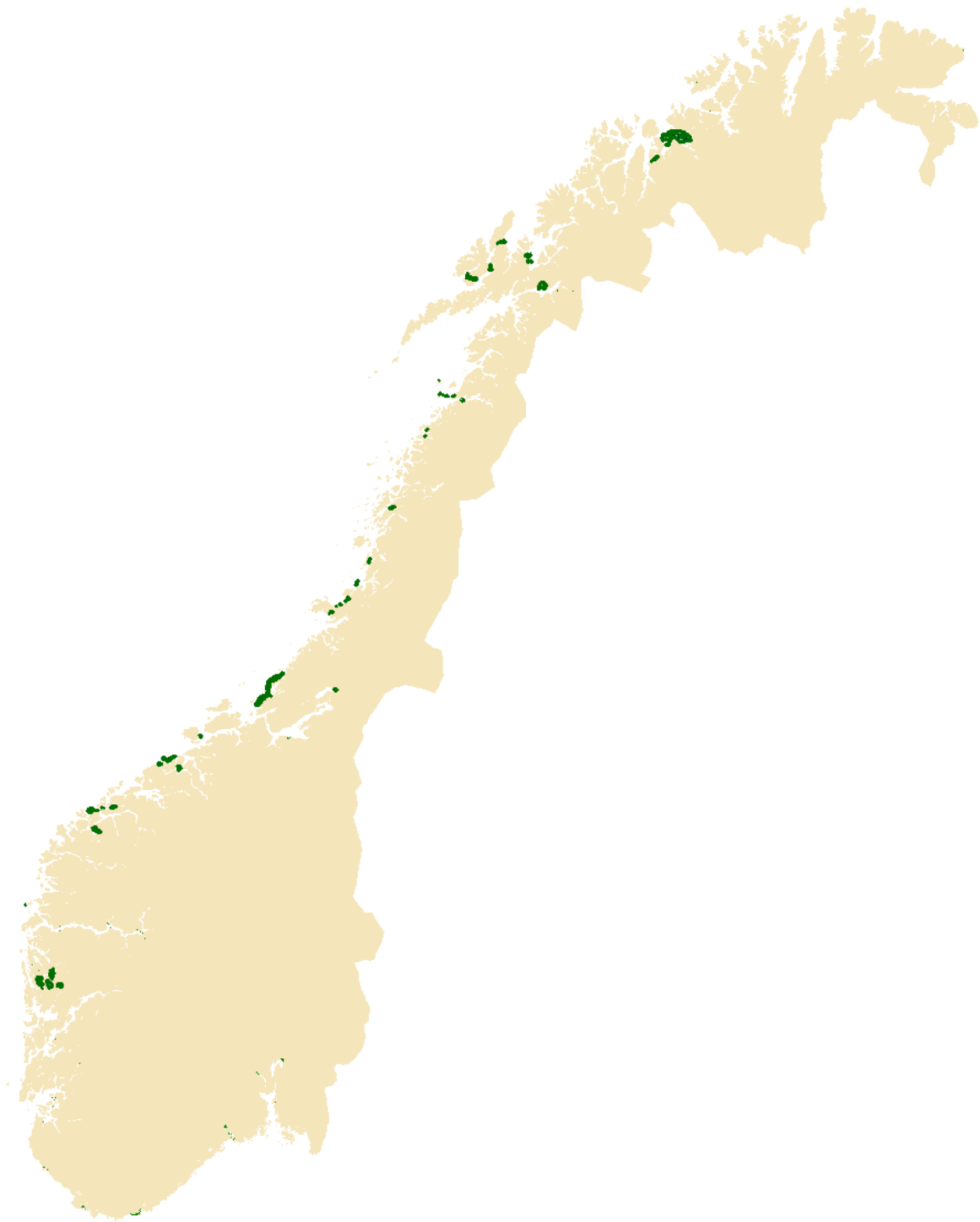
During 2021, R/V Hydrograf and its two survey launches have been working in the coastal waters of Norway.

#### **Norwegian coast**

The primary survey areas in 2021 have been fairway surveys along the western and northern parts of Norway between Bergen and Harstad.

In addition, some areas North-East of Tromsø were surveyed as a part of the coastal marine mapping program.

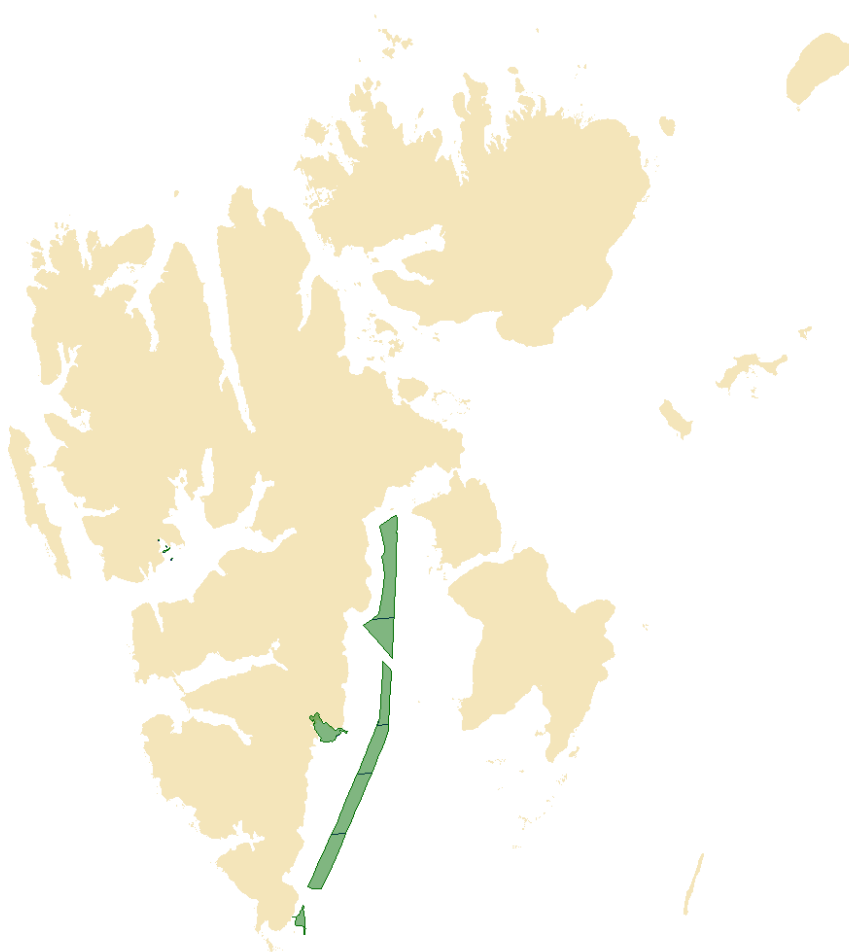
The total area surveyed within the territorial waters of Norway in 2021 was 907 km<sup>2</sup> (see figure next page)



**Figure 2 Area surveyed in territorial waters of Norway during 2021. Please note that the area sizes are exaggerated to make the smaller areas visible on the plot**

### **Svalbard**

The Svalbard surveys of 2021 were almost all restricted to Storfjorden. The total area surveyed within the territorial waters of Svalbard in 2021 was 1503 km<sup>2</sup> (see figure below).



**Figure 3 Areas surveyed in the territorial waters of Svalbard in 2021**

## **2.2 External conducted surveying 2021**

Only surveys within the MAREANO program were contracted to external companies. The 2021 MAREANO surveys were conducted by Arctia Meritaito Oy on Spitsbergenbanken and Høpendjupet in the Barents 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 programme partner in the MAREANO Executive Group with the Institute of Marine Research (IMR, programme management) and the Geological Survey of Norway (NGU).

**Results 2021:** The MAREANO program received NOK 100,15 mill in total through earmarked funding. 1 090 km<sup>2</sup> MBES (multi beam echo sounder data) were surveyed in 2021. In 2021 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](http://www.mareano.no).

**NSDI:** According to the MAREANO data policy all geodata from the MAREANO programme will be published in the Norwegian spatial data infrastructure; *Geonorge* [www.geonorge.no](http://www.geonorge.no) and [www.dybdedata.no](http://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.

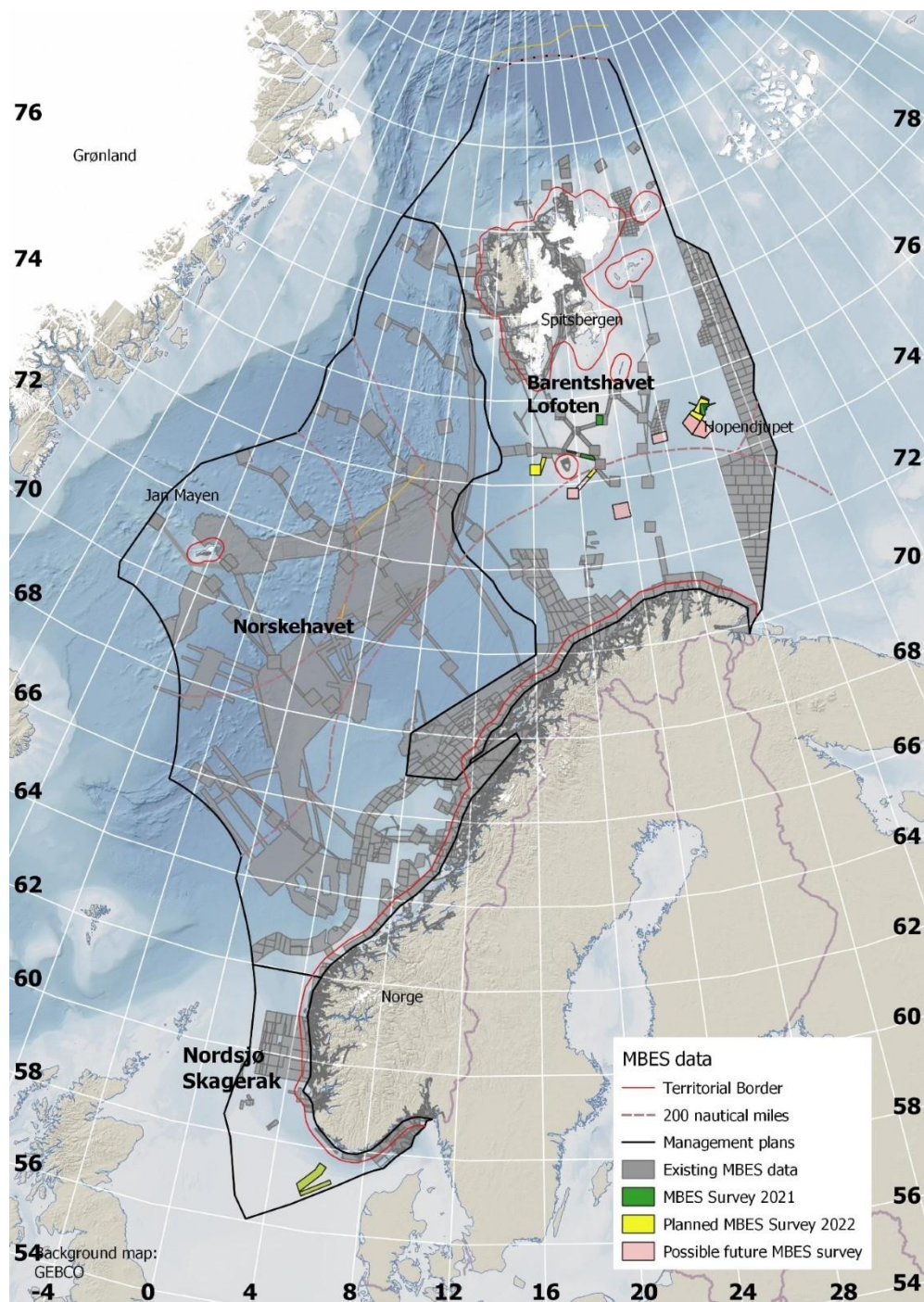


Figure 4. The Management plan areas and coverage of multi beam echo sounder data.

## 2.4 Marine Base Maps in Norway (Njål / Hanne)

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 optimising the growth of industries, better public administration and effective coastal zone management. Marine base maps in Norway (i) maps on a large scale the seabeds physical, biological and chemical environments

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

It is a cooperation project with 3 partners; The Norwegian 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.

We are running a pilot project in three pilot areas along the coast for a 3 year period 2020-2022. The budget for the 3-year pilot is NOK 84,6 mill. The pilot projects investigate and tests new technology for data collection and processing and, in addition, develop a cost-effective model for the implementation of a program for Marine base maps in Norway.

Workshops have been held in three pilot areas with planning staff of municipalities and provinces, government agencies and industry / commercial actors. Results have been used for many purposes and user cases are documented.

A proposal for a national program starting in 2023 has been send to the Ministry of Local Government and Regional Development.

## **2.5 FAIR-principles**

The FAIR-principles provide a set of defined guiding principles and practices that enable both machines and humans to find, access, interoperate and re-use digital assets.

**The Mareano programme and Marine Base Maps in Norway** have decided that all datasets collected and processed by the collaborating partners, shall be evaluated and adapted according to these FAIR-principles. An initial FAIR-implementation guide has been worked out to support ongoing activities, in accordance with relevant national infrastructures like [Geonorge](#) and [NMDC \(Norwegian Marine Data Center\)](#). The aim is to ensure that information pertaining to the seabed is made easily available to all who will benefit from its use, including those engaged in research, management and business ventures. An online status register has been developed within Geonorge to keep current track on the various dataset's fulfillment of the FAIR principles as well as other requirements from the NSDI. Ref. [Mareano Status Register](#).



### 3. Nautical Charts (Gjermund)

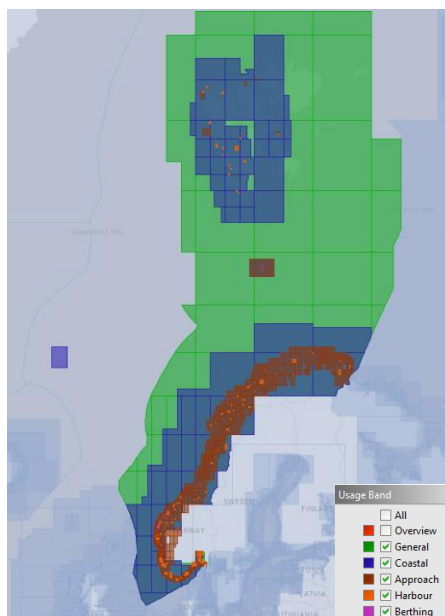
NHS has covered the Norwegian coast with ENC's and modernised paper charts. In the Arctic and Antarctic waters, there are still areas without any coverage. The NHS production department has been concentrating on replacing areas with old survey data with new data. NHS prioritize these areas based on safety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

#### ENC coverage, gaps and overlaps

The total number of Norwegian ENC's was 1209 at the end of 2021.

	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	764
5	Harbour	1:4 000 – 1:21 999	219
6	Berthing	> 1: 4 000	69

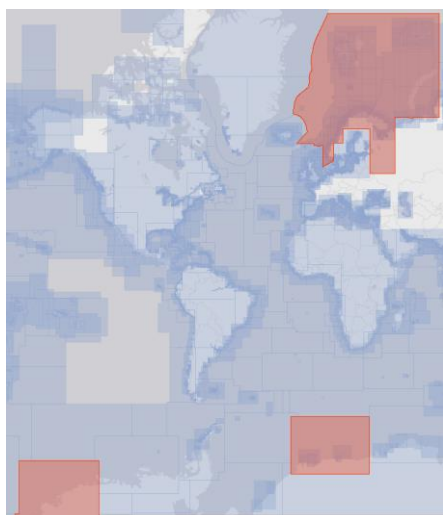
Table above: Number of ENC's in each usage band per 31 Dec. 2021.



**Figur 5**

ENC coverage for the Norwegian coastal waters (ENC's in User Bands 2-6).





**Figur 6**

ENC coverage in User Bands 1.

In 2021, existing ENC in several major- and most important fairways from Skagerak to Rogaland are updated with multibeam survey (Kragerø, Arendal, Kristiansand, Haugesund-Ryvarden, Sandsfjorden). Also in small parts of other existing ENCs along the Norwegian coast old bathymetry have been replaced with new survey based on request from users.

In addition, new Coastal ENCs between 69°N, 4°E and 73°N, 34°E are produced. We have hereby achieved full coverage in the Coastal usage band along the Norwegian coast after completing a project that started in 2009. General ENCs are also updated resulting in full consistency between all usage bands south of 75°N.

In Svalbard, sparse bathymetry with poor quality was replaced with multi-beam surveys in parts of existing ENCs in Forlandssundet and Kongsfjorden.



**Figur 7**

Multi-beam surveys within the red polygons were released in ENCs in 2021.

In 2021 a total of 2901 ER files and NE were issued as part of the continuous maintenance of the ENCs. In October 2020, NHS stopped publishing ENC updates in accordance with the Notices to Mariners (NtM). We went over to publish all reported corrections based on priority. Now all important updates are released within 7 days. Included Temporary (T) and Preliminary (P) notices.

## RNCs

The Norwegian Hydrographic Office 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). In 2021 three new INT-chart were issued as New Charts. This was:

Chart No.	Title	Scale
1. 312	INT 9315 / Andenes – LoppHAVet	1:350 000
2. 313	INT 9316 / LoppHAVet – Mehamn	1:350 000
3. 314	INT 9317 / Mehamn – Grense Jakobselv	1:350 000

## National Paper Charts

A total of 34 new editions of national charts were issued in 2021 due to updates from new surveys. 8 harbour charts, 24 main charts and 2 charts for Svalbard.

### National charts, new editions with new survey data published 2021

Chart No.	Title	Scale
1. 5	Svenner – Porsgrunn – Jomfruland	1:50 000
2. 6	Jomfruland – Risør	1:50 000
3. 7	Risør – Arendal	1:50 000
4. 8	Arendal – Lillesand	1:50 000
5. 9	Lillesand – Ny-Hellesund	1:50 000
6. 10	Ny-Hellesund – Lindesnes	1:50 000
7. 11	Lindesnes – Lista	1:50 000
8. 15	Ryfylkefjordane. Sjernarøyane – Sauda	1:50 000
9. 17	Karmsundet - Ryvarden - Skjoldafjorden	1:50 000
10. 19	Ryvarden – Selbjørnsfjorden	1:50 000
11. 24	Fensfjorden – Sognesjøen	1:50 000
12. 25	Sognesjøen – Stavenes	1:50 000
13. 26	Håsteinen – Batalden	1:50 000
14. 27	Sunnfjord	1:50 000
15. 34	Romsdalsfjorden. Molde – Åndalsnes	1:50 000
16. 38	Trondheimsleia. Terningen – Kyrksæterøra – Ørlandet	1:50 000
17. 43	Agdenes – Lauvøya	1:50 000
18. 65	Fleinvær – Bodø – Landegode	1:50 000
19. 77	Tjeldsundet – Harstad – Lavangen	1:50 000
20. 100	Ytre Sørøya	1:50 000
21. 111	Berlevåg – Båtsfjord	1:50 000
22. 121	Ytre Sognefjorden	1:75 000
23. 136	Beiarn – Saltefjorden	1:50 000
24. 142	Narvik – Skjomen – Rombaken	1:50 000
25. 453	Arendal havn med innseilinger	1:20 000
26. 457	Mandal havn	1:20 000
27. 459	Kristiansand havn	1:10 000

Chart No.	Title	Scale
28. 459	Kristiansand havn	1:10 000
29. 461	Narvik havn	1:10 000
30. 476	Bodø havn	1:10 000
31. 484	Molde havn	1:10 000
32. 487	Harstad havn	1:10 000
33. 513	Svalbard havner: Sveagruva, Forlandsrevet, Adventfjorden og Ny Ålesund	1:15 000 – 1:50 000
34. 522	Forlandsrevet – Femtebreen	1:100 000

### Other charts, e.g. for pleasure craft

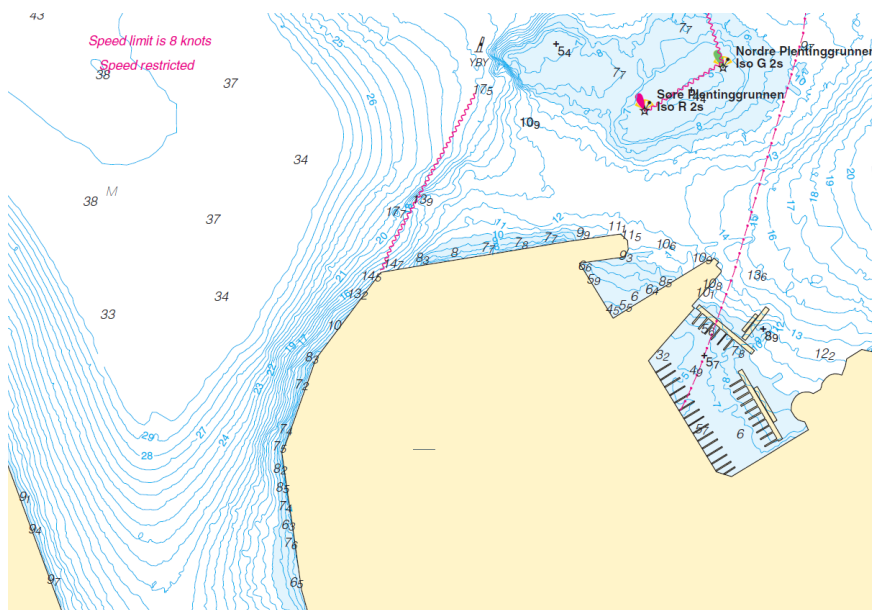
NHS do not produce any other charts than the official paper charts and ENC's for navigation, but are distributing S-57-cells (derived from the official ENC's) for use in charts and maps e.g. for the leisure boat marked.

### Challenges and achievements

In 2021 NHS achieved full coverage of the Coastal usage band ENC's along the Norwegian coast. Major- and most important fairways up to western Norway have been updated with multibeam surveys. On Svalbard, existing ENC's in western part (Forlandssundet and Kongsfjorden) were updated with new surveys. This year (2022) charts in eastern part of Svalbard (Storfjorden) will be updated.

The established cooperation with The Norwegian Coastal Authorities is ongoing. The common goal is to make sure that all major- and most important fairways are covered with adequate quality bathymetry.

The department for production are still looking into use of dense depth contours in ENC's (high density ENC's, HD-ENC's). The first goal is to make a high density-ENC (HD-ENC) covering part of Stavanger harbour and Bergen harbour to settle a production line for this product.



**Figur 8**

Part of HD-ENC I Stavanger harbour. Work in progress.

This project is a response to requests from the end users. 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 is a release of detailed depth information inside the 0-30m depth area.

#### **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 2022.

There is currently ongoing standardization work with the port data standard. Based on experiences and feedback from the survey's in 2020 (and adaptations to the marine harbour infrastructure (S-131) that are being developed by IHO/NIPWG) there has been revisions and improvement to the standard. The UML-data model and the registration document are now published in version 2.0, and we are working to a standardized product specification (version 3.0), expected to be completed by the end of 2022.

There has been great interest in port data from many parties, both private business, the ports themselves and other public or governmental agencies. There has been written a user needs report, with an analysis of the need and interest to the various stakeholders present in a port. This report has been used with regards to further adaptations to the standard. This work is expected to be completed first half of 2022.



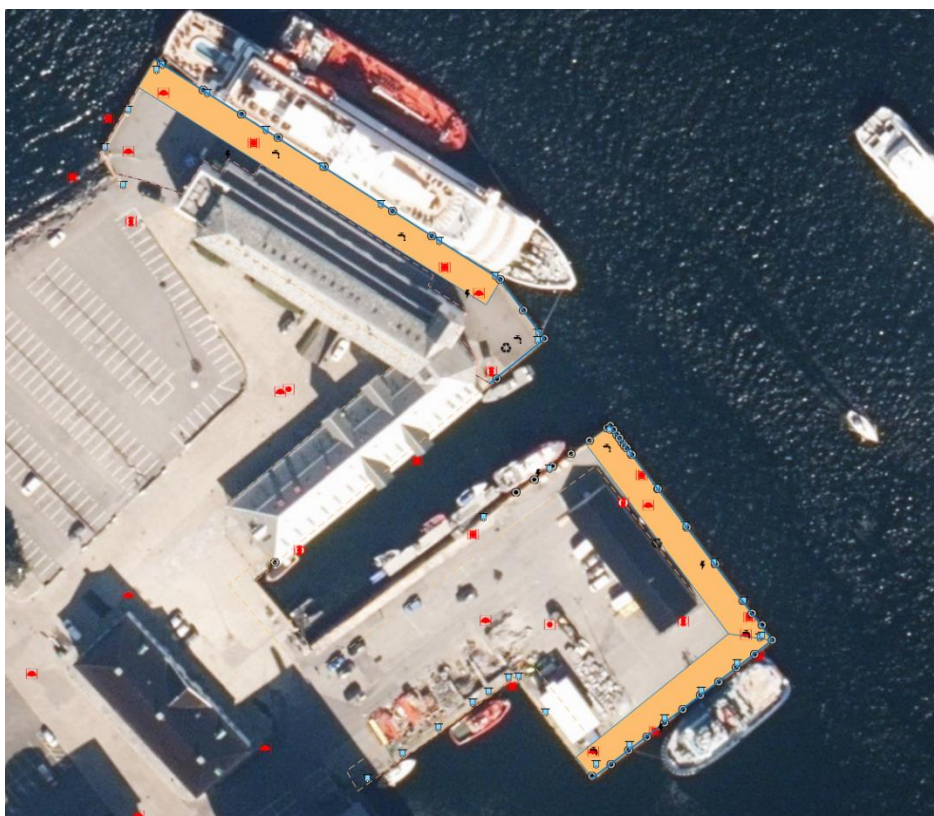


Figure 9 Example updated drawing rules (Port of Bergen)

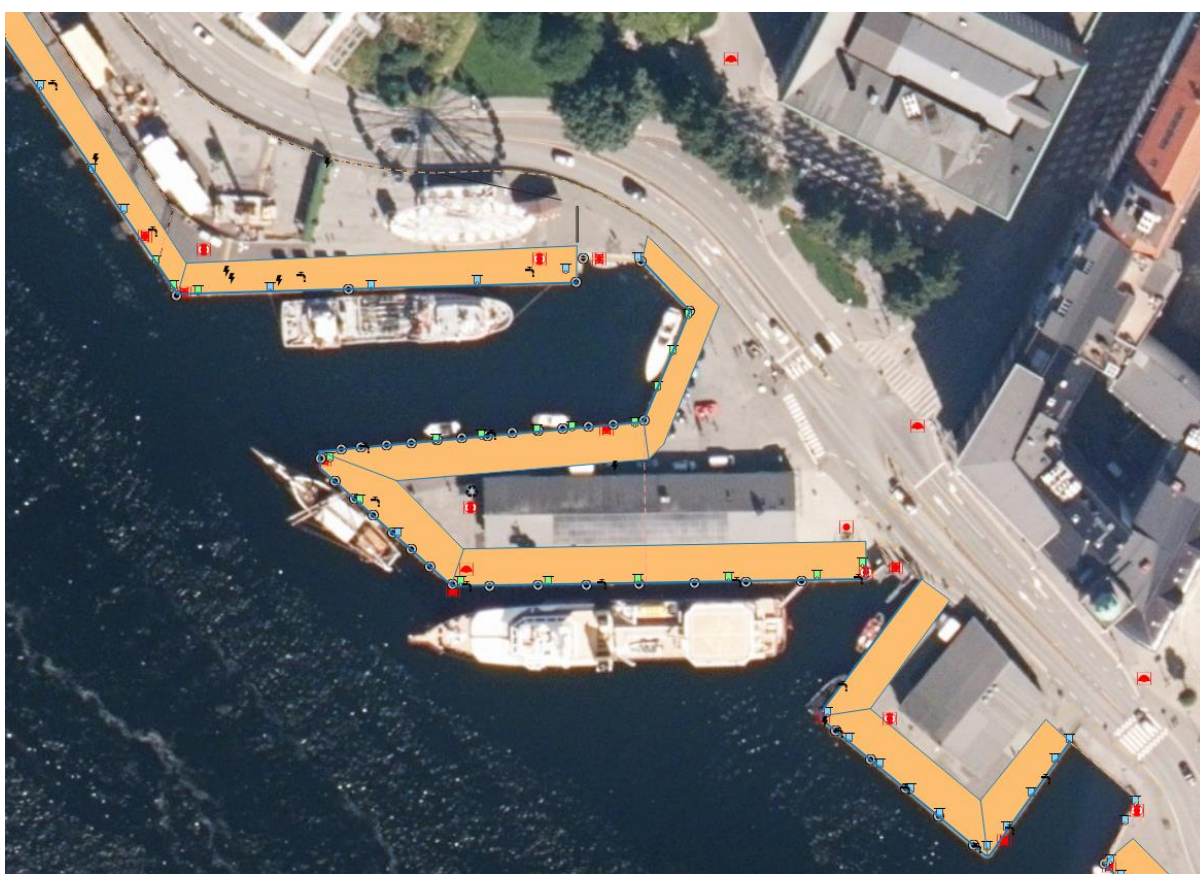


Figure 10 Example updated drawing rules (Port of Bergen)

Drawing rules have been made and new symbols are being prepared.

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.

In 2021 a project which is a collaboration between 9 major ports in Norway started up. The port of Oslo is project owner, and the Norwegian Mapping Authority is project leader. Accurate port data is a key component for success of this project. Port data can be used to develop tools for more efficient and easier management and 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 2021) and intersessional (March 2022) 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**

The tide gauge network in Norway consist of 24 gauges including one in Ny-Ålesund at Spitsbergen. We do short-term water level measurements at locations between the permanent gauges. These are used to construct the tidal zones used to provide water level data and information for most places along the Norwegian coast. Professional users can download data from an [API](#) directly. Our website [Se havnivå](#) provides tide tables, observed water level and water level forecast for 5 days (from a model run by the Norwegian Meteorological Institute). We also present figures showing different tide levels, land levelling datum and return periods (up to 1000 years). The information in the figures are very important in coastal planning.

To increase the use of water level observations and water forecasts instead of only tidal predictions, the official Norwegian tide tables will from 2022 no longer be published as a separate publication. All necessary information will be available in the web pages.

In 2021 national models describing the relation between the different datums; Chart Datum, the land levelling datum, Mean Sea Level and the ellipsoid were published. These models facilitate, among others ellipsoidally referenced surveying. The models are available at Geonorge.

In 2021 we also launched a new project which aims to improve the basis of existing and future products and services. This will be achieved through an increase 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 will consist of radar sensors for water level monitoring and geodetic sensors for land movement monitoring and will be installed in closed collaboration with the Geodetic institute. The project is currently planning the first installation, and plans to install around 10 new stations over the next 3-4 years. The figure 8 (next page) shows the locations that have been identified so far, but both locations and the number of new permanent tide gauges might change over the duration of the project.



Figure 11 Map showing location of existing permanent tide gauges along the Norwegian coast (red dots) and the areas that are identified as of interest for new permanent tide gauges.

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.

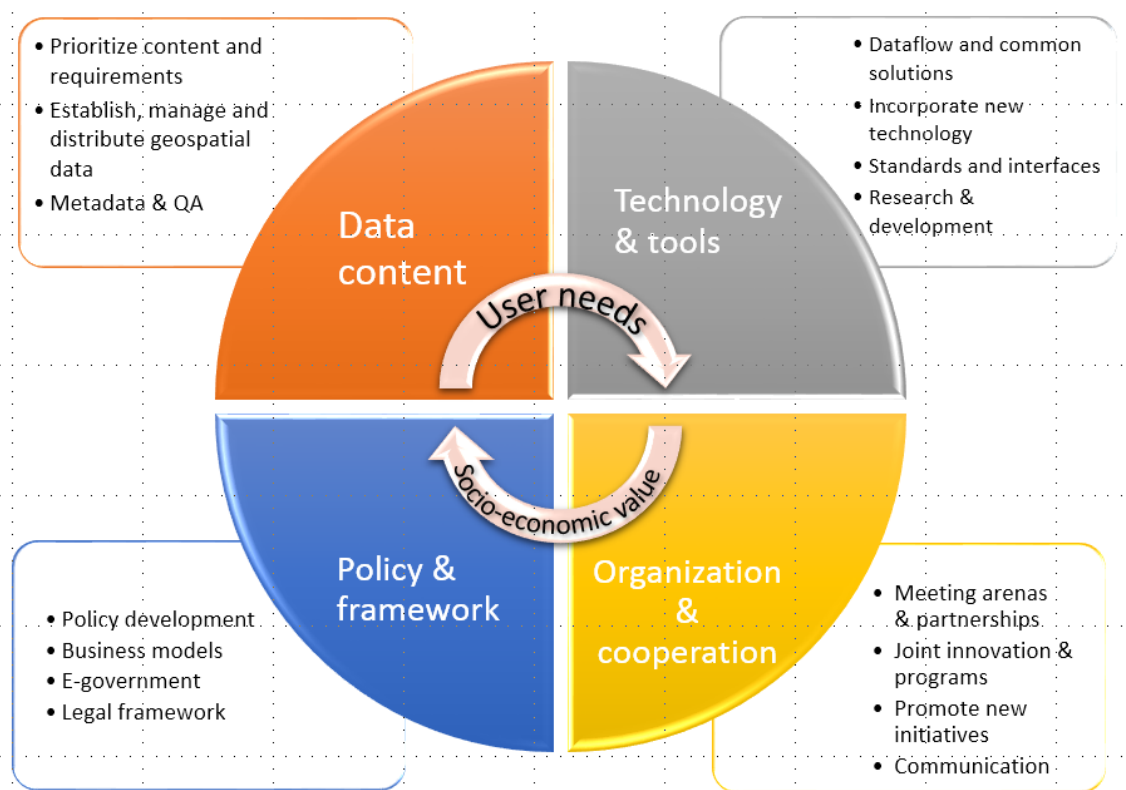


Fig.12 Norwegian SDI approach

[Geonorge](#) is the national website for geospatial information in Norway. One of the core services offered is the [Geonorge Map Catalogue Service](#) where the users can search for, discover, and access geospatial data and services offered by public authorities in Norway.

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 to improve the national SDI.

The national geospatial strategy is very much in accordance with UNs initiative on how to develop geospatial information as a component to carry out the Sustainable Development Goals. Ref. UN-GGIMs Integrated Geospatial Information Framework (IGIF).

## 10. Innovation

### NAUTILUS - New Hydrographic Infrastructure

NHS requires to renew its management, storage and processing system for bathymetric and misc. 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 project “Nautilus” (earlier named *New Hydrographic Infrastructure*) with the aim and goal to renew existing Hydrographic management systems/solution.

Norwegian governmental strategi set clear expectations to the solution and support an effective dissemination of various Marine Geodata and, at the same time, answer well to user needs and grow their values.

Expected changes to the data classification act, for bathymetric data and bottom objects, is understood to allow and define production and dissemination of new high-resolution geodata for the public, which also set requirements to the need for a greater degree of automation. NHS’s nautical product users expect navigation-critical data to be released faster and more efficiently. International commitments along with the need to support new nautical standards will come in effect in the coming years.

Requirements and processes for current management and production system for bathymetric data are largely based on and defined by nautical production and products. This will change to a more data and service generic solution, whilst maintaining a high quality nautical products portfolio.

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

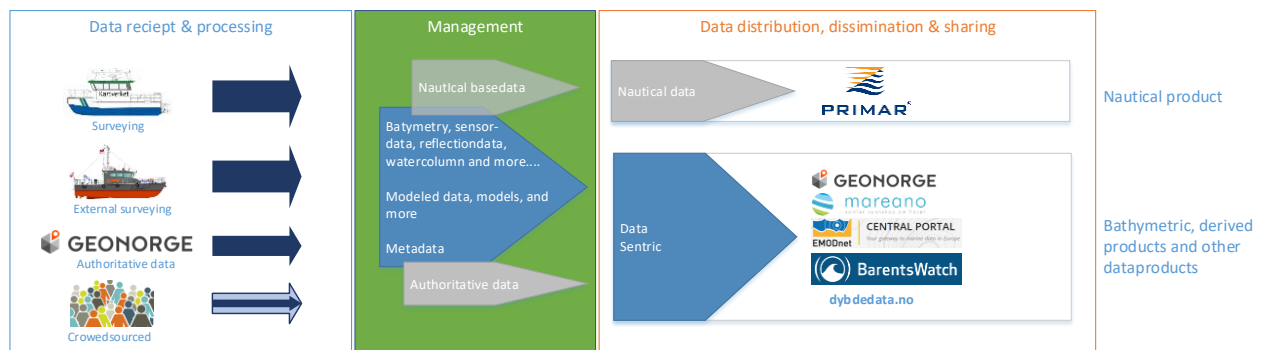


Fig.13. Concept of Nautilus

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

- an efficient and integrated nautical production
- multiple/various 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.).

NHS has identified the following processes that will be supported in the new solution, whereas processes within the yellow frame are given priority within Nautilus program:

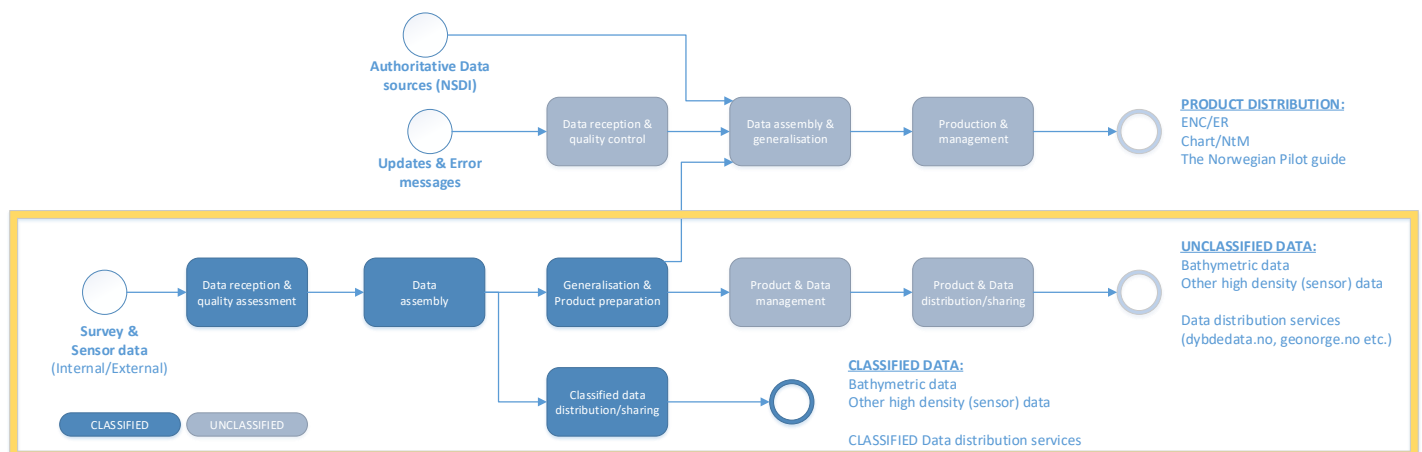


Fig.14 New Hydrographic Infrastructure, the Nautilus project

The Nautilus project (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 project will include organizational as well as technological changes.

Nautilus 2022-2026 development activities started to take a place. With the Nautilus principles in focus project plan is being established where both the priority tasks as well as

required competence are mapped. Internal and external cooperation is securing effective progress of the project.

## **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 2021. 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, sits on 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.