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# Recommendations on Usage of ECDIS and Preventing Incidents

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**The Oil Companies International Marine Forum (OCIMF)**
Founded in 1970, the Oil Companies International Marine Forum (OCIMF) is a voluntary association of oil companies having an interest in the shipment and terminalling of crude oil, oil products, petrochemicals and gas, and includes companies engaged in offshore marine operations supporting oil and gas exploration, development and production.

Our vision is a global marine industry that causes no harm to people or the environment.

Our mission is to lead the global marine industry in the promotion of safe and environmentally responsible transportation of crude oil, oil products, petrochemicals and gas, and to drive the same values in the management of related offshore marine operations. We do this by developing best practices in the design, construction and safe operation of tankers, barges and offshore vessels and their interfaces with terminals and considering human factors in everything we do.

**Terms of Use**

## Contents

## Glossary

**Assessment** An observation and evaluation of the practices and skill-sets of the individuals and bridge team to provide assurance of standards of navigation.

**Audit** Conducted to verify onboard compliance with the Safety Management System (SMS) and industry regulations.

**Company** The owner of the ship, or any other organisation such as a ship manager or bareboat charterer that has assumed responsibility for the operation of the ship from the owner of the ship, including the duties and responsibilities imposed by the International Safety Management (ISM) Code. May also be referred to as operator.

**Human factors** The interaction of people with procedures, equipment and each other. Often referred to as the human element.

**Master** The officer in command of a merchant vessel. He or she is the owner's representative on board and holds ultimate responsibility for all actions undertaken on board, particularly the safe and efficient operation of the vessel.

**Recommendations** OCIMF supports and endorses a particular method of working or procedure.

**Safety Management System (SMS)** A formal, documented system required by the ISM Code, compliance with which should ensure that all operations and activities on board a ship are carried out in a safe manner.

## Abbreviations

| | |
|---|---|
| **AIO** | Admiralty Information Overlay |
| **AIS** | Automatic Identification System |
| **ARPA** | Automatic Radar Plotting Aid |
| **CATZOC** | Category Zone of Confidence |
| **COLREGS** | International Regulations for Preventing Collisions at Sea |
| **DMAIB** | Danish Marine Accident Investigation Board |
| **ECDIS** | Electronic Chart Display and Information Systems |
| **ENC** | Electronic Navigation Chart |
| **EP NM** | Electronic Navigation Chart Preliminary Notice to Mariners |
| **GNSS** | Global Navigation Satellite System |
| **IHO** | International Hydrographic Organization |
| **IMO** | International Maritime Organization |
| **ISM Code** | International Safety Management Code |
| **MAIB** | Marine Accident Investigation Branch |
| **NAVTEX** | Navigational Telex |
| **NM** | Notice to Mariners |
| **OEM** | Original Equipment Manufacturer |
| **OOW** | Officer of the Watch |
| **PSC** | Port State Control |
| **RIO** | Radar Image Overlay |
| **RNC** | Raster Navigational Chart |
| **SCAMIN** | Scale Minimum |
| **SENC** | System Electronic Navigation Chart |
| **SIRE** | Ship Inspection Report Programme |
| **SMS** | Safety Management System |
| **SOLAS** | International Convention for the Safety of Life at Sea |
| **STCW** | International Convention on Standards of Training, Certification and Watchkeeping for Seafarers |
| **T&P** | Temporary and Preliminary |
| **UKC** | Under Keel Clearance |
| **UKHO** | United Kingdom Hydrographic Office |
| **VDR** | Voyage Data Recorder |
| **WGS** | World Geodetic System |
| **XTC** | Cross-track Corridor |

## Bibliography

*A.893(21) Guidelines for Voyage Planning* (IMO)

*A.1021(26) Code on Alerts and Indicators, 2009* (IMO)

*Accident Investigation Report 22/2017* (MAIB)

*International Convention for the Safety of Life at Sea (SOLAS)* (IMO)

*Model Course 1.27 Operational Use of ECDIS* (IMO)

*MSC.1/Circ.1503/Rev.1 ECDIS – Guidance for Good Practice* (IMO)

*MSC.232(82) Revised Performance Standards for Electronic Chart Display and Information Systems (ECDIS)* (IMO)

*MSC.302(87) Adoption of Performance Standards for Bridge Alert Management* (IMO)

*S-4 Regulations of the IHO for International (INT) Charts and Chart Specifications of the IHO* (IHO)

*S-62 List of IHO Data Producer Codes* (IHO)

**Recommended reading**

*III.2/Circ.2 Action to be Taken by Port States on the Required Updates of Electronic Chart Display and Information Systems (ECDIS)* (IMO)

*A.817(19) Performance Standards for Electronic Chart Display and Information Systems (ECDIS)* (IMO)

*Bridge Procedures Guide* (ICS)

*Guide to Best Practice for Navigational Assessments and Audits, A* (OCIMF)

*International Regulations for Preventing Collisions at Sea (COLREGS)* (IMO)

*MSC.1/Circ.1389 Guidance on Procedures for Updating Shipborne Navigation and Communication Equipment* (IMO)

*MSC.1/Circ.1496 Unified Interpretation on the Appendix to the SOLAS Convention Regarding the Records of Equipment Concerning Nautical Charts and ECDIS* (IMO)

*Recommendations on the Proactive use of Voyage Data Recorder Information* (OCIMF)

*S-32 Appendix 1, Hydrographic Dictionary – Glossary of ECDIS Related Terms* (IHO)

*SN.1/Circ.243/Rev.2 Guidelines for the presentation of navigation-related symbols, terms and abbreviations* (IMO)

*SN.1/Circ.266/Rev.1 Maintenance of Electronic Chart Display and Information System (ECDIS) Software* (IMO)

*SN.1/Circ.312 Safety of Navigation – Operating Anomalies Identified Within ECDIS* (IMO)

*User Guide: Admiralty Information Overlay (AIO)* (UKHO)

# 1 Introduction

## 1.1 Purpose and scope

High standards of navigation are crucial for the safety of crew members, protection of the marine environment and to safeguard vessels and cargoes. Passage planning is an integral part of ensuring safety of navigation. With the increasing use of Electronic Chart Display and Information Systems (ECDIS), it is becoming more important to focus on ECDIS-related navigational policies and procedures.

Over the last decade, there have been several significant navigational incidents where one of the contributory factors has been ECDIS-related. With an increase in the number of vessels now using Electronic Navigation Charts (ENCs) as primary as well as secondary navigational charts, the appropriate use of ECDIS is critical to ensure safety of navigation.

This information paper is aimed at owners, operators, Masters, Navigating Officers, bridge team members including Pilots and ECDIS makers. It provides recommendations to enhance policies and procedures regarding the safe use of ECDIS.

## 1.2 Analysis of ECDIS-related incident findings and SIRE observations

Table 1.1 summarises contributing factors identified from analysis of navigational incident as well as Ship Inspection Report Programme (SIRE) findings related to ECDIS.

The navigational incident analysed include 11 published reports and seven company investigation reports from between 2016 and 2018 involving tankers fitted with ECDIS. SIRE observations related to ECDIS were also analysed to identify common themes. The findings have been categorised into three main sections:

- Human factors and machine interface.
- ECDIS navigation procedures and practices.
- ECDIS hardware, software and ENC data.

The findings were also analysed in terms of four stages of voyage planning:

- Appraisal.
- Planning.
- Validation.
- Execution and monitoring.

While it is not a traditional stage of passage planning using paper charts, the validation stage has been included for ECDIS-specific procedures. This is in order to safeguard against the high rate of navigational incidents that have resulted either directly or indirectly from inappropriate validation steps before execution. The execution and monitoring stages have been combined for ease of reference and to eliminate ambiguity, as there is often overlap between these two stages.

Gaps in ECDIS-related knowledge and practical application by Navigating Officers and Masters remains a recurring theme when analysing incidents, as well as SIRE observations.

| | Human Factors and Machine Interface | ECDIS Navigation Procedures and Practices | ECDIS Hardware, Software and ENC Data |
|---|---|---|---|
| **Appraisal** | • Lack of ECDIS system familiarity and lack of knowledge of ENC symbols<br>• Failure to interrogate chart cautions and symbols, such as isolated danger marks or cautionary areas<br>• Overreliance on ECDIS<br>• Largest scale ENC not uploaded<br>• ENC data and other available information not properly analysed (including sector light zones, sailing directions, mariner's handbook and other relevant sources) | • Unclear ECDIS carriage policy<br>• Largest scale ENC not available<br>• Latest updates not applied to ENC database<br>• Under Keel Clearance (UKC) calculations do not consider Category Zone of Confidence (CATZOC), squat or height of tide<br>• Controlling depth (safe water) not accurately defined<br>• Unofficial charts used<br>• Minimum clearing distance from hazards not clearly defined (vertical – UKC and horizontal – distance off) | • Objects inaccurately charted<br>• ENC borders not aligned<br>• Chart and World Geodetic System (WGS) 84 datum discrepancies<br>• Features with area boundaries (such as reefs) are incorrectly programmed as point features<br>• Up-to-date port/berth information not shown on latest ENC |
| **Planning** | • Route plotted very close to or over navigational hazards<br>• Knowledge gaps and inability to distinguish between alarms, cautions and indicators<br>• Varying standards of ECDIS generic training, type-specific training and familiarisation<br>• Reducing safety margins (such as UKC or distance off) | • Berth-to-berth passage plan not available<br>• Incorrect application of safety depth and safety contour<br>• No-go areas and manual contours not defined as per calculated safe water depths or not made alarmable<br>• Safety parameters and alarm limits not set<br>• Cross-track Corridor (XTC) wider than available width of navigable waters<br>• Environmental factors (such as tidal streams) not considered in wheel-over calculation | • Software limitations for setting features such as wheel-over positions, manual no-go areas, manual layer and other information<br>• Course information not readily apparent over various legs<br>• Programmed safety contour layers not available at required safe water depth |
| **Validation** | • Automatic route check alerts ignored<br>• Lack of familiarity with route validation feature | • Visual checks not undertaken for each leg of the passage<br>• Manual route validation not conducted<br>• Automatic route validation feature not used<br>• Route validation (visual, manual and automatic) not undertaken by the Master as well as the Navigating Officer<br>• Route validated checks undertaken on a smaller-scale ENC<br>• After passage plan amendment, route not re-validated by Navigator and re-approved by Master | • Excessive number of alerts generated during system route check function<br>• Route validation feature is too complex to use |

| | Human Factors and Machine Interface | ECDIS Navigation Procedures and Practices | ECDIS Hardware, Software and ENC Data |
|---|---|---|---|
| **Execution and Monitoring** | • Bridge distractions<br>• Incorrect route loaded on ECDIS<br>• Watchkeeper fatigue or lack of alertness<br>• Deviation off-track not noticed<br>• Audible alarms disabled<br>• System alerts ignored<br>• Acknowledging alerts without investigation (such as exiting XTC, anti-grounding alarm or critical points)<br>• Look-ahead not set properly<br>• Lack of user knowledge and system familiarity; for example, in the case of pilots and new on-signers<br>• Display settings not optimised for day, dusk, night light conditions<br>• Lack of familiarity with contingency plans and procedures | • Planned safety settings changed or not set before execution of passage, or subsequently<br>• Compilation scale not being used (navigation on over-scale or under-scale ENCs)<br>• Minimum layers for safe navigation not being displayed<br>• Position verification/ plotting not being undertaken using combination of line of positions, radar overlays and/or parallel indexing, as and where available<br>• Look-ahead settings inappropriate or changed randomly<br>• Position not being monitored during pilotage<br>• Use of Automatic Identification System (AIS) on ECDIS as primary means of collision avoidance<br>• Lack of ECDIS-related contingency plans and procedures | • Course information not readily visually apparent over various legs<br>• Inadequate cyber security measures<br>• Visual perception of ECDIS data when set to day, dusk or night preset modes<br>• Issues with ECDIS power back-up |

**Table 1.1:** *ECDIS-related incident findings and SIRE observations analysis*

# 2 ECDIS carriage requirements

For safety of navigation, it is critical that ECDIS hardware, software and ENC data complies with the International Maritime Organization (IMO) performance standards.

The International Convention for the Safety of Life at Sea (SOLAS) Chapter V, Safety of Navigation, regulation 19 that is now in force provides ECDIS carriage requirements for ships. ECDIS must conform to relevant IMO performance standards, depending on the date of equipment installation, as per SOLAS Chapter V, regulation 18.

ECDIS being used to meet SOLAS chart carriage requirements must:

- Be type-approved.
- Use up-to-date ENCs.
- Be maintained as per latest applicable International Hydrographic Organization (IHO) standards.
- Have adequate and independent back-up arrangements.

The main and back-up arrangement of chart carriage must be clearly documented under the relevant record of equipment for the Ship Safety Certificate (Form E – Record of Equipment for the Cargo Ship Safety Equipment Certificate, in the case of tankers).

ECDIS systems must comply with SOLAS carriage requirements and be kept updated according to the latest version of the IHO ENC product specifications and presentation library.

## 2.1 Carriage of ECDIS and paper charts

The latest edition of paper charts corrected to the latest Notices to Mariners (NM) should be carried where official ENC data is not available, or where required by local regulations.

During a recent study (conducted between 2015 and 2020 and due to be published) on the use of ECDIS, the UK Marine Accident Investigation Branch (MAIB) and the Danish Marine Accident Investigation Board (DMAIB) noted that many shipowners opted to retain paper charts on board, either as the primary means of navigation or as a back-up during transition to ECDIS. The study's preliminary findings indicated that, where paper charts were nominated as the primary means and ECDIS was used as an aid to navigation or for training purposes only, in practice, ECDIS was being used as the principal tool for navigation because of the advantages it provided through real-time positioning. Consequently, paper charts were used only to periodically plot positions for the record, and ECDIS safety settings and alert parameters were not always set. A further disadvantage identified on board ships using both ECDIS and paper charts was that the Bridge Officer workload was increased because they needed to order, update and plan on paper charts as well as on ECDIS. This was corroborated by the results of a 2019 survey of OCIMF and INTERTANKO members, in which 58% of 599 responders stated that the workload of carrying both ECDIS and paper charts was the same or greater than carrying only paper charts. One of the aims of the IMO ECDIS performance standards was to reduce navigational workload, not increase it.

## 2.2 Recommendations

- The transition from paper charts to ECDIS navigation should be phased within the organisation. It should follow a robust risk assessment that considers the vessel's trading pattern after all Masters and Bridge Officers have been suitably trained in accordance with the company's Safety Management System (SMS).
- ECDIS navigational procedures should be effectively embedded into the company's SMS and adopted by the Masters and navigating officers.
- Implementation of ECDIS navigational procedures should be verified using a combination of traditional navigation audits and remote navigational assessments using Voyage Data Recorder (VDR) data.
- Carriage of ECDIS as the primary means of navigation and paper charts as the secondary means (or vice versa) should only happen after a risk assessment has been undertaken. Factors in the risk assessment should include the increased probability of errors when using different methods and the increase in workload for Bridge Officers, both of which were highlighted in OCIMF's survey results.
- ECDIS should be designated the primary means of navigation, along with a compliant back-up ECDIS system. Both should have independent power backups.
- Any defects or discrepancies noted in ECDIS performance should be immediately reported to the ECDIS maker along with appropriate notifications to the Flag State Administration or the Recognised Organisation. Risk-assessed mitigations should be implemented until the defects have been rectified.
- ECDIS makers should publish safety bulletins or software upgrades as soon as an error or discrepancy in ECDIS-related data or functions is noted either by a vessel's staff or by their own technical teams.
- Cyber security measures should be implemented to safeguard against cyber threats.
- Company should determine critical spare part list for ECDIS and make them available on board. List of minimum spares related to ECDIS should be included in the vessel's planned maintenance system to ensure reinstatement of ECDIS in the event of a failure. This should be done in consultation with ECDIS maker and identifying spares to be replaced during preventative maintenance should also contribute towards increasing ECDIS reliability.

# 3 ECDIS training and familiarisation

## 3.1 Statutory requirements

The International Safety Management Code (ISM Code) and the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW) 2010 Manila Amendments require all Masters and Bridge Officers serving on vessels with ECDIS as the primary means of navigation to have undertaken generic ECDIS training, as per the IMO Model Course 1.27, in order to obtain or revalidate their Certificate of Competency.

The shipowner or operator has the responsibility to provide training to Masters and Bridge Officers on ship-specific equipment, including ECDIS, in order to comply with the following requirements:

- ISM 6.3: "The Company should establish procedures to ensure that new personnel and personnel transferred to new assignments related to safety and protection of the environment are given proper familiarisation with their duties. Instructions which are essential to be provided prior to sailing should be identified, documented and given."
- ISM 6.5: "The Company should establish and maintain procedures for identifying any training which may be required in support of the safety management system and ensure that such training is provided for all personnel concerned."
- STCW Convention regulation I/14-5: Every company must ensure that "seafarers, on being assigned to any of its ships, are familiarised with their duties and with all ship arrangements, installation, equipment, procedures and ship characteristics that are relevant to their routine or emergency duties".

## 3.2 Recommendations

- Generic ECDIS training must be undertaken by all Masters and Bridge Officers. This training should as a minimum include provisions as per IMO Model Course 1.27.
- Additionally, ECDIS familiarisation for all Masters and Bridge Officers should be undertaken to include type-specific training as well as onboard familiarisation. The familiarisation should include:
  a) Type-specific ECDIS training for the specific system fitted on board, and developed by the ECDIS makers, should be provided by the company to all Masters and Deck Officers before they take charge of a navigational watch. Type-specific training could either be a course taken ashore or an online training, as long as it is specific and targeted at effective use of the make/type of ECDIS fitted on board. Verification of trainee's ability to use ECDIS should be incorporated as part of the type-specific training module.
  b) ECDIS familiarisation should be provided to all on-signing Deck Officers before they keep an independent navigational watch, and each time they join any vessel.
- Onboard ECDIS familiarisation should also include ship-specific contingency scenarios, such as power failure; loss of inputs from heading, speed and electronic position-fixing systems; as well as spoofing and jamming errors.
- Once the Masters and Bridge Officers have been trained and are fully familiar with the use of ECDIS (including but not limited to ENCs, chart symbols, safety contours, no-go areas, passage planning policies and procedures), the challenge of retaining ECDIS proficiency remains. Masters and Officers are recommended to maintain and improve their ECDIS knowledge and proficiency regularly through continuation and refresher training. They should be capable of using ECDIS effectively at all times and to demonstrate this during navigational assessments, audits and external inspections such as Port State Control (PSC) and SIRE.

  (MSC.1/Circ.1503/Rev.1 *ECDIS – Guidance for Good Practice*)

# 4 Passage plan

## 4.1 Route appraisal

### 4.1.1 ECDIS reliability

Factors that can affect ECDIS accuracy and reliability include:

- Issues with ECDIS hardware or software.
- Improper application of software updates/patches.
- Improper change management for hardware or software upgrades.
- ENC programming and accuracy with regard to scales, datums, point features versus area features, the survey date and survey techniques used.
- ENC database management and updating procedures.
- Slow response/refresh rates.
- Look-ahead feature not identifying or alarming grounding risk.
- Freezing of ECDIS monitors.
- Other ECDIS errors.

**Recommendations**

- Navigators need to be aware of the problems that can result from using point features instead of area features on an ENC. For example, there have been cases where an isolated danger mark (point feature) was used to highlight an area of reef that is also dangerous to surface navigation. Because the isolated danger was programmed as a point feature rather than an area feature (which would have covered the extent of the reef), the ECDIS might not identify the threat to the vessel. If a navigator plans a passage and assumes the danger only exists at the point marked, and is unable to interrogate other layers of ENC data, the vessel's track could pass extremely close or even over the area of reef. Because of this potential danger, some governments have scheduled re-surveys and re-programming of all local ENCs.
- Special consideration should be taken to create a backup of ECDIS data on a regular basis so any part of the passage could be reviewed. The company SMS should include frequency and arrangement of ECDIS data backup.

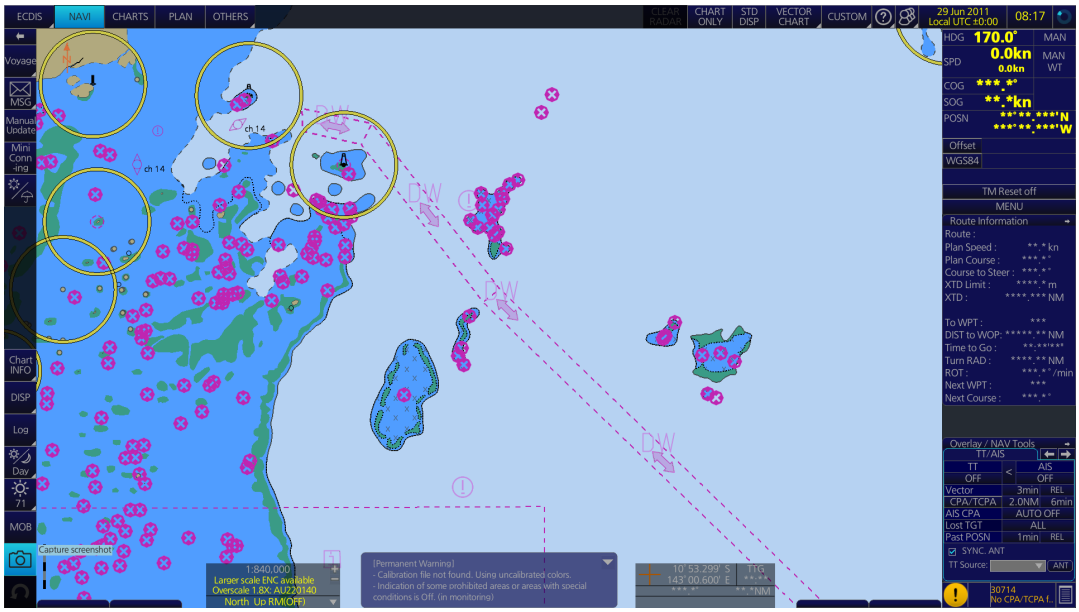



**Figure 4.1:** *ENC programming: area versus point features*

- ECDIS makers should ensure that hardware and software configurations of ECDIS remain compliant with IMO performance standards.
- Any subsequent updates by ECDIS makers should only be undertaken after proper testing, with release notes for the Masters and Navigating Officers that they are able to distinguish between any change. Currently, the IMO is reviewing this process and procedure, in particular, if type approval and additional testing/surveys are required by the Flag Administration or its Recognised Organisation.
- If makers note any discrepancies in ECDIS performance, they should issue technical bulletins to all vessel owners/operators who manage vessels fitted with their system, in order to highlight the issues.
- The maker's technical bulletins should include mitigating measures for Masters and Bridge Officers with future plans to rectify the discrepancies.
- Vessel owners/operators should engage with ECDIS makers and ensure relevant information is shared with vessels under management without delay and that Original Equipment Manufacturer (OEM) technical bulletins are acted upon with mitigations in place, as necessary.
- Masters should ensure that weekly updates to ENCs are being properly implemented on all ECDIS stations by the Navigating Officers as per latest NMs.
- Masters and Navigating Officers must familiarise themselves with ENC symbols, including type of scales and datums.
- Any errors displayed on ECDIS that cannot be resolved should be followed up with the makers, so they can be rectified as soon as possible. Risk assessment should be undertaken to identify interim mitigations until the error condition has been resolved.

### 4.1.2 ENC scales

Compilation scale is the scale at which the ENC data was originally compiled. This is the optimum scale to be used on ECDIS. ENC cells are currently split into six different scale categories (each with a range of scales within them):

- Overview.
- General.
- Coastal.
- Approach.
- Harbour.
- Berthing.

Each ENC is identified by an eight-character identifier, such as FR501050. The first two characters indicate the producer: FR for France, GB for Great Britain and so on. The third character (a number from 1 to 6) indicates the navigational purpose band. The last five characters are alphanumeric and provide a unique identifier.

For example, ENC cell number GB50202M would mean:

- GB = United Kingdom Hydrographic Office (UKHO) authorised.
- 5 = Harbour scale ENC.
- 0202M = Cell or chart number.

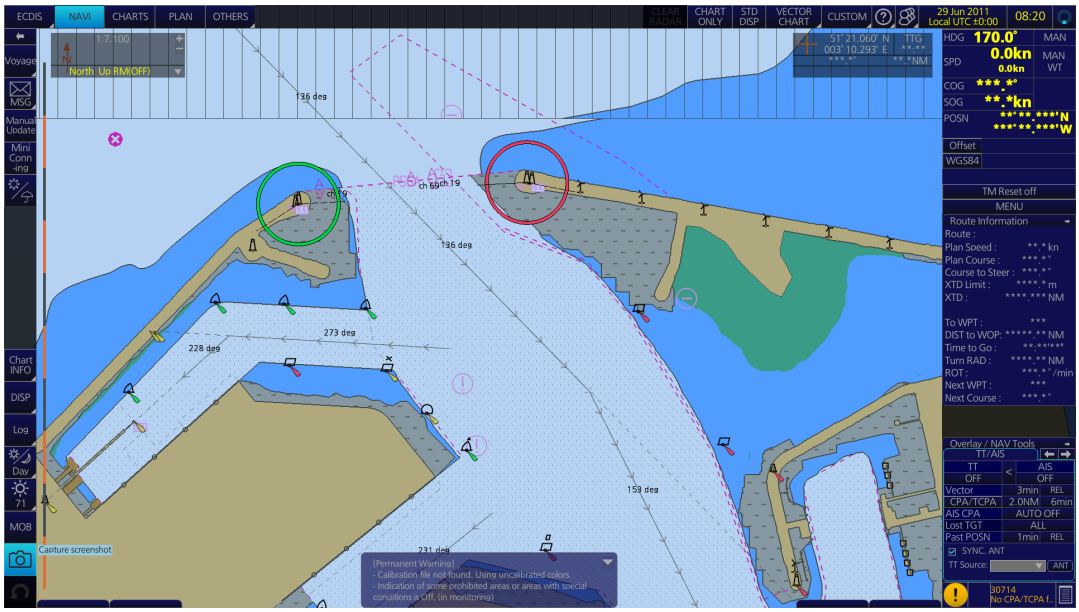
A complete list of producer codes is included in the IHO standard S-62.

Scale minimum (SCAMIN) is the term for the scale below which an object will not be displayed on an ENC. The main purpose of this feature is to reduce ECDIS screen clutter as seen by a user who could have zoomed out of the compilation scale.

Although zoom-in and zoom-out functions are available to assist users, compilation scale is the main scale to use in order to ensure that the display is optimised for navigation, without the risk that ENC features are overly enhanced or suppressed.

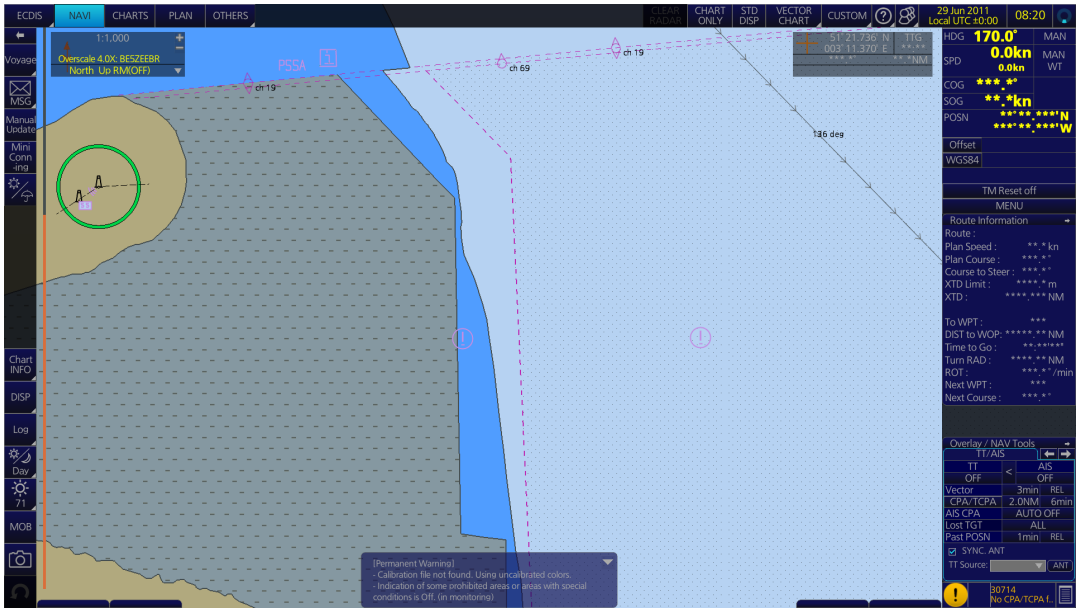
**Recommendations**

- Vessels should obtain licenses for and use the largest scale of ENCs available for all stages of each passage.
- Masters and Navigating Officers should use Compilation scale as far as practicable to ensure ECDIS screen displays features at the most optimum scale.
- Navigating Officers should be aware that they could zoom-in or zoom-out one scale above or below the compilation scale if required for examining data, and then revert to compilation scale.
- It is recommended that users do not zoom in or out more than one scale above or below compilation scale, as critical information may vanish, or its position may be distorted which would jeopardise safe navigation. Note that the presence of jail bars on the screen means that 25% of the information is missing or out of position.




*a) ENC data on compilation scale*


*b) ENC data on under scale*




*c) ENC data on overscale*

**Figure 4.2:** *Comparison of ENC data presented on compilation scale (a), under scale (b) and overscale (c)*

### 4.1.3 ECDIS displays

ECDIS displays can be broadly divided into four types:

- Display base.
- Standard display.
- Custom display.
- Full display.

The IMO performance standards for ECDIS:

> *Display base means the level of SENC information which cannot be removed from the display, consisting of information which is always available for all geographical areas. It is not intended to be enough for safe navigation.*
>
> *Standard display means the System Electronic Navigation Chart (SENC) information that should be shown when a chart is first displayed on ECDIS. The level of information it provides for route planning or route monitoring may be modified by the mariner according to the mariner's needs.*
>
> *Custom display means display as configured by the mariner for route planning or route monitoring.*

Full display means display of all layers of an ENC as selected by the mariner.

Although standard display shows more information compared to display base, information shown on standard display may still be insufficient for safe navigation under different navigational conditions.

**Recommendations**

- Standard displays or display base should not be used on their own, without the additional layers required for safe navigation.
- The minimum layers to be displayed for safe navigation (those other than standard display) should be included in the company SMS for different navigational conditions. For example, a company SMS might list the following minimum layers to be displayed:

  Under any navigational condition:

  – IMO standard display, plus:

  – Depth soundings and contours.

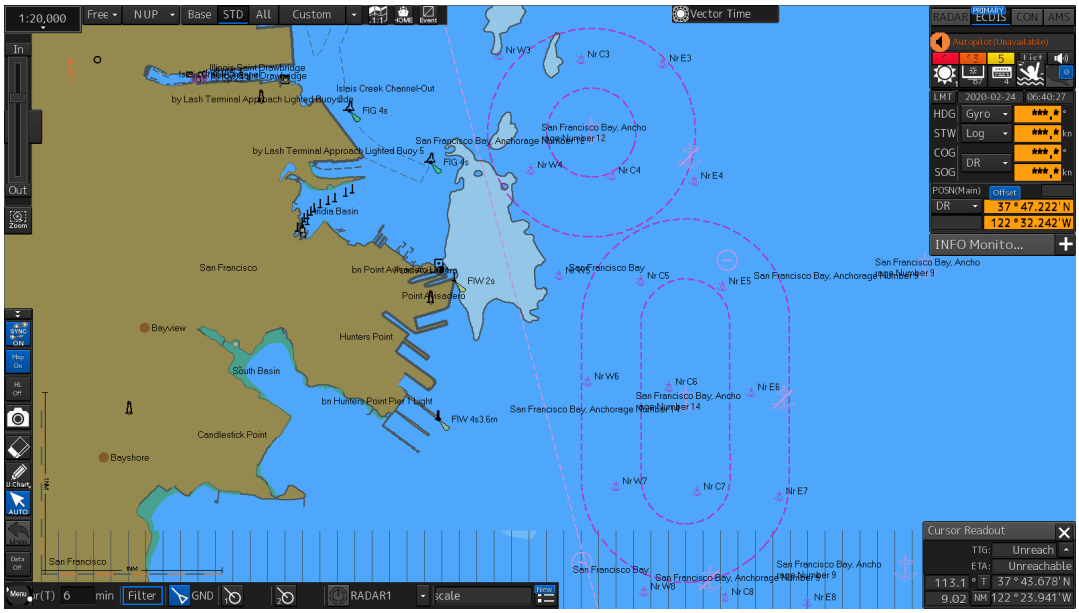
– Wrecks, obstructions and danger marks.
– Light characteristics (at night).

Additionally, when anchoring:

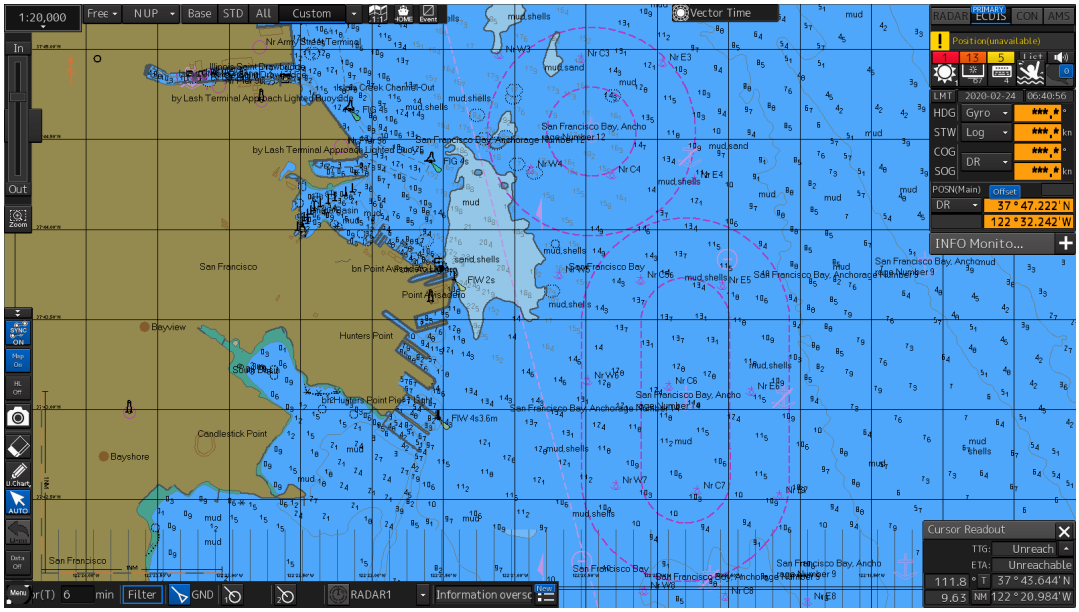
– Submarine cables and pipelines.
– Seabed characteristics.
– Anchorage identification.

- The company SMS should detail the procedure for customising ECDIS display layers for various navigational situations, watch handover procedures and Master's standing orders.
- Full display should be switched on when the vessel is due to breach the limiting boundaries of the XTC, the safety contour, the manual safety contour, or whenever the risk of missing navigational data could jeopardise safe navigation. Navigating officers should be aware that switching on all layers will lead to excessive data cluttering on the ECDIS. In this case, bridge manning levels should be increased and the Master should be called immediately.
- Navigating Officers should be familiar with ECDIS symbols and how they differ from symbols on traditional paper charts.

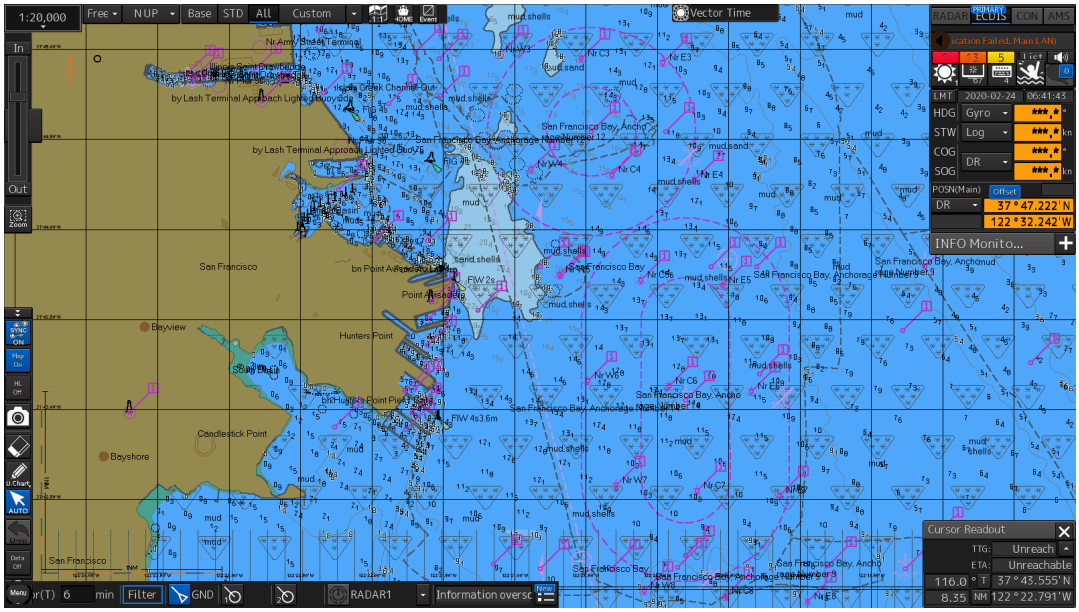

*a) ENC data using display base*




*b) ENC data using standard display*




*c) ENC data using custom display*




*d) ENC data using full display*

**Figure 4.3:** *Comparison of ENC data presented using display base (a), standard display (b), custom display (c) and full display (d)*

### 4.1.4 ECDIS overlays

As well as the sensor inputs of systems providing continuous position-fixing, heading and speed information, additional information can be overlaid on an ECDIS display. As per IMO performance standards, ECDIS should not degrade the performance of any equipment providing sensor inputs, nor should the connection of optional equipment degrade the performance of ECDIS.

Radar and Automatic Identification System (AIS) overlays can be displayed on ECDIS. Such overlays should not degrade the display of SENC information and should be clearly distinguishable.

Radar overlays are an important way to quickly and effectively cross-check vessel position against the input provided by continuous position-fixing equipment when near shore lines or charted objects.

ECDIS is also capable of superimposing AIS data using the AIS overlay feature. Although AIS is a means of vessel identification, not all vessels exhibit AIS information. Even if a vessel is exhibiting AIS information it might not be accurate and this can confuse the Navigating Officers. Recent security events have indicated that certain vessels might also switch off their AIS transmission when they are in certain high-risk areas.

Significant collisions have occurred because Navigating Officers made collision avoidance decisions based on AIS information, but they were not using the radar/Automatic Radar Plotting Aid (ARPA).

**Recommendations**

- Radar overlays should be used for position verification at regular intervals, as defined by company SMS requirements, and for various navigational conditions (such as in open waters, confined waters, fairways/channels or pilotage waters).
- Position plotting should also be undertaken using traditional techniques, using lines of position to plot visual/radar fixes. This will act as a cross-check and will be recorded on the ECDIS data log. Radar Parallel index should also be used, when practicable.
- The frequency of radar overlay position verification, as well as position fixing on ECDIS, should be defined in the company SMS, for various navigational conditions.
- Overlays should not be kept on constantly to avoid excessive clutter on the ECDIS, as this could lead to important ENC features being missed.

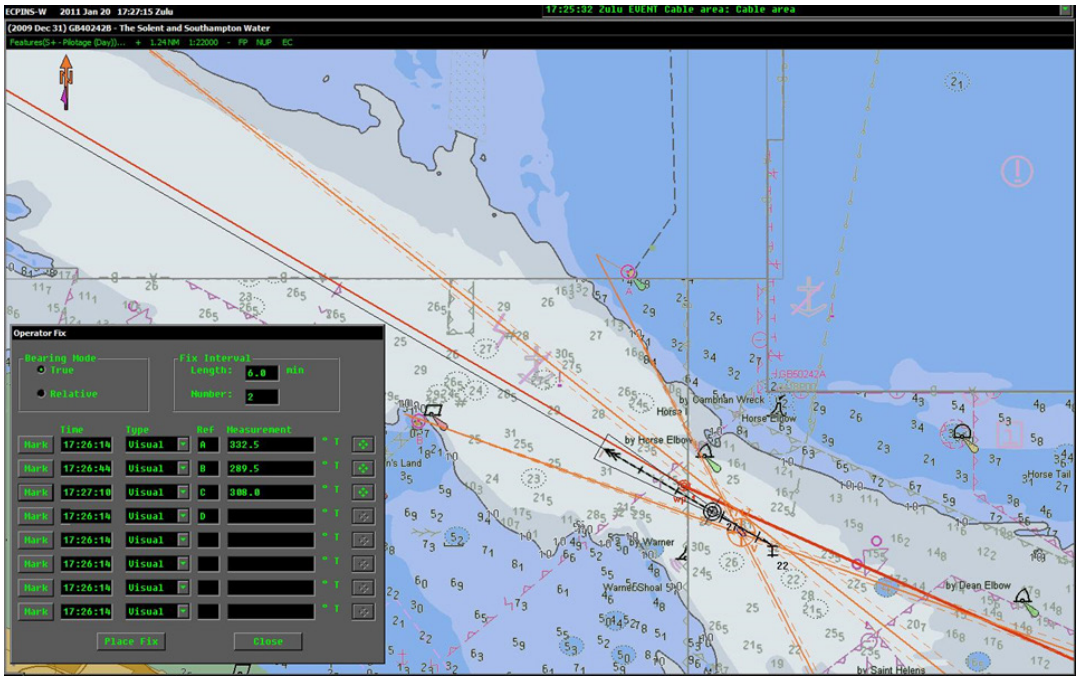



**Figure 4.4:** *ENC position verification using lines of position*

### 4.1.5 ECDIS monitor settings (day, dusk, night)

Day, dusk and night are preset modes programmed on most ECDIS units to allow Navigating Officers to readily select display levels based on natural light conditions. ENC features are pre-programmed to appear distinctly when a mode is selected, provided that it is suitable for the natural light conditions at the time.

Dimmer switches provided for individual monitors might suppress ENC objects so that they are not easily identified.

The optimum display set-up can also be affected by other aspects, such as:

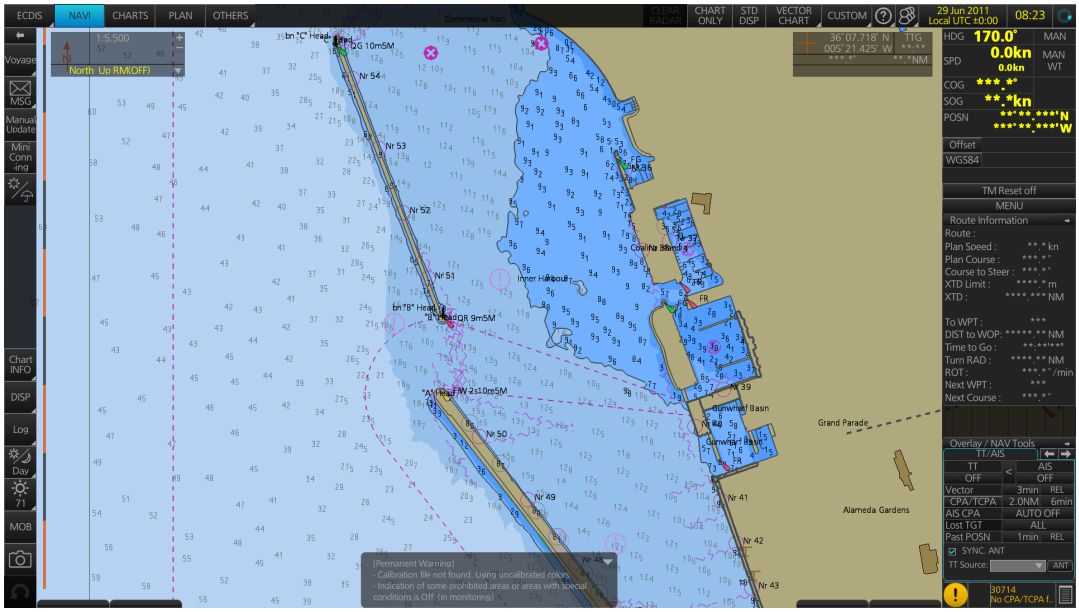
- Using day mode and then reducing brilliance at night to a very low level.
- Covering ECDIS monitors with home-made covers or anti-reflective sheets.

- Lack of re-adjustment under changing natural light conditions.
- Extensive user customisation of display and brightness settings.

Using suboptimal display presets could conceal crucial information.

**Recommendations**

- Navigating Officers should, as far as possible, use the preset modes for day, dusk and night conditions.
- Display settings should be part of navigational watch hand-over procedures.
- The display modes should be actively adjusted based on changing natural light conditions.




*a) ENC data using day settings*


*b) ENC data using dusk settings*

*c) ENC data using night settings*

**Figure 4.5:** *Comparison of ENC data using day (a), dusk (b) and night settings (c)*

## 4.2 Route planning

### 4.2.1 ENC selection

ENCs are available in six different scales, as described in section 4.1.2.

**Recommendations**

- An effective ENC management system should be in place on board to record ECDIS identification numbers and when licences/permits were received on board and should include a record of when the ENCs were last updated. This is generally part of ECDIS software logging.
- Company SMS and navigation policies should outline clear procedures to ensure all relevant ENCs for the passage have been ordered and are available on board.
- Vessels should obtain licenses for and use the largest scale of ENCs available for all stages of each passage.

A list of ENCs used for the intended voyage should be part of the passage plan.

### 4.2.2 Berth-to-berth passage plan

The IMO Assembly resolution A.893(21) *Guidelines for Voyage Planning* includes appraisal (gathering all information relevant to the voyage or passage); detailed planning of the whole voyage or passage from berth to berth, including those areas where a pilot is needed; execution of the plan; and monitoring the vessel's progress during implementation of the plan.

When it comes to making berth-to-berth passage plans, the principles of passage planning are broadly similar to those followed when using paper charts.

**Recommendations**

- If the destination has not been confirmed, passage should be planned from berth to a point the vessel is expected to sail towards.

All sections of the passage must be properly planned and validated on ECDIS before executing a route.

### 4.2.3 Manual layers

ECDIS includes an option to add manual layers that could be a visual representation of additional relevant information. Some of the manual layer features can be made alarmable to warn the bridge team during route validation, as well as during monitoring, if the look-ahead zone touches the feature.

**Navigational warnings, NAVTEX messages, local information and T&P notices**

Manual layers can be made and displayed on the ECDIS for various stages of the route. This could include navigational warnings, Navigational Telex (NAVTEX) messages or local information useful to Navigating Officers both during planning stages and while executing a passage.

When the passage plan needs to be amended due to a navigational warning, the amended passage plan needs to be checked and approved by the Master.

**Recommendations**

- The company SMS should outline a procedure for managing manual layers to ensure current important information is available and out-of-date material is archived or removed.
- Navigating Officers should use manual layers to display relevant information on the ECDIS as per the company SMS. For example, display all navigational warnings within the Cross-track Corridor (XTC) or within a certain number of miles either side of the planned track.
- Specific details of a critical navigational warning should be plotted and made alarmable by using the look-ahead feature to highlight the navigational hazard for the Officer of the Watch (OOW).
- Some ECDIS have a feature to automatically import navigational warnings from Sat-C or NAVTEX terminals. Navigation Officers should verify that navigational warning information is currently displayed.

### 4.2.4 Temporary and Preliminary Notices to Mariners, ENC Preliminary Notices to Mariners and Admiralty Information Overlay

Not all ENC producers include Temporary and Preliminary Notices to Mariners (T&P NMs) as part of their ENC updates. The UKHO provides a list of countries that include T&P NMs in their ENCs. In cases where T&P NMs are not included in local ENCs, T&P NMs issued for admiralty paper charts are available through a service called Admiralty Information Overlay (AIO).

AIO displays T&P NMs and Electronic Navigation Chart Preliminary Notices to Mariners (EP NMs), as well as areas where there is no admiralty paper chart, at an equivalent ENC scale on the ECDIS. T&P NMs and EP NMs are displayed as coloured polygons, whereas a grey hatched polygon labelled No Overlay is used where there is no paper chart at an equivalent ENC scale.

Note that there may be delays in updating AIOs from the time a T&P or EP NM has been published, updated or cancelled.

It is also important to note that AIO is a visual layer over an ENC and does not display details of the actual notice.

Where conflicts of scale occur between UKHO products and the areas covered by T&Ps, AIO will display No Overlay. In such circumstances, AIO users should gather information from other sources, such as local NMs to determine whether there are any relevant T&P notices.

**Recommendations**

- The company SMS should define policies and procedures for the OOW to display T&P NMs and use of the AIO function.
- Specific details of a T&P/EP NM should be plotted as a manual layer as opposed to a generic text box and made alarmable to highlight any navigational hazards. For example, the company SMS may require Navigating Officers to manually plot and display all T&P NMs within the XTC or within a specific number of miles either side of the planned track.
- Navigating officers should not entirely rely on AIO as they may not be updated, and applicable T&P notices should be verified against weekly notices to mariners.

### 4.2.5 Identification of safe water

As identified in table 1.1, there are several contributing factors to the inappropriate understanding or application of safety contour and safety depth settings, in trying to identify safe navigable water.

Identification of safe water can be broken down into the following sub-categories:

- Under Keel Clearance (UKC) Calculations and Category Zone of Confidence (CATZOC).
- Safety depth and safety contour.
- Manual safety contour with alarmable features.
- No-go areas with alarmable features.
- Two-shade and four-shade depth display.

**Under Keel Clearance and Category Zone of Confidence**

Once the UKC calculations have been completed, the resulting safety settings should be entered into the ECDIS to create the safety contour.

CATZOC gives an indication of survey reliability, like the original source data diagrams on paper charts. Note that CATZOC values indicate both position and depth accuracy and provide details of seafloor coverage and survey characteristics. The accuracy of CATZOC data should be considered in the vessel's UKC calculation, unless more accurate, up-to-date local information is available.

**Safety depth, safety contour, and no-go areas**

The safety contour can be a very important ECDIS setting, as it marks the area of safe water according to the operator.

ECDIS safety settings include:

- **Safety contour:** An alarmable safety feature that distinguishes between safe and unsafe areas, detects isolated danger marks and raises an anti-grounding alarm if the look-ahead zone breaches safety contour at any stage of the voyage (using both an audible and a visual alarm). Two other settings are available: Shallow and Deep contours, if four-shade depth display has been selected, neither of which have an alarm feature:
  - Shallow contour.
  - Deep contour.

  Depth contours are pre-programmed within the ENCs with default safety contour set at 30 metres.
- **Safety depth:** Visual display where depths at or below the safety depth setting are highlighted in bold, while depths above the safety depth setting are displayed in grey (there is no alarm feature for this). Some ECDIS have only one option for the safety contour setting, which is automatically used as the safety depth setting.

There are two possible scenarios based on the safety contour setting required:

**Scenario A: Appropriate safety contour available**

The following conditions should be met in an appropriate safety contour setting:

- Ideally, an appropriate safety contour setting is equal to the safety depth setting obtained by UKC calculations. Where a safety contour appropriate to the UKC calculation is available, it should be used to distinguish safe water.
- All depths inside the safety contour are highlighted in bold, as the safety depth setting is equal to safety contour setting.
- The safety contour distinguishes between safe and unsafe areas.
- All isolated dangers inside safety contours are displayed as magenta octagons with a white cross.
- The anti-grounding alarm activates automatically when the look-ahead zone touches or enters the safety contour.

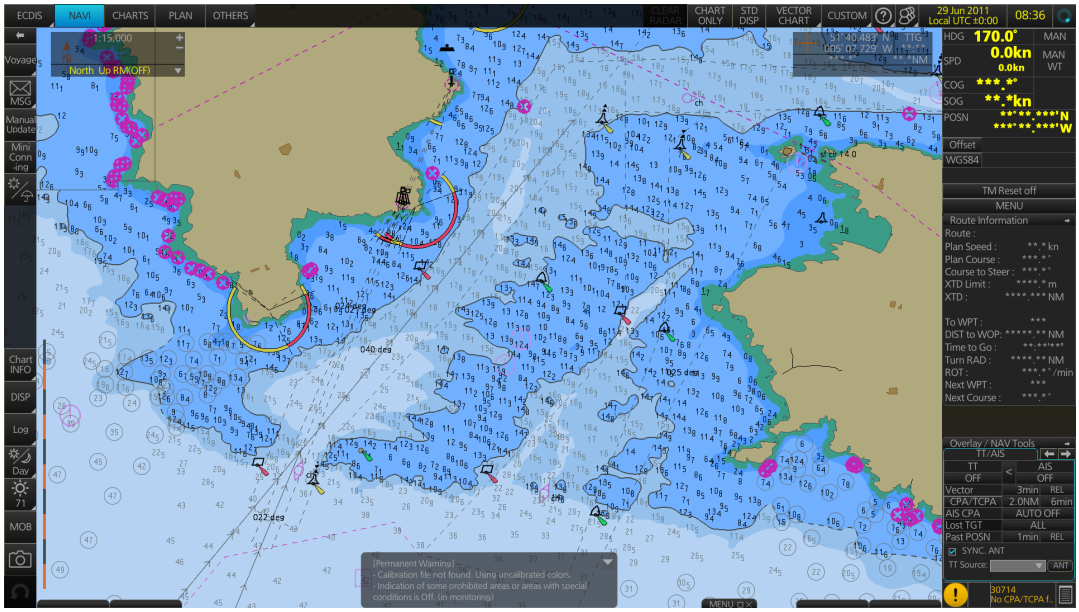



**Figure 4.6:** *Example of ENC where the required 15m safety contour is available, using four-shade contours*

**Scenario B: Appropriate safety contour not available**

Where there is no appropriate safety contour available on the ENC (the programmed depth contour on the ENC is not equal to the safety contour setting), the safety contour will default to the next available deeper contour. In areas where the next available contour is not suitable (for example, if 10m is unavailable, and the next is 20m), safe water should be defined using a manual alarmable no-go line. This line distinguishes between safe water and user-defined no-go areas. In such scenarios, a manual alarmable line could be drawn on a manual layer on the ENC, and if so, that layer should be selected and displayed during the passage.

There are two methods of achieving this and it is imperative that Company SMS clearly define the preferred method and highlight appropriate mitigations in their ECDIS navigation policy.

**Caution:** In both methods, the Navigating Officer should ensure that the manual no-go line is accurately plotted and alarmable. If a manual alarmable line has been plotted, it should be carefully cross-checked by the Master (in addition to normal passage plan checks).

- **Method 1:** Draw a manual alarmable line and reduce the safety contour setting to the next available contour below the original setting.
  - Advantages:
    - Vessel navigates within the safe area outside the manual alarmable no-go line.
    - Reduces number of unnecessary alarms, thus reducing alarm fatigue.
    - Anti-grounding alarm activates when the look-ahead zone breaches the manual alarmable no-go line drawn at the required safety contour setting.
  - Disadvantages:
    - Need to enter safety contour setting below the value required as per UKC calculations.
    - Generic isolated danger marks between the lowered safety contour and the manual no-go line may not show up, depending upon their depths.

- **Method 2:** Draw a manual alarmable no-go line and retain original safety contour setting that defaults to next available deeper contour.
  - Advantages:
    - No need to lower the safety contour setting below the value required as per UKC calculations.
    - Isolated danger symbols still display correctly, according to the safety contour setting.
    - The anti-grounding alarm sounds if the look-ahead zone breaches the manual alarmable no-go line, drawn at the required safety contour setting.
  - Disadvantages:
    - The initial anti-grounding alarm sounds if the look-ahead zone breaches the safety contour, leading to risk of alarm fatigue.
    - The vessel may navigate within the zone inside the safety contour and outside the manual alarmable no-go line.

**Recommendations**

- The company SMS should include navigational procedures, including a UKC policy and ECDIS-specific procedures, including passage plan forms, waypoint sheets and sample UKC calculations, and how to establish the safety contour and safety depth settings.
- Masters and Navigating Officers should have a clear understanding of CATZOC and how it affects the ENC data, considering both depth and position accuracy. There is no minimum allowance currently recommended for different CATZOCs, but Masters and Navigating Officers should make an informed decision that considers factors such as additional information available from local Port Authorities, available UKC allowance as per charted depths on ENCs, the latest bathymetric data, and height of tides. The CATZOC input or alternative source used should be identified within the plan.
- If an appropriate safety contour is not available on the ENC, a manual alarmable contour should be drawn as a manual layer on the ENC that should always be selected and displayed during the passage. There are two methods of achieving this (as described in Scenario B) and it is crucial that the company SMS clearly defines the preferred method, highlighting appropriate mitigations under its ECDIS navigation procedures.

**Depth contour shading: two-shade versus four-shade**

It is possible to select either two-shade or four-shade depth contours based on operator settings.

When two-shade depth contours are selected, the display will appear as either:

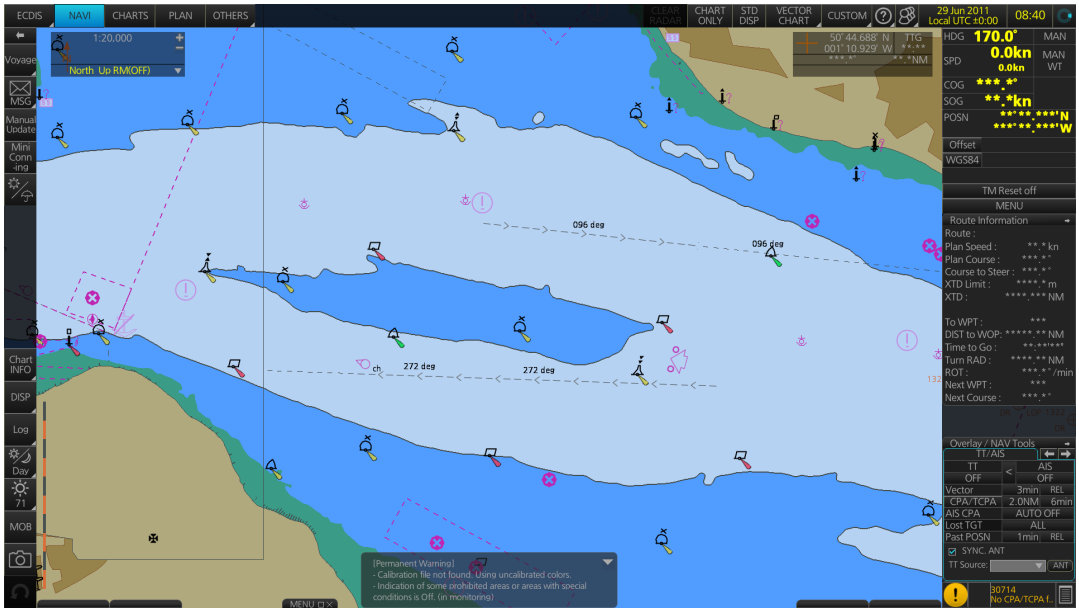
- Blue: inside the safety contour (as per safety contour setting), or
- White: outside the safety contour.

When four-shade depth contours are selected, the display will appear as one of the following colours:

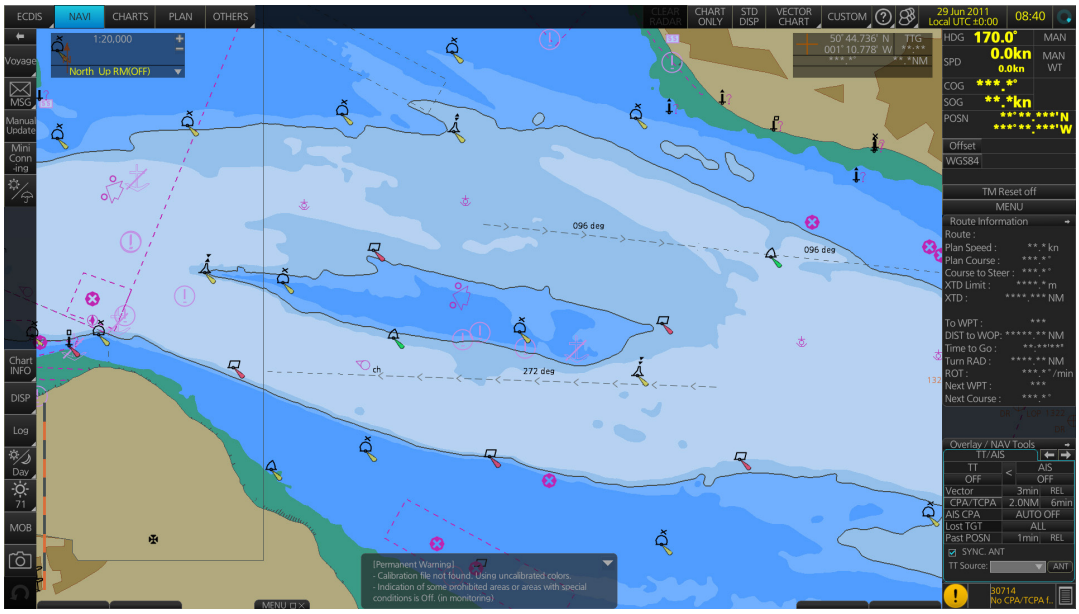
- Dark blue: inside the shallow contour.
- Light blue: inside the safety contour, between safety contour and shallow contour.
- Grey: outside the safety contour, between safety contour and deep-water contour.
- White: outside the deep-water contour.

When four-shade depth contours are selected, entries are made for shallow and deep-water contours, as well as for safety contour.

Using the day, dusk or night preset display settings might affect Navigation Officers' perception of colours, and might make it hard to distinguish between white, grey, light blue and dark blue.




*a) ENC displays using two-shade depth contours*




*b) ENC displays using four-shade depth contours*

**Figure 4.7:** *Comparison of ENC displays using two-shade (a) and four-shade (b) depth contours*

### 4.2.6 Safety corridor/cross-track corridor

Appropriate margins of safety, and therefore XTC, must be set for each leg of the passage, to make full use of ECDIS safety settings. Once set, XTC helps to identify hazards along a planned passage. Choosing the XTC setting should take various factors into account, including available sea-room on either side of the intended track, environmental conditions, possible deviations along the route, and expected collision avoidance situations.

Upon route validation, XTC will be scanned by the system based on safety settings to highlight any alarms, cautions or indications that need to be acted upon.

The set XTC values are of critical importance. If these values are too small, and if the vessel needs to deviate from its route, dangers near the route but outside the XTC will not be highlighted. If these values are too large, a substantial number of alerts might be generated.

**Recommendations**

- The ship operator should include considerations for defining the XTC in the SMS for various sea areas, such as pilotage waters, confined waters, coastal waters and open waters, for each leg of the voyage.
- Masters and Bridge Officers should interrogate ENC features within the planned XTC during the appraisal and planning stages of each voyage.
- Additional information lying within the XTC such as from T&P notices, Navigational/NAVTEX warnings or other relevant information should be plotted as a manual layer and made alarmable (as applicable).
- Within confined waters, the XTC should ideally be wide enough to cover the maximum width of available water for safe navigation, so the vessel can navigate within the XTC with confidence and without needing to exit the validated corridor.
- The XTC's maximum width for open waters should be identified in the company SMS. If a vessel is expected to leave the originally defined corridor, all layers should be switched on to highlight any information that may be useful to the Navigating Officers.
- Navigating Officers should call the Master if the vessel needs to exit the XTC.

### 4.2.7 Wheel-over positions and critical points

Wheel-over positions within ECDIS indicate upcoming alterations based on the vessel's radius of turn and speed at the respective leg. Similarly, critical points can be used along the route to highlight where the bridge team needs to be more alert, such as when entering confined waters, mandatory reporting points or abort points.

When using manual steering, some systems do not give an alarm at wheel-over points. In this case, a critical point could be used to give warning of an approaching wheel-over point.

**Recommendations**

- Navigating Officers should set wheel-over positions and critical points for various legs in the passage according to their company SMS.
- The company SMS should include requirements for setting wheel-over positions and critical points in the navigational manual.

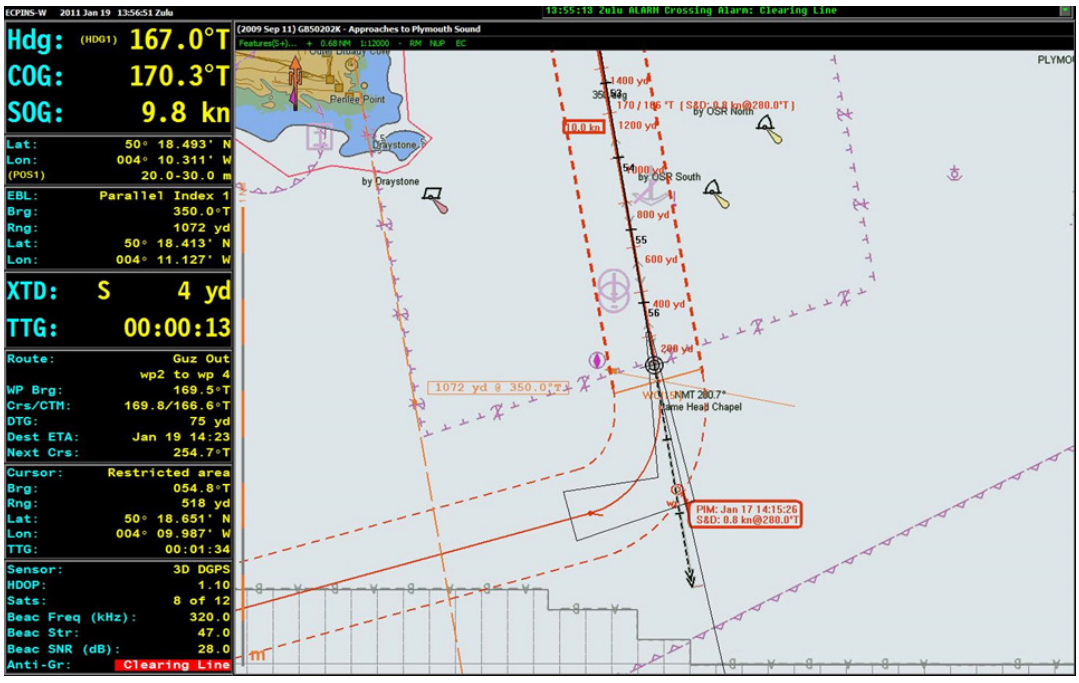



**Figure 4.8:** *Example of ENC indicating XTC and wheel-over position*

### 4.2.8 Look-ahead zone

The look-ahead zone, also referred to as the safety frame, anti-grounding cone or look-ahead time, angle or width, needs to be set correctly, taking into account factors that include vessel speed, proximity to navigational hazards, available sea-room, traffic concentration, geographical limitations and manoeuvrability. Correctly setting the look-ahead zone and associated alarms enables the system to generate warnings or alarms in case of navigational hazards.

This feature does not provide alarms for radars, ARPA, AIS targets or for navigational hazards on Raster Navigational Charts (RNCs).

**Recommendations**

- The parameters for the look-ahead zone should be planned so that the size of the zone is appropriate for the vessel's speed and manoeuvring characteristics. They should be set for each leg of the passage and should consider conditions such as proceeding from ocean to coastal waters, pilotage areas or speed.
- The look-ahead zone should be reassessed in CATZOC areas that have reduced position accuracy (such as B, C, D, U) to ensure the vessel has a sufficient safety margin. See *S-4 Regulations of the IHO for International (INT) Charts and Chart Specifications of the IHO*, where the CATZOC table and reference are indicated on pages 110 and 111.
- The look-ahead zone should be highlighted on the display.

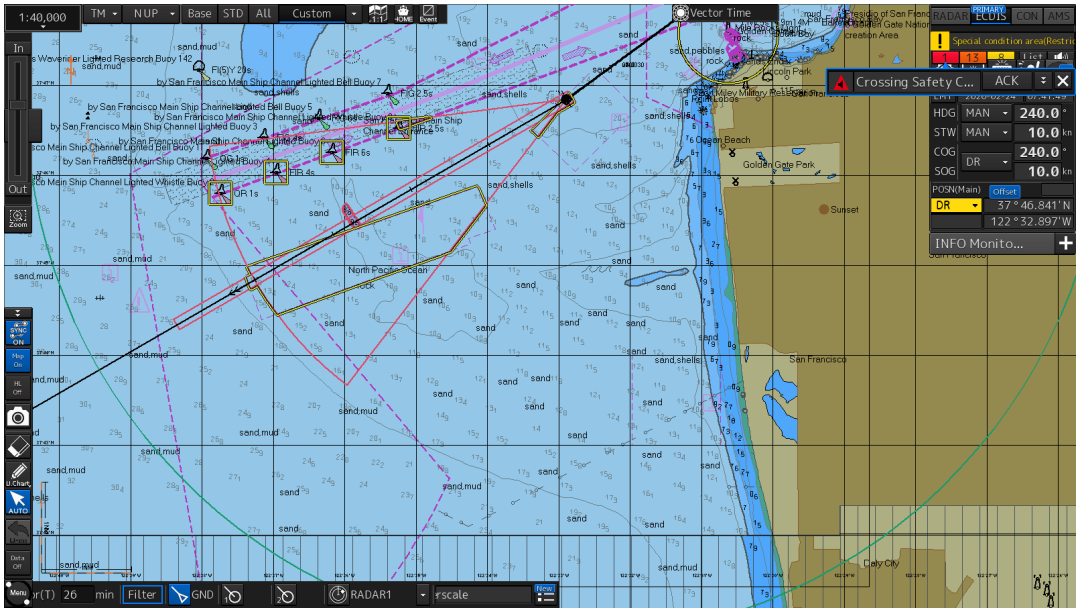



**Figure 4.9:** *Example of an ENC indicating the look-ahead zone*

## 4.3 Route validation

Route validation involves the following stages:

- Visual checks.
- Manual and auto-validation features.
- Cross-checks by the bridge team.
- Final validation and authorisation by the Master.
- Re-validation along the route.

### 4.3.1 Recommendations

- Route validation should be conducted before every voyage.
- Route validation should be conducted by at least the Navigating Officer and the Master, using both visual checks and route validation functions within ECDIS.

- Alarms, cautions and indications should be appropriately checked and actioned. Those that cannot be resolved and that affect the passage plan should be discussed with the Master.
- The route validation procedure should be defined in the company SMS.
- The Master should only authorise the plan once all stages of visual checks and route validation have been completed.
- The company SMS should define the procedure for recording the Navigating Officer's route validation and the Master's passage plan authorisation.
- Route re-validation should be undertaken by the Navigating Officer after any subsequent route changes, ENC updates, software/hardware, navigational warning changes. Once complete the Master should check and then re-authorise the plan.
- The company SMS should include the procedure for post-voyage review, so that any hazards or useful information discovered can be incorporated into future passage plans.

## 4.4 Route execution and monitoring

Route execution and monitoring stages occur after the passage plan has been finalised and after the route validation stage is complete, including the latest supplementary information, before passage begins. This involves configuring all ECDIS, including displays, safety contour and safety depth settings and look-ahead zones, uploading manual layers, and managing overlays, according to the authorised passage plan.

### 4.4.1 Recommendations

- Each leg on the passage should be reviewed automatically, visually and manually using the largest scale ENC at the compilation scale. The auto-validation feature has been known to omit hazards along the planned passage, which have been picked up through diligent route checking by the Bridge Officers or Master.
- A bridge team meeting should be held to review the passage plan before departure and commencement of the route.
- The company SMS should include a protocol for naming and identifying saved routes to avoid selecting an incorrect route. This could include using voyage numbers, port names (such as Dover to Gibraltar), or the terms laden/ballast.
- Navigating Officers should ensure that the appropriate route is selected and displayed before starting the voyage.
- The correct minimum layers, according to the company SMS, should be displayed.
- ECDIS safety settings should be verified against the passage plan for safety depth, safety contour (or the manual alarmable no-go line, if applicable) and look-ahead zones, and set appropriately so the anti-grounding alarm feature is appropriately configured.
- Mariners' Notes (manual layers) should be selected and displayed. These may include navigational warnings, T&P notices, local notices to mariners and explanatory notes pertinent to the route.
- Any changes to the ECDIS safety settings initially planned can introduce additional risks. ECDIS safety settings should not be changed without express approval by the Master. Amendments to the passage plan should be officially documented and specific changes recorded on the passage plan form, according to the company SMS.
- Before taking over a navigational watch, the incoming officer should positively confirm the ECDIS configuration against the passage plan requirements. The outgoing officer should highlight any changes to the ECDIS configuration outside the passage plan parameters.
- The company SMS should detail the procedure for recording and saving ECDIS voyage data, from the beginning to the end of the voyage.
- ECDIS should be backed up to ensure that latest data, such as planned routes, navigational warnings, manual ENC layers or other relevant information, are saved and can be retrieved when required, such as after an incident or for proactive navigational assessments and audits.

- A post-voyage review should be undertaken to record experience and knowledge gained, such as areas of high traffic concentrations or the effectiveness of the planned route including the safety corridor, look-ahead zones or manual layers.

### 4.4.2 Position verification and monitoring

It is critical that the navigator is constantly aware of the vessel's position and its accuracy. The Global Navigation Satellite System (GNSS) is the standard source of position data for ECDIS, but navigators must always be aware of its limitations. The vessel's position on ECDIS can be verified using a combination of techniques that include:

- Radar Image Overlay (RIO).
- Visual or radar bearings.
- Radar range and bearings.
- Parallel indexing.
- Celestial observations.
- Depth comparison using an echo sounder.

Parallel indexing and RIO are a quick and effective way to monitor the vessel's position relative to the planned route in coastal and pilotage waters. RIO is beneficial when cross-checking GNSS positions, because any misalignment between the radar image on ECDIS and the charted coastline on ECDIS can give an early indication of position accuracy.

Traditional methods of position fixing, such as radar or visual fixes, can also provide precise position comparisons to supplement RIO and parallel indexing, and can be useful to cross-check the vessel's position on ECDIS.

**Recommendations**

- The company SMS should define the frequency of, and preferred methods for, position verification while using ECDIS.
- A combination of techniques should be used, including RIO, radar/visual fixes, parallel indexing and celestial navigation, as per the company SMS.
- Regular and frequent position verification should help to safeguard against GNSS errors, as well as jamming and spoofing.
- Parallel indexing should be used on radar as opposed to the ECDIS.
- Masters and Bridge Officers should be aware that hardware or software used discrepancies might arise on an ECDIS, and they should use traditional position-fixing and navigational techniques to cross-check navigational information.

### 4.4.3 Settings during passage

Radar and AIS overlays are features that aid situational awareness. However, using these features may lead to error-enforcing conditions that navigators should be aware of.

Inherent errors related to radar, such as horizontal beam width distortion, heading deflection, improper acquisition of shore lines caused by the nature of the coastline, or environmental conditions could limit the use of radar overlays on ECDIS.

AIS information is not always accurate or complete, because other vessels might switch off AIS or transmit inaccurate AIS data. AIS information can be used to enhance situational awareness of traffic around the vessel. However, there have been many instances in which using AIS data alone to assess the risk of collision has resulted in catastrophic incidents.

**Recommendations**

- Radar overlays should not be kept on continuously as they can over-clutter the ECDIS monitor, obscure critical ENC information and in some cases also slow down the ECDIS refresh rate.
- The overlay information should be managed so that it does not cause over-cluster or obscure the ENC Information.
- AIS information overlaid on ECDIS should be used as an identification tool and not as a collision avoidance tool.

- Navigating Officers should use radar and ARPA for assessing the risk of collision and for taking avoiding actions.

# 5 Alarm management

For Navigating Officers and the bridge team, proper alarm management on ECDIS is very important. Alarm functionality can vary from one maker to another. Some ECDIS systems allow the operator to disable alarm sounds, thus downgrading alarms to a visual indication only.

According to the IMO resolution A.1021(26) *Code of Alerts and Indicators, 2009,* alerts and indicators are defined as follows:

*Alerts announce abnormal situations and conditions requiring attention. Alerts are divided in four priorities: emergency alarms, alarms, warnings and cautions.*

- ***Emergency Alarm.*** *The highest level of an alert as it signifies immediate danger and that immediate action should be taken.*
- ***Alarm.*** *An alarm is a high priority of an alert. Condition requiring immediate attention and action, to maintain the safe navigation and operation of the ship*
- ***Warning.*** *Condition requiring no immediate attention or action. Warnings are presented for precautionary reasons to bring awareness of changed conditions which are not immediately hazardous but may become so if no action is taken.*
- ***Caution.*** *Lowest priority of an alert. Awareness of a condition which does not warrant an alarm or warning condition, but still requires attention out of the ordinary consideration of the situation or of given information.*

*Additionally, an indicator is defined as a visual indication giving information about the condition of a system or equipment.*

Appendix 5 of resolution MSC.232(82) *Revised Performance Standards for ECDIS* provides requirements for mandatory alarms and/or indicators.

## 5.1 Setting alarms

During the route validation stage of the passage plan, alarms assist the Navigating Officer in checking that there are no dangers on the route. While at sea, alarms monitoring the passage plan assist the Bridge Officer by ensuring they are aware of new or unexpected hazards or dangers.

## 5.2 Alarm fatigue

Alarm fatigue occurs when Masters and officers are unable to tell the difference between categories of alarms and constantly have to respond to minor cautions in the same way that they responded to critical alarms.

To prevent alarm fatigue, the IMO introduced MSC.302(87), page 4, which mentions that the bridge team should be made aware of the alert situation, be able to identify it, assess the urgency of the alert(s), deal with the alert announcements in a consistent manner, and there should not be more than one alert for each situation. The method of display, silencing and acknowledging the alerts should be consistent across the bridge.

## 5.3 Alarm normalisation

Alarm normalisation occurs when Masters and Bridge Officers get into the habit of silencing alarms, warnings, cautions or indicators without checking what is causing the alert in the first place.

## 5.4 Recommendations

- Alarm-setting parameters should be agreed by the Master and Bridge team at the passage planning stage and captured in the relevant passage plan form.
- The criteria for setting alarms, warnings and cautions should be decided on board the vessel in accordance with the company SMS procedures for various navigational conditions.
- The alarms should be set to assist the Master and officers in maintaining their awareness and understanding of potential dangers to the vessel in a manner that reduces alarm fatigue.
- Once the alarm settings are determined, this should be clearly communicated to all navigating officers.
- Alarms should not be physically or routinely disabled.
- If an alarm has to be disabled for any reason, this should be recorded on a formal tracking form to be handed over to subsequent watches and approved by the Master.
- Before acknowledging the alarm, Masters and Officers should always understand and confirm the type of the alarm. The habit of acknowledging alarms for the purpose of eliminating noise and disturbance shall be avoided. The bridge team should review the alarm log on a regular basis to make sure that critical alarms have not been inadvertently overlooked.


**Figure 5.1:** *Example of icon legend for ECDIS alerts*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