Hydrographic Surveying in Greenland Waters

The Hydrographic Survey (SÃ¸pmÃ¥lingen) which is a part of the Oceanographic division within the Royal Danish Administration of Navigation and Hydrography (RADON), conducts hydrographic surveying in the Danish and Greenland waters. This article will focus on operations in Greenland waters. Hydrographic surveying in Greenland can be dated back to 1605. Until the 19th century existing charts were made from data gathered by civilian as well as navy vessels. At the end of the 19th century the Danish Government started considering how Greenland could be charted in a more systematic way.

The Charting of Greenland Waters

A scientific expedition was commissioned to Qornoq in GodthÃ¥bsfjorden in 1927. Its assignment was through astronomical observations to determine a datum that could be used to establish a common spheroid which could be used for all future charting of Greenland. This datum is today known as Qornoq 1927.

In the following years large amounts of resources were put into large-scale surveys as well as into definition of the coastline of the Greenland west coast. Modern hydrographic surveying in Greenland was initiated during World War II (W.W.II), when the US Coast Guard conducted surveys around their bases. After W.W.II various survey vessels resumed hydrographic surveying. The work was started in the Disco Bay area and the plan was to work southward along the Greenland west coast, while mobile Dec-stations were mounted on deserted islands near the coast. By 1953 the surveys had reached as far south as Sisimiut, but were suspended due to worn-down material and lack of resources.

After the loss of the passenger ship M/V HANS HEDTOFT in 1959 the charting of Greenland waters once again became a priority for the Danish Government. Four new survey vessels of the old KA-class were built and together with other naval vessels the survey of the west coast was continued.

By 1967 the surveys had reached Qagortoq in Southwest Greenland, but at this time the Dec-chain had reached the end of its lifetime and furthermore, interference with the LORAN chain caused a stop to surveying with the larger navy vessels. The hydrographic survey continued with the four small KA-vessels (older type) until they were taken out of service in 1980. Hereafter hydrographic surveying in Greenland came to a complete stop until 1989.

Hydrographic Survey-operations of Today

After eight years without hydrographic surveying in Greenland the Ministry of Defence decided that the Hydrographic Survey of Greenland was to be re-established. The Finance Committee granted the funds for a storage and repair facility at the GrÃ¸nnedal naval base.

In 1989 two new survey-vessels (SKA11 and SKA12) were lifted to Greenland. The SKA11 and SKA12 were intended to carry out operations for the coming years and they proved to be very useful for operations in arctic waters. The vessels have a total length of 20 metres - a breadth of 5.2 metres, a draft of 2.4 metres and a displacement of 50 tonnes. These dimensions make the SKA vessels ideal for operations in the narrow archipelago found around Greenland. The survey vessels always operate in vicinity of each other for safety considerations. Both vessels are under the command of a category A surveyor. The total crew of the two vessels is 12 and among these is a petty officer who holds a Petty Officers Qualifying Course.

Both survey vessels are equipped with four single-beam transducers transmitting on 30 and 210 kHz. In 2001 a Reson 8111 multibeam echo sounder was hired for a limited period and the following survey proved that multibeam surveying seems to be the most cost-effective survey method - including the remote arctic areas. Therefore multibeam is expected to replace the single-beam echo sounders in the near future.

Positional data is achieved by means of differential GPS using VHF links between the survey vessels and a reference station which is mounted on a mountain in the actual survey area. Apart from roads in cities, there are no roads at all in Greenland. All GPS base stations are erected on islands, and these islands are often completely covered by snow. Equipment with several parts having a weight of up to 25 kg must be brought ashore by a dinghy, then carried to the chosen location on the mountain. The chosen location often lies 200m above sea level. In addition to below zero temperatures and ice and snow covering the land, there are also slippery rocks along the coastline to contend with. It is obvious that these circumstances require special attention to avoid mishaps when installing and working with this equipment.

Navigation

Many chart soundings found in the inshore routes are of reconnaissance nature only, but they are always a better alternative to nothing at all. The best way to navigate in these areas is to look out of the window and use parallel indexes to islands on the radar. Depth inshore can change very rapidly. Changes from 200 metres to less than 5 metres within 5 seconds are not unusual when the survey vessel proceeds with slow speed (3.5 knots). It is obvious that a continuous lookout for shoals is necessary. Shoal indicators are breaking waves, the â€˜shapeâ€™ of mountains along the coast, as well as bird concentrations. The survey vessels therefore often run aground, when conducting surveys in unknown areas.

The weather too changes very unexpectedly. The radio-weather forecast is not reliable as gale-warnings are transmitted almost every day. Often the weather stays calm inshore even though it is stormy offshore. The best way to check the weather conditions in the area is by carefully monitoring the temperature, the air pressure and the shape of the clouds.

Being onboard a 20m long survey vessel far away from the nearest port, it is crucial not to ignore the indications of a coming â€˜sudostâ€™. Arriving to a new survey-area one of the first tasks is to find anchorages that give shelter for all wind directions whereby dangerous situations may be avoided.

Priority of Survey Areas
A user assembly is held in Nuuk (the Capital of Greenland) each year in October and from this meeting the RDANH receives a number of areas, which normally goes into the â€˜Directive for surveying in Greenland watersâ€™.
The survey vessels have a good relationship with users of sea charts in Greenland. New sailing information is very often exchanged between the hydrographic vessels and Royal Arctic Line, police cutters, and other navigators. The exchange will normally be on the radio or in harbours. This information is being used for navigation and to plan future survey areas in the coming years.

Survey in Greenland
In the beginning of April, the crew arrives at Groennedal by helicopter and the preparation will start. After preparations and trials are completed, the survey vessels must leave the area because of â€˜field iceâ€™. The field ice is the polar ice which drifts along the east coast of Greenland, then follows the current round Cap Farewell and north along the west coast. The field ice will normally arrive in the GrÃ¸nnedal area by the start of May. It is extremely dangerous for a vessel of our size to sail in areas with field ice.
The only part of Greenland without larger ice concentrations in the spring is the area between Paamiut and Sisimiut. Until June all survey operations must be in this area. In 2002 the area of Hamburgersound (65 deg. North) is to be surveyed. In June the west ice disappears and the vessel will leave to the second survey area, which is located in the Upernavik area (73 deg. North). The vessels will survey this area until the end of July.
90 per cent of all survey work on Greenland is conducted in areas, which have never been surveyed before. By use of aerial-photos, indications of the presence of hazards may be acquired by the surveyor before he enters a new area, but normally 50 per cent of all new hazards arenâ€™t found in the reconnaissance phase so survey operations have to take into consideration that hazards may be found almost anywhere in the survey area.
In the start of August the field ice is gone in the southern part of Greenland, and the vessels will leave to the Nanortalik area (60 deg. North). For the rest of the season the vessels will survey that area. By the end of September the vessels return to the base in GrÃ¸nnedal and the crew returns to Denmark.

The Weekly Routine Onboard
The vessels normally leave the nearest port in the survey area Sunday morning and a week of surveying commences. The vessels are then surveying every day from 0700 to 1800. The nights are being spent at anchor. During the period at anchor, it is vital that the watchman is keeping a sharp lookout for drifting icebergs. Very often the vessels have to move to another location, when icebergs are threatening the vessels. In the evenings the surveyor will check the data, which has been collected during the day. Friday morning the vessels will return to the nearest port, in order to get supplies, fresh water etc. Sunday morning the ships are sailing again.

New Challenges
In 2001 a test-survey was conducted in the Nanortalik area by use of a Reson 8111 multibeam echo sounder. This survey proved the multibeam to be a highly efficient instrument for surveys in arctic Greenland waters and steps have already been taken to introduce a multibeam system as the primary echo sounder for hydrographic surveys in Greenland. It is the intention that a multibeam is to be mounted in one of the survey vessels, while the other survey vessel will remain fitted only with single beam whereby the single-beam survey vessel may be used for reconnaissance purposes as well as for determining the shallowest depth above hazards.
Drawings are currently being made for replacements of the SKA vessels. A 70-m long Inspection Vessel with a minor launch onboard seems to be the future survey platform when in six years time the 20-year old SKA vessels have reached the end of their expected lifetime.