Scalable Charts - User Needs and Technical Challenges with Ice Charts as an Example

In the Survey of Mariners' Needs, respondents ranked "scalable ice charts" a close second in priority for what ice services should focus on. Jürgen Holfort convened and moderated a panel of experts to discuss what Ice Services can do to meet user expectations. The panelists were:

- Jens Peter Weiss Hartmann (Danish Geodata Agency)
- Richard Hall (Equinor)
- Pascale Bourbonnais (Enfotec/Fednav)

Introduction

Jürgen introduced the session by noting that there is a lot of confusion and misunderstandings about what constitutes scalable ice charts. Mariners are used to ECDIS and viewing navigation charts at different scales. We would like to emulate that with ice charts. However, it is a challenge for Ice Services to produce ice charts at all scales. We need consistent rules to scale up and down so as not to lose important information or overload the display with irrelevant information. Besides this, ECDIS manufacturers have to sell their products. Given the relatively small community of polar navigators, it is questionable whether there is a market. Given these challenges, it is right to ask if it is worthwhile doing.

Richard: My role in Equinor is to get the most from satellite images in ice infested waters to order services for offshore operations. Scalable ice charts should be all about the user. A ship going near the ice only needs the ice edge. A ship going into the ice needs much more information.

Pascale: Fednav is a privately owned shipping company that owns and operates 120 vessels. The fleet includes 65 vessels mostly of ice class 1C and 3 Polar Class 4 icebreaking vessels. Enfotec is Fednav's support group that works to improve knowledge about ice information and where to get it. ICENAV is the company's system to support navigation in ice. It is a tool to receive and display ice information. The software allows different scales depending on the operation and need. Operating in ice with a low-powered vessel requires floe to floe navigation – much finer resolution than an ice chart. More powerful icebreakers can go with just an ice chart.

Jens Peter: We have no experience in producing ice charts but lots of experience in navigation and hydrographic charts. Electronic navigation charts have 6 different user bands with predefined scales. If ice charts are to be displayed on ECDIS, you need standards to ensure that data can be exchanged and displayed. You also need principles to distribute data to value added resellers.

Jürgen: Shape files are scalable but they always show the same information in same manner. Hydrographic charts look different at different scales. We need rules to change the display content at different scales.

Jens Peter: You must agree and harmonize internationally on the details about what to display at each scale.

Richard: You can always scale up but never down. Ice chart production must be done at the highest resolution and use that to generalize upward. At our installations off of Newfoundland, we can zoom in to see and individual iceberg but, when zooming out, icebergs are grouped and show only one symbol with a number. Tha is all done in software. Linear features are more complicated but can be done if we ave agreement on the rules.

Pascale: If we are considering making ice charts at very fine scales, we must consider the bandwidth issues that ship communication systems face. Will the Ice Services be able to produce a small scale chart for a huge area. It would be worthwhile for Ice Services to accept user requests for detailed charts in a certain small area to reduce the geographic coverage needed.

Richard: When it comes to bandwidth, you must decide what you can do and what you will do and won't do.

Jürgen: If we make the ice chart at high resolution, the user could choose what resolution they need depending on available bandwidth and their operation.

Pascale: Beyond ice thickness and concentration, mariners need dynamics information - deformation, drift, pressure etc. Ships don't want to go into an area with deformed ice. An ice class 1C ship can go into 30cm ice but, if it is deformed, it might be 3 times thicker. That information is not available on ice charts now. If you go to navigation scale ice charts, that kind of ice information would be needed.

Jens Peter: Ice charts are used for both passage planning and navigation. New navigation charts can have no-go areas. An ice chart could present the same kind of information.

Richard: The most basic ice information is the ice edge. When you zoom in, you want to see more detail. Use AIS systems to draw lines and let the human experts focus on the 24-48 hour forecast.

Pascale: Based on our experience with IceNav, ice in ECDIS can become a bit overwhelming – a separate system is actually more efficient than tying up the ECDIS system. We should add winds, pressure information, anything to help navigate through ice.

Jens Peter: S411 could be presented on ECDIS but it could also be on and Electronic Navigation Chart System – front bridge and back bridge concept.

Richard: Information should be in a format that the navigator and captain prefer. We should not be sending satellite images directly to the bridge. But rather use models that have assimilated the data.

Pascale: You must know your users and their needs and must also consider the voyage planning aspect.

Richard: We are heading towards a piloted system where planning will be done onshore. The ship's captain will no longer make the decisions on his or her own but will be fully supported from shore. In the future will see autonomous ships fully piloted from shore.

Pascale: That is an interesting point of view. I agree with the point about interaction with shore - that is the way Fednav works. But from a commercial point of view, a pilot has no legal responsibility. If there is an accident, it is the captain's responsibility. Also, the captain knows his ship best. Our captains know how to interpret a SAR image but not everyone does. In 2/10 ice, they want to know where the floes are.

Richard: An image may not be sent to the ship but rather an interpretation will be sent. Not just a traditional ice chart but something with much more information.

Jürgen: What is worthwhile doing? It would be a lot of work for the Ice Services to produce high resolution charts for a large region. Is that really the way to go?

Pascale: Ice Services should accept requests and produce ice charts at an appropriate level of detail to meet a specific need.

Jürgen: It might work in the Arctic with just a few ships. It is not feasible for the Baltic Sea or the trans-Atlantic shipping lane.

Richard: We are at a crossroads with the amount of data coming. EuMetsat could analyze the images for all of the Ice Services. That would provide a standard product that would be more tractable for ice services. It would reduce their workload and would satisfy users.

Jens Peter: If we don't do it, somebody else will. Unlike the IHOs that have legal authority, Ice Services have none – anyone can produce an ice chart.

General Discussion

Patrick Eriksson: When we speak about including dynamic features in ice charts we are not talking about classical ice charts any longer. The product must have a new name – perhaps nowcasts. That would require development and innovation. The users

tend to want the most accurate and timely info but going to this scale will require more uncertainty information as well.

John Parker: An analogous interpretation is how meteorology works these days. Observations from satellites, ground and oceans stations are still being looked at. Some users really want to see this detail of information. There is interpretation at different levels in the weather world. The user needs to be careful of where the information is coming from, so authoritative information is still needed. The U.S. invested in the GOES satellite series and it is expected that the information will be used by people, not just computers. Ice services will need to work with the user on uncertainty tolerances and how the information is used. The geographical coverage is huge, even when broken down nationally. Ice Services can't support each to the same level.

Oleg Folomeev: Information from vessels helps analysts to interpret satellite imagery. We are testing systems where users take SAR data in their own preferred size and format.

Jens Peter: An additional question is security. How do you ensure that nobody makes fake data? S101 means anyone can do it. Do you need an implementation plan for S411? In the future, bandwidth will be less of a problem. We will still have to consider how to deliver the information to the user.

Pascale: We still deal with ships that have no internet. Companies can be cheap.

Jürgen: S-412 and S413 for weather, sea level, ocean currents, etc has similar probems.

Duke Snider: The variety of what is needed by mariners is wide and can never be handled remotely. Mariners will have various levels of experience. The Baltic can probably be covered with 1-2 ice charts. However, that won't work elsewhere. The National Weather Service Alaska Region has 1 shapefile covering the entire area. If it can be downloaded on a ship to visualize it, that is great. That is all that is needed. But if you can't download it, you are dependent on the paper and multiple charts.

Anna Telegina: Ice charts are used for planning, not necessarily for navigating. Given the vast geography involved, is it feasible to make scalable ice charts useful for navigating? How much time will it take to actually create the ice chart? By the time is produced and distributed, the ice has probably changed.

Pascale: For tactic scale, a ship needs SAR images. If you start making an ice chart on the scale of the satellite image, you might as well just give the image and have a 3rd party annotate it. It is feasible with the right staff/resources to annotate, since we currently do this at Infotech with MODIS imagery. A chart is for planning your route on a 24hr basis. Tactical navigation isn't using this.

Neal Young: In the Southern Ocean when Antarctic sea ice is at its maximum, there are 20 million square kilometres to analyze. It is impossible to analyze it all. We just use images for tactical operation.

Richard: Automated ships will be feasible. Algorithms that can process an image into a product at the same resolution will be developed. It won't happen tomorrow but it will happen. I predict within 10 years.

Pascale: When connecting with users, don't just ask if they want scalable information. It is like asking if you would like $1million. The fact that the captain wants it doesn't mean the owner/bill payer will buy/pay for it. What do you need? What is missing? In an ideal world what would you get? That is more useful.

Jens Peter: When we discuss what we want to do tomorrow, we should not look at what we do today. In future, a lot of what is done manually now will be done automatically.

Pascale: Who are the users? What do they want? Not all ice products are totally aimed at mariners. What is feasible?

Richard: A known situation is a safe situation. We will be faced with huge amount of data - control it or it controls you. Embrace change.

Co-Chairs' Wrap-up

Tom: We are at a cross between the hydrologic and met-ocean communities. As vitally important as navigation is near the ice, we are talking about a meteorological hazard to be dealt with.

Marianne: When we meet in task teams on Thursday, we should dig closer into users. One idea is to suggest some kind of pilot project and see if we could analyse some of these variables.