

UPDATES ARCTIC HYDROGRAPHY NORWAY

Summary

This report gives an update of the activities that have taken place within the Norwegian Hydrographic Service (NHS) since our last report for ARHC 6 (September 2016).

Some highlights are:

- *Norwegian program Arktis 2030 sponsored project for better access to geodata for arctic marine areas*
- *Continued high activity in the Mareano project in both coastal and open sea arctic areas*
- *Pilot project for digital nautical publications*
- *Pilot project for S-102 sponsored by Norwegian Research Council*
- *Planning of the MAGIN (Marine Base Maps in Norway) program*

1. Hydrographic Office

The Norwegian Hydrographic Service (NHS) has experienced an increased demand for high-resolution bathymetric data and updated charts. In an ever more digitized world, we, as a government service, are subject to expectations of a population that has gotten used to the functionality of web services such as Google maps, the agility and ingenuity of Tesla and efficiency of Toyota. This, combined with the Norwegian governments focus on moving the transportation of goods from roads to sea and their strategy to increase output from marine farming fivefold, has increased the NHS workload to a point where our resources are reaching their limits.

The need to prioritize what we do, and most importantly; what we do not do, has become increasingly important. This is why the NHS has implemented a new role in its organization, a Production Planner. The main responsibility of the planner is to establish and follow up systems and routines that ensure that government money is spent on activities that give the greatest return on investment to society. Without a documented request from one of our stakeholders, an activity should never start.

Previously, the NHS received requests at several points in our production. This could easily lead to an ad hoc approach to production planning. The different departments could prioritize work on matters they thought to be important, but they lacked both a systematic approach to prioritization and a complete overview of the production line.

At the NHS we are now moving towards a system where all requests are routed into our customer relations system (CRM), and are subject to the same evaluation. We have established a scoresheet for every request containing amongst other things a risk assessment and a cost / benefit analysis.

Once the scoresheet has been completed, each request will be given a priority, and a production order will be produced.

Our experience so far, with testing the new procedures, is that several of the things we at the NHS thought were high priority, are not. We can already see that we are moving from a state where everything is high priority to a state where only the high priority request are high priority, and the medium are medium and the low are low thus ensuring that we are working on the right things.

2. Hydrographic Surveys in 2016

Svalbard

NHS conducted two survey operations, each of five weeks duration, within the Svalbard region in 2016. During most of the first survey, Hydrograf (equipped with EM710) surveyed for Mareano in an area between Spitsbergen and the Bear Island. The last part of this first survey was spent surveying coastal areas close to the southern cape of Spitsbergen.

Mareano also mainly financed the second survey. This survey mainly focused on establishing a safe route between the northern part of Hinlopen and Rijpfjorden north of Nordaustlandet. Due to deteriorating ice and weather conditions, the last part of the second survey was moved to areas further south. The coastal areas were mainly surveyed using two survey launches equipped with EM2040 dual RX. The operations were organized 24/7.

In 2016 the NHS Svalbard surveys comprise a total of 1750.8 km². Out of these, 964.5 km² were surveyed as part of the Mareano program. The nearshore surveys are shown in figure 1.

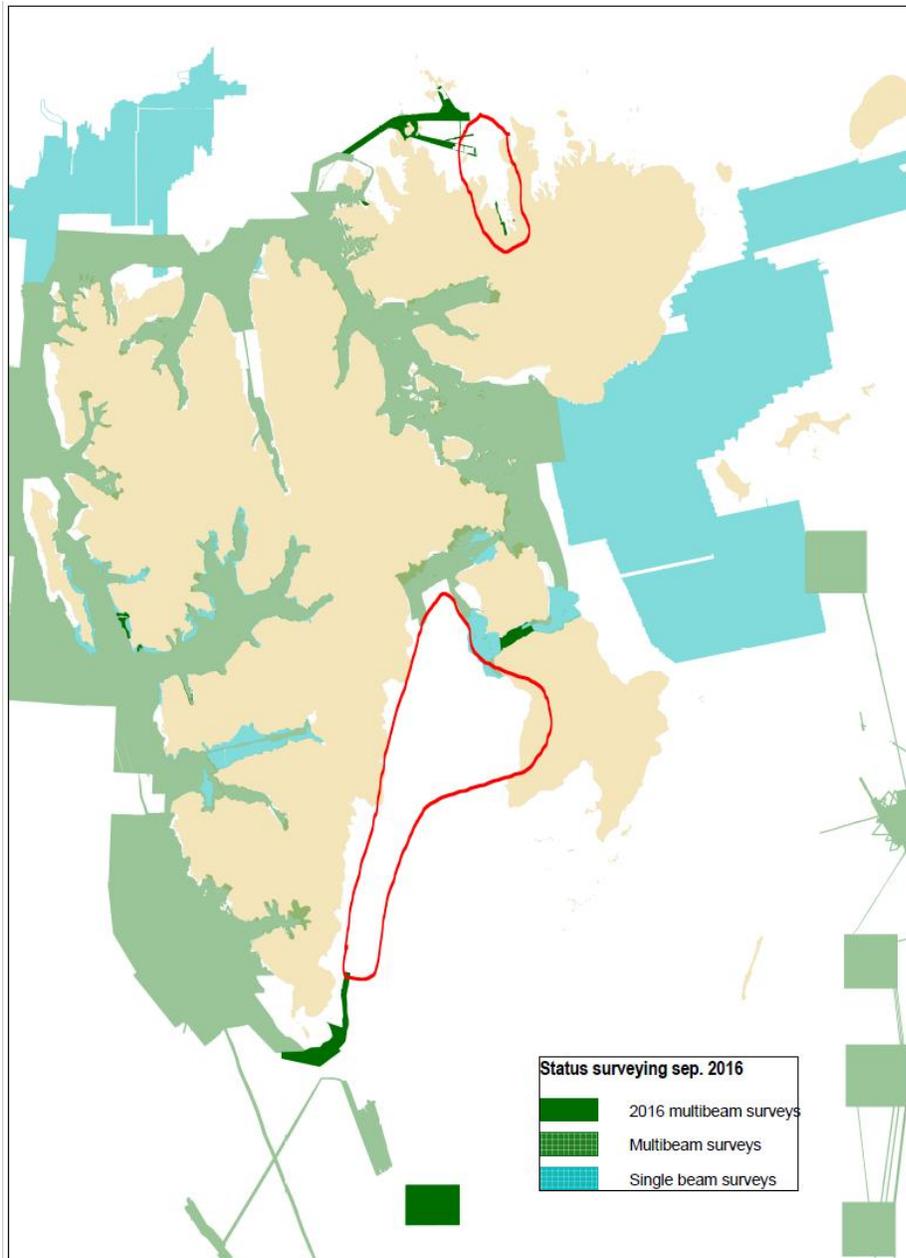


Fig. 1. Surveyed areas around the coast of Svalbard and an indication of survey areas for 2017

Barents Sea

As part of the MAREANO programme, surveys have taken place along the agreed delimitation line between Norway and the Russian Federation and in the central/western Barents Sea during 2016.

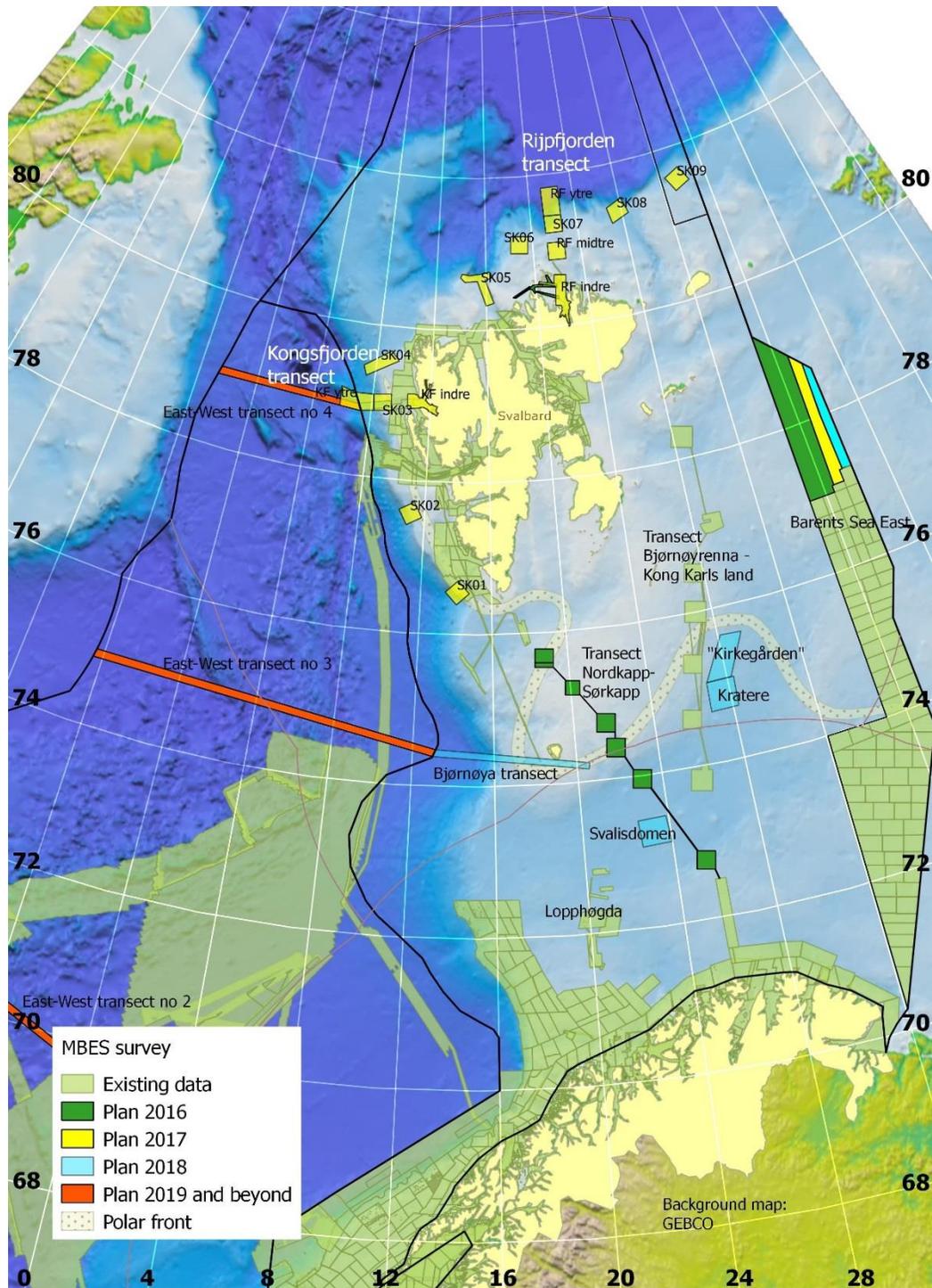


Fig. 2. An overview of the existing multibeam datasets in the Norwegian Arctic waters. The figure also include the planned surveying for the MAREANO programme for 2017 and beyond.

About 13.500 km² will be surveyed by MAREANO in 2016. More information about the Mareano program is available at www.mareano.no.

Norwegian coast

Two survey launches, equipped with EM2040D, have been operating 12-hour daily, when available. Our R/V Hydrograf has contributed with the EM710 multibeam echo sounder in some fjords in addition to the surveying off the coast (Mareano project). All the surveyed coastal areas are outside the region of interest to ARHC.

3. New charts and updates

We are in the process of revising the way we make our survey and charting plans.

3.1. Paper charts

The Main chart series at Svalbard is in scale 1:100.000. Since Sep-2016 (previous ARHC report) the following has been done with Arctic Charts:

- New Chart, national charts no 541 Nordporten – Sjuøyane issued covering new sailing routes.

3.2. ENC

Since previous ARHC report a safe sailing route between the northern part of Hinlopen and Rijpfjorden north of Nordaustlandet has been published in the existing ENCs.

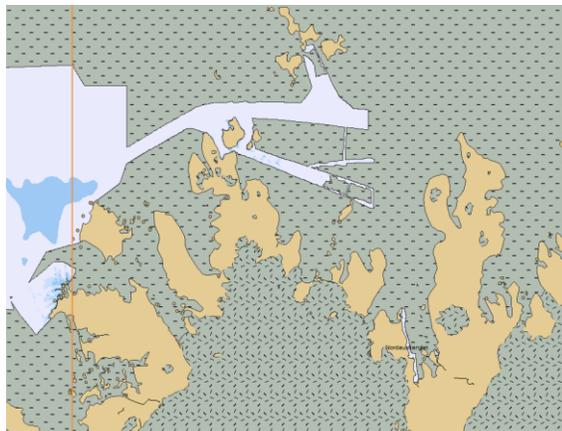


Fig. 3. A safe route north of Nordaustlandet in General usage band

In addition, several ports and passages in Northern Norway have been upgraded in the ENC's with new multibeam survey data.

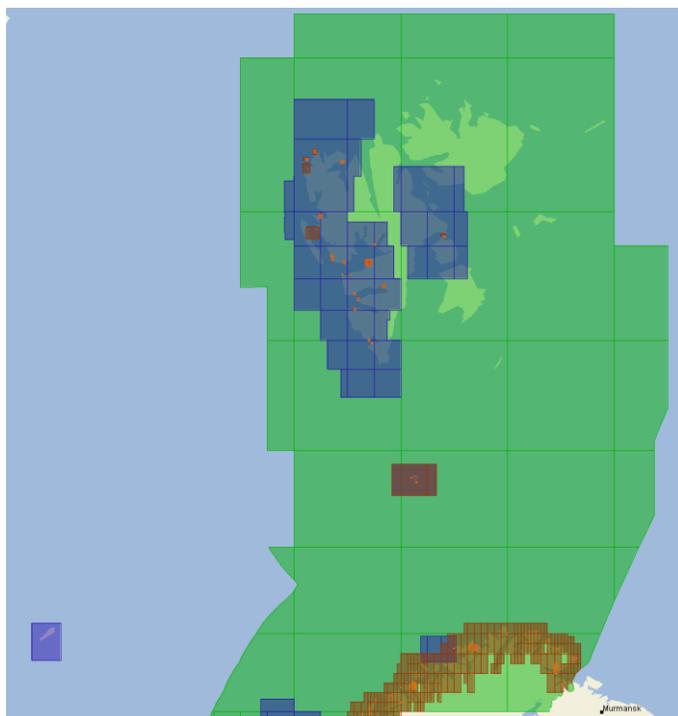


Fig. 4. Present ENC coverage Northern Norway and Svalbard

3.3. Print On Demand (POD)

At present 231 charts (the entire Norwegian chart portfolio) are offered as POD. NHS does not print charts any longer.

4. Nautical Publications

The Norwegian Pilots Guide «Den norske los» is to be revised and customized for the professional users. The current updated pdf versions of the Pilots can be download 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. The project, aiming to digitize our nautical publications, is making good progress and the goal is to complete the project in 2018.

Notices to Mariners (Etterretninger for sjøfarende)

A total of 24 editions were published in 2016 through our official digital version kartverket.no/efs. All Norwegian paper charts have a QR-code. Using your smart phone, you are directed to the NtMs' relevant for that specific chart.

As a supplement to the NtM a digital tracings service is fully operationally on the same website.

5. MSI

The Norwegian Coastal Administration is the national authority responsible for MSI in Norway.

6. C-55

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 2017. 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 and capacity. Formal education and training in hydrography is ongoing for three persons and planned for one in marine cartography. This year we provided Albania with a survey launch fitted with new survey equipment and a new engine. A chart production system was installed last year and training is ongoing. The Norwegian Ministry of Foreign Affairs finances the project. The budget is NOK 10.2 mil.

8. Oceanographic activities

Our tide gauge network consist of 25 gauges including one in Ny-Ålesund at Spitsbergen and one at the remote island Jan Mayen. Short-term water level measurements at locations between the permanent gauges (more than 400 series) have made it possible to construct tidal zones that are used to calculate water level in the zones based on the permanent gauges. On our web-page <http://www.kartverket.no/sehavniva/> it is possible to get tide tables, observed water level and water level forecast for 5 days (based on a models run by the Norwegian Meteorological Institute) for most of the sites along the Norwegian coast. We also present figures with different tide levels, land levelling datum and return periods (up to 1000 years). The information in the figures are very important in coastal planning. Frequent users can download data with an API without going via the web page.

We are presently engaged in an important project with our Land and Geodesy divisions to find a method for describing the Chart Datum (CD) surface relative to the ellipsoid, and to establish a connection between CD and land levelling datum (see para 9.1). The Norwegian coast with long and deep fjords and high mountains make this work difficult. The project involves tide gauges, GNSS and gravity measurements from a boat and land levelling.

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, 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.

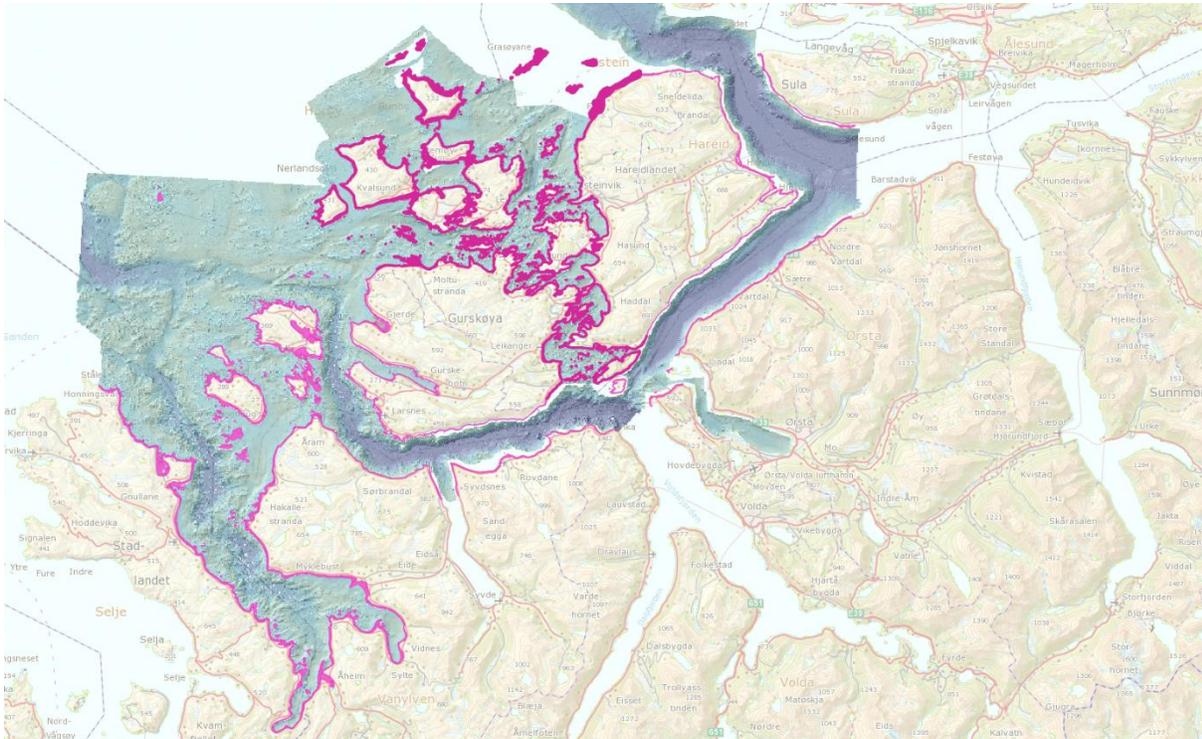


Fig 5. Søre Sunnmøre region with area planned for green laser survey in pink (92km²)

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 conducted the survey during the first half of 2017 and will deliver processed and classified data in early fall. Final results will be ready by the end of 2017.

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. All the measurements are now in and we have started analyzing them and improving the preliminary model. 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 estimated return heights for storm surges and sea level projections. 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 analysis and development are on-going and the final product will be delivered by the end of this year.

9.2. Marine Spatial Data Infrastructure

MSDI is an integrated component of the national SDI in Norway. 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, where over 50% are involved in coastal and/or offshore activities.

NHS has been one of the key players in the establishment of a marine and maritime interest group under Norway digital, to improve the cooperation around common interests and challenges attached to marine geospatial services through a general and coherent SDI perspective.

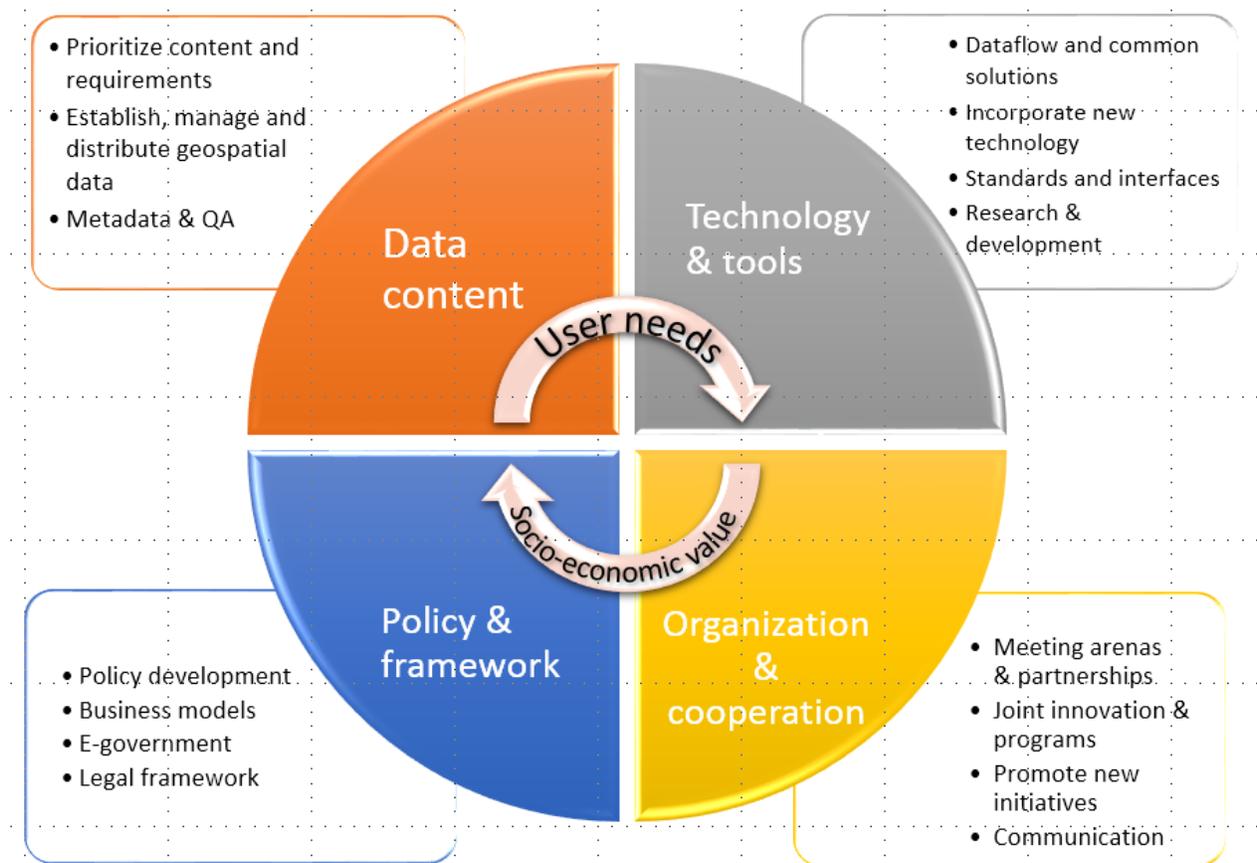


Fig. 6. Norwegian SDI approach

9.3. 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 geospatial services to underpin the MSP processes and the work with the integrated marine management plans for Norwegian sea areas.

The project released a prototype version in November 2016, and will release a final version in November 2017. The project represents a major step forward in the process to integrate the marine component in the Norwegian SDI.



Fig. 7. Norwegian management plans for the Barents Sea, Norwegian Sea, and the North Sea & Skagerak, representing an area exceeding 2 mill. km².

9.4. Better access to geodata for Arctic marine areas

The Norwegian Mapping Authority have received funds to carry out a project to investigate how to gain better access to geographic information for the Arctic marine and ocean areas. The project will prepare an overview, a guide and a plan for better access to geospatial data with [Arctic Spatial Data Infrastructure](#) (Arctic SDI) as a common platform for data sharing. The primary target group of the project is [the Arctic Council working groups](#), with the aim to provide concrete and direct support to their work.

The initiative include will imply continuation of relevant and well established cooperation between the Arctic SDI representing the eight national mapping agencies of the Arctic nations and the Arctic Council working groups. The project will partner closely with the Arctic Regional Marine SDI Working Group established by the Arctic Regional Hydrographic Commission (ARHC under the International Hydrographic Organization) and utilize the project to develop the ties between the Arctic SDI, the ARHC working group and the Arctic Council working groups.

The project includes a user survey and stakeholder workshops. Current relevant data sources will be mapped and services will be tested and integrated within current user-applications. Experience from the implementation of the Norwegian Marine Management Tool – currently under development - will also be utilized.

9.5 MAGIN (Marine Base Maps in Norway)

MAGIN 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. MAGIN 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 4 partners; The Norwegian Hydrographic Service (leading the project), Geological Survey of Norway, the Institute of Marine Research and the Norwegian Institute for Water 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 currently running a pre-project (pre-MAGIN) planning a pilot project in a confined area. The pilot project will investigate and test new technology for data collection and processing and, in addition, develop a cost-effective model for the implementation of a MAGIN programme. The goal is to start the pilot project in 2019

9.6. 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, CSPC, IEN, MSDI, CSB and WEND. We have participated in the HSSC and the IRCC meetings in 2014. 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. We have delivered data with resolution 50x50 meter for the majority of our coastal waters to the EU project EMODnet.