ECDIS: Challenges for the Navigator

THE HONOURABLE COMPANY OF MASTER MARINERS

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At a time when ships are going paperless and paper charts are being discontinued, the ongoing lack of standardisation across Electronic Chart Display and Information System (ECDIS) manufacturers poses a challenge to seafarers. With the recent announcement by the UK Hydrographic Office that they intend to cease paper chart production by 2026, is it time for the current disparity between ECDIS systems and the training required to be reviewed?

A recent collaborative study was conducted by the Maritime Accident Investigation Branch (MAIB) together with their Danish counterparts (DMAIB), following a spate of groundings that occurred on vessels using ECDIS as a primary means of navigation. The aim was to understand practical application and usability, and to support future ECDIS design, training and the development of best practices.

The study included 155 users, where ECDIS was either the primary means of navigation, a back-up or a navigation aid. This study identified a mismatch between the way in which ECDIS is used and the intended way it should be used.

The study was undertaken from the practitioners' perspective and the report produced highlighted the challenges seafarers are currently and will continue to face. Together with the observations discussed in the report, Daniel Cunningham, HCMM, MNI and Karley Smith, BSc (Hons), MNI, WISTA, have combined their personal experiences to outline some of the benefits and challenges of working with ECDIS.

The Benefits

There is no doubt that ECDIS has many benefits, such as the live position update through GPS as well as live ETA calculations for each waypoint and a 'speed required' function for a timed ETA. Furthermore, with additional inputs possible such as radar overlay, echo sounder, wind sensor, speed log, and Navtex, the seafarer can have an increased situational awareness. If used correctly, the dynamic use and displaying of data allowed by ECDIS is fundamentally more useful to the watch officer than purely paper charts and individual separate navigation aids. If set up properly, an ECDIS will warn the user that they are approaching a danger such as shallow water. An ECDIS can also help a navigator quickly establish where it is safe to navigate.

Further benefits include a reduced workload. For instance, the weekly update procedure is relatively quick and simple compared to correcting paper charts. Likewise, route planning is much less time consuming. The ordering procedure for acquiring new charts and publications can be much quicker too, with Electronic Navigational Chart systems offering several different ways to acquire charts. The navigator can often select a chart by clicking on the cell and having the permit electronically transferred to unlock that cell within a matter of hours.

In a recent review of shipping trends and developments for shipping losses and safety by Allianz Global Corporate and Specialty, it was noted that the total losses caused by vessels grounding has declined from

29 in 2012 to one in 2021. It could be argued that the introduction of ECDIS has contributed to this reduction.

The Challenges

ECDIS also presents several challenges. Due to the number of alerts and alarms that can be generated, alarm fatigue ultimately leads to the muting and disabling of alarm parameters, and/or a blind acknowledgement without investigating the cause. This also results in alarms being viewed as 'normal', rather than necessary to respond to and investigate.

Whilst on a maiden voyage for a new build with an integrated bridge system, and ECDIS as the primary means of navigation, it was required to double up the watches due to alarm fatigue and management. Too many alerts and alarms can be very distracting for the watchkeeper, taking concentration away from keeping an effective lookout.

Additionally, some traditional passage planning techniques are not as easily applied to ECDIS. As an example, whilst the use of parallel indexes, hatching of no-go areas and the application of text boxes are possible, these are more time consuming to apply, often with several menus to sift through until you locate the correct function. User defined features can also be easy to move or delete accidentally if the user is not careful or familiar with the settings.

Whilst the route check function on completion of a passage plan could also be viewed as a benefit, the alerts generated during the check of the track and XTD defined by the user can be cumbersome. Each leg of the route which has a hazard identified, is highlighted in yellow. The hazard itself is also highlighted with a yellow box. These will often appear in a list format for the user to scroll through. Due to the number and type of alerts generated however, these can be ignored or missed, often blindly acknowledged by the operator.

After navigating with different ECDIS manufacturers, it is very challenging to create a route on an ECDIS that does not result in a multitude of alerts. This is because any port entry will create numerous 'precautionary area, anchorage area, buoyage area etc.' alerts and alarms, which are exactly what is to be expected on a berth-to-berth passage plan. However, as discussed above, these can become cumbersome, and create the risk of being overlooked and blindly acknowledged, which may in fact hide a genuine point of concern on the route.

XTD has just been referred to, but what is XTD? A further challenge faced by seafarers is the different terminology currently being used to refer to the same component. As per the Bridge Procedures Guide, the definitions are as follows:

"Cross track distance (XTD) A specified limit for deviations from the planned track."

"Cross track error (XTE) The lateral distance between a planned track and the position of the ship."

The XTD is defined by the user, creating a safety corridor which is checked as part of the route. The XTE is live information updated to show how far the vessel is from the intended track. However, different ECDIS manufacturers may also refer to the above as a safety corridor, cross track limit (XTL), cross track corridor (XTC) and deviation corridor just to name a few. This in itself is probably another challenge for ECDIS users; a lack of standard terminology. A further challenge with setting an XTD in a narrow channel or fairway is that the route should be on the starboard side meaning that separate port and starboard XTD limits should be set which can prolong the planning process.

The complex menus have already been referred to, which lead to users focusing too much on the ECDIS and not on watchkeeping. The interface complexities actually increase the workload of the seafarer.

Safety Contour and Safety Depth

In the MAIB study, it was also highlighted that some seafarers did not understand the difference between safety contour and safety depth. As per the UKHO ADMIRALTY Guide to ENC Symbols used in ECDIS (NP5012), the definitions are as follows:

"Safety Contour is represented by a thick bold contour line and a prominent change in depth fill colour. If the mariner does not set a value, a default of 30 metres is used."

"Safety Depth emphasises soundings which are less than the selected value. This is intended to highlight depth information where no appropriate safety contour is available in the ENC."

Safety depths and safety contours can be selected by the user, and the exact naming and display option configurations differ across different ECDIS systems. There is a choice of 2 or 4 depth shades depending on the ECDIS and most ENC data is derived from paper charts which use a limited set of contour intervals, typically 0, 2, 5, 10, 20, 30, and 50 metres, but others are possible.

Following paper charts, the darker blue is the presentation for shallow water, blue for unsafe water, light blue for safe water and white for deep water. If set up correctly, this allows the mariner to see quickly which areas are potentially unsafe to navigate. Additionally, alarms can be initiated to alert the user if you are expected to cross a safety contour or cross a shallow depth, which could be seen as another one of the benefits of ECDIS.

The MAIB report was conducted following several groundings that had occurred on vessels using ECDIS as primary means. This would appear to support the conclusion contained within their report; the pictorial depiction of safe and unsafe water on ECDIS can be impractical in many instances.

IHO Standards

With regards to the current IHO standards for ECDIS, the MAIB and DMAIB report also highlighted technical shortcomings. Mariners have still not adjusted to, or caught up, with the current performance

standards, S-52 and S-57. S-52 provides the specification and guidance for issuing and updating ENCs and their display in ECDIS and was developed in conjunction with IMO performance standards to ensure a consistent display of ENC features across different types of ECDIS. S-57 is the standard used for the exchange of digital data between hydrographic offices and manufacturers, mariners and other data users. However, as discussed, these do not always ensure standardisation or unification across ECDIS units.

Furthermore, in casualty investigation work, there are situations whereby charted features are either not included or incorrectly displayed on the ECDIS. The seafarers have applied the weekly updates correctly but the relevant hydrographic offices responsible for promulgating the most up to date information for those cells have not. This has led to vessel casualties as the user has trusted the information displayed, as expected.

The International Hydrographic Organisation is already creating new standards for the future, with the introduction of the S-100 Universal Hydrographic Data Model. With more data being collected and made available in the maritime and geospatial industries, a common set of standards is being developed with the aim of underpinning the next generation of navigation technology and sustainable ocean management.

Training Requirements

As technology is constantly evolving, and our bridge systems become more advanced, the current requirements for training may need to be revisited. With mandatory paperless navigation on the horizon (due to the option of paper charts becoming unavailable), the training period allowed for in nautical colleges to train seafarers to use and work with ECDIS, appears limited when compared to the training currently provided on paper charts. The requirement for a navigator to be competent in the use of ECDIS is only going to increase, given the evolving nature of modern navigation.

For vessels where ECDIS is the primary means of navigation, the requirement is for officers to have both the generic and relevant type specific ECDIS training. In the past, a seafarer could transfer between different vessels with ease where paper charts were the primary means of navigation. Now however, the situation could involve joining a vessel fitted with an ECDIS system that the seafarer has not previously worked with and has not yet completed the type-specific training for. This usually requires a period of training and familiarisation onboard during the handover period, where an ECDIS familiarisation checklist is completed.

For type-specific training, it is open for the teaching to be done by either the manufacturer, an authorised training provider, or by ‘trickle-down’ training conducted onboard. Whilst the ideal scenario is for every officer to receive structured training direct from the manufacturer or a designated training centre, many officers could instead receive ‘trickle-down’ training, due to both the cost of formal training and the time constraints which would be placed on the officer being either away from home on leave or taking them away from the vessel to complete the training.

With regards to the training carried out during a cadetship, nautical colleges currently incorporate the generic ECDIS course into their training programmes. It could be another consideration for the type specific training for that manufacturer to be included also, given that the cadets are already familiar with certain functions of that type.

Summary

As highlighted, currently there are many benefits and challenges with ECDIS and yet industry is already looking towards the introduction of the S-100 Universal Hydrographic Data Model. This framework of trial data is intended to incorporate navigation warnings, UKC data, bathymetric data and traffic information just to name a few, adding more complexities to a system that is already complex.

Given the ECDIS challenges that seafarers are facing, could a review of the standards and course training requirements potentially alleviate future problems?