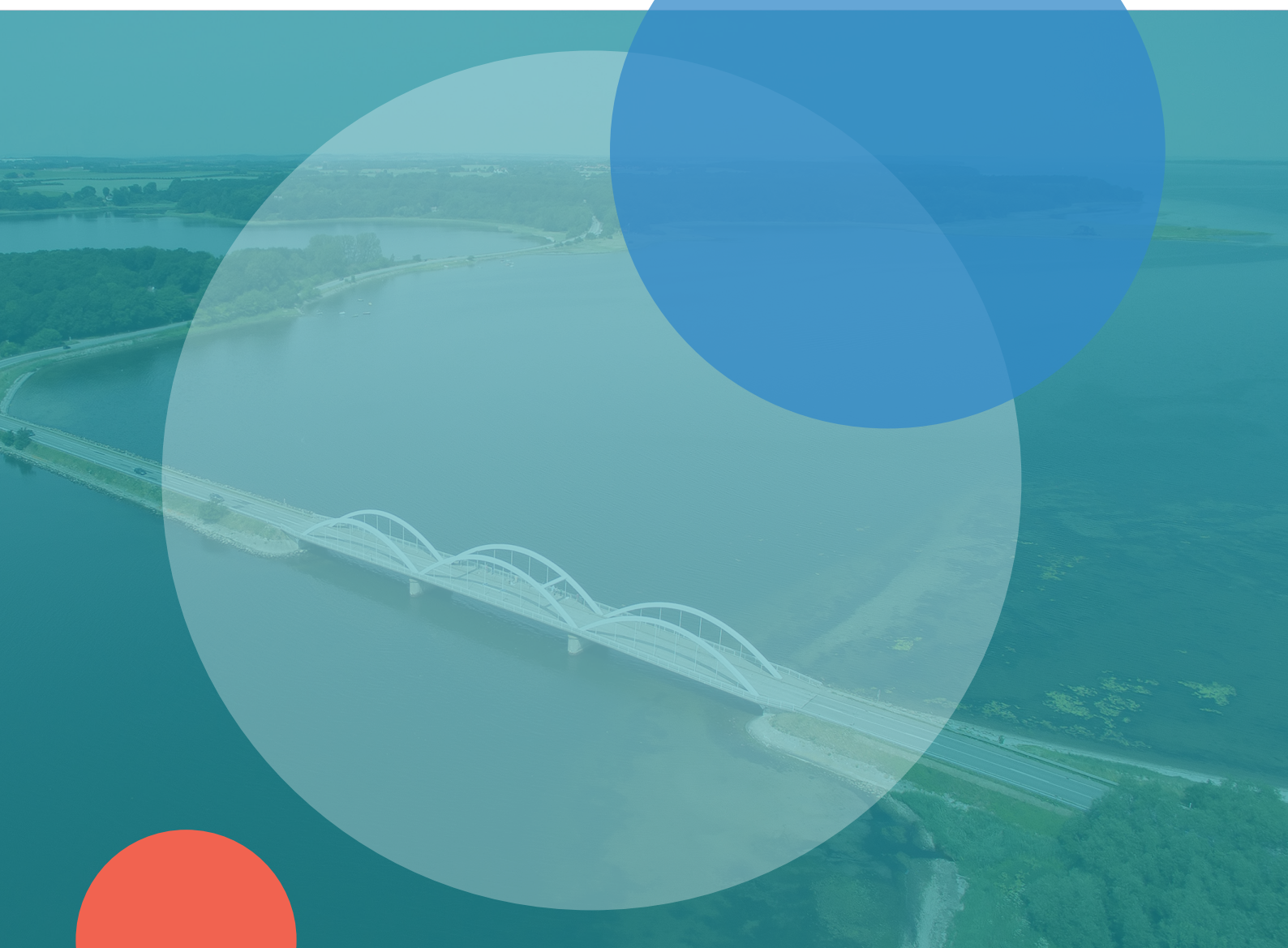


BHSC

National Report of Denmark

August 2020



Executive summary

This report gives a summary of the main activities within the Danish Hydrographic Office since the last report given at the BSHC 24th meeting 10-12 September 2019, Gdańsk, Poland

1. Hydrographic Office

The Danish Geodata Agency (DGA) is part of the Danish Ministry of Climate, Energy and Utilities. The Ministry consists of the Central Department, the Geological Survey of Denmark and Greenland, the Danish Meteorological Institute, the Danish Energy Agency, the Danish Geodata Agency and the Agency for Data Supply and Efficiency.

DGA in its role as a hydrographic office has responsibility for hydrographic surveys and charting in Denmark and Greenland. It is responsible for the production of nautical charts of the waters surrounding Denmark and Greenland and for issuing Chart Corrections and related nautical publications such as INT 1 and pilots (sailing directions). DGA is further responsible for the Danish MSDI and also represents Denmark internationally within the marine geodata field (MSDI). The Hydrographic Office is currently divided in two geographical oriented divisions (Denmark and Greenland), but expect to implement a new management organisation during 2020.

The practical work of hydrographic surveys is carried out with personnel and ships from the Royal Danish Navy (Danish Hydrographic service). Survey personnel from the Navy are part of the organisation of the Danish Geodata Agency.

The Danish Geodata Agency works closely together with the Danish Maritime Authority, which is responsible for issuing of Notices to Mariners and List of Lights. Tide tables and operational tide gauges are the responsibility of the Danish Meteorological Institute.

January 2020, the Faroese Government took over the responsibility for surveying and mapping the waters around the Faroe Islands. A cooperation agreement between Umhvørvisstovan and DGA has been signed in order to ensure the safety of navigation and the ongoing development of competences in Umhvørvisstovan. According to the cooperation agreement DGA continues with the practical tasks for the time being to ensure that the value and production chain is not broken while Umhvørvisstovan gradually take over the operational responsibility for the different hydrographic areas.

In the future, on behalf of the Kingdom of Denmark the DGA will still have the responsibility for areas related to foreign, security and defense policy for the Faroese waters. These is e.g. visualization of limits and boundaries in nautical charts, INT charts, nautical charting for the Defense, negotiations in international forums etc.

2. Surveys

2.1 Overall status and surveys 2019

Denmark

The Survey Directive for the Danish waters reflects the decisions taken at the HELCOM Ministerial Council meetings in Copenhagen in September 2001 and October 2013 on the re-survey of the main navigation routes and other areas of interest for shipping in the Baltic Sea and inland Danish waters. Furthermore, surveying is carried out in connection with establishing recommended sailing routes in the Skagerrak along the west coast of Jutland.

The ships used in Danish waters:

- I / F Jens Sørensen/Poul Løwenørn (Danish Maritime Authority)
- The surveying vessels FYRHOLM and BIRKHOLM (Danish navy)
- The survey boats SOM-1 and SOM-2 (Danish Navy)

The target for sea surveying in Denmark in 2019 was 15,000 Km surveyed line. The result was 24.000 Km. Surveying was carried out in Danish waters during the period March to October.

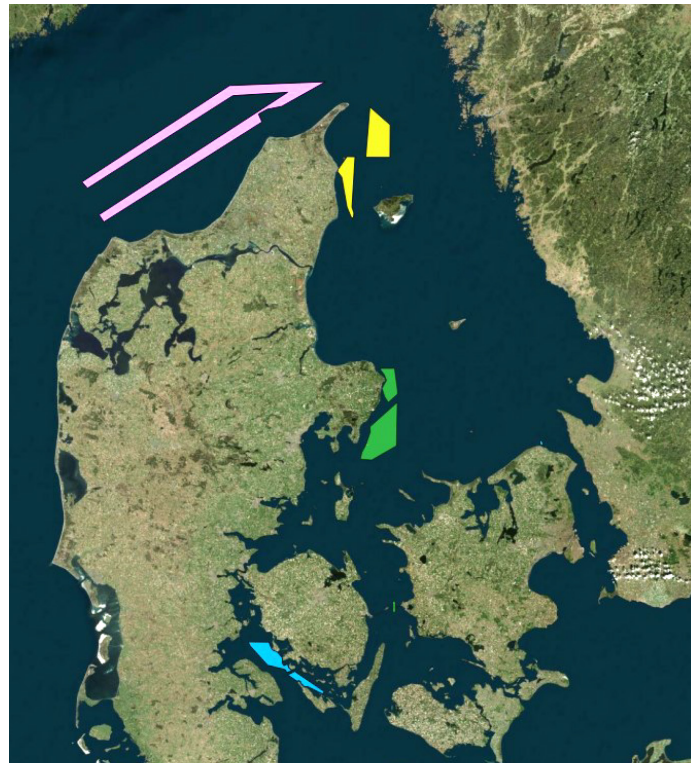


Figure 1: Surveys in Danish waters 2019 total 24173,6 Km surveyed line.

Greenland

The Survey Directive for Greenland is based on the overall priority of surveying areas in Greenland, which has been agreed with the Government of Greenland.

The overall priorities for surveying in Greenland in 2019 were as follows:

Priority 1.

The inland routes between the cities of Greenland's west coast from Nunap Isua (Cape Farewell) to Upernavik.

Priority 2.

Survey of sailing routes in coastal areas on the west coast of Greenland, where the general water depth is less than 200 meters and the basis of survey is insufficient. Examples of priority 2 may be coastal areas where inshore sailing is not possible, due to ice conditions and geography and surveys are of older date or completely missing.

Priority 3.

Surveying areas of particular interest for business and tourism development. Examples of priority 3 areas may be: Selected fjords with frequent visits of cruise ships and areas of impending mining where increased sailing with larger ships is expected.

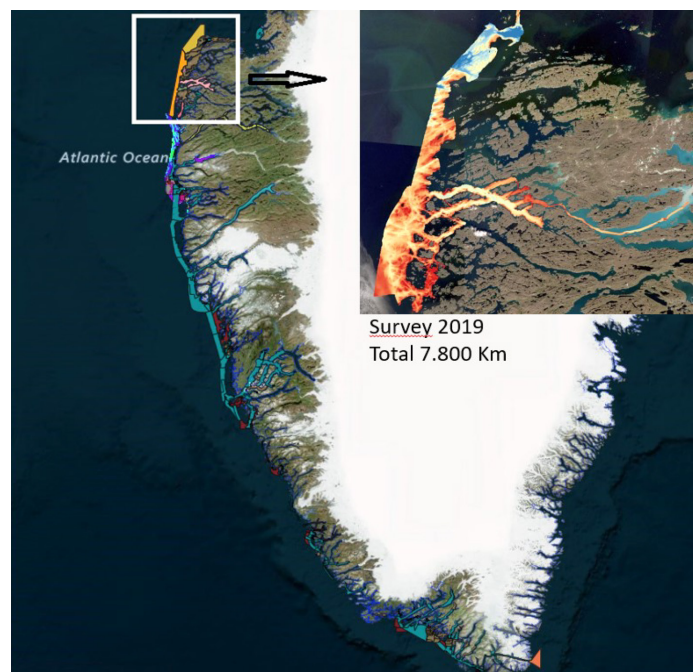


Figure 2: Overall survey status and result for Greenland 2019.



Figure 3: The sun in bearing North, at midnight off the coast of Greenland during survey.

Surveys were carried out in Greenland waters in June and July, with:

- LAUGE KOCH Arctic patrol vessel (Danish Navy)
- The survey boat SAR-3 (Danish Navy)

The target for surveying in Greenland in 2019 was 5,000 Km surveyed line. The result was 7.800 Km.

In addition to the planned survey in Greenland, the Danish Hydrographic service provides personnel for co-navigation and operation of the survey equipment during periods when LAUGE

KOCH and EJNAR MIKKELSEN operate in remote areas on the coast of Greenland. To the extent that the ship's other tasks permitted, reconnaissance surveys were made for future survey planning.

2.2 Survey Vessels

The Danish Maritime Authority has provided a large ship JENS SØRENSEN for surveying off shore in Danish waters. After a rebuild POUL LØWENØRN replaced JENS SØRENSEN in September 2019. JENS SØRENSEN was sold later in the year.



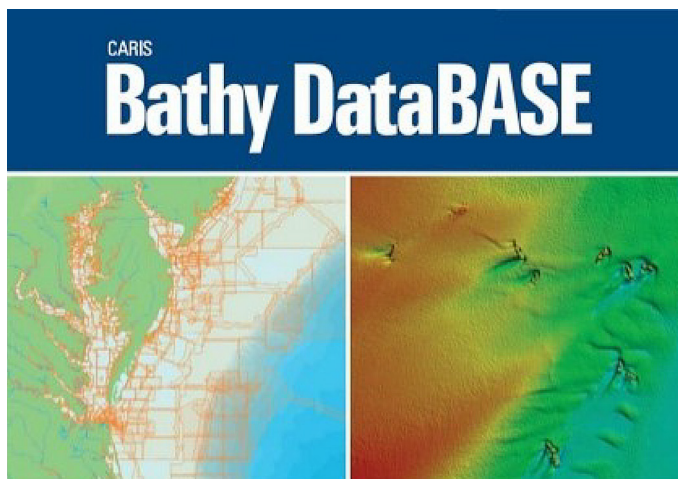
Figure 4: POUL LØWENØRN was fitted with two new cabins, a larger mess and was built 5 meters longer.

2.3 Depth Database

From September 2018 onwards, DGA has been working with Teledyne CARIS Ltd. to create a contemporary depth data management system to support DGA's vision to become a data driven agency, to handle exponentially increasing amounts of data and to support future developments in the hydrographic field. The system is based on CARIS Bathymetry DataBASE COTS software with custom tools to facilitate the automation of depth data management processes. System features several databases to house survey data and deliverables.

In 2019, DGA focused its efforts on implementing and testing the system. DGA faced challenges with fitting the customized tools to support all types of existing data.

Rigorous testing of the system resulted in multiple revisions for both COTS software and the custom tools. Development and testing required more resources than expected, from both DGA as well as the system supplier. As a result the acceptance of the system was delayed and the project timeline extended. As of 17-02-2020, DGA signed the final acceptance of the system and the migration of current data will begin during the spring of 2020.



2.4 New Technology

Crowd Source Bathymetry (CSB)

Many vessels already possess the minimum equipment needed to collect Crowd Source Bathymetry (CSB), and they only need to install a data logger, or enable logging software, to begin collecting CSB. Such data can be especially critical for remote areas where performing regular hydrographic surveys is too time consuming and/or expensive. Based on such considerations, the DGA is developing a pilot project to collect and use crowd source bathymetry using smart devices. The target carriers of such devices are the vessels of the Royal Arctic Line who is a strategic partner in the pilot project.

Preliminary efforts have included the retrieval of currently adopted solutions by other agencies (e.g., the NOAA pilot project developed in collaboration with Rose Point Navigation Systems) and the IHO Trusted Node Model (as described in the IHO's B-12 Guidance on Crowdsourced Bathymetry).

Airborne LiDAR Bathymetry (ALB)

Today, surveying in Greenland is primarily undertaken by ship in the summer using multibeam echo sounder technology (MBES). ALB has the potential to complement MBES in coastal and shallow waters, which in Greenlandic waters will be depths of approx. 0-20m depending on the local conditions. Factors like water column clarity, sea ice, seabed characteristics, low clouds, outlet glaciers, wind and precipitation may significantly limit the LiDAR method, and it is known to have limitations on object detection. That said, ALB can potentially be a time- and cost-efficient data collection method based on the aircraft speed, flight altitude and the ability to survey both land and waters. Very little LiDAR bathymetry mapping has been carried out in Greenland.

Due to an increasing interest in LiDAR in the arctic, DGA took the initiative to write a state-of-the-art report on ALB and develop a project plan for a pilot project in Greenland that will be ready for adaption if funding for such a project becomes available.

Satellite Derived Bathymetry (SDB)

The satellite technology and remote sensing is expected to become more prevalent in the future and SDB is a technique that has gained a lot of attention in the recent years. It is a method that uses multispectral sensors and from the images taken by satellites one can derive parameters like water depths and sea bed characteristics. The method has a large coverage and is very cost-effective, but it is also more limited in the depths achieved and reliability in object detection.

In 2019, DGA acquired SDB data for three different areas in Greenland from different providers in order to assess the performance, depths achieved and uncertainties of SDB in the Arctic. The project is in the final stages and the next step is to look into how SDB can give value to DGA.

2.5 The role as depth manager

In 2019, DGA had the goal to establish the framework for strengthen its role as Denmark's depth data manager going forward with the aim of conducting an efficient and value-creating depth data collection, processing and distribution. DGA has prepared preliminary analysis for Denmark's depth data management, including vision and preliminary objectives. As an essential prerequisite for creating value with depth data, DGA has established a depth database based on CARIS software (see section "Depth Database").

3. Nautical Charts

3.1 New ENC and Paper Charts

All ENCs and paper charts for the Kingdom of Denmark are produced and updated by the Danish Geodata Agency. The portfolio is divided geographically between Danish, Faroese, and Greenlandic waters.

Rosendahls, who is the official distributor of Danish paper charts, has a website where it is possible to get an overview of the charts available for Danish, Faroese, and Greenlandic waters
www.kobsokort.dk/categorynav.aspx?catid=916

All the produced ENCs and updates are distributed through IC-ENC authorized distributors.

Denmark

The portfolio consists of 63 Danish Paper Charts. 12 new Editions were published in 2019

The portfolio consist of 246 Danish ENCs. 107 New Editions (EN) and 435 updates (ER) were published in 2019.

Usage Band	Number of Danish ENCs
1 Overview	1
2 General	9
3 Coastal	3
4 Approach	18
5 Harbour	215

Faroe Islands

The portfolio consists of 8 Faroese Paper Charts. No new editions were published in 2019.

The portfolio consists of 21 Faroese ENCs. 6 New Editions (EN) and 25 Updates (ER) were published in 2019.

Usage Band	Number of Faroese ENCs
1 Overview	0
2 General	1
3 Coastal	3
4 Approach	16
5 Harbour	1

Greenland

The portfolio consists of 102 Greenlandic Paper Charts. 3 new rectified paper charts and 6 new editions were published in 2019.

The portfolio consists of 127 Greenlandic ENCs. 7 new ENCs and extended coverage on 2 ENCs were produced in 2019. 24 New Editions (EN) and 16 updates (ER) were published in 2019.

Usage Band	Number of Greenlandic ENCs
1 Overview	5
2 General	0
3 Coastal	40
4 Approach	50
5 Harbour	32

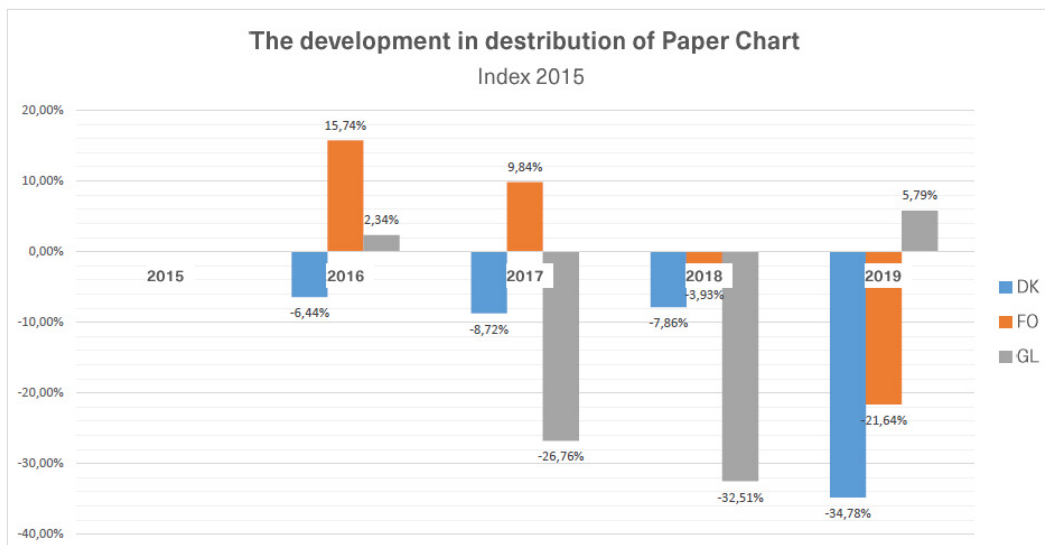
3.2 Distributions and sale

The need for ensuring correct sales reporting

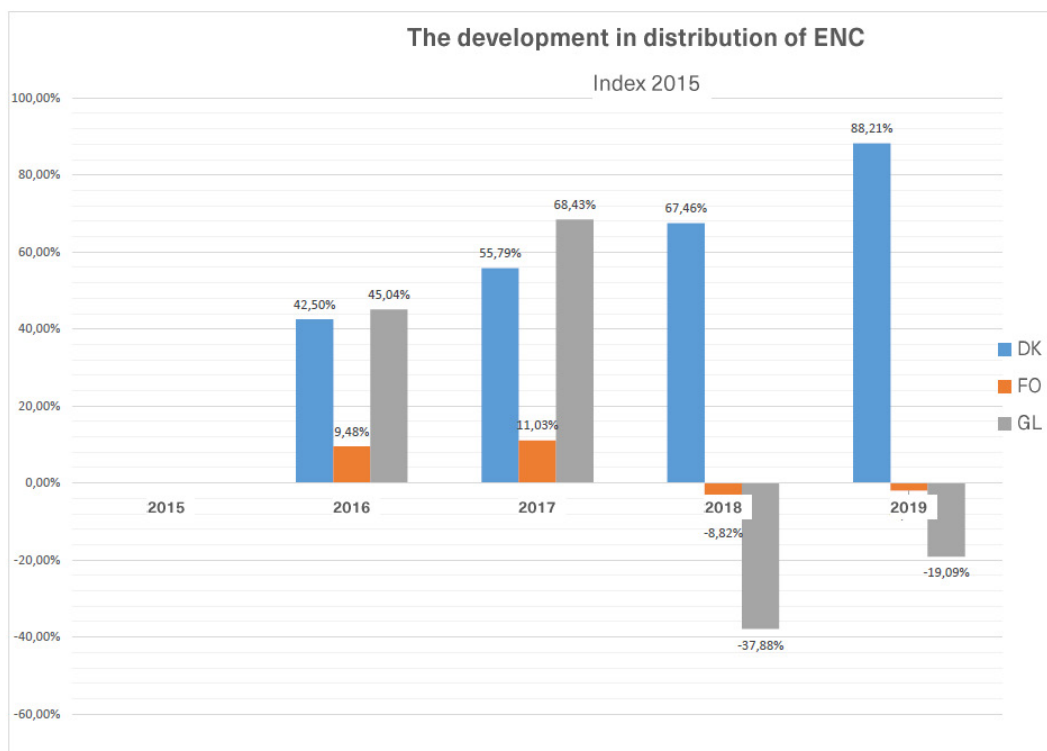
The Danish Geodata Agency has from the national auditors “Rigsrevisionen”, received a requirement to ensure correct sales reporting from third parties. The Danish Geodata Agency is therefore looking into ways to ensure correct sales reporting and quality assurance methods, when third parties in the market are selling products based on the agency’s data and products. As a possible solution it is being considered to demand annual auditor reports based on international standards.

The following tables, based on a 2015 index, show the development of sales numbers from 2015 until 2019 for paper charts and ENC respectively. No new Greenlandic paper charts were published in 2016 and 2017 and only two paper charts were published in 2018. In 2019, the prices for paper charts and ENC were increased.

Paper charts



ENCs



3.3 New Nautical Chart Production System (NCPS)

DGA is implementing a new Nautical Chart Production System (NCPS) based on Esri's ArcGIS for Maritime. The supplier, Geoinfo A/S, has been present at the DGA premises since February 2019 and are working together with the DGA project team to configure and install the new system, migrate data and products, and train staff. The system is expected to be fully implemented by the end of 2020. When the NCPS is implemented, DGA will have one common, database-based production system for both the Greenlandic, Faroes¹ and the Danish productions.

3.4 New Shipping Routes in Danish and Swedish waters

DGA is in the process of producing and publishing a number of new paper and electronic charts covering the relevant areas. The work includes processing of new depth data as well as renewed and closer selection of depths from existing depth data. In addition, harmonization of depth data across the border to Sweden is included. An updated coastline is added to the new charts.

The paper charts will be released April 2020 and the ENC's 1st July 2020 when the new routing system enter into force

The intention of the project is to create more predictable traffic patterns for the benefit of the safety of navigation in the area, and to reduce the large number of ships in the existing Route T by establishing a new recommended route – Route S – along the Swedish coast.

The ship traffic in the area off Skagen will, with the establishment of new traffic separation schemes and associated precautionary area, be more aligned and structured with a lower risk of collision and grounding.

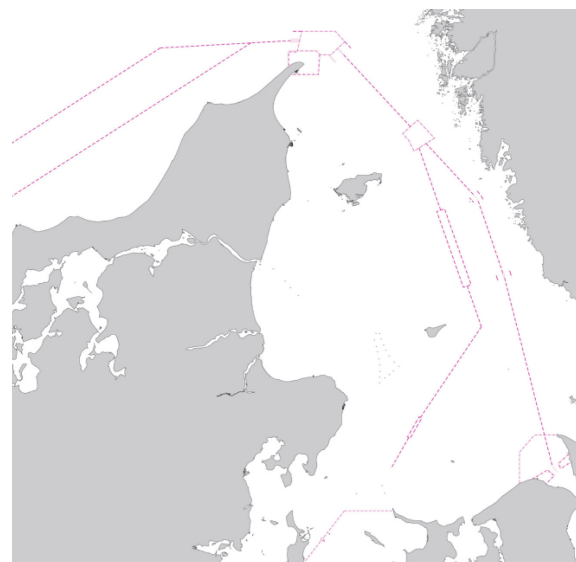


Figure 5: New Shipping Routes.

3.5 New Harbour Map

In 2019, DGA has produced a new harbour map together with the Association of Marinas in Denmark and DGAs official map distributor in Denmark, Rosendahls. The harbour map gives information about all danish marinas and on the backside of the map is additional information about e.g. nautical charts available, the Danish Harbour Pilot and safety information. All information is in Danish, English and German The harbour map is produced as a paper map only and has been freely available in all marinas in Denmark. The harbour map has been well received by the users; an approximately 27.000 maps were given away in 2019.

DGA expects to produce and distribute a new version in 2020 including information about the new Shipping Routes.

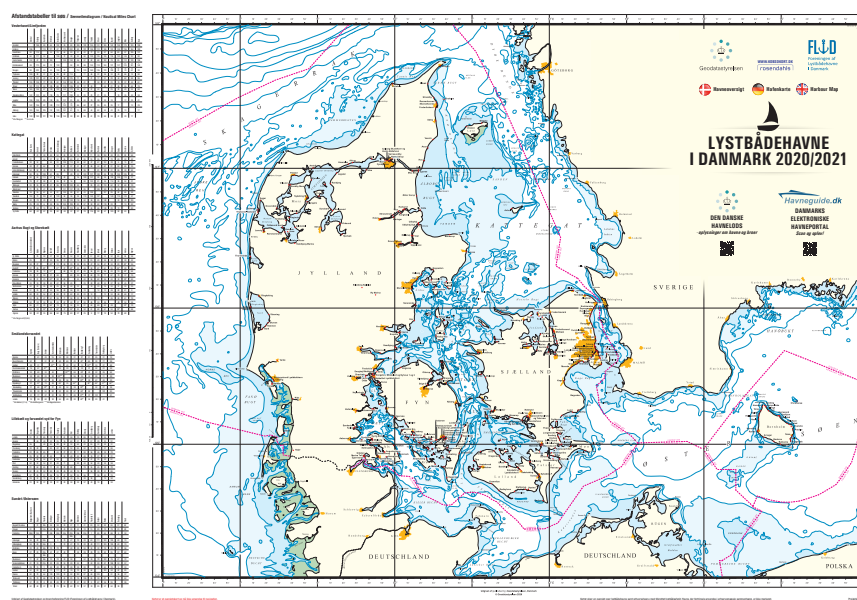


Figure 6: New Harbour map.

1 Danish Geodata Agency produce paper charts and ENC's covering the Faroes waters on behalf of Umhvørvisstovan.

4. New publications & updates.

4.1. New publications

Greenland Pilot – General Information about Greenland

https://gst.dk/media/2920970/130120_dgl_ostvestgronland_dk-skr_05_2020.pdf

4.2. Updated publications

The Danish Notices to Mariners (EfS) are available on the website of The Danish Maritime Authority:

<https://www.dma.dk/SikkerhedTilSoes/Sejladsinformation/Advarsler/Sider/default.aspx>

The Danish Meteorological Institute updates the tides tables:

<https://www.dmi.dk/hav-og-is/temaforside-tidevand/tidevandstabeller-for-danmark/> (only in Danish)

The Danish Geodata Agency publishes a number of publications, which can be found at the DGA website:

<https://gst.dk/soekort/nautiske-publikationer/>



Figure 7: Different Greenlandic pilots.

Publication	Formats			Available in English
	Paper	PDF	Digital	
Denmark				
Denmark Harbour Pilot			X	No
Denmark Pilot - General informations		X		No
Denmark Pilot II	X			No
Greenland				
Greenland Harbour Pilot			X	Yes
Greenland Pilot – General Information about Greenland		X		Yes
Greenland Pilot - Sailing Directions for East Greenland		X		Yes
Greenland Pilot - Sailing Directions for West Greenland		X		Yes
Greenland Pilot - Explanations of the place names		X		Yes
Faroe Islands				
Faroe Islands Harbour Pilot	X			No
Faroe Islands Harbour Pilot - Appendix 3		X		No
Harbour information for Faroe Islands	X			No
Other				
Kort 1 · INT 1	X	X		Yes
Behind the Nautical Chart		X		Yes
Danish Chart Corrections		X		Yes
Product Catalog	X	X		No
Mariners' Routing Guide Baltic Sea			X	Yes
Navigation.gl			X	Yes

5. MSI

NAV Warnings are available in English on the following web page:

Navigational warnings Denmark:

<https://www.dma.dk/SikkerhedTilSoes/Sejladsinformation/Advarsler/Sider/default.aspx>

6. C-55

C-55 was updated March 2020.

7. Capacity building

The Danish Geodata Agency (DGA) volunteered to finance the development of the MSDI training material. The MSDI training material is now available free of charge from the IHO webpage and from the DGA webpage.

The establishment of MSDI training material, including the teaching material, is divided into two phases:

- Phase 1. MSDI orientation. The course is aimed at students who are marine-focused, but have very little experience of MSDI concepts or practice. This course is modelled on the IHO MSDIWG standard orientation syllabus and is aimed at decision makers possibly at a senior level, not necessarily from a hydrographic background, but certainly involved in marine geospatial data.
- Phase 2. Fundamentals of a Marine Spatial Data Infrastructure. The course is aimed at students who are marine geospatial professionals but who have very little experience of MSDI. It is designed as an introductory, one-day course in the fundamentals of MSDI concepts, theory, and practice.

The course is based on material in the public domain, the many sources of information about MSDI available, and includes notes on the accompanying slides and exercises to be considered as appropriately. These exercises would also be useful in a group context for the delivery of workshops supporting the course.

There are two main uses of these documents in conjunction with the course slides themselves.

1. A participant who wants to download and self-learn from the materials provided.
2. A participant who wishes to deliver the materials in a group setting with stakeholders.

8. Oceanographic activities

8.1 Water levels

The Danish Meteorological Institute (DMI) and other governmental bodies maintain a network of water level stations located across Denmark. The collected data are used in several ways: primarily for safety of navigation, but they also represent an integral part of the national storm surge monitoring and prediction system. Newly collected data are transferred from the stations to the oceanographic database every ten minutes.

Online observations and forecast are available on several web sites:

<https://www.dmi.dk/dmis-vejrprodukter/vandstand/> (in Danish)

<http://fcoo.dk/> (in Danish and English)

Tides are predicted for Danish, Faroese and Greenland waters, and the tables are updated once a year. In 2020, DMI provided tide forecasts for a total of 167 locations spread across 92 Danish, 66 Greenlandic and 9 Faroese sites. For the Greenland waters, the number of sites with calculated tides has been increased by 6 stations based on water level data collected by the DGA in 2019. These data are also used to contribute to the LAToid project. This project - coordinated by the Danish Agency for Data Supply and Efficiency (SDFE) with contributions from DGA and DTU Space - aims to estimate the LAT (lowest astronomical tide) height above the ellipsoid based on satellite altimetry, hydrodynamical modeling and local observations.

9. Marine Spatial Data Infrastructure in Denmark

DGA is responsible for the Danish MSDI, which gathers around 100 authoritative marine datasets from 11 marine authorities and serves as an inter-governmental tool for viewing of marine data as well as access to the data on a day-to-day basis. In Denmark, there is an increased demand for open and easy access to governmental spatial data, including marine data. To support this, DGA are planning the following further developments of the Danish MSDI:



- Public access to main parts of the Danish MSDI (planned May 2020)
- An increase in marine dataset from new data sources, e.g. municipalities and NGO's
- Development of new tools to support the retrieval and presentation of data, including time series

DGA is supporting the Danish Maritime Authority (DMA) in the process of drafting the first Danish Maritime Spatial Plan (MSP), which will be the first legally binding digital plan in Denmark. DGA have developed an intergovernmental MSP version of the national MSDI, which brings together all relevant MSP input data for use in preparing the Danish MSP. In addition, DGA are also supporting DMA in developing a legally binding MSP-website.

10. Innovation

Relevant activities described under item 2.4 New Technology.



11. Other activities

11.1 International activities

Participation in IHO Working Groups

The Danish Geodata Agency has the chairmanship for the IHO MSDI Working Group and the Baltic Sea and North Sea MSDI Working Group (BS-NSMSDIWG).

The Danish Geodata Agency has been involved in the work done by e.g. IRCC, HSSC, S100-WG, ENCWG, WENDWG, NCWG, NIPWG, IENWG, CSBWG and DQWG, OGCMDWG and UNGGIM MWG.

Seabed 2030

The GEBCO Seabed 2030 project will facilitate mapping of the ocean floor by the year 2030. The aspiration is to compile all available bathymetric data into a high-quality, high-resolution digital model and to promote international efforts to collect new data. Denmark will support this initiative mainly by submitting gridded bathymetry.

11.2 Activities in Greenland

ENC-Simple (New name from 2020, Basis ENC)

In 2019, DGA continued testing of ENC-Simple for selected areas in South Greenland.

ENC-Simple data is compiled for pilot assisted navigational purposes in areas with no coverage of ENCs but where full multibeam surveys have been carried out. Full bathymetric data coverage is not required, but must cover areas intended for navigation and this data must be full coverage multibeam data.

DGA developed a set of specifications intended to enable Hydrographic Offices to produce a consistent ENC-Simple, and manufacturers to use that data efficiently in an ECDIS under supervision of a certified pilot. An ENC-Simple must be produced in accordance with the rules defined in the ENC-Simple Specification.

The Danish Navy and the Greenlandic Pilots participates in the pilot project. The ENC-Simple has been tested in 2018 and 2019 for the two areas covering Prins Christian Sound and Skovfjord to Narssarsuaq. ENC-Simple has to pass final evaluation before becoming an authoritative charting source in the future.



Figure 8: ENC-Simple produced for Prins Chr. Sound, which is very popular destination among the cruise ships.

Greenland Chart Ambassadors

In order to strengthen and increase awareness of navigational safety among small leisure craft users, fishermen and hunters, DGA has initiated a pilot project “Greenland Chart Ambassadors” in corporation with the Greenland Government and other local partners.

The challenge seen from a Greenlandic perspective is that it is difficult to get in touch with the many potential users as they are spread across a large number of settlements and towns and that they do not use official paper charts or use charts in different electronic versions that are often not updated.

One way to meet these challenges is to appoint local Greenland Chart Ambassadors who can spread the knowledge of charts, publications and the need to update charts and publications, and report errors and shortcomings in charts and publications.







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