 Kartverket	ARHC 10th Conference Virtual 13-14 August 2020	ARHC National Report NORWAY
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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 ARHC9 Conference in Murmansk, September 2019. Some highlights:

- *Pilot project for digital nautical publications*
- *Pilot project for S-102*
- *Pilot project for Marine Base Maps in Norway*
- *Development of a marine spatial planning tool*
- *Continued high activity in the Mareano project in both coastal and open sea arctic areas*
- *Capacity Building projects with Albania and Montenegro*
- *Covid-19*

1. Hydrographic Office (Torstein)

2019 has been an eventful and challenging year for the Norwegian Hydrographic Service (NHS). The strain of budget cuts are starting to show, but at the same time they are forcing us to look at our organization with a critical eye. Instead of hiring new employees, our current staff are encouraged to make lateral moves to fill gaps that occur. That way we maintain a flexible organization and increase the skill level of our employees.

In order to streamline operations and save cost, our ministry asked the NHS to make a study of the potential of transferring the operations of our survey vessel to the Institute of Marine Research who also received the same request by the Ministry of Trade, Industry and Fisheries. Our reports concluded that although there wouldn't be any cut in cost for either organization, the potential for streamlining survey and research operations across sectors is so good that a transfer is recommended. The final report has been handed over to our respective ministries, but no decision has been made yet.

2019 has also been a year marked by some great achievements:

- **Organizational changes**
The new Nautical Charting Authority department has been staffed, and made operational. The NHS now has a department that is responsible for managing both quality requirements to our nautical products and input from our users to make sure we produce charts where it gives the highest benefit.

With the latest organizational changes, the NHS now has a flat management structure. All department and section heads now report directly to the Director. This has had the benefit that cross-departmental cooperation has increased due to improved communication.

- **Strategy work**

Over several workshops, the NHS management has worked on strategy. Using input from the PESTEL analysis performed in 2018, and the results from the strategy workshop at the NHC in Malmö, we formed a new and ambitious vision for the NHS: *"Norwegian waters shall have the world's most usable and dynamic geographic data"* The work is still ongoing.

- **Marine Base Maps**

In the last quarter of 2019, we got confirmation that the Marine Base Map pilot would receive government funding. Over a three year period the project has been awarded a total 84,6 million NOK. The NHS will be managing the project

- **Digital nautical publication**

The new digital Pilot guide for Norwegian waters was launched in November 2019 by the Minister of local Government and Modernization. The digital Pilot guide has now replaced the former PDF version as the official version of the Norwegian Pilot guide.

- **New Hydrographic Infrastructure**

In an effort to renew our digital production line, the NHS has launched a project named New Hydrographic Infrastructure. For 2020, we have hired a full time project manager, and our ambition for the project is to replace the current production system that was established in the late 1990.

- **Covid-19**

Covid-19 hit Norway in March 2020, and on the 13th Norway went into lock down. All NHS employees were sent home, and our survey vessel M/S Hydrograf sent to port and the crew sent home.

During the last weeks of March, the IT division worked around the clock to set up the necessary infrastructure to allow all of the 800 National Mapping and Cadaster Authority employees to work from home, and from early April all NHS employees working on non-restricted data were able to work from home. Both chart updates and chart production has continued through the period.

Employees working on restricted data have been working at the office according to a rotation scheme since April, and have since June been working at near full capacity.

Even though we have managed to work from home, the onset of Covid-19 has had some consequences for our production output. The most notable consequence is that this year's survey in Svalbard has been cancelled. We will not see the full effect of this before 2021.

We will also have some delays in our nautical production as we are almost two months delayed with our planned surveys, and the post processing unit has been working with 50 % capacity in the same period.

2. Hydrographic Surveys

2.1 Internal conducted surveying 2020

So far this year R/V Hydrograf and its two survey launches have been working in the coastal waters of southern Norway. Focus has been on fairway surveys near several of the southern cities of Norway. The survey progress has been limited due to a two month stop related to the Corona situation. The work was resumed in mid-May, and after one month with work for the Marine Basemap program in the Stavanger area, the fairway survey is now ongoing.

Norwegian coast

The primary survey areas in 2019 have been some exposed areas north of Ålesund and the fjords north-east of Tromsø. Both these areas are surveyed as a part of the coastal marine mapping program.

In addition to the major survey areas, quite a few areas along the coast from the Swedish boarder to Stavanger were covered by surveys related to fairways and development projects in the coastal zone.

The total area surveyed along the Norwegian coast in 2019 was 654 km². Figure 1 presents the coverage of surveying within the territorial waters.

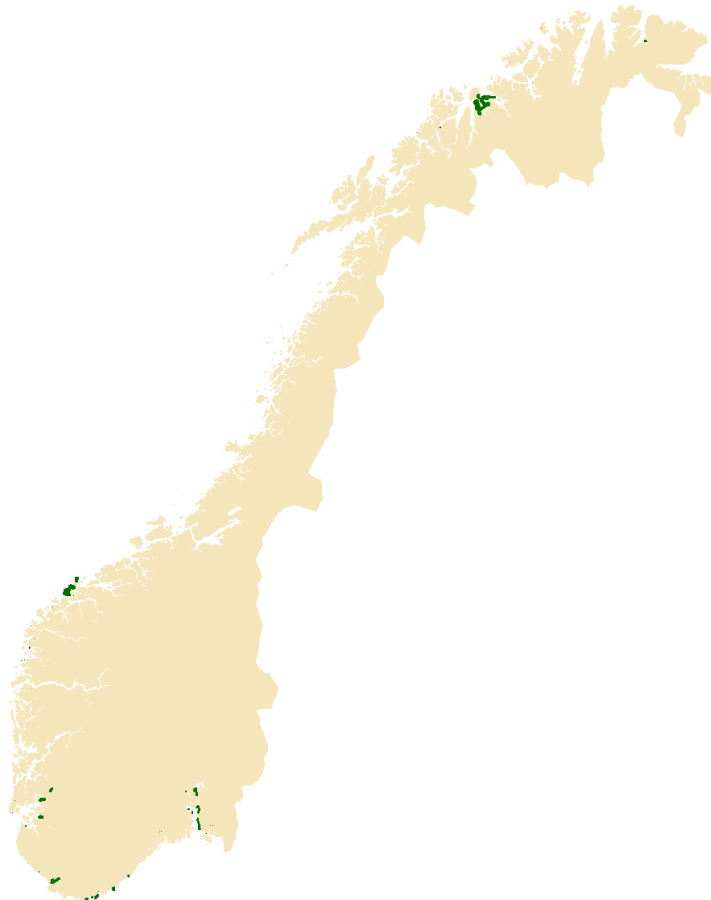


Figure 1 Area surveyed in territorial waters during 2019. Please note that the area sizes are exaggerated to make the smaller areas visible on the plot.

Svalbard

R/V Hydrograf and two survey launches operated at Svalbard for 10 weeks in 2019. Totally 1937 km² was surveyed, see Figure 2. These are all internal surveys. MAREANO surveys at Svalbard are shown in the next section.

Due to the Corona-situation, there will be no coastal surveys at Svalbard in 2020. Mareano surveys are planned east of Bear Island.



Figure 2 Surveying at Svalbard during the 2019 season

2.2 External conducted surveying 2019

Only surveys within the MAREANO program were contracted to external companies. The 2019 MAREANO surveys were mainly conducted by the Norwegian company DOF Subsea. Some of the areas were surveyed by Fugro Germany Marine and the Norwegian Defence Research Establishment.

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 5 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 2019: The MAREANO program received NOK 109,2 mill in total through earmarked funding. NHS received NOK 66.1 mill. 69 000 km² was surveyed in 2019. In 2019 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 programme will be published in the Norwegian spatial data infrastructure; *Geonorge* www.geonorge.no.

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

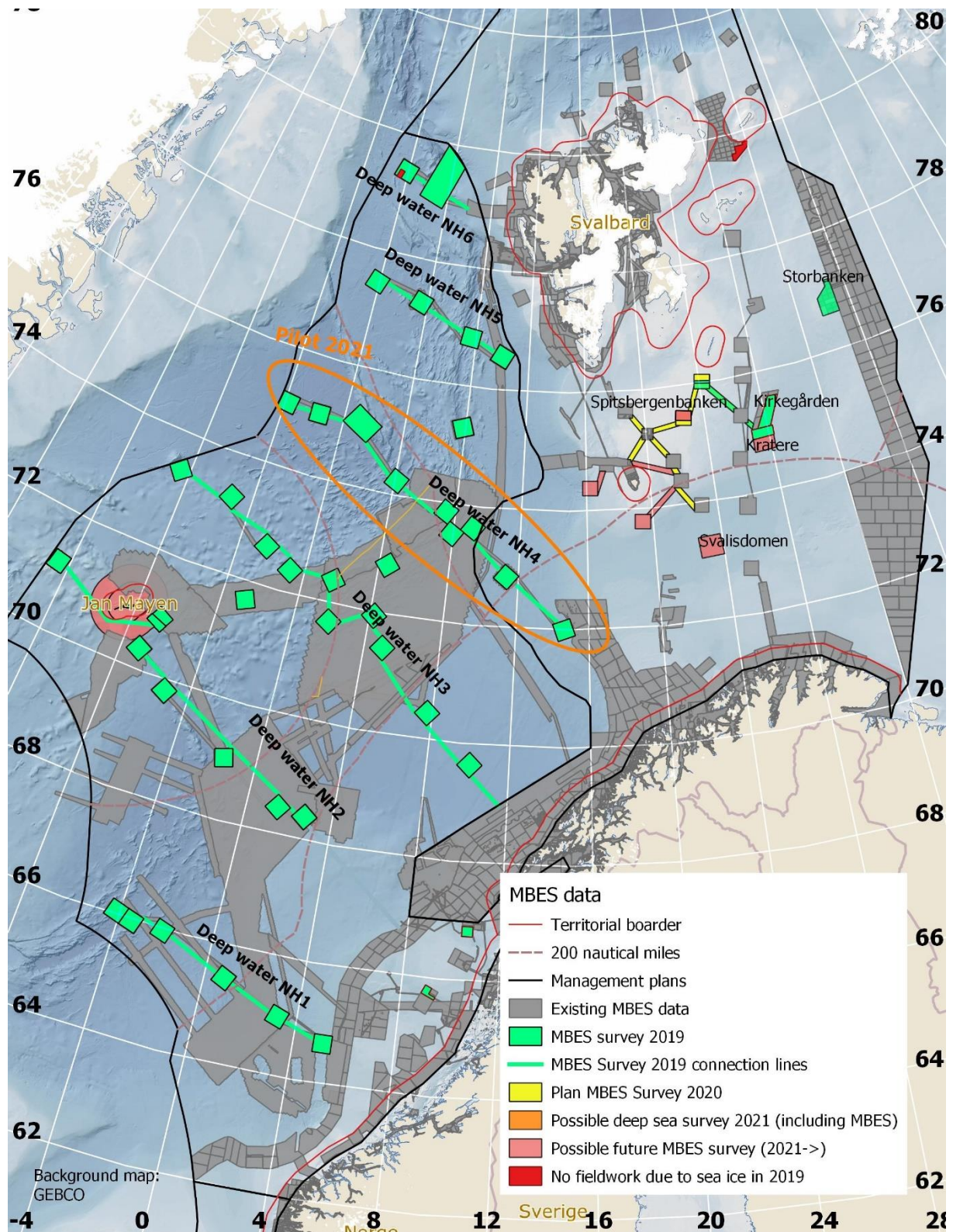


Figure 3. The Management plan areas and coverage of multi beam echo sounder data.

2.4 Marine Base Maps in Norway

Marine base maps in Norway is all about gathering detailed information and boosting the knowledge of the sea bed 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 will (i) map on a large scale the sea beds physical, biological and chemical environments (ii) analyse the data and (iii) distribute a set of standardised products in formats that would cater to the different needs of end users. The marine data collected can be distributed as stand-alone or combined with other datasets to create "Marine Base Maps". 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 will allow 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 mill. The pilot projects will investigate and test new technology for data collection and processing and, in addition, develop a cost-effective model for the implementation of a Marine base maps in Norway program.

Workshops have been held in three pilot areas with planning staff of municipalities and provinces, government agencies and industry / commercial actors. We have identified and documented planning processes in a way that shows what type of marine geospatial information is needed, what the requirements are (level of detail, quality, update frequency) and what are the requirements for distribution of the data. In addition we aim to identify datasets that can become part of our official national geographical information baselayer (in Norwegian: DOK: det offentlige kartgrunnlaget) containing all official datasets required for planning and building processes in Norway. Once a geospatial information dataset is part of "DOK", it

- meets specific ISO-standards,
- is INSPIRE compliant
- is available in WMS, WFS and WCS, pluss has atom feed
- can be harvested from our national geoportal "Geonorge"

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 production – Region N

In Region N (Arctic) the following ENC's were released from January 2019 to June 2020 due to updates from new surveys.

- NO3C5036 Gustav V Land, new ENC
- NO3C5028 Svalbard Moffen, new edition
- NO3C4836 Svalbard Hinlopenstretet, new edition
- NO3C4828 Svalbard Wijdefjorden, new edition

- NO3D4640 Storfjorden, new edition
- NO3D4636 Storfjorden, new edition
- NO3C4436 Storfjorden, new edition
- NO3A2820 Malangsgrunnen, new ENC
- NO4D4933 Sorgfjorden, new ENC
- NO4D5036 Kinnvika, new ENC

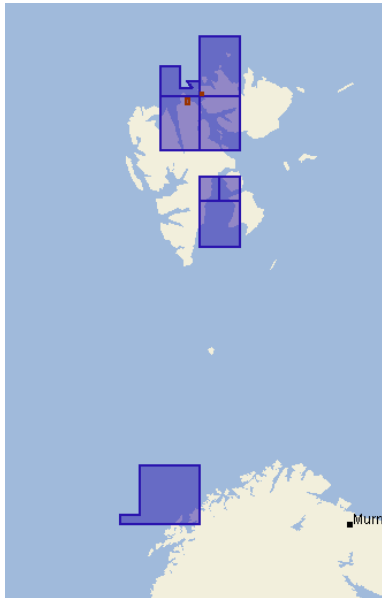


Figure above: Shows the new ENCs and new editions. Usage band 3=blue and usage band 4=brown.

The total number of Norwegian ENCs in June 2020 are 1204.

	Usage band	Compilation scale	No of ENCs
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	216
6	Berthing	> 1: 4 000	67

Table above: Number of ENCs in each usage band per 12 June 2020.

The new ENC between 69°N and 71°N (NO3A2820) was produced as a part of the expansion of full coverage in usage band 3 along the Norwegian coast.

In Svalbard new ENCs corresponding with paper chart 537 were produced in 2019. In 2020 the ENCs in Storfjorden and Fremannssundet were expanded with the new surveying from the 2019 season. In addition the ENC coverage in Wijdefjorden were expanded with new surveys.

Due to these activities also affected usage band 2 ENC's have been updated and published as new editions to achieve consistency between all usage bands.

During this period also some selected ports and passages in the northern Norway have been updated with new surveys in usage bands 2-6 after requests from the users.

Paper charts

INT Charts – Region N

Norway has 9 INT-charts in Region N (Arctic) in the chart portfolio. Most of them are small-scale charts (general and coastal charts). For the next years we plan to add 3 more coastal charts to our portfolio. All three will be in the Arctic region (N).

A total of 2 new editions of INT charts were issued in Jan-2019 – May-2020 due to updates from new surveys. 1 coastal chart and 1 general chart.

Chart No.	Title	Scale
1. 311	INT 9314 / Støtt - Andenes	1:350 000
2. 507	INT 9313 / Svalbard. Nordsvalbard	1:700 000

National Paper Charts – Region N

1 New Charts were issued in Jan-2019 – May-2020:

Chart No.	Title	Scale
1. 538	Wijdefjorden	1:100 000

A total of 18 new editions of national charts were issued in Jan 2019 – May 2020 in Region N, due to updates from new surveys. 1 harbour charts, 10 main charts and 7 charts for Svalbard.

National charts, new editions with new survey data published Jan 2019 – May 2020:

Chart No.	Title	Scale
1. 84	Gibostad – Rystraumen – Hekkingen	1:50 000
2. 93	Fugløya – Arnøya	1:50 000
3. 95	Brynnilen – Loppa – Sørøya	1:50 000
4. 96	Altafjorden og Langfjorden	1:50 000
5. 100	Ytre Sørøya	1:50 000
6. 103	Måsøya – Nordkapp – Honningsvåg	1:50 000
7. 104	Nordkapp – Lille-Tamsøya – Sværholt	1:50 000
8. 111	Berlevåg – Båtsfjord	1:50 000
9. 112	Båtsfjord – Hamningberg	1:50 000
10. 116	Sør-Varanger. Bugøynes – Grense Jakobselv	1:50 000
11. 466	Tromsøysundet – Sandnessundet med Tromsø havn	1:20 000
12. 525	Bellsund – Van Mijenfjorden	1:100 000

Chart No.	Title	Scale
13. 532	Storfjorden. Kvalpynten – Agardhbukta	1:100 000
14. 533	Storfjorden Nord. Freemansundet – Heleysundet – Sørporten	1:100 000
15. 537	Hinlopenstretet N. Fosterøyane – Nordporten	1:100 000
16. 540	Hinlopenrenna Moffen – Lågøya	1:100 000
17. 540	Hinlopenrenna Moffen – Lågøya	1:100 000
18. 541	Nordporten – Sjuøyane	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 2019, NHS completed the last ENC's to make it possible for sailing around Spitsbergen using only ENC's.

NHS established a cooperation with The Norwegian Coastal Authorities to make sure that all major- and most important fairways are covered with adequate quality bathymetry. One of the major tasks in year 2020 is to update charts with modern bathymetry in these areas.

The chart section has an ongoing project looking into use of dense depth contours in ENC's (high density ENC's). The first goal is to make a prototype ENC and then test the product among selected end users to gain experience. 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 soon expecting a change of this regime. The indications is a release of detailed depth information inside the 0-30m depth area.

4. Nautical Publications

The Norwegian Pilots Guide «Den norske los» was digitized and more customized for the professional users in November 2019. The new solution are available for browsers and tablets as an webapp. The information content is be based partly on our charts and partly on georeferenced information from external partners and our own survey.

By digitizing the Norwegian pilot we had to develop a new national port standard. The standard will be ready in 2020. 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 will be updated.

Combining all the data this way proves very useful to the mariner and is something municipalities and ports should keep updated themselves.

Data is delivered into .dwg (AutoCAD) which is transformed into Shape, geojson, gml, xml and sosi data (Norwegian standard). All data will be available for download via APIs in the same format. It is a goal of NHO that all data can be used on different devices in the future.

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 (Evert)

Norway participated in the annual meeting of the IHO Capacity Building Sub-Committee in May 2019. 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.

NHS entered into a cooperation with Albania in September 2014. The original project lasted until mid 2018. The main goals are related to building competence, survey, and ENC production capacity.

To ensure long term results, Norway has decided to stay committed to Albania for an additional three years (2018 – 2020) with follow-up support with potentially support from the Norwegian Ministry of Foreign Affairs for a fourth year in which to prepare for a new application to support hydrography in Albania. In addition, Norway is engaged with Capacity Building in Montenegro, aiming to achieve modern survey of prioritized harbor and coastal areas through regional cooperation with Croatia.

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. The official Norwegian tide tables are now only available as a Pdf-file that can be downloaded from the website.

In most Norwegian tide gauges floats are used in stilling wells. The draft of the float depends on the water level. This dependency was studied, and is now corrected for in real time. The correction was implemented in 2019. A technical specification for water level measurements was also implemented. We have currently started an initiative to look into new techniques for permanent monitoring of water level. This is done with an aim to increase the number of permanent tide gauges in the Norwegian network.

A project with our Geodetic institute to find a method for determining a common reference frame between sea and land so that Chart Datum (CD) and land levelling datum can be coupled is now finished. The last phase of the project was focusing on finding the mean dynamic topography (MDT) and the dynamic topography (DT) in the longest fjord in Norway, Sognefjorden. Sognefjorden is 200 km long and we measured water level at 20 sites. Long series (one year) provided us with information on seasonal effects. Other important data was GNSS measurements, existing gravity measurements and levelling to connect the tide gauges to the land levelling network. In collaboration with the Norwegian Meteorological Institute we also had a look at hydrodynamic modelling in this project. Comparison of the results from the project with satellite altimetry was done to see if altimetry could be used inshore. One important goal was to find a method that could be used along the Norwegian coast in a cost effective way. The project was ended in December 2019, and the results from the project will be published in a report, which is expected to become available soon. We have now started the process of making a first version of ellipsoid based reference levels covering the entire Norwegian coast and sea areas.

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

9.1. Marine Spatial Data Infrastructure

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.

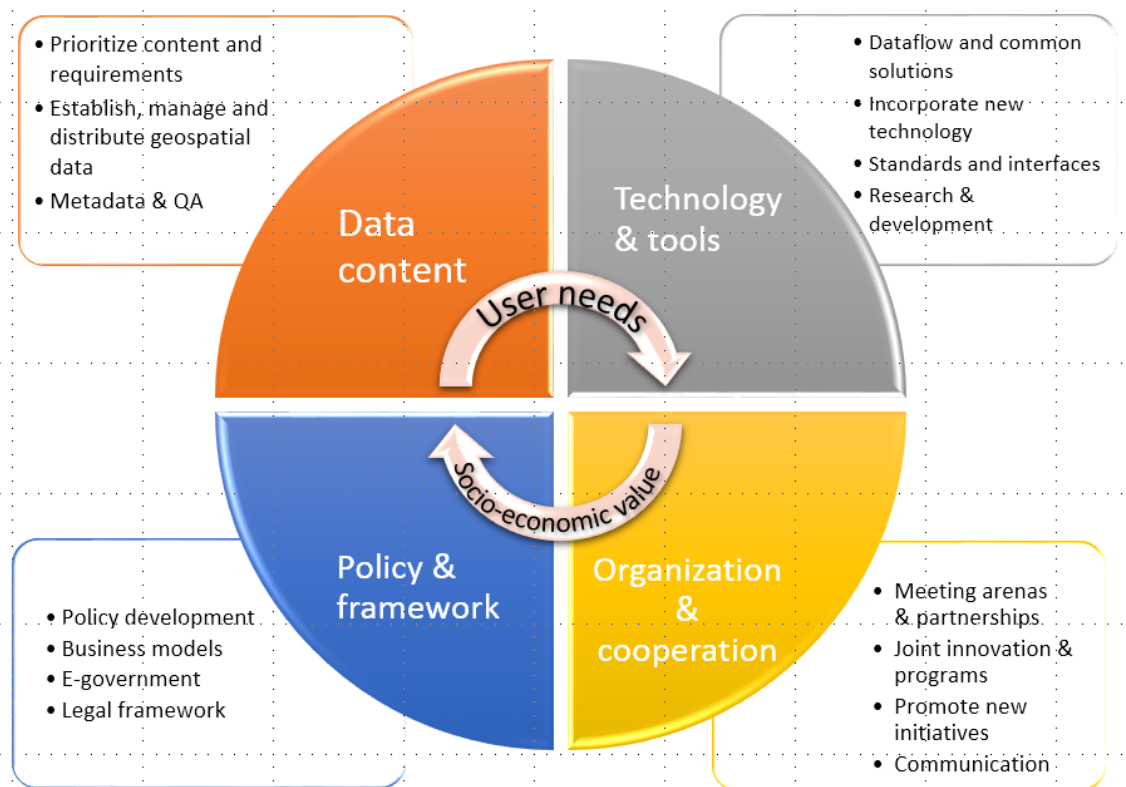


Fig.6 Norwegian SDI approach

[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 Government will work for

- A national knowledge base of geospatial information that meets important societal needs
- Shared solutions and technology that support effective problem solving and enable new application opportunities in society
- Well-functioning interaction with respect to management, sharing, development and innovation between both public and private actors

- Framework conditions that are predictable and well suited to the challenges of digital society

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). In addition, Norway comply with the EU's INSPIRE directive according to the requirements for data sharing, digital services and cooperation arrangements through the national Spatial Data Act.

9.2. Marine Spatial Planning

NHS is participating in the development of the [Marine Spatial Management Tool](#) (MSMT) for MSP in Norway. The MSMT project “Arealverktøysprosjektet” is a national cross-sectoral cooperation, developing and assembling standardized and harmonized geospatial services to underpin the MSP processes with integrated, multi-thematic geospatial information relevant to the Marine Management Plans covering the Norwegian sea-areas.

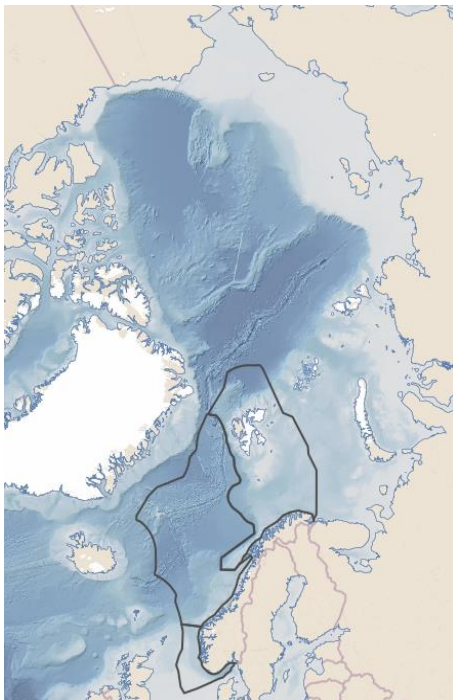


Fig.7. Norwegian management plans for the Barents Sea, Norwegian Sea, and the North Sea & Skagerrak, representing an area of 2.3 mill. km².

An important objective is to ensure proper inter-operability between the MSMT and the national SDI to release expected synergistic effects like re-use of data and services, improved data flows, richer data content, etc. The agile driven software development of MSMT released a new major version in November 2019. Further improvements and development continues during 2020.

The MSMT represent a major step forward in the process of integrating the marine component in the Norwegian SDI. So far, 11 governmental agencies share their authoritative data through their geospatial services, consumed and integrated through the MSMT, ensuring regular, updated data content.

The MSMT was successfully utilized during the last major revision process of the management plans for the Norwegian sea-areas.

(Ref. linked-in example: [showing overall industrial activities together with plans- and regulations](#)).

10. Innovation

New Hydrographic Infrastructure (John Kåre)

NHS needs 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, quality and lead time

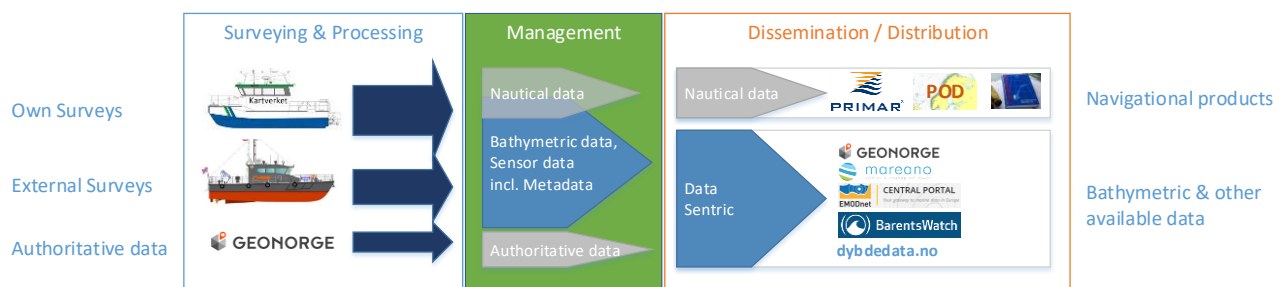
NHS have therefore established a project “New Hydrographic Infrastructure” with the aim and goal to renew our Hydrographic management systems/solution.

Norwegian governmental strategies set clear expectations to the solution and how to achieve an effective dissemination of different Marine Geodata and, at the same time, answer 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 also 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 product generic solution, not relieving the importance of nautical products.

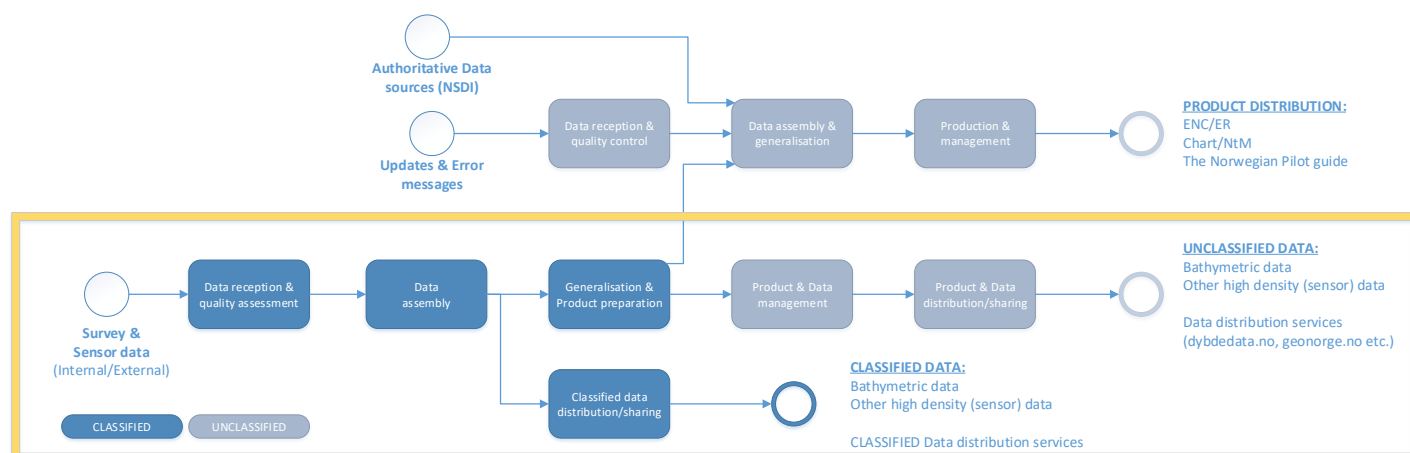
The new system is expected to be an integrated and complete management solution supporting effective preparation and dissemination of a broad range of marine geodata, including also bathymetric and derived bathymetric products. The solution must still ensure an effective production of authorized nautical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



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

- an efficient and integrated nautical production
- different digitization and data sharing solutions
- fast data access and effective bathymetric production (short processing time / increased automation)
- 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 NHI program:



The NHI project is planned to take up to 5 years to complete, and will include organizational as well as technological changes.

11. Other activities

International activities

The NHS is involved in several Working Groups, Committees and Commissions related to IHO. Norway has representatives in the following Sub-Committees and Working Groups: IHO Council, CBSCG, S-100, DQ, ENC, NC, NIP, TWC, IEN, MSDI, CSB and WEND. We have participated in the HSSC and the IRCC meetings in 2019. 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.