IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Enhancements assessments of using electronic navigation chart and safety contour setting alarm system

Joel Michael Ojode

Abstract. *Electronic Navigational Charts (ENC) is the human modern science navigation equipment technology that converts nature geographical physical information features to electronic date sets information features is the display picture system that supports all marine navigation. In addition, enabling the mariner to operate and execute all navigation planning, control and monitoring for safety navigation from one place to another. ECDIS equipment complying with SOLAS requirements can use as an alternative to paper charts. The key point is to reduce the navigational workload compared to using the paper chart. The paper assessed the safety setting such as safety contour Setting, Shallow contour settings, deep contour setting and analyses The main common navigation equipment failures such as ECDIS which tend to loose position (position of cursor) because of power interruption and an untimely chart update also cause the vessel to deviate from control vessel sailing along desired track. In addition, paper recommended the navigator should transfer navigation to the back-up system. The actions to taken in the case of an ECDIS Failure and solutions in order to keep the system running. The future ECDIS functions should be providing information support for the full realization of navigation automation.*

Keywords: Reliability, Marine navigation Equipment Failure, ENC, ECDIS, Safety contour setting.

1 INTRODUCTION

Electronic Navigational Charts (ENC) is the human modern science navigation equipment technology that converts nature geographical physical information features to electronic date sets information features in the display picture system that supports all marine navigation. It has become easier for a ship is navigating crew to interpret information date and pictures displayed in the screen to determine locations and attain directions.). In addition, the function of the display screen consists of the chart display region, TCS bar, menu title bar and display panel see **figure 1**. Which enable the mariner to operate and execute all navigation planning, control, and monitoring for safety navigation from one place to another. The sophisticated navigational computer system known Electronic Chart display and information system (ECDIS), originally designed for all ship of 150gt and over and all passenger ships also use for naval ship.

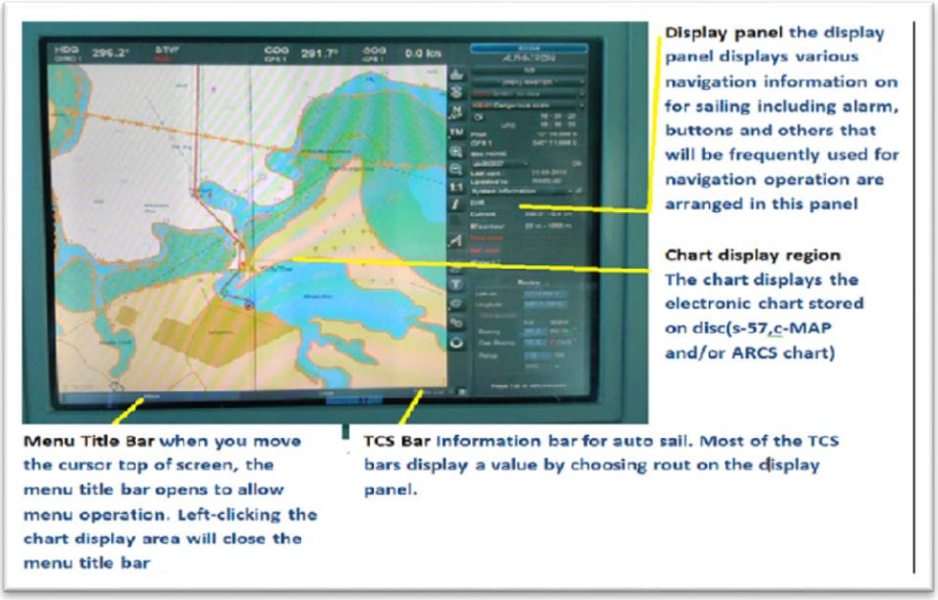

Figure 1 ECDIS displays information screen

1. 1 core analysis of ECDIS

ECDIS is one of equipment on the bridge of a modern ship, is the core of an integration navigation system (INS) or integrated bridge system (IBS) that supports one-man bridge operation such as safe sailing and energy-saved sailing. ECDIS complies with IMO Regulation V/19 & V/27 of SOLAS convention as amended, by displaying selected information from a System Electronic Navigational Chart (SENC**).** ECDIS equipment complying with safety of life at sea (SOLAS) requirements can used as an alternative to paper charts. Besides enhancing navigational safety, ECDIS greatly eases the navigator's workload with its automatic capabilities such as route planning, route monitoring, automatic estimated time of approach (ETA) computation and ENC updating. In addition, ECDIS provides many other sophisticated navigation and safety features, including continuous data recording for later analysis.

The ECDIS utilizes the feature of the Global Positioning System (GPS) to successfully precise determine the navigation position. It also has to note that the ECDIS adheres to the stipulations set by the International Maritime Organization, and thus it adds to the trustworthiness of the electronic chart system. ECDIS basically interfaced with navigational information system from others navigation equipment such as the GPS/DGPS, GPScompass, Radar, Automatic Radar Plotting aid (ARPA), Echo sounder, Log, (Navigational Telex (NAVTEX,) automated information system (AIS) and Autopilot.

1. 2 Types of ECDIS charts

The two most widely used types of electronic chart data listed below. ENCs are vector charts that conform to the requirements for the chart databases for ECDIS, with standardized content, structure and format, issued for use with ECDIS on the authority of government authorized hydrographic offices. ENCs are vector charts that also conform to International Hydrographic Organization (IHO) specifications stated in IHO Publication S-57.

- **Raster Chart** is direct copy or a scan of the paper charts. It looks identical to a paper chart as all the information shown is directly printed.
- **Vector Chart** is computer-generated charts. The details on an ENC can turn on and off depending on the requirement of the user.

1. 3 Main key points of ECDIS

Reliability and enhancement performance ECDIS should be accuracy, and the same available to the presentation displayed in all chart information necessary for safe and efficient navigation. That originated by and distributed on the authority of government authorized hydrographic office. That would facilitate simple and reliable updating of the electronic navigational chart. In order to reduce the navigational workload compared to using the paper chart. Moreover, to enable the mariner to execute in a convenient and timely manner, of all route planning, monitoring and positioning currently performed on paper charts. In addition, capable to continuously plotting the ship's position and provide appropriate alarms or indications with respect to the information displayed or malfunction of the equipment.

2. The basic working principle of ECDIS

The nature geographical physical information features and physical effects detected by navigation sensor that integrate into electronic signal, and transmit to the graphical working station (processor) Central Processing (CP) the PC processing and interpret, into electronic date sets information features and read by User interface (UI) in the display chart system. The System Electronic Navigational Chart (SENC) means a database resulting from the transformation of the ENC by ECDIS for appropriate use, updates to the ENC by appropriate means and other data added by the mariner. The relevant international standards of ECDIS are:

- S57 - IHO standard for the exchange of hydrographic data
- S52 - specification for content and display of electronic charts
- S58 -- recommended ENC verification and inspection standards
- S63 -- IHO data protection scheme

2. 1 The Components of ECDIS

Usage data and functionality designed and configured, according to international standards. ECDIS include hardware, software, and data. The difference is that standards for hardware

- Hardware the most important parts of computer is the brain of a computer calculate every command, is graphics capability a high performance PC or a graphics workstation installed in a console linked with other items of ship's equipment, to prevent overheating on hardware is usually equipped with heat sink and fan.
- Software that makes the computer an ECDIS consists of the user interface (UI) and the so-called ECDIS kernel, the software that makes it possible to read the data and display a chart. This software also called [3]function library.
- Data is the System of Electronic Nautical Chart (SENC) generated from the original data of the ENC. The ENC kept unaltered in order to be able to reconstruct the SENC data if this unintentionally damaged or destroyed may occurs.

3 Safety Settings

The safety parameters according to the ship are static as dynamic particulars, that change ECDIS from the traditional paper charts and example of safety setting is such as safety contour setting, Shallow contour settings**,** deep contour setting etc.

3.1 Safety Related issues

- Minimize that possibility of missing electronic charts or other navigation information while sailing
- Minimize the mistakes in case of an emergency under stress conditions
- Minimize the mistakes of routine operation, e.g. wrong updates, or expired ENCs, etc.

3.2 key safety settings on ECDIS screen

Now let us see how the ECDIS screen will look like with all these settings indicated. So let us say vessel's draft is 9 meters and vessel requires 14 meters depth to comply with companies under keel clearance (UKC) policy. Therefore, we have these settings**,** Shallow contour: 9 meters**,** Safety depth: 14 meters**,** Safety Contour: 15 meters**,** Deep Contour: 50 meters. In addition, when I enter all these numbers in the ECDIS, this is how a ECDIS screen would display these settings, if you notice for safety contour ECDIS has taken the 20-meter contour because 15-meter contour is not available. There is another option in the ECDIS to use two colors to show these areas as describe in Figure 3.

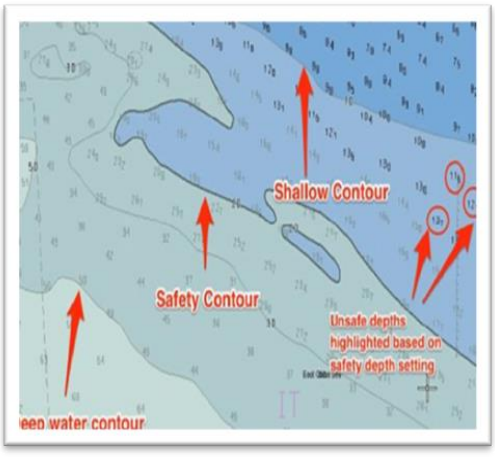

Figure 3. Safety contour

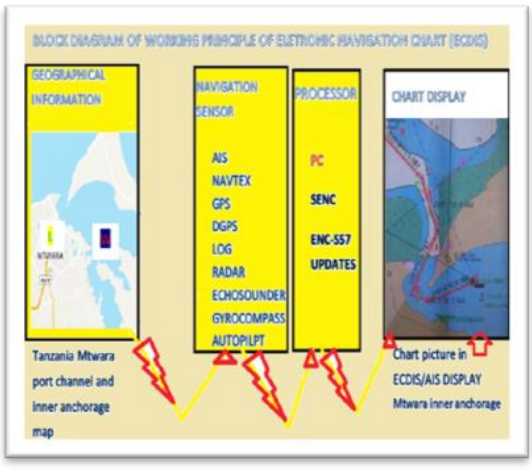

Figure 4 ECDIS working principal

Table 1 alarm function and indication in ECDIS

Alarm function	Indication in ECDIS
Safety depth crossing	Exceeding cross track limits
Dangerous areas crossing alarm	Crossing selected safety contour
Waypoint arrival alarm	Deviation from the route
Starboard XTD alarm	Different datum from the positioning system
Port XTD alarm	Largest scale for alarm (present chart too small a scale)
	Area with special condition

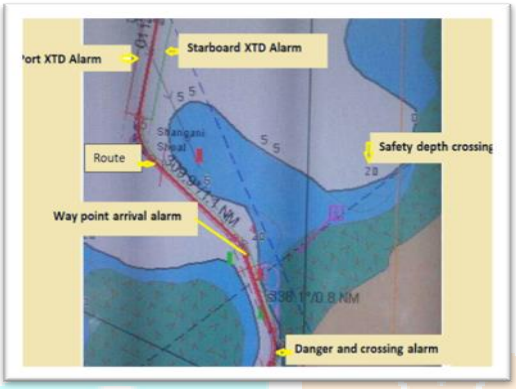

Figure 5 Alarm setting function

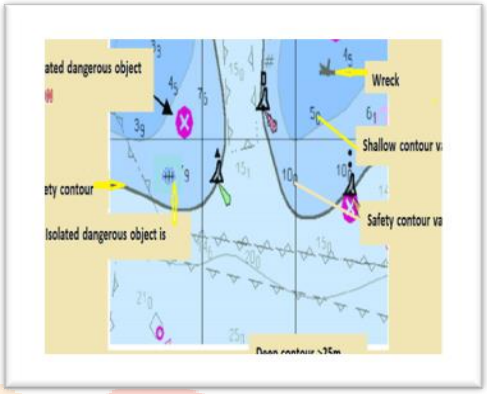

Figure 6 Area with special condition

When show isolated danger in shallow water, shallow pattern is ON, isolated in danger in shallower water than safety contour display as mark

In addition, when show isolated danger in water shallow pattern is OFF, isolated in danger in shallow water than safety contour display as ma

3.3 Definition

- Shallow contour: the color of sea indicate on the chart for the present depth can be changed
- Safety contour: depth smaller (or shallower) than the present value are displayed enhanced
- Safety depth: sport soundings smaller than the present value are displayed enhanced displayed only at the value
- Deep contour: the color of the sea indicated on the chart for the present depth can be changed
- Two color depth: generally the sea is displayed on charts with sea depths divided into four colors, however when (two color depths) is selected in two colors with line of shallow contour and safety contour, display as one color, and line of deep contour's displayed as another color, safety depth is displayed at the value, this feature is used to clearly indicate the sea into safe areas and dangerous area where care must be taken during the voyage, just like shallow pattern described earlier
- Shallow pattern: the check mark adds grid lines to shallow contour and safety contour in the for selectable depths, the function is for high lighting areas that require special cares during the voyage

4 SPECIFIC-JRC-ECDIS models

JRC (Japan Radio Co.LTD) sophisticated user interface (ECDIS) is a geographic information system for voyage planning and route monitoring to support the safety navigation of ships at sea. JRC's conventional ECDIS models and Type-specific training (TST) of ECDIS has adopted a new operation system and TST program supporting the new operation system as required. The TST for the new ECDIS has given at JRC's major branches, agents, and training institutions around the world see figure 7.

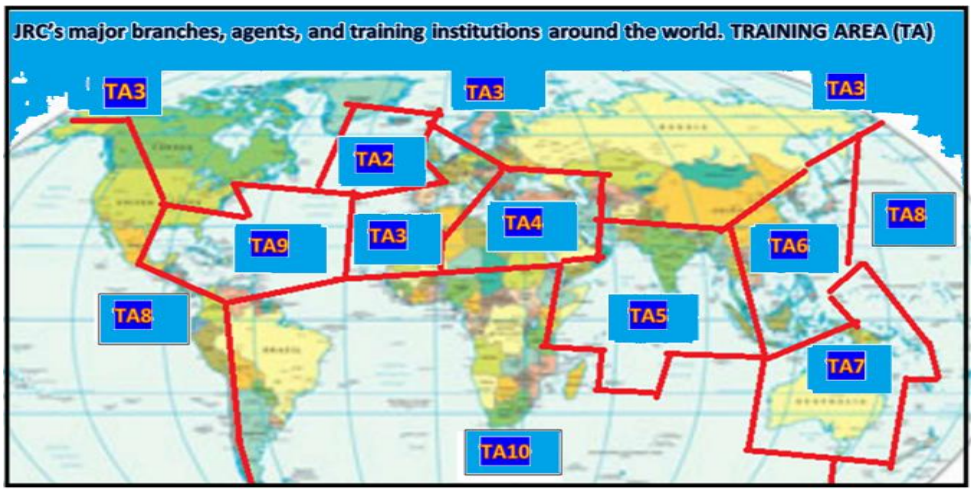

Figure 7 JRC's Branches in the world.

4. 1 JRC/Alphatron marine

Alphatron marine offers different kinds of operational and technical training at multiple training centers worldwide for distributors, shipping companies, yards, and other players in the field like crew, superintendents, installation crew, shore maintainers, or onboard maintainers. Since February 2020, the training department in Rotterdam has new VSTEP simulators available on which trainees trained while using the latest software. With these new simulators up and running JRC proudly, announce the re-introduction of ECDIS Type Specific Training and Marcum-training. The ECDIS Type Specific Training for both JRC and Wärtsilä (Transas) ECDIS offered for an international audience in English and provides you with the required knowledge for the general use of the ECDIS as well as a detailed introduction to the system's features.

For ECDIS training required, that the trainee should have adequate experience on ECDIS and has accomplished the IMO Model Course 1.27.

4.2 Specific training

JRC (JAN901B/701B/2000) This Type Specific Course provides the trainees with specific knowledge of functionality and effective use of the ECDIS. The course concluded with a compulsory test and if passed the certificate issued. The certificate confirms and proves the successful completion of the type specific ECDIS course. Training Contents includes,

- Overview
- General User Interface
- ECDIS Basic Display Features
- Sensor, Chart Work
- Route Planning
- Route Monitoring
- Alarms
- Chart Maintenance
- Navigational Tools and Other Related Information.

5. Main problem in using JRC ECDIS.

The vessel's position updated manually on the Transas ECDIS with the "Set by cursor" option under sensors; this gives the option of placing the vessel adjacent to buoys in a channel or crossing a specific sounding. It is a fact that ECDIS is becoming necessary and more vessels are relying wholly on it, bringing up concerns regarding Officer of the watch (OOW's) actions in the case of a failure on ECDIS system. The kind and number of failures vary from a single unit failure that may require the system's reboot to a double failure on both primary and secondary ECDIS. Equipment may fail during vessel's voyage in the open ocean and while vessel is navigating in narrow channels under pilotage.

The number of ECDIS failures increased with the use of USB flash drives and cables, connected to the system. Three failures in 2010 caused from viruses on USB flash drives, resulting in disfunctions of the system, such as error messages, false alarms, and very slow speed. In 2016, a seafarer plugged his smart phone into the ECDIS to charge it and as the phone began to update itself, it wiped the entire chart folio. If the failure occurs in shallow waters and it is not safe to proceed then sometimes it is best to wait at anchor for charts to come. Some other problems are such as:

- Alarm functions are disturbing.
- Develop faulty operation, a
- Lack of ECDIS content in the watch handover checklist and wider problems with the systems' design.
- ECDIS failure Similar to other electronic navigational equipment,
- ECDIS can fail, either outright or in a way that can give misleading information

The navigator shall transfer navigation to the back-up system and the following below are actions to be taken in the case of an ECDIS Failure

- In the event of a power failure with both systems reverting to Unit Processor System (UPS) supply, consider a controlled shut down of one system.
- In a timely manner to coincide with the expiry of the UPS on the first system, restart the second system.
- On restoration following a power failure or uncontrolled shut down of the system, confirm that there are power supplies to each system
- ECDIS check-off cards should be checked to ensure that settings of anti-grounding cone, safety depth, safety contour, velocity vector, units, chart priorities and chart auto-load are correct
- Confirm that the heading source is selected and is working correctly
- Check vessel's current position
- Conduct Alarm self-set.

5.1 Potential explanations

Solutions in order to keep the system running, all ECDIS systems are equipped with the function of entering positions manually. The majority of errors made on the Electronic Chart Display Information System (ECDIS) are in the user's interpretation of how the ECDIS displays information. The user given the freedom to present the chart in a number of ways: as such without a thorough understanding of how the system works, there may be some confusion in what the system in presenting. Navigator should use the "old fashion" navigational positioning with radar lines, bearings, depth lines, estimated or dead reckoning position and enter same into ECDIs system and also the following should kept in mind,

- In All deck, officers on paperless ships must have conducted an IMO model flag state approved ECDIS course.
- ECDIS navigation ingrained from joining as a cadet alongside paper navigation to appreciate the basics in both
- ECDIS forms a greater part in mandatory chart work exams for Certificate of competence (CoC's.)
- ECDIS and IBS training must evolve and develop concurrently with systems use.

5.2 Power Supply

Power should be possible to operate ECDIS and all equipment necessary for its normal functioning, when supplied by an emergency source of electrical power in accordance with the appropriate requirements of SOLAS. Chapter II-1 and changing from one source of power supply to another or any interruption of the supply for a period of up to 30 seconds should not require the equipment to be manually re-initialized.

5.3 Common fault

For all its potential, ECDIS is only computer software running on a marinades PC. As a result, it suffers from all the faults and errors of any computer. The greatest single danger from ECDIS is to assume that it correctly configured with regard to the Route, Safety Depth, Safety Contour, Alarms, and Displayed Data. A ship can ground just as easily because of improper configuration as it could from sloppy chart work on a paper chart. Where the ECDIS in use supports it, display configurations should save so that the system can be set up quickly when transiting between different environments such as confined Waters, anchoring, coastal navigation, and Open Ocean. This will save time when setting up the system. The temperature may rise and cause fire or malfunction of the central processing unit and if this happen the fan alarm may rise and immediately turn off power. Cleaning the surface of the equipment or Liquid-crystal Display (LCD) by using dry clothes, organic solvent such as benzene or thinner, alcohol, gasoline may deteriorate the surface coating. Therefore, use clean soft clothes to wipe off dust and dirt in the equipment and LCD. In addition, inspection of ECDIS may prevent it from malfunctions. Limitation for user not allowed to attempt to check or repair the inside of the equipment. Because checking or repair by an unqualified person may cause a fire or an electrical shock. It recommended to contact ECDIS manufacture head officer or near branch or local office to request servicing.

6. Conclusions

The concept of ECDIS is something that is gaining more and more popularity in today's times. ECDIS used not only for chart display, track plotting, and providing navigation information, but also for analyzing and integrating navigation and related information. As a comprehensive information-processing platform, electronic charts should provide basic support for the full realization of navigation automation. By adopting this electronic system marking and charting navigational routes, has become easier to avoid any unwanted accidents, as the ship is dependent on modern technology rather than human aid. ECDIS is now firmly established as a navigation aid within the industry, but it will only be mastered when it fully embraced. Embracing ECDIS will enable an organization to know its strengths and weaknesses. Organizations that base their decisions relating to ECDIS on research and sound principles will be able to get the most out of their equipment and take steps to mitigate the risks associated with its use. For example, any ships without a gyrocompass, ECDIS should be connected to a marine transmitting heading device.

7. References

[1] Safety 4 sea (2020) Bridge procedure (The importance of passage planning**)** https://safety4sea.com/cm-bridge-procedures-

[2] ECDIS (part of maritime Group) (n.d) Not just ECDIS problems, but solutions; https://www.ecdis.org/not-just-ecdis-problems-but-solutions

[3] Japan Radio co Ltd (2019) Jan.9201/7201 ECDIS https://www.jrc.co.jp/eng/product/lineup/jan9201_7201/pdf/jan-9201_7201_e.pdf

[4] Alphatron marine (2020) JRC/Alphatron Marine reintroduces Marcom-A training and ECDIS Type Specific Training on our new VSTEP simulators. https://www.alphatronmarine.com/en/article/jrcalphatron-marine-reintroduces-marcom-a-training-and-[5] Marine Insight (2020) what is (ECDIS)https://www.marineinsight.com/marine-navigation/what-is-electronic-chart-display-and-information-system

[6] What is the ECDIS (Electronic Chart Display Information System (2019) What is the ECDIS (Electronic Chart Display Information Systemhttps://www.marinemachinery-juvi.com/what-is-the-ecdis/