INTERNATIONAL HYDROGRAPHIC BUREAU

BUREAU HYDROGRAPHIQUE INTERNATIONAL

4, Quai Antoine 1er
B.P.445 - MC 98011 MONACO Cedex
PRINCIPAUTE DE MONACO

IHB File No. S3/0128

27 October 2011

HCA Letter No. 04/2011

Draft IMO Circular on Polar Navigation
Annex "Precautions in Using Navigational Charts in Polar Waters"
Antarctic Appendix

To: HCA Members and Observers (see list at Annex A)

Dear Sir or Madam,

Document HCA11-05B, referred to at the 11th HCA Meeting, provided an initial draft of an Annex "*Precautions in Using Navigational Charts in Polar Waters*" to a proposed IMO Circular that is under preparation by a group of IMO Member States led by the Danish Maritime Authority. The Annex will include several appendices, giving specific information on various Polar Regions, including Antarctica.

The Commission decided to set up an ad hoc sub working group to draft the "Antarctic appendix" to the Annex during the meeting. The SWG led by Australia completed, as planned, the Antarctic appendix which was endorsed by HCA-11.

In accordance with Action HCA11/10 the IHB was to "*Circulate by HCA Letter the latest draft of the Danish paper "Precautions in Using Navigational Charts in Polar Waters" (Draft IMO SN Circ. on polar safety of navigation) and its Antarctic appendix*". You will find at Annex B a revision of the Annex to the proposed Danish IMO circular, which includes the Antarctic appendix prepared at HCA-11.

HCA members are invited to review the text at Annex B and, as appropriate, contact the Danish Maritime Authority via their national IMO representatives **by 15 December 2011**, to provide their input and comments to the proposed circular, and advise that Authority as to whether they agree to be listed:

- as supporting the Antarctic appendix, and/or
- as co-sponsoring the overarching generic polar navigation circular.

Contact details for this matter at the Danish Maritime Authority are as follows:

Carsten Jensen (SFS)
Special Adviser

Danish Maritime Authority
Centre for Maritime Regulation
Dir. tel.: +45 39 17 45 58
E-mail: CGJ@dma.dk

Thank you for your attention. Yours sincerely,

Hugo M. GORZIGLIA
Captain – Chilean Navy
IHB Director and Chairman of HCA

Enclosures: Annex A – HCA Membership and Observer List
Annex B – Annex to draft IMO Circular “Precautions in Using Navigational Charts in Polar Waters”, including an Antarctic appendix

Annex A to HCA Letter 04/2011

HCA MEMBERSHIP AND OBSERVERS LIST
(October 2011)

I. Members	Name	E-mail
Argentina	RAdm Andres Roque DI VINCENZO	dhidro@hidro.gov.ar
Australia	Comdre Rod NAIRN ***(Vice-Chairman)***	international.relations@hydro.gov.au
Brazil	VAdm Luiz Fernando PALMER FONSECA	int.rel@dhn.mar.mil.br
Chile	Capt Patricio CARRASCO	shoa@shoa.cl
China	Capt CHEN Aiping	hydro@msa.gov.cn
Ecuador	Cdr Jorge CARDENAS	direccion@inocar.mil.ec
France	Ing Gén Bruno FRACHON	Bruno.Frachon@shom.fr
Germany	Dr Mathias JONAS	mathias.jonas@bsh.de
Greece	Comdre Alexandros THEODOSIOU	director@hnhs.gr
India	RAdm Saroj KUMAR JHA	inho@dataone.in inho-navy@nic.in
Italy	RAdm Andrea LIACI	iim.sre@marina.difesa.it
Japan	Dr Shigeru KATO	ico@jodc.go.jp
Korea (Rep. of)	Mr Dong Hyun SIM	infokhoa@korea.kr
New Zealand	Mr Adam GREENLAND	agreenland@linz.govt.nz
Norway	Mr Kjetil WIRAK	Kjetil.Wirak@statkart.no
Peru	RAdm Javier GAVIOLA TEJADA	dihidronav@dhn.mil.pe
Russian Federation	Capt Alexander V. SHEMETOV	main@gunio.ru
South Africa	Capt Abri KAMPFER	hydrosan@iafrica.com
Spain	Capt Guillermo MOREU MUNAIZ	ihmesp@fn.mde.es
United Kingdom	RAdm Nick LAMBERT	Nick.Lambert@ukho.gov.uk
Uruguay	Capt Orestes PEREYRA	Sohma_jefe@armada.gub.uy
USA (NOAA)	Capt John LOWELL	John.Lowell@noaa.gov
USA (NGA)	RAdm Christian ANDREASEN	Christian.Andreasen@nga.mil
Venezuela	RAdm Jesús ORTEGA Hernández	dihn@dhn.mil.ve
II. IHB	**Name**	**E-mail**
	Capt Hugo M. GORZIGLIA ***(Chairman)*** Ing en Chef Michel HUET ***(Secretary)***	hgorziglia@ihb.mc mhuet@ihb.mc

III. Observers	Name	E-mail
ATCM	Dr Manfred REINKE (Executive Secretary)	manfred.reinke@ats.aq
COMNAP	Mrs Michelle ROGAN-FINNEMORE	sec@comnap.aq
IAATO	Mr Steve WELLMEIER Ms Kim CROSBIE	Swellmeier@iaato.org kimcrosbie@iaato.org
IALA	Mr Gary PROSSER	gary.prosser@orange.fr
SCAR	Dr Henk BROLSMA	Henk.Brolsma@aad.gov.au
GEBCO/ IBCSO	Dr Hans-Werner SCHENKE	hans-werner.schenke@awi.de
IOC	Dr Mitrasen BHIKAJEE	m.bhikajee@unesco.org
IMO	Capt Gurpreet SINGHOTA	gsinghota@imo.org

ANNEX

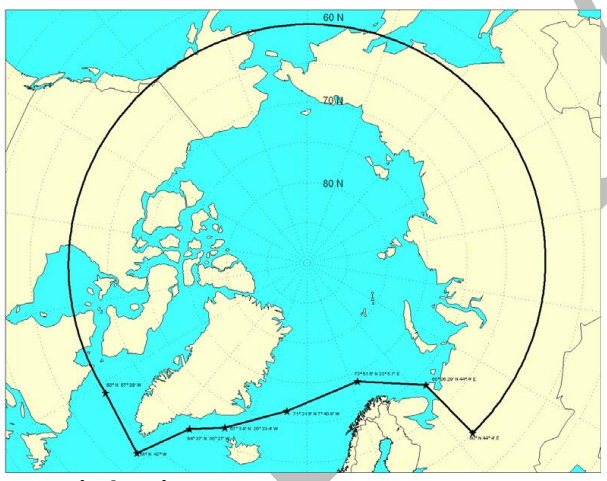
(to a draft IMO Circular on Polar Navigation; under preparation – Denmark Lead)

Precautions in Using Navigational Charts in Polar Waters

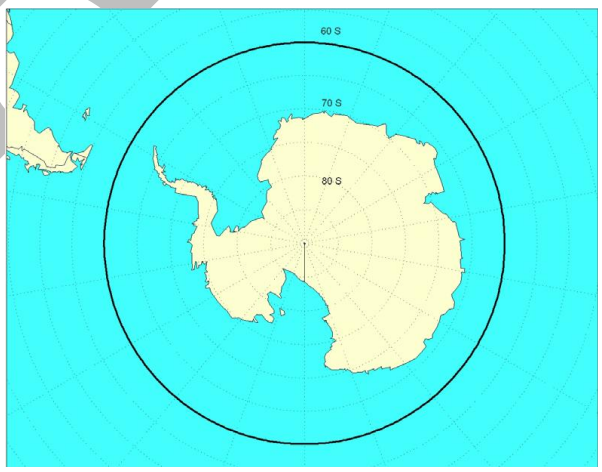
Background

1. At its eighty-sixth session the Maritime Safety Committee adopted a carriage requirement for an Electronic Chart Display and Information System (ECDIS) applying for various SOLAS vessels with an implementation period from 2012 to 2018. This coupled with increasing levels of shipping in polar waters has illustrated the requirement to provide guidance to mariners on the charting factors that specifically impact polar navigation in Arctic and/or Antarctica as Electronic Navigational Charts (ENC) become a primary form of navigation.

2. This circular provides information on the navigational considerations in polar waters that relate to navigational charts and positioning. General information is provided in this circular and more specific information is contained in the appendices.



i. Arctic waters



ii. Antarctic waters

Note that these areas are for the purpose of IMO Res A.1024(26) Guidelines for Ships Operating in Polar Waters and do not define the Arctic, Antarctic or Southern Ocean as detailed in IHO Special Publication Number 23 on Limits of Oceans and Seas.

3. Navigation in polar waters differs significantly from navigation in other (non-Polar) waters. In general, it is difficult for mariners who are not familiar with the conditions to navigate around in these areas. It is, to a high degree, also due to the climate and the influence of the weather. In addition, systematic and completely covering hydrographic surveys have not been carried out in many areas due to the wide extent of remote coast lines

and archipelagic areas. In other words, depth information may be unknown or depth data will be of poor quality in large areas. Source material for navigational charts can be out of date. For mariners it is essential to understand the limitations of source material providing the basis for the production of charts and, consequently, the information given in charts must be carefully interpreted.

4. It may be many years before some areas are surveyed or re-surveyed and charts updated or produced. Hence mariners need to be cautious about the safety issues in this circular. In many cases ENCs are made using pre-existing paper charts based on older source material. Therefore coastal navigation in polar regions, conducted primarily by means of GNSS navigation should be planned with caution unless during the voyage planning assessment it can be determined that the ENC source material is trustworthy.

General precautions when using navigational charts in polar waters

5. Due to the remote location of the polar waters and the historically low density of maritime traffic, the assistance offered to mariners in the form of charts within the scope of relevant standards and other facilities, such as navigation marks, have not reached the same level as in other regions. Despite increased levels of shipping in polar waters mariners cannot currently expect large scale charts to be generally available. In the case of water based navigation marks, it is unlikely that any comprehensive buoyage scheme will be established due to ice conditions and recorded depths of water, although land based leading and clearing marks may be possible. It is important for mariners to understand the limitations of some source material providing the basis for the production of charts and, consequently, the information contained in polar region chart must be interpreted with caution.

6. Systematic and complete hydrographic surveys have not been carried out in many areas due to the wide, remote and inhospitable coastline and the numerous archipelagic areas. Many areas remain unsurveyed, inadequately surveyed or have poor quality datasets from old surveys based on local datums. These areas can be readily identified from the chart source or zone of confidence (ZOC) diagrams, when included on paper charts and ENC, and the soundings presented on the chart (eg. few soundings and large sections of unsurveyed areas in the chart). At present the development of new ENCs' in polar waters is at an early stage, and mariners should consult information from the national hydrographic offices on the accessibility of recently produced ENC.

7. Modern navigation based on Global Navigational Satellite Systems (GNSS) continuously records a ship's position on an ENC in an ECDIS. GNSS receivers predominantly output positions in the World Geodetic System 1984 (WGS-84) datum. It is important to note, that for some paper charts covering distant waters and areas, the source material for chart datum may be unknown.

8. The use of ECDIS in polar waters requires the availability of ENC which refer to WGS-84 datum and which are recently produced with accurate positioning of topography, including the coastline and hydrographic data and in particular water depths.

9. At present, the paper charts available for polar waters are in many areas not compatible with GNSS navigation, as e.g. GPS, for several reasons. A major difficulty with Polar water paper charts is also seen by the incorrect positioning of the coastline with reference to the chart graticule from either projection errors or inaccurate data. In some cases

the coastline positioning may be inaccurate and differ from the real coastline by several nautical miles. Therefore a GNSS derived position should only be transferred to a chart if it can be assured that any differences in geodetic datum have been accounted for. Wherever possible checks of position should always be made using independent terrestrial navigation techniques.

10. Terrestrial navigation including information from radar, gyro, log, echo sounder and visual bearings should be the primary means of navigation where charts are known to be of poor quality. Care needs to be taken when using terrestrial navigation in areas where shore ice is prevalent. In addition, poor quality depth information may prevent navigation using echo sounder information alone.

11. Operating ECDIS in RCDS mode (ie. using Raster Navigational Charts (RNC)) should include cross checking of position using terrestrial navigation techniques.

12. It is important to observe that the datum correction notes on paper charts may vary from chart to chart and that the correction is only to be used if the GNSS receiver has not been pre-selected to the referred datum. If the GNSS receiver's datum is adjusted the mariner must be aware that depending on a ship's individual equipment configuration this can have an unintended effect on the vessel's Automatic Identification System (AIS). This is because the vessel's broadcast position is transmitted in the datum that it is received, which may not be the same as that being used by other shipping in the same vicinity. This can increase the risk of collision when AIS is used to assist with collision avoidance.

13. Vessels that receive differential or wide area GNSS corrections should note that no corrections are received in polar waters without specialist polar differential correction receivers. This is due to the low elevation of geostationary satellites that allow even icebergs to block corrections. Without differential or wide area corrections standard GNSS receivers may experience periods of poor performance.

14. GNSS should be used as a secondary system for navigation in polar waters taking into account the use of terrestrial navigation as a primary method. It have to be concluded, that 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. With approximately 65% limited sky area to track GPS satellites vessels should use multiple system GNSS receivers.

15. Magnetic variation at high latitudes can be considerable and can reach up to 180° as magnetic poles have dynamic positions away from the geographic poles. Relevant information on charts should be consulted.

16. Mariners should be cognisant of the physical science effects of higher latitude on solid state navigational equipment and their additional handling requirements. Other instruments such as magnetic compasses may be unusable and gyrocompasses may be unreliable. Since both magnetic poles are in polar regions the horizontal intensity of the earth's magnetic field is insignificant and its force is minor or absent for magnetic compasses to be of use in some areas. The phenomenon *polar light* or aurora caused by magnetic storms can also influence magnetic compasses.

Other general polar navigation precautions

17. The navigators' traditional way of observing a charted sea area is by the Mercator projection with meridians perpendicular to the latitudes. In polar areas this is different with meridians converging towards the poles which are the centre for the concentric latitude circles. This extreme convergence of meridians makes it unsuitable for determining direction, other than North/South, from the chart. Other compass lines will be curved and will differ considerably from a great circle even for short distances. Visual bearings cannot or with great inaccuracy represent a compass, or rhumb, line on a chart. This means that Mercator charts become less useable at higher latitudes. Another disadvantage with Mercator charts is the North/South variation in scaling which introduces errors in measuring distances and distorts land areas.

18. Attention is also drawn to the fact that source diagrams are lacking in many of the paper charts available for polar waters. A lack of IHO compatible survey data for chart production should make ships keep an additional safety distance when passing charted underwater rocks and obstructions.

19. Vessels is in the coming decades expected to be able to navigate into previously unknown areas due to melting of glaciers and fast or other sea-ice. These areas must be considered with uttmost caution if navigating here.

20. For electronic navigation it has been revealed, that an ECDIS can be unable to display a Mercator chart north of the 84th latitude. Here it will be necessary for the ECDIS to use other projection standards such as the polar stereographic projection. However, projections other than Mercator are not yet included in the ECDIS standards. [**ECDIS can select appropriate datum above 84th latitude, the reason it can't be presented is due to software issues that can be overcome.]**

21. For some paper charts covering distant waters and areas, the source material for chart datum may be unknown. xxxxxxxx

22. A note has been inserted in some paper charts covering polar coastlines, stating e.g.: *Due to age, quality and some of the source material, it must be expected that positions obtained from satellite navigation system are more accurate than those on this chart* or *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.*

Polar waters reference documents issued by the IMO

23. Before planning a voyage into polar waters, the following IMO guidelines and resolutions should be consulted in addition to sailing directions and other relevant 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

- Res. A.893(21) on Guidelines for voyage planning
- Res. A.999(25) on Guidelines on voyage planning for passenger ships operating in remote areas
- Res. A.1024(26) Guidelines for Ships Operating in Polar Waters

These guidelines and resolutions and other IMO guidance material can be downloaded from the IMO website, www.imo.org under *Our work / Circulars* and *Knowledge Centre / How and where to find IMO information / Index of IMO Resolutions / Assembly.*

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APPENDIX XX

Antarctica – Australia, Brazil, Chile, Ecuador, France, Germany, Korea, New Zealand, Norway, UK, USA, France, Norway, Uruguay, Spain, South Africa and Venezuela

The unique status of Antarctica and nautical chart production

1. Under the Antarctic Treaty System there are unique arrangements for the conduct of hydrographic surveys and the production of nautical charts. The International Hydrographic Organization's (IHO) Hydrographic Commission on Antarctica (HCA) oversees an international chart scheme (INT chart scheme) for the Southern Ocean. INT charts are steadily being produced within this scheme by the hydrographic offices belonging to member countries of the Antarctic Treaty (Argentina, Australia, Brazil, Chile, Ecuador, France, Germany, Italy, Japan, New Zealand, Norway, Peru, Russian Federation, South Africa, Spain, United Kingdom and United States of America).

State of Antarctic charting

2. Progress of chart production is dependent upon demand for new charts and resources available for the conduct of new surveys and subsequent chart production. Until the INT chart series for Antarctica is complete some existing charts (paper and ENC) are not compatible with GNSS navigation due to different or undefined horizontal datums or the use of old or inaccurate source material.

3. Since October 2004 approximately half of the IHO HCA members have conducted surveys aimed at improving the portfolio of Antarctic charts. Due to limited resources and national charting priorities Antarctic waters are often considered to be a low priority. The majority of national operations conducted in Antarctica are for geophysical and oceanographic research rather than for hydrography.

Hydrographic surveying and source material collection

4. IHO HCA members have plans for ongoing hydrographic data collection and paper chart and ENC production in Antarctica. The isolation, harsh conditions and subsequent lack of support has been noted by many IHO HCA members as a constraint on their survey activities.

5. Members of the IHO HCA produce national reports that detail the status of navigational charts and national surveying and charting operations in Antarctica. These reports show that considerable collaborative work is taking place under the Antarctic Treaty System. Improved arrangements for information exchange are being developed and an increasingly strategic approach is being taken ensure the effectiveness of survey and charting activities.

Assisting Antarctic chart producers

6. Operators of all vessels sailing in Antarctic waters are strongly encouraged to engage with relevant hydrographic authorities in order to establish arrangements to provide information that will subsequently enable the quality of nautical charts to be improved.

Mariners are reminded of the use of Hydrographic Notes as a means of providing of important information to hydrgraphic offices. Of particular use in the Antarctic is the provision of feedback to hydrographic offices on charting anomalies, errors or deficiencies (refer to advice on Hydrographic Notes in relevant nautical publications).

Antarctic characteristics relevant to navigation and nautical charts

7. Navigable Antarctic waters are some distance from the South Pole and hence the Mercator projection is used for the majority of charting in Antarctica.

8. The weight of ice on the Antarctic continent has depressed the continental shelf and hence the water is generally deep offshore. However, closer to the coast the sea bed can be irregular, with deep holes, shallows, reefs, and the possibility of uncharted rocks, making both navigation by soundings, and anchoring, difficult.

9. Transit routes to and from Antarctic research bases and frequently visited tourist sites are generally well surveyed and charted. Seasonal ice may sometimes block such transit routes and great care is required if navigation is conducted away from usual transit routes. When planning passages mariners are advised to always ascertain the quality of a chart's source material (Source or ZOC diagrams and ENC source data quality indicators).

10. Mariners navigating in Antarctic waters are reminded of the need to take great care when determining their position and placing position information on charts. Whether navigating using paper charts or ECDIS (including ECDIS in RCDS mode) reliance on a single source of position should be avoided. In particular great care is required when using GNSS and it should never be solely relied upon.

11. Terrestrial navigation information should always be used whenever possible (e.g. radar, gyro, log, echo sounder and visual bearings). Nonetheless, care needs to be taken when using terrestrial navigation in areas where shore or glacial ice may conceal the coastline. Further, poor quality depth information may prevent navigation using echo sounder information.

12. As with most polar regions very few aids to navigation, such as buoys, beacons and lighthouses are available. In the future it is possible that there could be a greater use of virtual aids to navigation, provided through equipment such as Automatic Identification of Ships (AIS) transceivers.

13. Further Antarctic specific information my be found from the following sources:

- Antarctic pilots
- Special publications produced by hydrographic offices
- IHO HCA webpage: www.iho.int > Committees & WGs > Hydrographic Commission on Antarctica (HCA)

APPENDIX 3

Greenland – Denmark

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*".

Present status and future developments of nautical charts for Greenland waters

Guidance to mariners on navigation in Greenland is generally given by publishing official nautical charts, nautical publications and Notices to Mariners.

The nautical charts available for Greenland waters include paper charts, port plans and, in very few cases, electronic navigation charts (ENC). Today, Greenland waters are covered by 94 paper charts of various scales, while only 10 ENCs have been produced by mid 2011. ENC coverage is, consequently, a long-term process, which has only just begun.

In 2006, the Danish Hydrographic Office launched a project with the purpose of producing improved paper charts in terms of the geometric precision of the paper charts (i.e. topography, including coastline, and hydrography, etc.). In addition to this improvement, the paper charts will also be transformed into WGS-84 datum. In the improved paper charts, the coastline will be provided with a degree of precision that makes the use of satellite navigation sound and secure.

It is expected that ENCs corresponding to the improved paper charts will be produced and published as an ongoing process ahead. Among the ENCs published, ENCs in usage band overview (corresponding to scale 1:3 500 000 for sea passage) are published in 2010. Navigational and hydrographic information is much simplified or completely left out in areas close to land. Consequently, it is only possible to use these ENCs in usage band overview for navigation in open waters.

Conclusion: At present ENCs are not available for Greenland coastal navigation, except for a few exceptions. It is expected that the ENC coverage will be continuously improved, but complete ENC coverage in coastal areas will not be in place in 2012. In coastal areas, ships will therefore as a general rule have to use paper charts for navigation.

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APPENDIX 4

Svalbard - Norway

Present status and future developments of nautical charts for Svalbard waters

Svalbard is a group of islands situated between 77°- 81°N and 10°- 30°E. The relative warm North Atlantic Current and its extension, the Spitsbergen Current, keeps the North Atlantic passage to western Svalbard free of ice for most of the year. Close to the west and north coast the ice coverage will be less than 1/10 (classified as "open water") all year round. The fiords on the west coast freeze every winter. The ice condition on the east side is much more challenging. A greater part of the east side has "open water" only in the period July-October.

The Main Chart Series Svalbard constitutes 14 paper charts at scale 1:100 000. The charts cover the western part and the passage Hinlopen. All except 3 charts are referred to WGS-84. An additional 12 charts is planned. The west coast is covered by ENCs in user band NO3. The release of additional ENC cell will be synchronized with new paper charts.

Two INT charts at scale 1:700 000 cover the waters around Svalbard. On the east side the surveying is scattered and non-systematic. The bad positioning available during the old and sparse surveying has resulted in general low accuracy of shorelines etc. Several identified shoals have doubtful position.

Especially the eastern part of Svalbard is inadequately surveyed. Due to the short season with open waters the ongoing survey program is expected to last for decades. Plans for enhanced surveying exists but not yet funded. From the season 2011 some priority has been given to surveying corridors for safe navigation around the islands. All ongoing surveying take place with multibeam echosounder systems, giving100% coverage of the survey area.

Conclusion: The western part of Svalbard is covered with fairly good quality ENCs and paper charts. For the eastern part new charts and ENC will be published when adequate surveying has taken place.