LP Focus

The London P&I Club

Is your ECDIS contributing to safe navigation or introducing risk?

Numerous groundings and near misses have occurred on ECDIS-equipped ships that could have been avoided but for failures in the setup and use of ECDIS. Like most of the world's merchant fleet trading internationally, your ship(s) is most likely equipped with an Electronic Chart System (ECS) or Electronic Chart Display and Information System (ECDIS). Maybe it is fully compliant with the IMO requirements for an ECDIS and therefore the primary means of navigation, or perhaps you are still transitioning towards an approved system.

The primary function of ECDIS is to enhance the safety of navigation, but experience is showing that installation and approval alone are not enough to achieve this goal. Comprehensive training, including type-specific familiarisation, and updated Safety Management System (SMS) procedures are essential to ensure safe ECDIS use without introducing new risk. Furthermore, Port State Control Authorities have reported an increase in deficiencies concerning ECDIS use following Concentrated Inspection Campaigns (CIC) on safe navigation. The age of e-Navigation[1] is firmly upon us and the transition to electronic-based navigation is a fundamental shift away from the not-so-distant past where azimuth sights, sextants, and parallel rulers were the indispensable tools of every navigator.

[1] E-navigation is defined by the IMO as "the harmonized collection, integration, exchange, presentation and analysis of marine information on board and ashore by electronic means to enhance berth to berth navigation and related services for safety and security at sea and protection of the marine environment."

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A base ENC with limited chart information compared to the unfiltered chart of the same channel and location. Over-use or improper use of filters and contours may result in ambiguous displays of soundings and potentially dangerous interpretations.
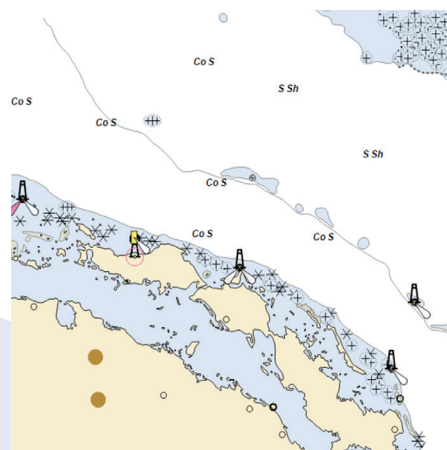
BASE ENC
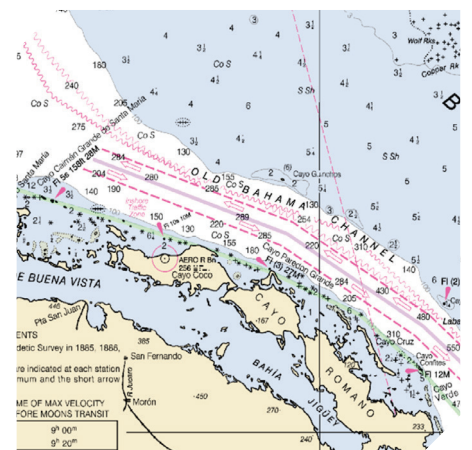
UNFILTERED ENC

Implementation recap

By now, it should be common knowledge that amendments to Safety of Life at Sea (SOLAS) Chapter V "Safety of Navigation" entered into force on 1 January 2011 and included significant changes to the chart-carriage requirements. Since then, the SOLAS-mandated carriage of ECDIS has been on a rolling timetable since July 2012, with more ships undergoing surveys to verify conformance with the regulations no later than their first survey following the implementation date for its ship type and size.

The UKHO reported in 2017 that almost three-quarters of cargo ships over 20,000 gt were ECDIS-ready – this in addition to tankers and passenger ships which were among the first required to carry ECDIS. In July 2018, the regulation extends to all existing cargo ships over 10,000 gt and will complete the implementation timetable.

One observation in recent years is the common misconception among ships' masters and deck officers (particularly on ships currently without ECDIS) that compliance with the carriage requirements necessitates a dual-redundant ECDIS system be fitted – that is, two independent type-approved ECDIS units to allow the ship to sail paperless. This, however, is not the case, and a ship required to be fitted with ECDIS needs only a single unit if a backup paper chart folio is carried. The backup system must of course be kept up to date.

Whether a single or dual ECDIS system is carried, the importance that shipowners and operators go beyond the initial survey approval and continue to actively manage the changeover is imperative. Doing so requires thorough assessment of risk, identification of hazards, and corresponding mitigation measures. This is true for both the human element as well as hardware and software.

Risk factors

Everything a ship's officer can do on a paper chart must be feasible on an ECDIS device; i.e. a functional equivalent. This includes the most basic of navigation tasks such as manually plotting the ship's position by range and bearing; thorough passage planning, including voyage notes and callouts; marking of no-go areas; applying manual chart corrections ... and so on. The reality is, ECDIS can do all this and a whole lot more.
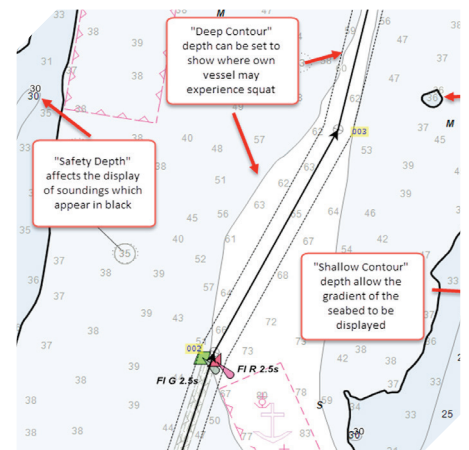
Modern ECDIS systems are now so functional that inadvertent actions or settings may be applied, which can then go unnoticed. Safety contour and safety depth functions, for instance, may be misused rendering the alarm meaningless.[2] Display settings may reduce the visibility of essential information from the screen as previously shown.

Position data and/or reference points may have unwanted offsets – for instance, when was the last time the CCRP (Consistent Common Reference Point) settings were checked? Are they correct for multiple antennas and radar systems? Are the CCRP settings locked and password protected against accidental meddling?

[2] The Safety Contour Depth should normally be set to the "Vessel Safety Draft," which is commonly calculated as: Vessel Safety Draft = Vessel Draft + Dynamic Squat + Safety Margin. The Safety Contour marks the boundary between "safe-water" and shallow water and can be set to give an alarm if the ship is approaching the contour.
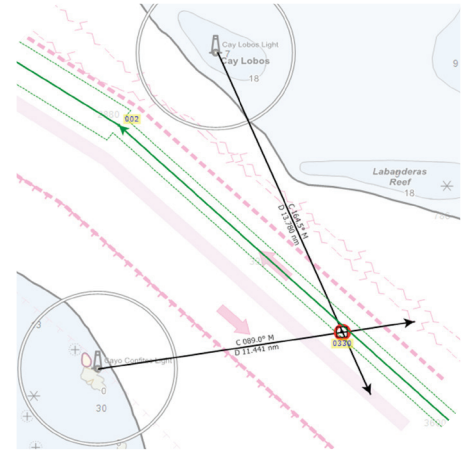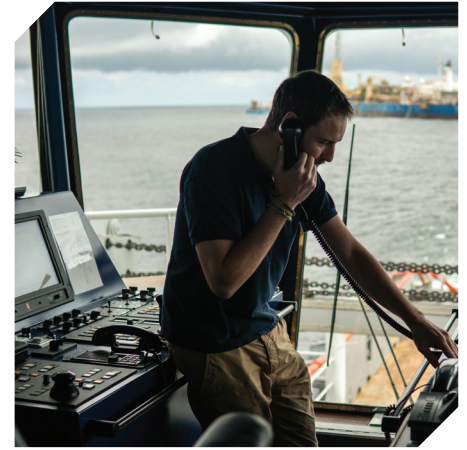

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Manual position plotting can be done quickly and easily on an ECDIS, but it is critical that officers familiarise and regularly practise this function. GPS positions should be cross-referenced using visual/radar range and bearings.
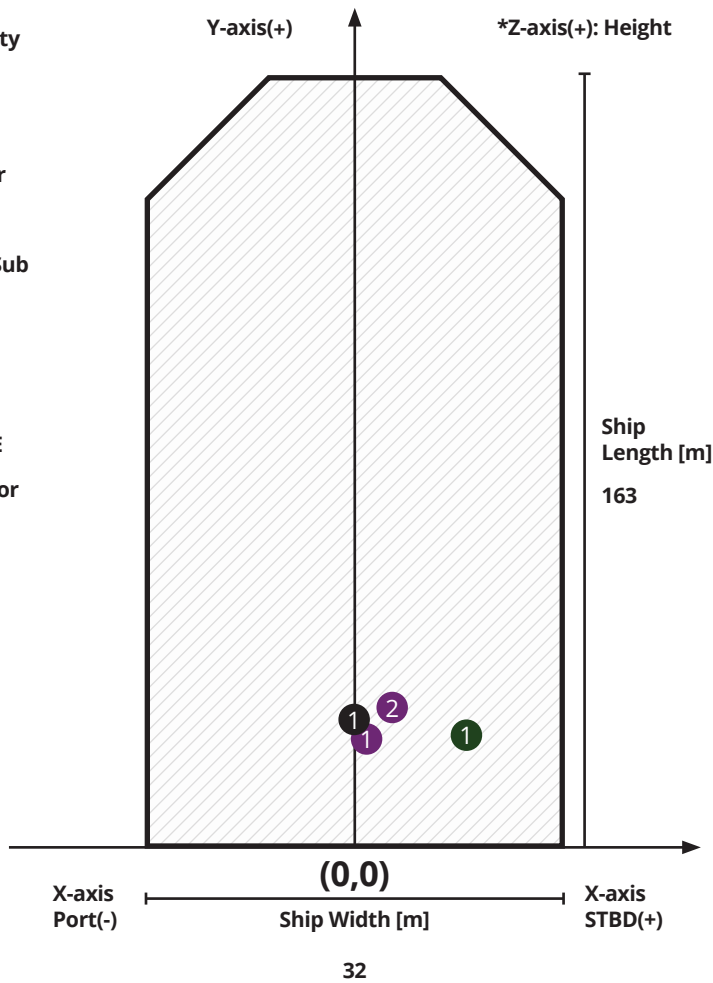

"Deep Contour" depth can be set to show where own vessel may experience squat

"Safety Depth" affects the display of soundings which appear in black

"Shallow Contour" depth allow the gradient of the seabed to be displayed

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Safety contour and safety depth settings can drastically affect the display and when alarms are given.

G	Gravity
P	Pivot
●	CCRP
●	Radar
▲	RCB
▼	RCB Sub
●	GPS
●	AIS
●	Echo
●	SDME
●	Anchor

Y-axis(+)

*Z-axis(+): Height

Ship Length [m]

163

(0,0)

X-axis Port(-)

Ship Width [m]

X-axis STBD(+)

32

These are just a few of the unwelcome risks that may be introduced unintentionally if navigators are not properly trained and instructed in the correct use of the systems fitted aboard their ships. The following list of questions should be chief among those asked by shipowners, operators, ships' masters and crew:

1. Are safe and efficient operating procedures in place that include the use of ECDIS as a primary navigation aid?

2. Have departure/arrival/watch handover/passage planning checklists been updated to include ECDIS?

3. Do blackout procedures consider ECDIS?

4. Are new crew consistently checked to verify that formal type-specific training has been completed?

5. Is on-board ship-specific training accounted for?

6. Do ISM audits include ECDIS operation and training needs?

7. Are checks carried out to ensure up-to-date ENCs and RNCs are maintained?

8. Are the limitations, sensors, and risk of improper functioning/data inaccuracy clearly understood?

Common operational mistakes

When properly operated, ECDIS is an exceptional tool that drastically improves situational awareness and operational efficiency, and can reduce errors. On the other hand, over-reliance or lack of familiarity can lead to calamitous consequences. The term "ECDIS assisted Grounding" has not arisen from nowhere, and based on our experience, recurrent themes often include the following:

Improper use of charts: i.e. not using or having the necessary charts for the intended voyage or not applying chart updates frequently and correctly.

Not following or being aware of the manufacturer's software maintenance updates and not updating the ECDIS to be compatible with the latest version of the IHO Standards.

Improper use of safety settings and built-in safeguards such as route checking and safety alarms related to depths.

Improper display settings, filters and scale.

Not using the route checking function at all or not using it with an appropriate Cross Track Distance (XTD). Not visually checking the route at an appropriate scale.

Lack of familiarity with the specific ECDIS type onboard.

Over-reliance on ECDIS and the displayed GPS position.

Inability to use or lack of familiarity with manual position fixing functions such as range and bearings.

Handover between deck officers including ECDIS-related information.
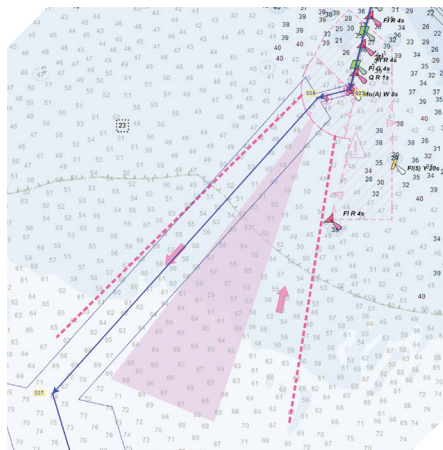
When Cross Track Distances are properly set to each leg of a voyage plan then route checking assists in checking for potential obstructions, dangers and insufficient depths.

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Beyond approval

When fitted, ECDIS must be type-approved, conform to the relevant IMO performance standards[3], connect to an emergency source of electrical power, and have at least gyrocompass, speed log and GPS receiver inputs. The system must have up-to-date Electronic Nautical Charts (ENC), or Raster Navigation Charts (RNC) where ENCs are not available or of an appropriate scale. All nautical charts for the intended voyage(s) must be installed and maintained to be compatible with the latest applicable International Hydrographic Organization (IHO) chart content and display standards. Backup arrangements must be available, which can be either a secondary type-approved ECDIS or official, up-to-date paper charts.

Beyond the aforesaid general requirements of a SOLAS-compliant ECDIS, shipowners and operators are encouraged to undertake regular risk assessments of ECDIS navigation, including potential over-reliance of the system and improper use of the safety settings.

Periodic evaluation and training of the master and deck officers should highlight the limitations and possible inaccuracies of the ECDIS and its sensors. The need for a proper lookout at all times and by all available means should be emphasised, as well as independent checking of the ship's position outside of the ECDIS-displayed GPS position. ECDIS is only one of many navigation tools available to the modern navigator, but the dangers of over-reliance are becoming an all too common theme.

For further information on some of the topics discussed here, I recommend the IMO circular: ECDIS – Guidance for Good Practice (MSC.1/Circ.1503/Rev.1).

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[3] IMO resolution A.817(19), as amended or resolution MSC.232(82), depending on the date of installation.

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