

PRECAUTIONS IN USING NAVIGATIONAL CHARTS IN GREENLAND WATERS

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INTRODUCTION

1. Greenland covers a large Arctic area (2,127,600 km²) and is navigationally considered a remote area. The distances between the settlements in Greenland are large, and the consequences of an accident may be greater in Greenland compared to more densely navigated waters, where search and rescue facilities are seldom far away. In addition to this, an accident could have a serious impact on the vulnerable Arctic environment.

2. Navigation in Greenland waters differs significantly from navigation in other (non-Arctic) waters. In general, it is difficult for mariners who are not familiar with the conditions to navigate around Greenland. Furthermore, instruments such as magnetic compasses may be unusable and gyrocompasses may be unreliable.

3. Due to the remote Arctic location and the historically low density of maritime traffic, the assistance offered to mariners in the form of charts within the scope of relevant IHO standards and other facilities has not reached the same level in Greenland. Furthermore, floating markings are not an option due to ice conditions and great depths.

4. In addition, systematic and completely covering hydrographical surveys have not been carried out in many areas along the coasts of Greenland due to the wide extent of the sea area and the Greenland archipelago. In other words, depth conditions will be unknown or depth data will be of poor quality in large areas. For mariners it is essential to understand the limitations in the source material providing the basis for the production of paper charts and, consequently, the information given in the paper charts must be interpreted with caution.

5. Modern navigation is based on Global Navigational Satellite Systems (GNSS) as, e.g., GPS. The continuous marking of the ship's position on an ENC in the ECDIS system is made by means of GNSS. Positions obtained from satellite navigation systems refer to World Geodetic System 1984 (WGS 84) datum.

6. The use of ECDIS in Greenland waters requires the availability of ENCs which refer to WGS 84 datum and are produced with a correct positioning of topography, including coastline, and hydrography in the geographic net. At present, ENCs are not available for Greenland coastal navigation, except for a very few exceptions.

7. In Greenland coastal waters, the inaccuracies in the present paper charts could endanger safety of navigation if the navigator relies on satellite based electronic navigation instead of the use of terrestrial navigation.

8. At present, the paper CHARTS AVAILABLE FOR GREENLAND WATERS ARE NOT COMPATIBLE WITH GNSS navigation, as, e.g., GPS, for several reasons.

9. INCORRECT POSITIONING OF TOPOGRAPHY AND HYDROGRAPHY IN THE GEOGRAPHIC NET. A MAJOR DIFFICULTY WITH THE PAPER CHARTS AVAILABLE FOR GREENLAND WATERS IS THE INCORRECT POSITIONING OF THE COASTLINE IN THE GEOGRAPHIC NET IN THE CHARTS. AT THE NORTHERN AND EASTERN COASTLINES WHERE THE UNCERTAINTY IS MOST DISTINCT, THE COASTLINE MAY BE POSITIONED SEVERAL NAUTICAL MILES INCORRECT. IN OTHER PARTS OF GREENLAND, THE UNCERTAINTY MAY BE LESS, BUT STILL AT A SUBSTANTIVE LEVEL WHEN COMPARING WITH THE ACCURATE POSITION ACHIEVABLE FROM A GNSS RECEIVER. IN GENERAL, CHARTS OF THE NORTHERN AND EASTERN GREENLAND COASTLINES ARE MISPLACED BY 0-5,000 METRES, AND IN SOME AREAS OF THE EXTREME NORTHEAST GREENLAND EVEN MORE.

CHARTS OF THE WEST GREENLAND COASTLINES ARE MISPLACED BY 0-1,000 METRES.

10. In the paper charts covering the Greenland east coast, the following note is found: The difference between satellite-derived positions and positions on this chart cannot be determined; mariners are warned that these differences MAY BE SIGNIFICANT TO NAVIGATION and are therefore advised to use alternative sources of positional information, particularly when closing the shore or navigating in the vicinity of dangers.

11. Conclusion: In the paper charts available for Greenland waters, the positioning of the information in the charts (i.e. topography, including coastline, and hydrography, etc.) is inaccurate, which means that ships cannot navigate safely by means of satellite navigation on the basis of the present paper charts.

12. IT IS IMPORTANT TO EMPHASIZE THAT, DESPITE THE INACCURACIES OF THE PAPER CHARTS; IT IS POSSIBLE FOR SHIPS TO NAVIGATE IN COASTAL AREAS IF THEY USE THEIR RADAR EQUIPMENT AS THE PRIMARY POSITIONING INSTRUMENT AND RELY ON TERRESTRIAL NAVIGATION METHODS WHEN NAVIGATING IN GREENLAND WATERS.

13. Chart datum. The paper charts available for west Greenland waters are produced in the geographical datum "Qornoq 1927". On each paper chart a note has been inserted giving the correction to be used if positions are obtained from a satellite navigation system, such as GPS, which refers to WGS 84 datum. This could state, e.g., Positions obtained from satellite navigation systems refer to WGS 84 datum; they should be moved 0.08 minutes northward and 0.25 minutes westward to agree with the chart.

14. For paper charts covering northern and eastern Greenland waters, the source material for chart datum may be unknown.

15. It is important to notice that the correction may vary from one chart to another and the correction is only to be used if the GNSS receiver has not been pre-selected to the Qornoq 1927 datum.

16. The use of the geodetic datum Qornoq 1927 instead of the WGS 84 may have the following effect for Automatic Identification System (AIS) which relays the ship's position signal from a GNSS receiver. It can get this information in two ways: From an external or a built-in receiver. AIS with an internal receiver transmits the ship's position in WGS 84 coordinates. AIS with an external receiver can transmit the ship's position in WGS 84 or in Qornoq 1927. This can give rise to misunderstandings and misinterpretations when AIS is used for anti-collision purposes.

17. CONCLUSION: GNSS SHOULD BE USED ONLY AS A SECONDARY POSITIONING INSTRUMENT, AND IF USED AS SUCH, MARINERS MUST BE AWARE OF THE NECESSARY CORRECTION BETWEEN THE REFERENCE CHART DATUM IN THE PAPER CHARTS AND THE INFORMATION RECEIVED FROM GNSS.

18. Hydrographic survey. IHO Special Publication No. 55 Third Edition (2004) on status of hydrographic surveying and nautical charting worldwide, latest update of 8 May 2009, states the following for Greenland: The coastline of Greenland is very complex and the total sea area of the EEZ is ca. 2,000,000 square kilometres. Due to permanent ice cover, the limit for navigable waters has been set to 75 degrees northern latitude. The east coast is sparsely

populated and only surveyed near populated areas. A prioritised programme is in force to resurvey navigable routes to and between populated areas on the west coast of Greenland, to modern standards.

19. The lack of survey data or its poor quality is reflected in the charts by, e.g., waters where depths are given only by passages of reconnaissance lines or even as white unsurveyed areas in the chart. Attention is also drawn to the fact that source diagrams are lacking in many of the paper charts available for Greenland waters. The basic lack of IHO compatible survey data for chart production should make ships keep an additional safety distance when passing underwater rocks and obstructions.

In summary, at present caution must be taken in consideration that:

- official ENCs are not available for coastal navigation;
- only paper charts are available for coastal navigation, but these are not compatible with GNSS navigation;
- paper charts have incorrect positioning of coastlines in the geographic net;
- chart datum "Qornoq 1927" is used for some areas, mostly at west Greenland, instead of WGS 84 datum;
- for other areas, mostly north and east Greenland, the source material for chart datum may be unknown and the accuracy may be affected by the age and quality; and
- hydrographic surveys may be sporadic and areas may be considered as unexplored.

In some areas, depths are only given by sounding tracks from passages of a reconnaissance nature.

Planning a voyage to Greenland, the following IMO guidelines and resolutions should be consulted further in addition to the ordinary use of paper charts and nautical information:

- SN.1/Circ.207/Rev.1 on Differences between RCDS and ECDIS;
- SN/Circ.213 on Guidance on chart datums and the accuracy of positions on charts;
- SN.1/Circ.255 on Additional guidance on chart datums and the accuracy of positions on charts;
- SN.1/Circ.276 on Transitioning from paper chart to ECDIS navigation;
- Resolution A.893(21) on Guidelines for voyage planning;
- Resolution A.999(25) on Guidelines on voyage planning for passenger ships

operating in remote areas; and

- MSC/Circ.1056 on Guidelines for ships operating in Arctic ice-covered waters.