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PROBLEMS ENCOUNTERED WITH ELECTRONIC CHART DISPLAY AND INFORMATION SYSTEM (ECDIS) FOR LAWYERS AND P&I CLUBS

BY

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1.0 INTRODUCTION

1.1 There is a continual over-reliance and operator error on ECDIS systems by navigating officers.

1.2 ECDIS, while very useful for navigation should be seen only as a tool and not the sole means of navigation as over-reliance and operator error have led to some very costly mistakes.

1.3 An ECDIS qualification forms part of the statutory STCW Deck Officer license requirements. However, it is important when assessing ECDIS issues that the expert has real-life experience so that they can diagnose the root cause of the issue correctly before they apply them to the world of maritime law and insurance.

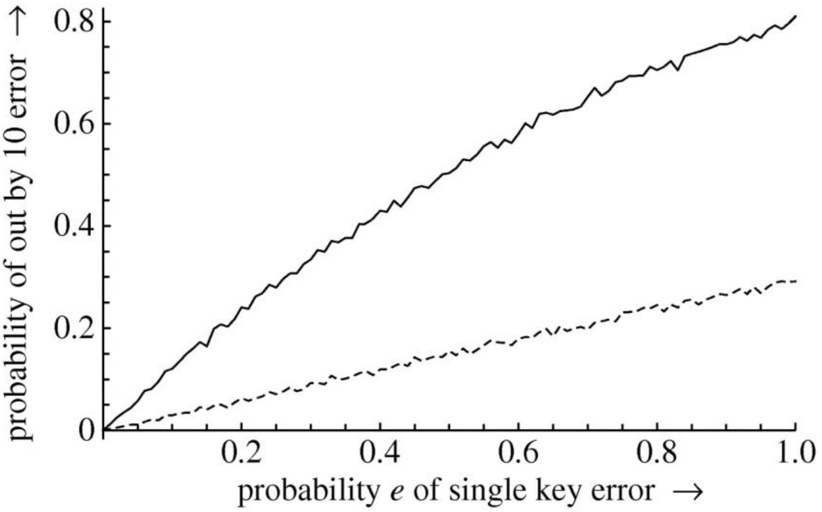
1.4 Learning ECDIS in a classroom is very different to actual use in real life. Today's vessels have highly complex ECDIS systems that are interconnected with other navigational and operational systems such as engine and helm digital management systems, Automatic Identification System (AIS) and shore-side monitoring.

1.5 In this short article I will briefly touch upon the issues encountered with ECDIS.

1.6 Estimated reading time 20 minutes.

2.0 COMPUTER SAYS…YES…OR...NO…OR I JUST DO WHAT YOU TELL ME!

2.1 The single most important error is what is termed in the technology sector as **'Garbage-in, Garbage-out' (GIGO)**. Navigation officers only need to input the wrong data for a grounding or a collision to occur. This may have been the result of simply inputting a decimal point in the wrong place, for example, 100 metres as opposed to 10.0 metres or a single key error. The graph below shows the probability of such an action.



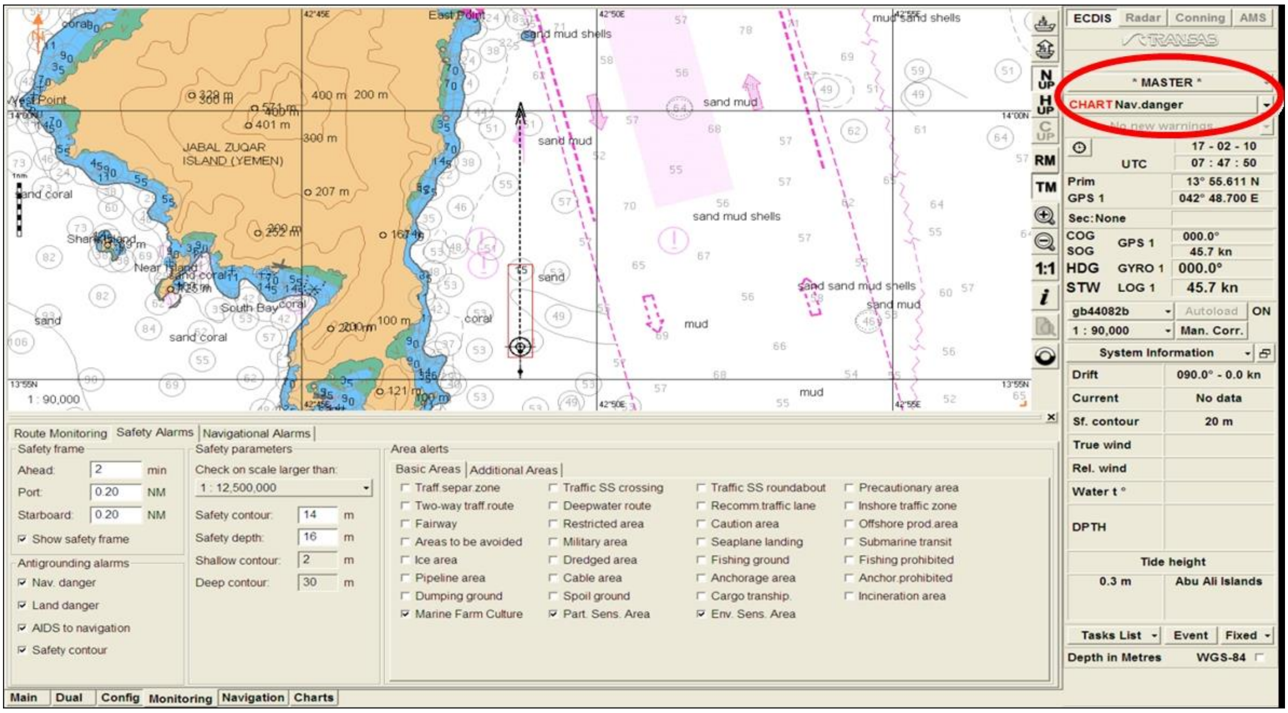
2.2 Another acronym used to express GIGO is **- Garbage in, Gospel out**. The navigating officer may put excessive trust in the output of data, and blindly accepts what the ECDIS says and therefore does not or cannot question its accuracy. We are continually told to watch for the navigational 'error chain' but how do we see when the error chain is occurring when it is deep within a computerized system such as ECDIS and when one is so reliant on the data output?

2.3 Some will point to the fail safe's within the ECDIS system and the procedures within the Safety Management System to prevent error chains, however we would not have costly casualties if the systems were bullet proof and furthermore the Safety Management System may be out-of-date and/or not dynamic enough to cope with the multiple variations of port characteristics and voyage planning in relation to ECDIS.

3.0 MENU, SUB-MENU'S AND SUB-SUB MENU'S

3.1 Navigating the depths of the operating system through main menu, sub-menu and sub-sub menu bars to set crucial navigational parameters, particularly when the ECDIS system is different from the last vessel, can be complicated and confusing.

3.2 Consider what happens when key step's in setting navigational parameters have been missed, for example, confusing feet over metres or forgetting to checkmark an anti-grounding alarm box or highlight a possible navigational danger or alert.



3.3 Understanding the ECDIS hierarchical menu system takes training and practice. The system will have fixed values for basic navigation that cannot or should not be changed but every navigating officer has different user preferences and it is these that can cause issues whereby crucial parameters may get changed between watches or voyages. Like all operating software we are fascinated by how far we can go into the system and what it will allow us to do. Not resetting or adjusting a crucial parameter for a new voyage can have dangerous consequences, especially when you reverse an outbound route expecting it to be the same as the last inbound route.

4.0 THE SETTING OF DEPTH ALARMS

4.1 We all know that the sailing draught will change (particularly over long voyages) when one considers fuel burn, ballast requirements (bending moments), changes in water density and the squat factor in shallow water. Consider a large vessel whose draught was 10.0 metres in salt water (1.025) and had set its alarms to trigger at 11.0 metres in order to give an under keel clearance of 1 metre in accordance with the ships Safety Management System (SMS) for the upcoming port.

4.2 The vessel then subsequently arrives late in an upriver port where the water density is 1.005 after heavy rainfall. There has also been a small shift in the channel seabed and therefore the depths have changed marginally. The Chief Officer then begins to start ballast operations early as the vessel is running late. She proceeds upriver at a greater speed than previously planned to make up lost time and suffers a greater degree of squat than previously calculated. The result is not surprising, and the vessel subsequently runs aground. Alarm deafness is also not uncommon by the navigating officer; ask yourself have you ever switched off the annoying parking sensor alarm on your car?

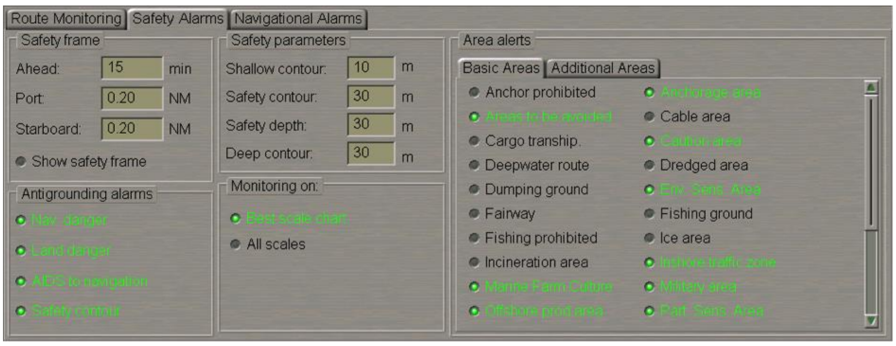
5.0 WHAT IS THE DIFFERENCE BETWEEN SAFETY DEPTH, SAFETY CONTOUR AND SAFETY CONTOUR DEPTH?

5.1 There are numerous cases where vessels have run aground due to safety depths not being set correctly. The International Hydrographic Organization and IMO Resolution MSC.282 (86) provide good definitions on safety depth's and contours and how one should apply that to ECDIS.

5.2 It is vitally important that the navigating officer has a thorough understanding of the definitions and application thereof but more importantly the basic practical seamanship knowledge (training) that will give a good basis in determining which safety depth to set, in which order and by how much.

5.3 The definitions from the IHO are as follows:

- *Safety Depth: Value set by the mariner that is used by ECDIS to portray soundings as black if they are equal to or shoaler than the value and grey if they are deeper.*
- *Safety Contour Depth: Value set by the mariner that is used by ECDIS to select a "Safety Contour" from among the depth contours available in the SENC (System Electronic Navigational Chart) that is equal to or deeper than the value.*
- *Safety Contour: A specific depth contour set by ECDIS. It demarks the boundary between "safe-water" and shallow water with an extra wide isoline and is used to give an alarm if the ship, within a time specified by the mariner, is going to cross the safety contour. It is also used to determine the tints used for depth areas and for other purposes.*



All great…if the values and alarms have been set correctly…and you understand it!

6.0 SPATIAL UNDERSTANDING / AWARENESS

6.1 The ECDIS says I am here, but where exactly are we? In the ‘good old days’ you took bearings from the ship to a number of geographical landmarks and fixed the vessels position accordingly. This naturally gave you spatial awareness as it made you identify the key landmarks from the chart and gave you an overview (birds-eye view in your head) of where you were between landmarks. GPS, albeit very accurate, obviously gives you a latitude and longitude, which presents itself as a numerical value. This numerical value is extremely difficult to visualize for anything less than a 500-mile radius.

6.2 Imagine you are standing in a square box. Now, if I told you, that you were 45 degrees from 2 corners (not opposite corners!) you would deduce you were in the middle. If I told you that you were 41’43.32N 49’56.49W***** within the same box, would you be able to deduce where exactly in that box you would be? Probably not. Now let’s take it one step further, imagine your GPS has defaulted into dead reckoning (an estimated position) mode and the ECDIS alarm was cancelled because it was annoying (Alarm Deafness). Pretty soon you may be aground. There are multiple cases where the vessel has grounded due to dead reckoning when the GPS has lost its signal.

6.3 Understanding your surrounding area particularly in close proximity to land is obviously important and that old saying from seasoned Masters of “Take your head out of the radar and look out of the windows” should now be “Take your head out of the ECDIS and look out of the windows and stop cancelling alarms, there is a reason they are going off”.

7.0 IT'S A MATTER OF SCALE

7.1 I have always found when looking at the ECDIS monitor that I have a scale issue going on in my head. I have to zoom in and zoom out of the electronic chart a couple of times to determine where exactly I am. Fortunately, after years of fixing a ship manually, I can still visualize where I am by looking out of the windows first by using my 'mark-one eyeball' on geographical landmarks and then compare visual observations to the ECDIS to fully understand where the vessel is. The monitor does not in my mind perform the same spatial perception as a paper chart. Is it the tactile feel of paper, the angle of the monitor or the lack of traditional fixing onto a paper chart?

7.2 Picking the right scale paper chart was always important. As scale is linked to speed and thus distance travelled the zoom function on ECDIS can lead to a loss of spatial awareness. This is because the navigating officer does not appreciate how far the vessel will travel when the Electronic Navigation Chart is zoomed in. The COLREGS with regards to Rule 6 'Safe Speed' therefore become more difficult to apply effectively as the vessel proceeds quicker over the electronic chart zoomed in and before you know it you are running out of water and aground.

7.3 In my view fixing a vessel's position manually is still extremely important as it gives the navigating officer an understanding of where they really are geographically. In general though it is now a thing of the past when ECDIS is carried unless the Master specifically states so or it is part of the SMS bridge procedures. It is of course possible to fix a manual position onto the ECDIS but over reliance on GPS has made that redundant.

7.4 Scale and spatial issues can trick the navigating officer into believing what he see's on the screen is the reality outside the bridge windows. Couple that with erroneous data and the error chains really start to pile up.

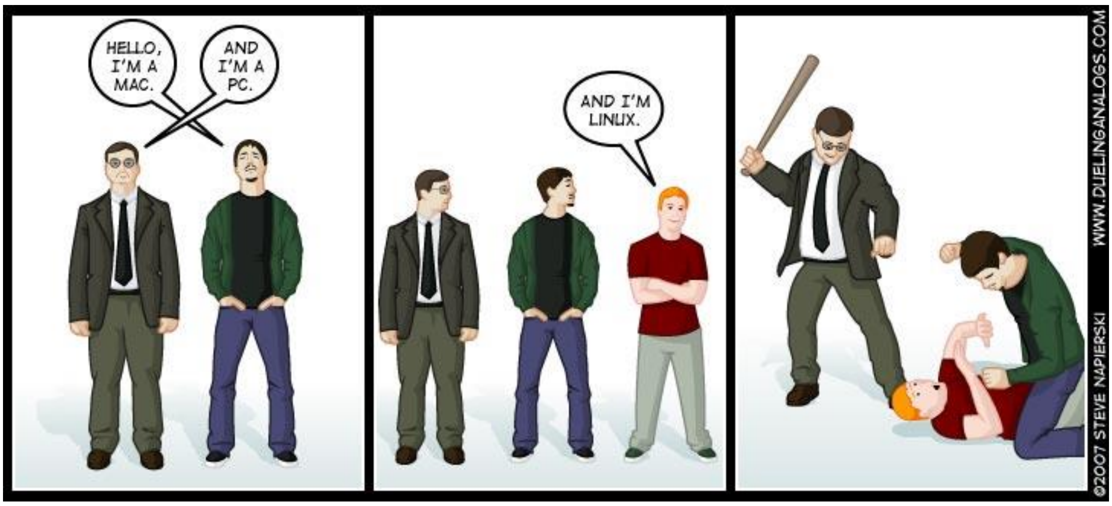
8.0 MAC OR PC OR LINUX?

8.1 How many different ECDIS systems are out there? Tokyo Keiki, Furuno, Sperry, Transas, JRC, Kelvin Hughes, Simrad etc. Each of these systems requires different ECDIS type specific training.

8.2 Consider what happens when a navigating officer goes ill and is repatriated and an emergency replacement is flown out on short notice and that replacement does not have the type specific qualification for the system on board. I think it would be fair to say that not all navigating officers would have the entire qualification required for all the different types of systems that are out there.

8.3 Understanding how each system fully works is obviously very important. As described above the menu's are very different and therefore full onboard familiarization is required before the navigating officer is let loose. However, commercially, time may not present itself initially and the pressure of getting the ship out of port sometimes unfortunately warrants on-the-job training, which may be particularly difficult when navigating the Malacca Strait! It is also not unusual for an officer to have to wait to receive such type specific training until the next leave period.

8.4 Furthermore like all computer systems there are upgrades and new advanced features, which in turn require new familiarization.



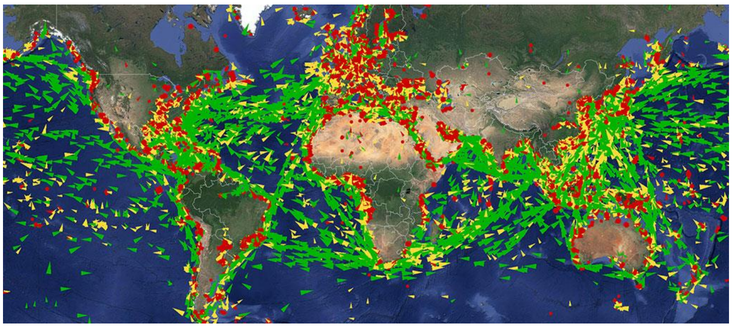
9.0 <u>AIS AND ECDIS, A SYMBIOTIC PARTNERSHIP?</u>

9.1 We have all heard the old story of 'VHF assisted collisions', i.e. "ship on my port bow", and the wrong ship answers resulting in a collision. Well now we have another assistant in contributing towards collisions - AIS. A case in particular between the multipurpose cargo vessel Rickmers Dubai with a crane barge, Walcon Wizard, being towed by tug Kingston (MAIB report available) shows just how important it is not solely to rely on AIS data for collision avoidance. The AIS information transmitted is subject to multiple errors that can occur due to operator error, i.e. inputted voyage data that suggests the vessel is alongside when clearly it is at sea and data errors such as position, heading, speed and transponder issues.

9.2 In my experience navigating officers have sometimes made anti-collision manoeuvers based on the expectations of vessels, with special reference to their transmitted destination port. They make such anti-collision manoeuvers based on which way they **<u>assume</u>** the ship is going to go at that particular moment, for example assuming an alteration to starboard to approach a nearby port, when in fact the vessel in question is continuing along its merry way. The knock-on effect is that they do not appreciate the data error and therefore ignore what the COLREGS actually stipulate. This may result in close quarters or collision situations.

9.3 Basing collision avoidance on acquiring AIS targets on the radar (overlaid with ECDIS) rather than the ARPA (Automatic Radar Plotting Aid) can mean a loss of the actual target's real visual **<u>aspect</u>**, i.e. the targets course made good and ship's head being noticeably different in reality (compass errors?).

9.4 It is also the case that some vessels do not have AIS. Therefore a reliance on the ECDIS and AIS combined with poorly tuned radars may result in vessels without AIS not being detected at an adequate range.



9.5 So, imagine all the errors that can present themselves with ECDIS and now let us add in the errors with AIS. It can be quite confusing as to what exactly is going on. This can result in what is known as data and information overload. Sole reliance on ECDIS and AIS can therefore be very misleading.

10.0 COST REDUCTION?

10.1 Wasn't ECDIS supposed to cut costs and time spent correcting charts? It appears today that the cost of an electronic chart is not as cheap as originally planned for. The costs of subscribing to a chart supplier still remain high. The electronic Admiralty updates, if a satellite signal can be obtained, remain an integral part of keeping a portfolio up-to-date and even sometimes the monthly or yearly subscription renewal may be accidentally overlooked.

10.2 There is of course the expense of the ECDIS installation.

10.3 Of course there is the cost of training for specific types of systems, which as discussed above are numerous in number.

10.4 There may also be a high turnover of navigating officers and/or a lack of officers with the specific ECDIS training for the type fitted.

10.5 When vessels deviate from their original planned voyage for one reason or another it can be a hard scramble in obtaining an electronic chart particularly in an emergency. Prior to ECDIS vessels usually had a good stock (some would say over stock) of paper charts onboard and a suitable chart could normally be found onboard or perhaps supplied by a pilot on arrival at the pilot station.

10.6 Internet connection costs can be high and subsequent download times for new charts and system upgrades can be painstakingly slow, which further increase cost.

11.0 <u>CONCLUSIONS</u>

11.1 There are many other issues with ECDIS not touched upon in this article, such as data and information overload, system lag, resistance to change, track control and voyage planning while using the active ECDIS. ECDIS remains a very useful tool but should always be checked against other means of navigating the vessel.