Kartverket	**NHC 61th Meeting** **Elsinora 6-8 March 2017**	**NHC** **National Report** **NORWAY**

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 NHC60 Conference in Stavanger, March 2016. Some highlights:

- *New director has taken office from 1 September 2016; Ms Birte Noer Borrevik*
- *Socio-economic study of increased production and improved availability of marine geospatial data executed (study provided separately)*
- *Pilot project for digital nautical publications*
- *Pilot project for S-102*
- *Development of a marine spatial planning tool*
- *Establishment of a Marine Maritime Forum in Norway to improve access to marine geospatial data*
- *Continued high activity in the Mareano project in both coastal and open sea arctic areas*
- *First commercial survey company certified in accordance with NHS survey standards*
- *Cooperation project with Albania*

1. Hydrographic Office

Figure 1. New organization structure Norwegian Hydrographic Service

The reorganization of the Norwegian Hydrographic Service in 2015 has resulted in the following major changes:

- 4 departments, organized around our 4 strategic tasks:
    - To coordinate and harmonize bathymetric data collection and dissemination for Norwegian waters (Geodata department)
    - To ensure safe and effective sea transport within our role as nautical chart authority (Nautical department)
    - To operate and further develop the PRIMAR RENC (PRIMAR)
    - To assist in building a national spatial data infrastructure that includes the marine and maritime domain (Marine Infrastructure Department)
- Technology personnel lifted out of their specific production environment to secure a holistic technology development
- Several functions centralized to mother organization Norwegian Mapping Authority: IT, Communication, Procurement, HR, M&S but located physically at the Hydrographic Service

2016 was the first year with the new organization structure in place. In January 2017 we started an evaluation process that will provide us with feedback whether or not additional changes are required.

2. Hydrographic Surveys

Internal conducted surveying 2016
During 2016, R/V Hydrograf and its two survey launches have been working in the coastal waters of Norway and Svalbard. In addition, R/V Hydrograf surveyed at open sea for the MAREANO project.

The new survey launces are efficient working platforms giving a good progress in the survey work. The Caris processing software is also quite well integrated in our organization, but there is still room for improvements.

Norwegian coast
The primary survey area between Sognefjorden and Stadt was completed in 2016. The secondary priority area beween Haugesund and Bergen was also almost completed.

A new primary survey area was opened in the outer part of the Oslo fjord, where the surveying started close to Tønsberg in October 2016.

In addition to the major survey areas, a lot of smaller areas along most of the coast were covered by revisory surveys.

The total area surveyed along the Norwegian coast in 2016 was 813 km². Figure 1 presents the coverage of surveying within the territorial waters.

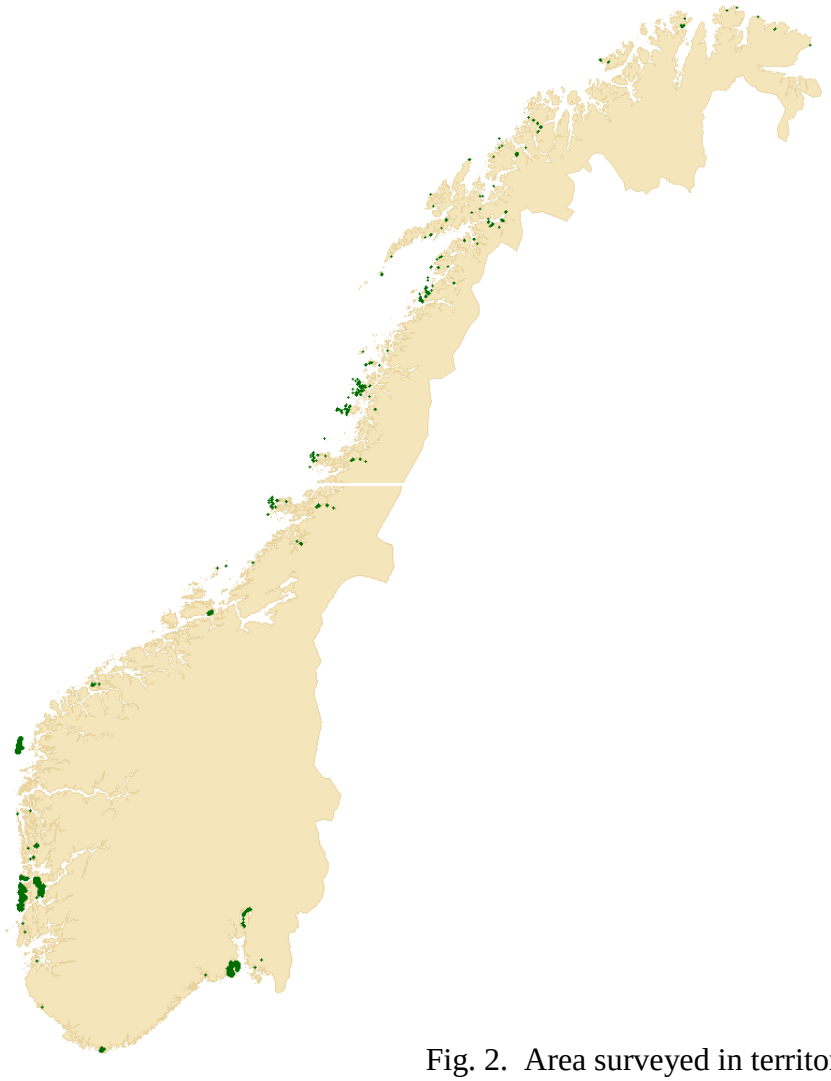

Fig. 2. Area surveyed in territorial waters during 2016. Please note that the area sizes are exaggerated to make the smaller areas visible on the plot.

Svalbard
R/V Hydrograf and two survey launches operated at Svalbard for 10 weeks in 2016. Totally 605 km^2 was surveyed, see figure 2.

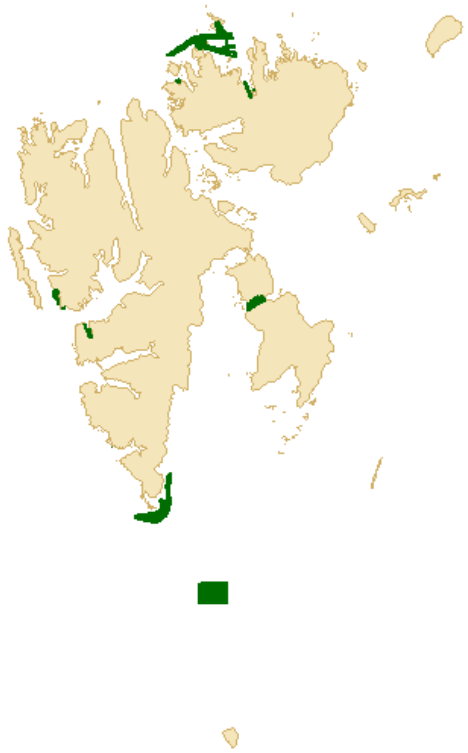

Fig. 3. Surveying at Svalbard during the 2016 season
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External conducted surveying 2016
Only surveys within the Mareano program were contracted to external companies. The 2016 Mareano surveys were mainly conducted by the Finnish company MeriTaito. Some of the areas were surveyed by the Norwegian Defence Research Establishment.

Certification of hydrographic survey companies
Several companies conduct hydrographic surveys in Norway, for different purposes and to different standards. In order to allow for the credo: Survey once, use and reuse many times for different uses and in order to be able to scale up hydrographic survey capacity in Norway when funding allows for it, NHS has developed a set of hydrographic survey requirements for external organisations. The requirements include technical requirements and requirements for a management system. Organisations (companies) meeting the requirements may apply for an approval and obtain the privilege to deliver hydrographic data to the Norwegian Hydrographic Service. The approval process starts by an evaluation of the management system and technical documentation and is followed up by an assessment conducted at the site of the applicant. At present, one company is certified and one more is being evaluated.

3. Nautical Charts

3.1. Maritime Primary Database

The Maritime Primary Database consists of selected bathymetry, coastline, shoreline constructions, pontoons, lights and navaids, submarine cables and pipelines, overheads cables, anchor berthing, marine farms, wrecks and obstructions, restrictions, precautionary area, traffic separation zones etc. In 2016, the production comprised replacing areas with older survey data with new survey data mainly in harbours chart of Haugesund(469) and Kårstø/Karmsundet (491) and starting the work of Main Chart Bremanger (28). Besides the new surveyed areas, updates were received continuously from many different governmental partners, contractors and customers. These updates enter into the Maritime Primary Database immediately. The production of Notices to Mariners ("Etterretninger for sjøfarende") and the production of all charts/ENCs are based on the information extracted from the Maritime Primary Database.

The Norwegian Coastal Administration is responsible for the fairways and its aids to navigation. They maintain a database with all navigational lights, marks, buoys etc. At present, it is still a manual and therefore a resource demanding process when they inform us of changes (new lights, move of buoys, etc) that we need to put in our Primary Database. That is why we, together with the Coastal Administration, run a pilot project of automated geo-synchronizing. Results are expected fall 2017 so that potential required funding for necessary investments can be planned for in 2018.

Notices to Mariners (Etterretninger for sjøfarende (Efs))

24 editions were published in 2016. The publication is only available on the Internet, free of charge for downloading, at the Efs service www.kartverket.no/efs. The Internet solution also allows searches for messages sorted for each chart index. The Efs service provide tracings as a supplement to the notices.

3.2. Chart production

Since autumn 2008, when the NHS completed the major task of covering the Norwegian coast with ENCs and modernised paper charts, the production 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.

3.3. ENC production

In 2016, the NHS produced 3 new Coastal ENCs in Svalbard corresponding with chart 536, see Figure 3. At the same time 3 existing General ENCs with poor quality were updated with multibeam survey data and new coastline. Along the Norwegian coast, New Editions of existing ENCs corresponding to chart 455 were produced. This resulted in 7 updated ENCs in the Berthing, Harbour and Approach user bands, with new multibeam survey data, new coastline and other updated objects. This job is not finished and will continue in 2017.

The expansion of coverage in the Coastal user band to all Norwegian waters south of 63°N was completed. In addition, coverage in the Coastal user band west of chart 309 and 310 due to new chart coverage were expanded. In this connection, 2 new Coastal ENCs were produced and 8 existing Coastal ENCs were published as New Editions.
Also 5 existing General ENCs were upgraded and published as New Editions as a result of this task.

Between 67°N and 71°N, 5 new ENCs in the Coastal user band were produced and 6 existing ENCs in the General user band were upgraded and published as New Editions, see Figure 4.

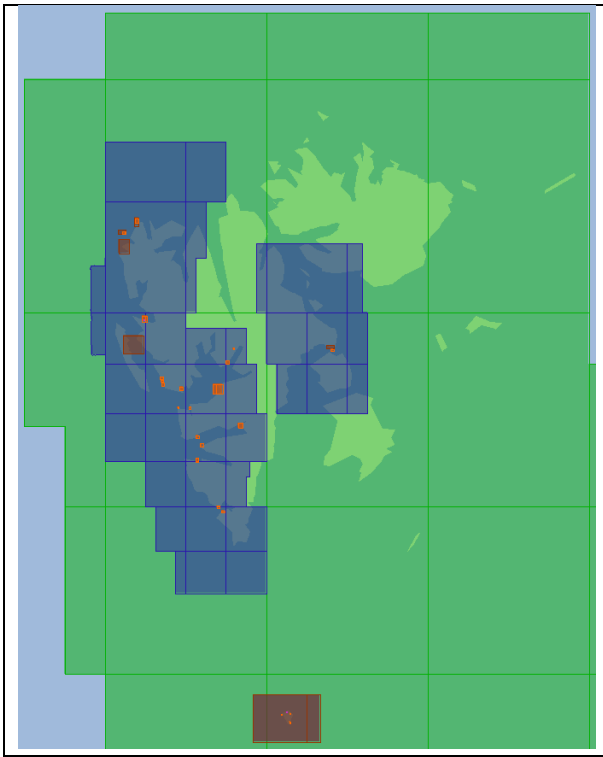


Figure 4.
ENC coverage for Svalbard (ENCs in User Bands 2-6).

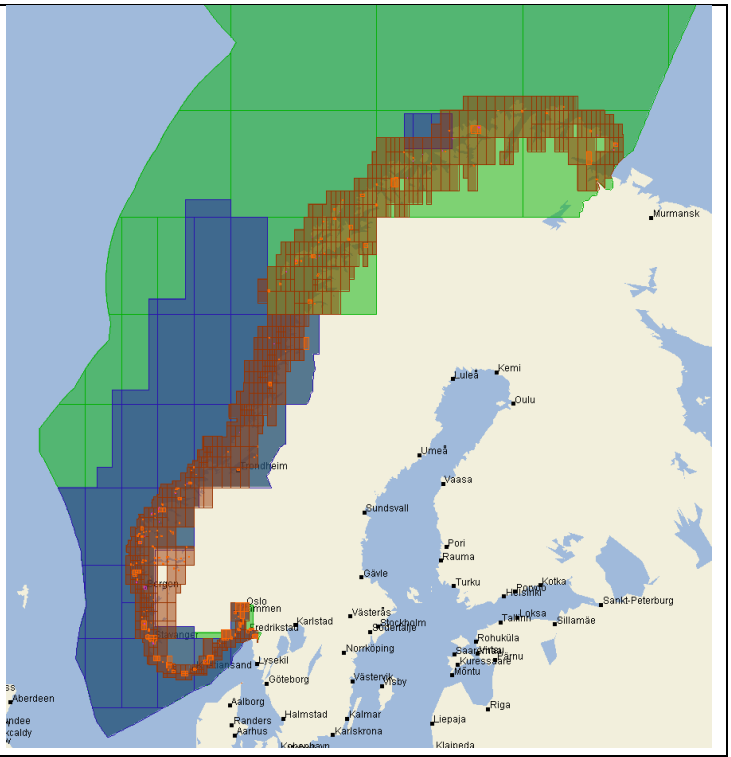
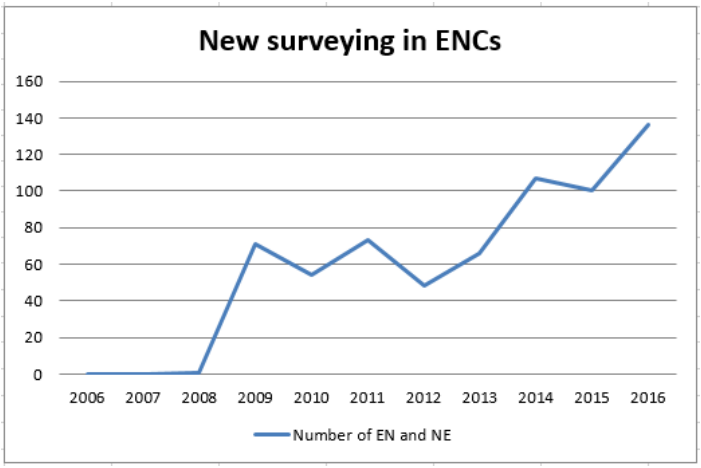


Figure 5.
ENC coverage for the Norwegian coastal waters (ENCs in User Bands 2-6).

Besides those already mentioned, totally 136 ENCs in the user bands 2-6 have been upgraded with new multibeam survey data in limited areas. 15 as new ENCs produced in accordance with pilot sketches and 121 published as New Editions of existing ENCs.

The graph below shows the trend in upgrading the ENC with new survey information in recent years.



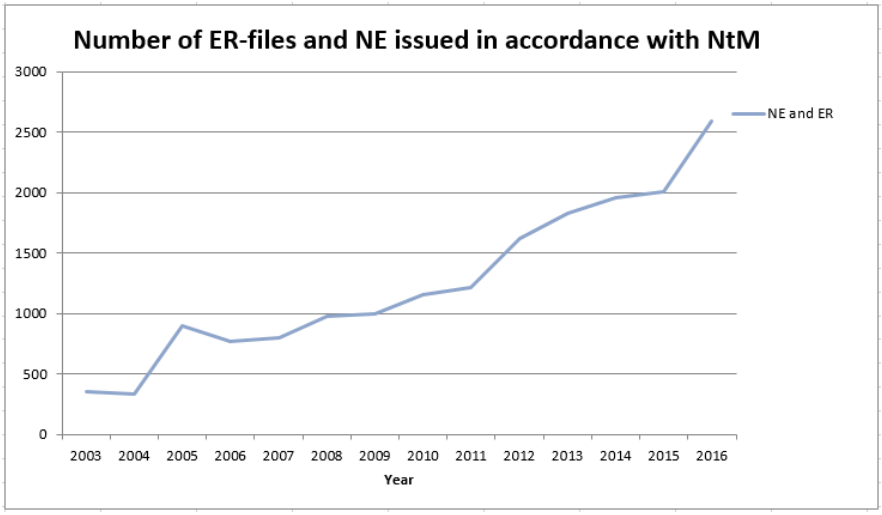
The total number of ENCs was 1155 at the end of 2016.

	Usage Band	Compilation scale	No of ENCs
1	Overview	< 1:1 499 999	3
2	General	1:350 000 – 1:1 499 999	69
3	Coastal	1:90 000 – 1:349 999	77
4	Approach	1:22 000 – 1:89 999	753
5	Harbour	1:4 000 – 1:21 999	204
6	Berthing	> 1: 4 000	49

Table above: Number of ENCs in each usage band per 31 Dec. 2016

The updating via ER profiles were issued in accordance with the Notices to Mariners (NtM) and other updates, and distributed through Primar. A total of 2589 ER files and NE were issued as part of the continuous maintenance of the ENCs. Temporary (T) and Preliminary (P) notices were published as ER files. They are included in the numbers.

The graph below shows the trend in recent years. The number has increased gradually, especially after NHS started to publish T/P notices in 2011.



Planned activities in 2017:

In 2017, the work with the ENCs corresponding to chart 455 will be completed, Approach, Coastal and General ENCs remains. Existing ENCs corresponding to chart 478, 469 and 491 will be published as New Editions based on new multibeam survey data.

New General ENCs between 67°N and 71°N will be produced.

The publishing of New Editions and new ENCs based on updated survey data will proceed.

Updating via ER profiles in accordance with the NtM will continue.

3.4. Paper chart production

A total of 60 new editions of charts were issued in 2016 due to updates from new surveys.

14 harbour charts, 39 main charts, 4 coastal chart and 3 charts for Svalbard.

*5 charts were issued as new edition twice in 2016.

New charts/ new editions with new survey data published 2016:

Chart No.	Title	Scale
3	Oslofjorden. Fulehuk – Filtvet – Rødtangen	1:50 000
4	Oslo – Rødtangen – Drammen	1:50 000
15	Ryfylkefjordane. Sjernarøyane - Sauda	1:50 000
17	Karmsundet - Ryvarden - Skjoldafjorden	1:50 000
19	Ryvarden - Selbjørnsfjorden	1:50 000
21	Selbjørnsfjorden - Bergen	1:50 000
22	Samnanger-, Bjørna- og Ytre Hardangerfjorden	1:50 000
25	Sognesjøen - Stavenes	1:50 000
27	Sunnfjord	1:50 000
28	Bremanger	1:50 000

Chart No.	Title	Scale
30	Haugsholmen - Ålesund	1:50 000
31	Breidsundet – Fjørtoft	1:50 000
33	Harøyfjorden – Molde	1:50 000
60	Ranfjorden	1:50 000
61	Træna – Nesøya – Myken	1:50 000
69	Tranøy - Raftsundet	1:50 000
72	Lofotodden – Stamsund	1:50 000
73	Ure - Gimsøystraumen - Svolvær	1:50 000
74	Fuglehuk – Ramberg – Eggum	1:50 000
75	Eggum - Gimsøy - Gaukværøya - Stokmarknes	1:50 000
76	Stokmarknes – Sortland – Malnes	1:50 000
78	Hovden – Langenes – Risøysundet	1:50 000
79	Risøysundet - Kvæfjorden - Harstad	1:50 000
84	Gibostad – Rystraumen – Hekkingen	1:50 000
87	Rystraumen – Tromsø – Grøtsundet	1:50 000
90	Ullsfjorden og Lyngen	1:50 000
95	Brynilen - Loppa - Sørøya	1:50 000
97	Sørøysundet, Stjernsundet og Rognsundet	1:50 000
98	Sørøysundet – Vargsundet – Hammerfest	1:50 000
98*	Sørøysundet – Vargsundet – Hammerfest	1:50 000
99	Kvalsundet – Revsbotn – Reinøysundet	1:50 000
100	Ytre Sørøya	1:50 000
102	Rolvsøysundet – Måsøya	1:50 000
106	Porsangerfjorden. Kistrand – Lakselv	1:50 000
111	Berlevåg – Båtsfjord	1:50 000
126	Storfjorden. Ytre del med Hjørundfjorden	1:50 000
126*	Storfjorden. Ytre del med Hjørundfjorden	1:50 000
140	Tysfjorden	1:50 000
144	Lopphavet	1:100 000
305	Skagerrak	1:350 000
306	INT 1400 / Nordsjøen	1:350 000
306*	INT 1400 / Nordsjøen	1:350 000
308	INT 1402 / Florø – Smøla	1:350 000
401	Oslo - Spro	1:25 000
402	Spro - Filtvet	1:25 000
452	Oslo havn	1:10 000
452*	Oslo havn	1:10 000

Chart No.	Title	Scale
456	Ålesund havn	1:20 000
463	Mo i Rana	1:10 000
466	Tromsøysundet – Sandnessundet med Tromsø havn	1:20 000
471	Kvitsøy og Skudeneshavn	1:20 000
479	Florø havn	1:10 000
482	Moss havn	1:20 000
485	Sandnes havn	1:10 000
489	Hammerfest med innseilinger	1:20 000
489*	Hammerfest med innseilinger	1:20 000
494	Nyhamna*	1:10 000
505	INT 9311 Svalbard. Bjørnøya - Isfjorden - Storfjorden - Hop	1:700 000
507	INT 9313 Nordsvalbard	1:700 000
536	Hinlopenstretet S. Sørporten – Fosterøyane	1:100 000

*5 charts were issued as new edition twice in 2016.

Planned activities in 2017:
The chart production for 2017 will be focused on production of charts in the Stavanger, Haugesund and Flekkefjord areas. We will issue coastal chart 311 and 312 as INT charts.

Print On Demand (POD)

The complete Norwegian chart portfolio (230 charts) is produced for POD only.

4. Nautical Publications

The Norwegian Pilots Guide «Den norske los» is to be revised and more customized for the professional users. A pilot project with the purpose of developing a test version of a Digital Pilot is ongoing in the first half of 2016. The new solution will be available for browsers and tablets as an app. The information content will be based partly on our charts and partly on georeferenced information from external partners (like refueling locations, mooring positions, electricity supply etc. The pilot version of the new product will cover the coastal area between Stavanger and the city of Haugesund (north of Stavanger)

Until the revised editions are available, the current updated pdf versions of the Pilots can be downloaded from The Norwegian Hydrographic Service's homepage: www.kartverket.no. The Pilots are updated twice per year (May and November). Important changes are reported in the Notice to Mariners.

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 February 2017.

7. Capacity building

Norway participated in the annual meeting of the IHO Capacity Building Sub-Committee in June 2016. 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 project will last until the end of 2017. The main goals are related to building competence, survey, and ENC production capacity. Two student have finalized a Cat B course (one at Skilltrade and one at the Italian HO) and one has participated in surveying at NHS. One student participates in a Cat A course at the university of Genoa. A Data management and Chart Production system have been acquired and are operational. Relevant training has been delivered. A MBES with motion sensor has been acquired and installed on a survey launch that we provide to the project. The survey launch has been transported to Durres Albania, where it arrived late January and is now undergoing sea trials.

8. Oceanographic activities

Our main oceanographic activity is the operation of a tide gauge network of 23 gauges and to analyze and distribute the data and water level information to our own hydrographers and other users.

The number of users on our web site http://www.kartverket.no/sehavniva/ are steadily increasing.

We see that local governments find important information like minimum recommended levels for construction work in the coastal zone and the future change in the water level.

We continue our cooperation with the Norwegian Coastal Administration where we establish CD at places where it is necessary with dredging or building breakwaters. Another activity is to help the Mapping Authority to transfer land-levelling datum from the mainland to the islands. This involves accurate water level measurements both sides and careful analyses of the data.

9. Other activities

9.1 Southern Sunnmøre projects.

The Søre Sunnmøre region (just south of Ålesund) is a pilot and testbed area for several of our activities. High resolution bathymetric and topographic data is available and enables us to, from a data viewpoint, to make a seamless high resolution 3D land-sea terrain model.

At present, we are engaged in three projects in this region.

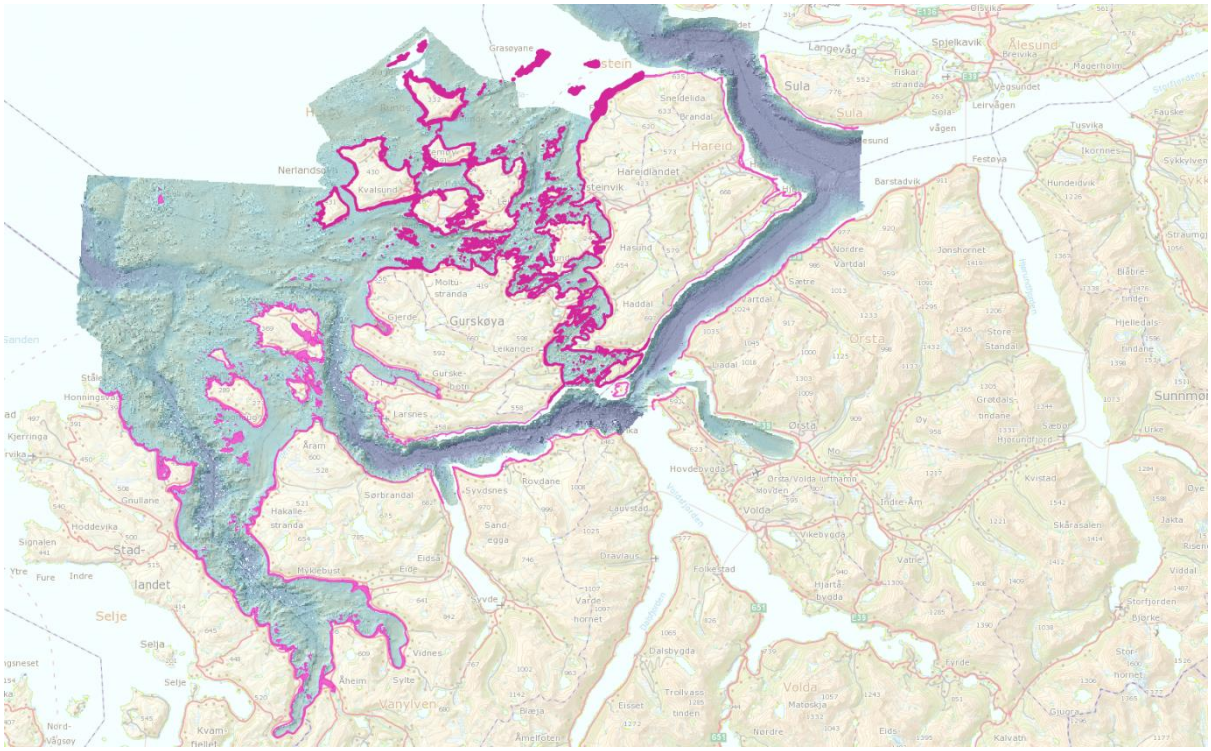


Fig 6. Søre Sunnmøre region with area planned for green laser survey in pink (92km2)

What we lack in data is a narrow strip of coastline (roughly MSL to 4m waterdepth (LAT)), depicted in pink in figure 6, which will be covered by airborne green laser survey. Terratec has been awarded the contract for the survey and the first survey data has been provided to NHS for validation and processing. Final results will be ready prior to NHC62.

The second project aims to find a common reference frame between sea and land so that Chart Datum (CD) and land levelling datum can be coupled. There is increased focus on activities in the coastal zone. In the project we combine water level measurements with pressure sensors, GNSS measurements from a boat, gravity measurements from both a boat and air, and land levelling to find the best relation between the different reference levels. One important goal is to find a method that we can use along the Norwegian coast in a cost effective way. So far, we have measurements from two areas in Søre Sunnmøre with results for a third area to follow soon. We have started analysis of the measurements and we have made a preliminary model in a very small area, that proved so far, that the methods and programs which are developed are working. At the end of this year, the report will be ready with a model in Søre Sunnmøre and a recommendation for a strategy for the rest of Norway.

In the third project "Visualization of the sea level" we will combine the detailed elevation model with information of historic storm surges and prediction of future sea levels. The project will result in a map based web service meant for the general public as well as a more specialized service for professional users such as coastal development planners, decision makers etc. The project will start up this year and deliver by the end of this year.

9.2. 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 but very sensitive 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 with the Institute of Marine Research (IMR, programme management) and the Geological Survey of Norway (NGU).

Results 2016: The MAREANO program received NOK 98.9 mill in total through earmarked funding. NHS received NOK 48.6 mill. 9 700 km^2 was surveyed in 2016.
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; *Norge Digitalt* 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.

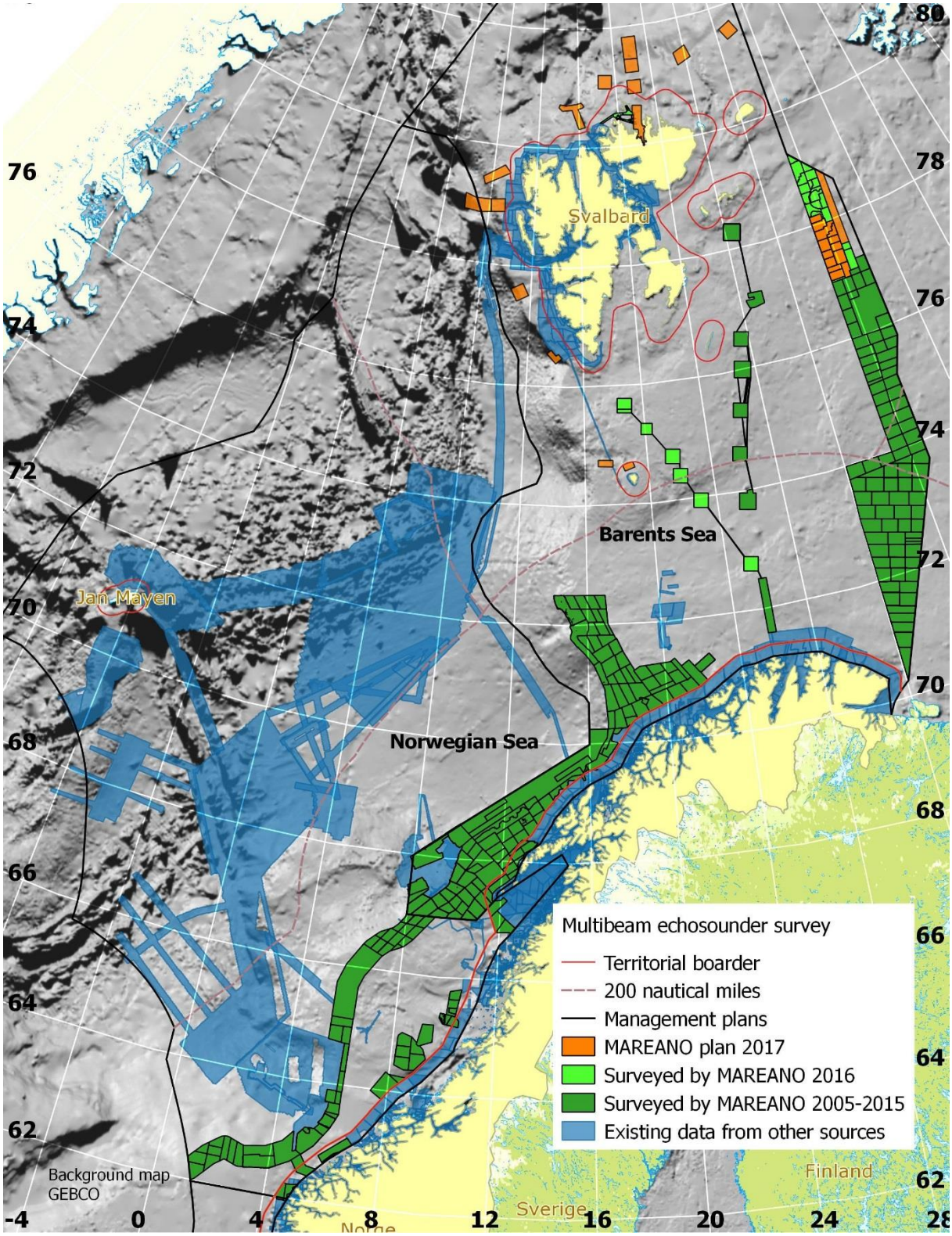


Figure 7. The Management plan areas and coverage of multi beam echo sounder data.

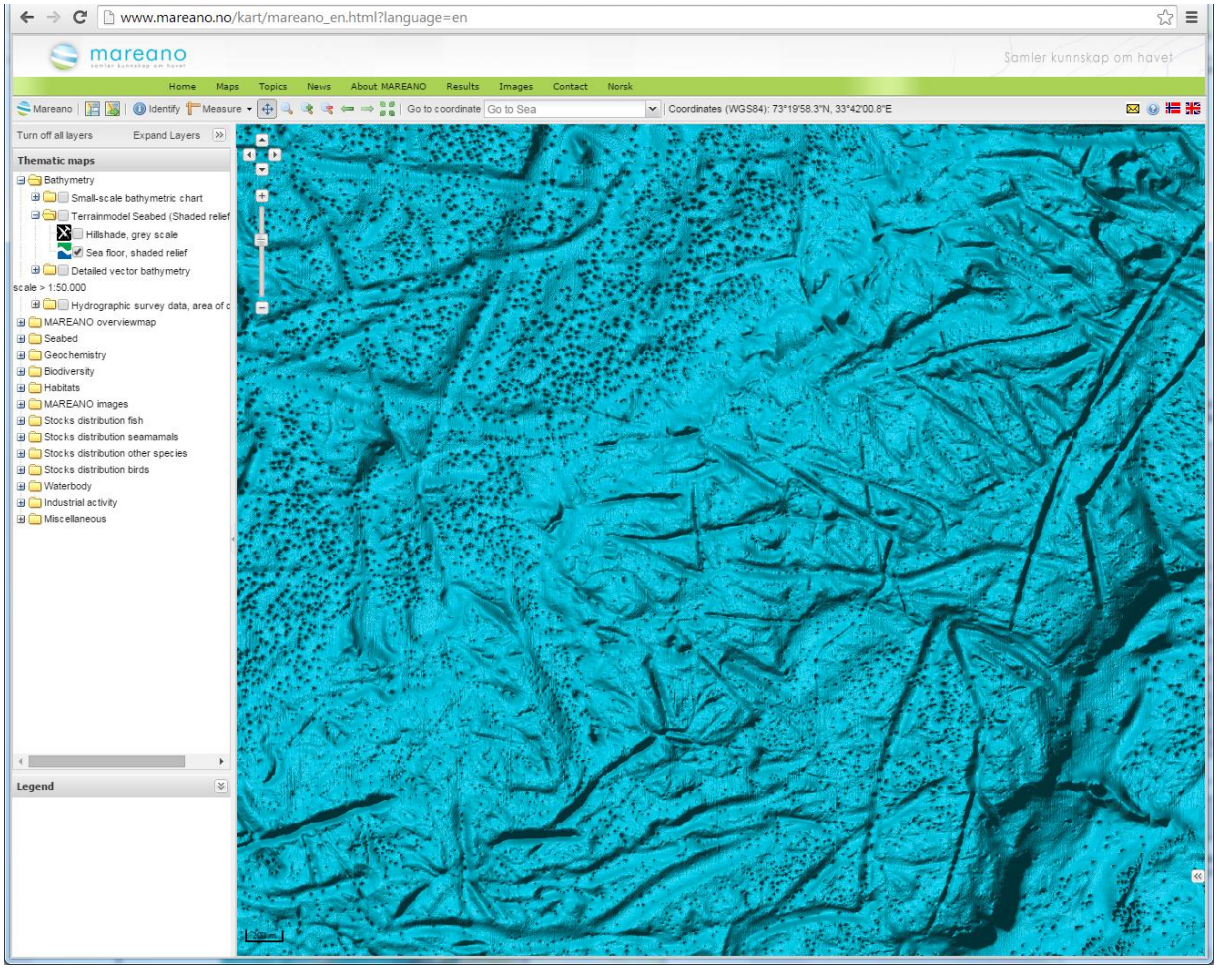


Figure 8. An example from the WMS shadow relief map service showing seabed with pockmarks and iceberg plough marks in the Barents Sea (screendump from map service on **www.mareano.no**)

9.3. Marine Spatial Data Infrastructure

NHS is taking active part in building the national spatial data infrastructure in Norway through the Marine Infrastructure Department, which has a central role in the coordination of activities in the marine and maritime domain. The national spatial data infrastructure cooperation, Norway digital, counts for more than 600 organizations, whereupon 50% are involved in coastal and/or offshore activities. Norway

NHS has been one of the key players in establishing the Marine and Maritime Forum under Norway digital in January 2017. The aim is to develop the cooperation between data owners, service suppliers, and end-users to improve the user-value of marine and maritime geospatial services to society.

NHS has been taking part in the SDI support against the national MSP, looked into possibilities of regional cooperation around CZM, and participated in activities to ensure compliance with INSPIRE.

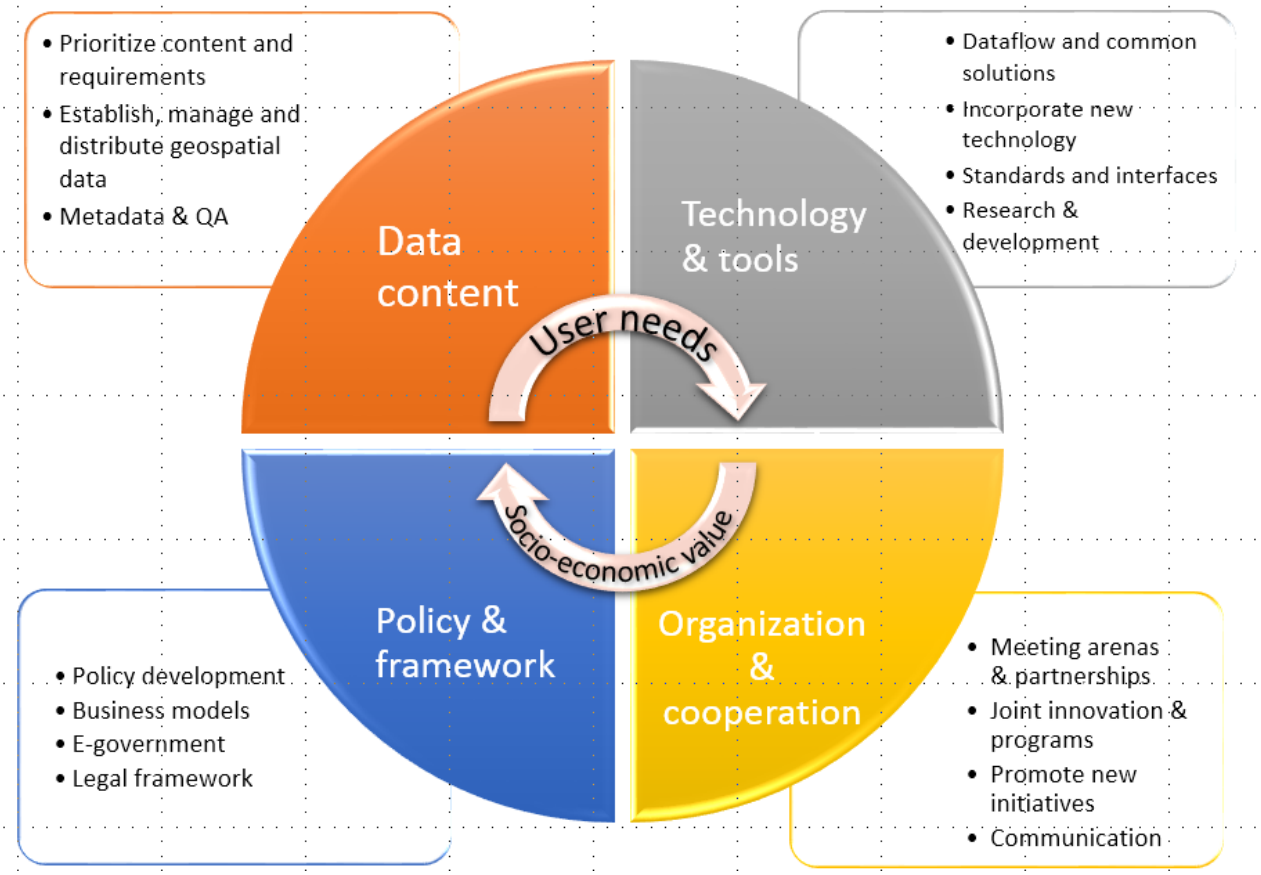


Figure 9. Norwegian SDI approach

9.4. Marine Spatial Planning

NHS is participating in the development of the Marine Spatial Management Tool (MSMT) for MSP in Norway. The MSMT project "Arealverktøyprosjektet" is a national cross-sectoral cooperation, developing and assembling standardized and harmonized SDI services to underpin the MSP processes with integrated, multithematic geospatial information.

Although Norway has been working with MSP and produced integrated management plans for Norwegian sea-areas during the last 10 years, there has been a lack of proper SDI support. One of the objectives is to ensure proper interoperability between the MSMT and the NSDI in a way that will release expected synergistic effects like re-use of data and services, improved planning and decision making through one common geospatial knowledge platform, etc. The project released a limited test version in November 2016, and will release a final adequate version in November 2017. This represent a major step forward in the process of integrating the marine component in the Norwegian SDI.

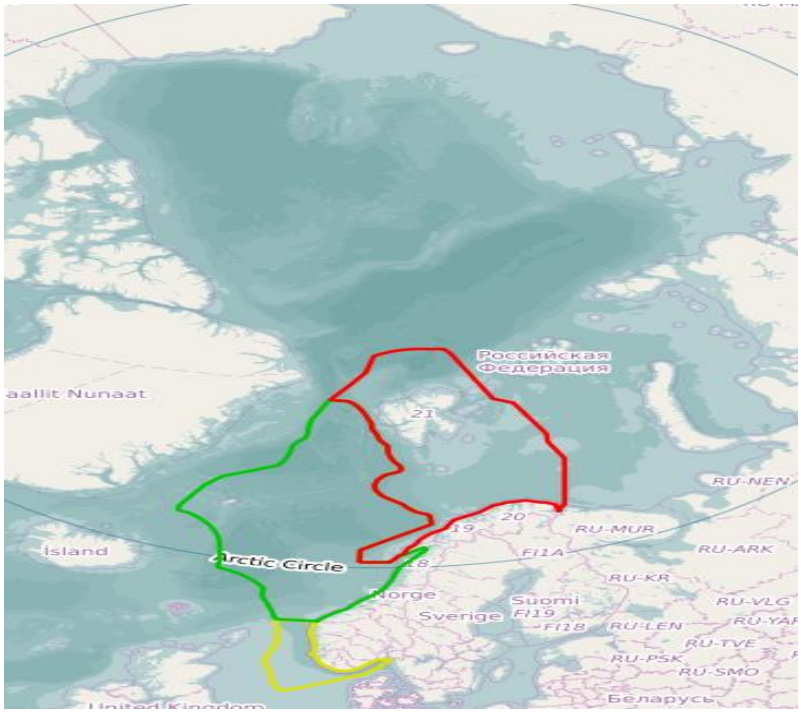


Figure 8. Norwegian management plans for the Barents Sea, Norwegian Sea, and the North Sea & Skagerak, representing an area exceeding 2 mill. km^2.

9.5 International activities

The NHS is involved in several Working Groups, Committees and Commissions related to IHO. Norway has representatives in the following Working Groups: S-100, DQ, ENC, NC, NIP, TWC, IEN, MSDI, CSB, CBSC and WEND. We have participated in the HSSC and the IRCC meetings in 2016. Norway is actively participating in 5 Hydrographic Commissions: ARHC, HCA, NHC, NSHC and SAIHC.

As operator of Primar we participate in all related meetings.

During the last few years we have contributed with a substantial part of high resolution bathymetric data, obtained through the Mareano project, to the GEBCO (and IBCAO) database.

A model with grid size of 50x50 meter, based on all available survey data from Norwegian coastal waters, has been developed. The information is made available to EMODnet.

NHS is an active partner in the EU project Coastal Mapping and is part of the new consortium that has won the contract for the EMODNET High Resolution Seabed mapping project.