AN ECDIS IS NOT A PAPER CHART ON A SCREEN

An interview with Øssur Hilduberg about a safety study on the use of ECDIS

The way ECDIS is used on ships has been named a contributory factor in recent groundings. Therefore, the Marine Accident Investigation Branch of the United Kingdom (UK MAIB) and the Danish Maritime Investigation Board (DMAIB) are now carrying out a safety study into its use. SWZ|Maritime approached Øssur Hilduberg, Head of the DMAIB, to ask about the status of the study and he provided some fascinating insights.

An Electronic Chart Display and Information System (ECDIS) is a geographic information system used for nautical navigation. Concerning its role in recent incidents, the following passages in report 22/2017 of the UK MAIB grabbed my attention: 'The MAIB has recently investigated several grounding incidents in which the way the vessels' ECDIS was configured and utilised was contributory. There is increasing evidence to suggest that first generation ECDIS systems were designed primarily to comply with the performance standards required by the IMO, as these systems became a mandatory requirement on ships, with insufficient attention being given to the needs of the end user. As a consequence, ECDIS systems are often not intuitive to use and lack the functionality needed to accommodate accurate passage planning in confined waters. This situation has led to seafarers using ECDIS in ways which are at variance with the instructions and guidance provided by the manufacturers and/or expected by regulators.'

'The MAIB is conducting a safety study, in collaboration with the Danish Maritime Accident Investigation Board, designed to more fully understand why operators are not using ECDIS as envisaged by regulators and the system manufacturers. The overarching objective is to provide comprehensive data that can be used to improve the functionality of future ECDIS systems by encouraging the greater use of operator experience and human centred design principles.' I discussed this study with Hilduberg.

At which state is the study presently?
'The draft is being reviewed. After reviewing, there will be a round of consultation with stakeholders. We expect to publish the study at the end of this year.'

What triggered this study and how did it come about that it is a combined study of the UK MAIB and the DMAIB?
'An investigator of the DMAIB did the MSc study "Human factors

Photo: ECDIS challenged and changed navigational practices fundamentally (photo RH Marine)

and system safety" at Lund University. As a subject for his thesis, he chose working with the ECDIS. The title became "How does the ship's bridge know where it is?" During his research, he also talked with colleagues working for the UK MAIB. Both organisations had investigated several navigational groundings where ECDIS was used as primary means of navigation. Navigational grounding means that the grounding is not caused by break-downs (such as loss of propulsion). In quite a number of cases, the way that the ECDIS was used and configured contributed to a grounding. Globally, there were many more of such incidents. In 2018, this led to an agreement to do a large scale study together.'

'In short the main questions of the study were: "In which way did ECDIS as a system contribute to groundings?" and "Why is there a mismatch between use and intended use?"' (Ed: sounds similar to the ideas of Erik Hollnagel and David Woods with regards to work as done versus work as imagined.)

Hilduberg adds: 'We hope that the result will benefit future ECDIS design, training strategies and the development of best practices. There have been some studies that looked into the use of ECDIS, but we felt that what was lacking was qualitative information from a user's perspective. What problems do the end users have?'

How was the study performed?
'We visited 31 ships, of various types, primarily operated in Northern Europe. A visit could last up to four days. We observed the practical operations and interviewed some 155 users. From that data, we started an analysis to get a proper understanding of the use of ECDIS during normal operations.'

No standard product
I understand that as the study is not finalised, you are not able to share the conclusions. However, could you share with us some of the issues that struck you?
'What became clear is that a horizontal analysis, from ship to ship, is difficult as the systems differed too much. There is a spectrum of use, with on the one extreme the fully integrated bridge of for example cruise vessels including high quality company tailored training, and on the other extreme some of the short sea vessels, where there is hardly any integration at all and the crew only have generic training, and all sorts of in-betweens.'

'With papers charts, there was a common way of working for all ships. For navigation by ECDIS, navigators have to be familiar with the relevant type of operations. Navigation by ECDIS has caused a diversified way of working. A navigator is no longer a "standard product".'

Automating the paper chart
'Early on, the performance standard was based on a vison of "automating" the work that was done on a paper chart,' continues Hilduberg. 'The purpose was to contribute to safe navigation by reducing workload (no more plotting a ship's position and such). But ECDIS is not a paper chart on a screen. It challenged and changed navigational practices fundamentally. As working on ECDIS is fundamentally different, will it suffice to educate navigators for years on pa-

per charts and give them one workweek training in ECDIS, or should we start on ECDIS immediately and if required, add a week's course on paper charts?'

'We noticed that even on ships that do not carry ECDIS, there is generally some sort of ECS. Almost without exception, in real life operations, the ECS will be used as primary means of navigation, with paper back-up, even though the certificates say different.'

It becomes clear that "one size fits all training" regarding ECDIS will be insufficient

'One of the main contributions of ECDIS is that the position is plotted continuously, real time, on the chart. This real time navigation is highly valued by users, and leads to the use of ECS as primary means even if this is not the certified way. Across age, nationality and type of ship, the users seem to be happy with the system. They feel that ECDIS/ECS really contributes to safe navigation. They mention that there is less running around on the bridge, as taking fixes on compass and radar and plotting these on the chart is no longer needed.'

Real best practices not yet established
But there are a variety of challenges according to Hilduberg. 'There is some difference in what the users see as challenges, and what we as a result of our observations identified as challenges. The ECDIS is only as good as the underlying hydrographic data. There are some system limitations that are rooted in the underlying hydrographic data. For example the issue with safety depth, which is connected with the low density of depth lines. This causes alarms that you cannot avoid.'

'Alarm management seems to be one of the main issues. Alarms are caused by all sorts of underlying reasons: some because of the system design, some because of the underlying hydrographic data, or in combination with the two (for instance safety depths and contours). Other alarms can be traced back to training and the chosen settings, often influenced by company procedures.'

'The required knowledge and expertise is dependent on where ship and crew are at the spectrum of use. Real best practices for the specific operation are not yet established. We saw often that practices followed the logic of paper chart navigation. I'll give an example: the procedure to verify the position relative to the dangers. If the ECDIS has a radar overlay, when the radar picture and the ECDIS with respect to shore lines, navigational marls, etc. correspond, the ECDIS will be aligned properly. Still, quite a number of company procedures and port state standards require a fix based on Lines Of Position. This actually reduces the added value of ECDIS, adding unnecessary distraction and work load.'

'Sometimes the procedures do not recognise that using GPS position to check GPS position is not useful. They require for example

Øssur Hilduberg: 'Best practices on one ship, are not necessarily best practices on another ship.'

plotting a GPS position on ECDIS' (Ed: or using Parallel Index on ECDIS).

He adds that 'best practices on one ship, are not necessarily best practices on another ship: it all depends on the level of integration, the trade you are in, the underlying hydrographic data in the area, the training that the navigators have enjoyed. This is very different from working on a paper chart, where best practice is the same across the board. It becomes clear that "one size fits all training" regarding ECDIS will be insufficient.'

Who operates the ECDIS?

'ECDIS also influences the division of work on the bridge,' Hilduberg goes on. 'Before there was an established division of work, often with the captain operating the radar, the officer of the watch (OOW) doing the chart work and so on. With one ECDIS in the centre console, who is going to operate it? Are you allowed to use a personalised configuration on your watch? When there are more navigators on the bridge, who operates the settings? On the radar, the navigator using it is allowed to work with the settings within limits.' (Ed: although with more people on the same radar, coordination is needed.)

'With ECDIS, it is not always certain who is allowed to change set-

tings and what is allowed. Unlike radars, often companies give instructions concerning settings, including alarms, without being able to judge all relevant issues.' (Ed: I have had quite a few complaints from pilots about alarm overkill. It is distracting and hinders communication. The crew have become so used to it, that they hardly respond.)

'A paper chart is static: you plot your position, walk away and everything on the chart will stay the same. ECDIS is dynamic: the position changes, new numbers, new values, new alarms, etc. appear whether you are working with it or not. When you don't look at it for a little while, a lot can have changed. It demands attention,' stresses Hilduberg. 'Just looking out of the window doesn't work, the ECDIS requires me to monitor and nurture it.' (Ed: I believe that we need to develop scanning patterns, fit for the specific operation. How long do you look at what? In which order? Training needs to imprint this, because when you are under stress, you tend to get tunnel vision. This way, you can make best use of visual and instrument navigation.)

Hilduberg continues: 'It also asks for judgment calls, what value is the correct value? As an example: what is the appropriate look ahead? These settings need to change depending on situation: from high seas to coastal waters to harbour entry. There are a number of such settings, just think of zoom in - zoom out, look ahead, safety depth, cross track distance, etc.'

'Even well-known entities get a different meaning: a way point on a paper chart is only an intersection between tracks. On ECDIS, it can have different functions, it can be used to set a different Cross Track Distance (XTD) on the same track. Even these words don't follow the same logic. There is a need to reconfigure your thinking.'

No automated paper chart

Hilduberg concludes the interview with what he sees as the main points that can be taken away from the study:
- An ECDIS cannot be looked at as an automated paper chart.
- There is a large spectrum of use and competencies required, which leads to the job of navigator being diversified.
- The use of ECDIS calls for many judgement calls that are not rooted in best practices, because they have not been developed yet.
- Alarm management is a major issue rooted in both training, the hydrographic data and system limitations.
- Best practices need to be developed that reflect these realities.
- The balance between paper chart and ECDIS in education and training needs to be reversed.

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