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ECDIS Display, Safety Settings and Alarm Management

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Abstract:

For the optimum situational awareness, navigators must recognise the level of display for objects presented when using Electronic Chart Display and Information System (ECDIS). The appearance and content of data displayed may be changed by the different settings as the display is generated in line with IHO Presentation Library (S-52) specifications. Improper management of the system may result in the anti-grounding alarms and other indications failing to activate as required for the safe conduct of the navigation. Navigators must exercise extreme caution when using the scale or zoom facility of the electronic charts. It is possible to zoom-in to a scale larger than that used in the compilation of the data which could create a false impression about the reliability of the charted information. Consequently, it could give a false impression of safe waters around the vessel where some dangers may not be shown due to the limitations imposed by original chart scale.

Appropriate safety settings are of paramount importance for ECDIS display. Failings in appropriate settings have recently resulted a few grounding incidents (e.g. CSL Thames and LT Cortesia). The values for the safety depth and safety contour must be understood and entered to achieve a sensible and considered meaning. The navigators must remember that the display of underwater obstructions or isolated danger symbols can change according to the settings of this safety contour which also marks the division between ‘safe’ and ‘unsafe’ water. Additionally, the shallow contour could be utilised to indicate the gradient of the seabed (adjacent to a channel) and the deep contour to indicate the depth of water in which own ship may experience squat and interaction. This paper recognises the limitations of ECDIS display, the significance of appropriate safety settings as well as the alarm management.

Keywords: ECDIS, safety settings, display information, accuracy, software updates, alarm management, electronic navigational charts.

Introduction:

Navigating a ship with an Electronic Chart Display and Information System (ECDIS) is fundamentally different from navigating with paper charts. With ECDIS, navigators must recognise the level of display and the objects to display for the optimum navigational information for any situation. It is essential that the Masters, navigating officers, and ship-owners are aware of the benefits of managing the chart display, safety settings, and alarm system of ECDIS. Improper management of the system may result in the anti-grounding alarms and other indications failing to activate as required for safe conduct of the navigation. The appearance and content of the chart data displayed on ECDIS may change significantly from different settings as the display is generated as per the specifications characterised by the IHO (International Hydrographic Office) Presentation Library (S-52). Some of the examples are:

- The Safety Contour, Safety Depth, Shallow Contour, Deep Contour set by the user.
- The SENC (System ENC: a database, in the manufacturer's internal ECDIS format) information for display by the user. I.e. Base, Standard, Other and Custom display.
- The Chart (Cell) Scale in use;
- The cells used on the ECDIS to display and the features of those cells e.g. Scamin (Scale Minimum) , Date Start and End attributes;
- The difference in interpretation and implementation of the IHO Presentation Library (S52) by various manufacturers;
- ECDIS may be unable to correctly display the latest approved chart symbols, if the software is not upgrade to the latest.

Safety Settings:

Appropriate safety settings are of paramount importance for ECDIS display. Failings in appropriate settings have recently resulted a few grounding incidents (e.g. CSL Thames and LT Cortesia). The navigators must understand the values for the safety depth, safety contour and set them properly to achieve a sensible and well thought-out implication.

The safety contour marks the division between 'safe' and 'unsafe' water. If the navigator does not specify a safety contour, this will default to 30m. When the safety contour is not displayed to the specified value set by the navigator, then the safety contour is shown to the next deeper contour as per the default layers in the electronic charts. Moreover, the contours may also differ between electronic charts produced by different hydrographic offices. During route planning, an indication will be made if the route is planned to cross the ship's safety contour. At the time of route monitoring, ECDIS should give an alarm if, within a specified time set by the navigator, own ship is likely to cross the safety contour.

The division between 'safe' and 'unsafe' water is highlighted by chart colouring, with blue colour used to indicate unsafe area and white or grey for safe area. The unsafe area may be further defined with the selection of a shallow contour, showing dark blue in the shallow water and light blue between the shallow water and the safety contour. The navigator must remember that displayed underwater obstruction or isolated danger symbols can change according to the settings of the safety contour. Furthermore, the safe water may also be sub-divided with the selection of a deep contour, in which case the area between the safe contour and the deep contour will be coloured grey.

The shallow contour should be used to highlight the gradient of the seabed adjacent to the safety contour and the deep contour to highlight the depth of water in which own ship may experience squat. It is acknowledged that not all ECDIS manufacturers provide separate controls for safety contour and

safety depth value, some have a common or a linked control. Some flexibility of the system is lost when there is only one common control for 'Safety Depth' for both the 'safety depth' and the 'safety contour'. In such cases, the navigator must decide the value to be given for safety depth i.e. draught or draught plus an allowance for UKC (Under Keel Clearance)? Author recommends that the safety contour value should be used for the safety depth on ECDIS with such feature.

Where the manufacturer provides for separate controls for safety depth and safety contour, the user can substantially increase their situational awareness by choosing, for example, values as indicated in the Figure 1 below:

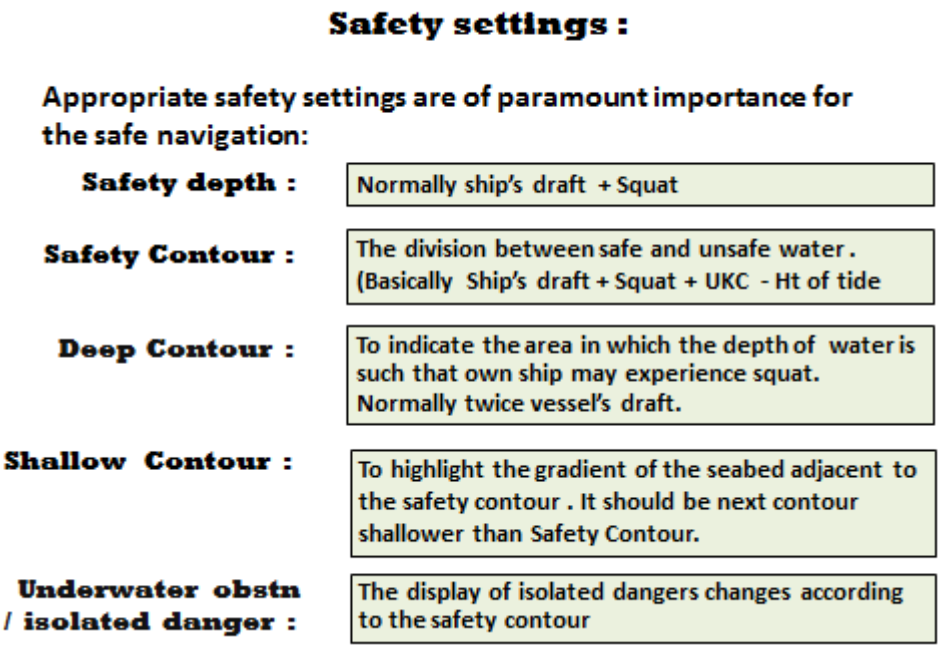

Figure 1: Recommended Safety Settings on ECDIS

(Source: Bhuiyan, Z., 2010. Implementing ECDIS training for navigation officers. Seaways- Nautical Institute's international journal, May 2010).

Unlike paper charts where source data diagrams are mostly provided, ENCs (Electronic Navigation Charts) do not provide this information. Instead they provide the navigator with a facility to examine reliability and quality of source data by means of CATZOCs (Category of Zone of Confidence). This gives an estimate of the reliability of data related to five quality categories for assessed data (CATZOC A1, A2, B, C and D) and a sixth category for data which has not yet been assessed. It is also recommended to consider these CATZOC features while determining a ship's safety settings.

Display of SENC Information

Chart objects and information available for display are sub-divided into three categories:

- base display;
- standard display;
- all other information.

The 'base display is an absolute minimum and cannot be reduced. Its use may be helpful for initial appraisal in the planning stage as well as when moving the chart display to allow a faster re-generation of the display. It is not intended for safe navigation. ECDIS should present the 'standard display' at any time by a single operator action. The standard display, as defined in the ECDIS Performance Standards, does not necessarily display all the chart objects necessary for safe navigation under all circumstances, e.g.

- Spot soundings - display may be preferred to assist monitoring integrity of position;
- Underwater obstructions - useful to know if it is intended to anchor.

These and other objects are all listed or classified as 'All Other Information' display.

Different manufacturers provide different facilities for managing the display of chart objects and chart information. Control of individual groups of objects, e.g. spot soundings, tidal diamonds, place names, may vary according to each ECDIS manufacturer. Selection of certain layers of information or objects for display becomes more obvious with experience but until then navigators will need to understand the layer selection requirements for an efficient navigational display. Mariners need to remember 'Displaying everything, without seamanlike consideration, should not be an option'.

With some systems, it is possible to run a complete safety check for any hazards along the planned route at any time during the route planning process and on completion of planning. However, this functionality varies among the different makes. *Mariners using ECDIS are reminded not to rely solely on automated voyage planning and monitoring checks and alarms. Some ECDIS appear only to undertake route check functions on larger scale ENCs and therefore alarms might not activate. This may not be clearly indicated on the ECDIS display. Mariners should always undertake careful visual inspection of the entire planned route using the 'other/all' display mode to confirm that it, and any deviations from it, is clear of dangers.* (NAVAREA1 Warning 317/10)

Guidance on the accuracy of ENCs:

The IMO Performance Standards for ECDIS require that the latest edition of information originated by a government authorised hydrographic office must be used which must conform to the standards laid down by the IHO. Furthermore, only officially approved vector charts should be used with ECDIS if it is to comply with the performance standards. Navigators should interrogate the quality of the vector charts that complies with IHO standards and therefore enables the user to assess the quality of the hydrographic data used to compile it.

Navigators must exercise extreme caution when using the scale or zoom facility of the electronic charts. It is possible to zoom-in to a scale larger than that used in the compilation of the data which could create a false impression about the reliability of the charted information. Consequently, it could give a false impression of safe water around the vessel where some hazards to navigation may not be shown due to the limitations imposed by original chart scale. It could also give the impression that the position of charted features is known to a greater degree of accuracy than is in fact the case. In the event that the chart is not displayed at the compilation scale (In ECDIS the Scale at which the Chart data was compiled) and is therefore not compatible with the selected usage (e.g. coastal or approach), then an over-scale or under-scale warning is displayed.

The hi-tech appearance of an electronic vector chart interfaced with systems such as GNSS (Global Navigation Satellite System) could mislead the user to believe that the charted data is more accurate than it really is. Another important feature that could lead to human/operator error where the users need to be very careful is known as Scamin (Scale Minimum). Scamin is an optional attribute by the chart producer (defined by IHO S57) that can be used to label ENC chart features to be suppressed above a certain display scale. The main function of Scamin is to de-clutter the chart display, enabling the user to focus on the most useful navigational information for the display scale in use. Scamin may

affect the display as it removes certain information from the display if best scale chart is not being used i.e. safety critical information may be removed from the display. When in use, this feature should provide 'Scamin filter' warning to the users. Navigators should always check the passage plans at 'compilation scale' before use and during route monitoring. Zoom in/out function should only be used for short periods of time.

When monitoring a route, the prudent navigator must always maintain a check on the integrity of the displayed position of own ship. When the source of the displayed position is the own ships GNSS, there is always a possibility that the position displayed may not coincide with the ship's actual position in relation to the chart or the charted hazards. A check may be made quite simply by utilising one or any of the following:

- manual position fixing (visual/Radar);
- look out of the window;
- comparison of ARPA overlay of a fixed mark with the charted position;
- comparison of a radar overlay with conspicuous land or fixed targets;
- observation of a parallel index on the radar display to monitor comparison with planned track;
- monitoring the depth shown by echo sounder where appropriate;
- checking the track history;

The need to keep ECDIS software updated:

If ECDIS software is not upgraded to read ENCs based on the latest version of the ENC Product Specification or to use the latest version of the S-52 Presentation Library then the ECDIS may be unable to correctly display the latest approved chart symbols. If an ECDIS is unable to interpret and draw any newly introduced chart symbol, it will display a question mark (?) instead. Additionally there will be a possibility that alarms and indications for any newly introduced features may not be activated even though they have been included in the ENC. Because of this, the IMO have issued guidance on the maintenance of ECDIS software in Sn.1/Circ.266.

A list of the current IHO standards relevant to ECDIS software is maintained in the ENC/ECDIS section of the IHO website (IHO Publication S-66). ECDIS users should ensure that their ECDIS software always conforms to the latest IHO standards. This can be accessed from the "about" function in the software or from the ECDIS manufacturer.

An ECDIS anomaly is an unexpected or unintended behaviour of an ECDIS which may affect the use of the equipment or navigational decisions by the user. The UK Marine Information Note (MIN) 406 "Reporting Operating Anomalies Identified within ECDIS" describes the procedures for the reporting ECDIS anomalies in accordance with IMO MSC.1/Circ.1391. Navigators must use the quickest means of communication available to send the required information to the Maritime & Coastguard Agency in the UK or similar organisations overseas so that an appropriate action can be taken to rectify the anomalies. Some examples of the ECDIS anomalies are:

- A failure to display a navigational feature correctly;
- A failure to activate alarm correctly;
- A failure to manage a number of alarms correctly.

The Alarm Management on ECDIS:

From navigators' perspective, ECDIS alarm management is very critical as

- it could vary from manufacturer to manufacturer;
- the level of control over alarms may vary from being very detailed control to minimal control;
- some manufacturers allow the mandatory alarms to be disabled; and
- some even allow choice of chart scale for alarm checking.

The five mandatory alarms (indicated by audible means or audible and visual means indicating a condition requiring attention) are:

i. crossing safety contour;
ii. deviation from route;
iii. positioning system failure;
iv. approach to critical point; and
v. different geodetic datum.

The guard zone (also known as Safety Frame) provides the user with an advance warning of dangers/cautions. The user sets the dimensions of this guard zone which must be altered according to the prevailing circumstances to prevent unnecessary alarms or to give adequate warning. The navigators need to remember that not all dangers are enclosed by a contour and guard zone remains active even if it is not selected to display on the screen. In order for the alarm system to be properly effective (when the route is being monitored) the own ship's guard zone must be set in a seamanlike manner, i.e. with a sensible time or range warning depending on proximity to hazards and planned speed etc. It is recommended to set the guard zone "As large as possible as the circumstances allow".

Conclusion:

It has been recently observed that many navigators have a tendency to put too much reliance on ECDIS with a potential to threaten the safety of navigation. Navigators should always cross check ECDIS information with the other sources and most importantly, a visual lookout, as 'human eyes are the most valuable tool at a navigator's disposal'. ECDIS is a valuable asset in assisting navigators and allowing them more time to maintain a proper lookout by providing them with more detailed situational awareness. However, until used accurately and properly, ECDIS may 'contribute to accidents' rather than preventing them.

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