



Navigation officer performing position verification

Navigation Safety: Using Electronic Chart Display and Information Systems

An Electronic Chart Display and Information System (ECDIS) is a computer-based navigation system that complies with IMO regulations. It is an IMO carriage requirement for most ships on international voyages and is widely used as an alternative to paper navigation charts. All ECDIS units on board must be approved by the ship's Flag administration. ECDIS is intended to support safe navigation, however grounding incidents have occurred in which the poor use of ECDIS has been identified as contributory factors.

In addition to the risk to the safety of crew and ship, navigation-related incidents such as groundings pose the risk of harm to sensitive marine environments¹. Environmental damage is likely to result in significant clean-up costs and penalties, as well as irretrievable reputational loss. Some of the safety issues associated

with groundings and collisions have been related to inadequate passage planning, position finding and communications. Some of these are linked to inadequate training in navigation practices and supporting safety systems¹. Companies have a primary role to play in ensuring crew are appropriately trained, familiar and have supporting and adequate systems in place in the use of ECDIS for safe navigation.

A recent review of the usability and applicability of ECDIS by the UK's Marine Accident Investigation Branch & the Danish Maritime Accident Investigation Board concluded that, from a user perspective, ECDIS does contribute to safe navigation. However, the challenges that have accompanied its introduction remain problematic². This bulletin explores practical ways to address these issues to improve navigation safety.

In this issue, we focus on navigation safety, in particular issues associated with the use of Electronic Chart Display and Information Systems (ECDIS).





Case study 1 — MV Kaami – Little Minch, Scotland.

At 0141 local time on 23 March 2020, the general cargo ship Kaami ran aground on to rocks in the Little Minch on the west coast of Scotland, causing significant hull damage³.



The MV Kaami aground (MAIB)

The investigation report identified that:

- the mandatory generic and type specific training for the ECDIS were found to be inadequate for crew to perform their functions safely.
- the on-board operation did not allow adequate opportunity for the voyage plan to be checked and verified by a second member of the bridge team.
- the safety management system did not provide adequate safeguards

for voyage planning and ECDIS use, and the ship operator's internal auditing program did not identify shortfalls in practice.

While there were no injuries and environmental impact was minimised, the damage to Kaami's hull was extensive and the ship was declared a constructive total loss.

Case study 2— Kea Trader – New Caledonia.

At 0055 local time on 12 July 2017, the Maltese registered container ship Kea Trader ran aground off the coast of New Caledonia⁴.

Prior to the grounding, a minor change to the voyage plan was authorised, resulting in the track passing over an isolated danger. The danger symbol appeared outside of the charted track due to zooming-in and possibly over-scaling the ECDIS display. This led the crew to incorrectly assume the track was safe.

The incident investigation determined that:

- No independent route check was conducted, nor was the plan signed off by the master.



MV Kea Trader, aground with fractured hull (Maritime Cyprus)

- No warnings or reference to the isolated danger were documented or discussed in bridge team briefings.
- The ECDIS route check function had not been enabled.
- The audible alarm was muted during the ship's voyage.

None of the watchkeepers were aware of the actual safety settings on the ECDIS, despite the completion of bridge equipment familiarisation forms. The 'caution area' messages repeatedly displayed in the subsequent navigational watches were largely overlooked by the bridge team.

During the salvage attempt, a structural fault resulted in the hull fracturing in heavy seas. The ship was declared a constructive total loss.

AMSA incident and inspection data

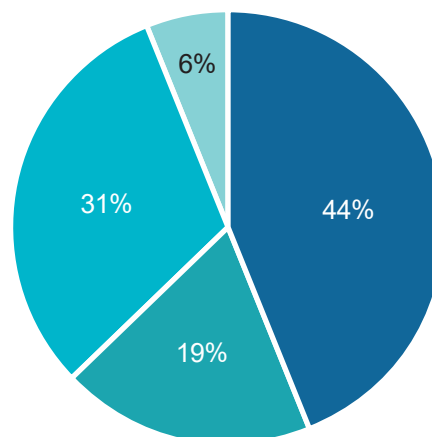
AMSA recorded 11 reported grounding incidents involving regulated Australian vessels between 2016 and 2020, that were due to navigational issues. Some of the issues identified within these incidents are shown in the chart.

6% - operating on non-approved software (ECDIS), 1

44% - Inadequate passage planning, 7

19% - Poor watchkeeping, 3

31% - Poor navigational practices, 5



Grounding incidents related to navigational issues

AMSA inspection data from 2018 through to 2020 shows that 13 percent (746 out of 5663) of all deficiencies were related to navigation shortfalls. Additionally, 5 percent (23 out of 502) of all ship detentions for this period were due to ECDIS related deficiencies. These detentions were all related to safety management system shortfalls associated with officers' being unfamiliar with ECDIS operations, which also suggests issues in terms of effective training. The likelihood of navigation-related issues leading to potentially catastrophic consequences means that improving navigation safety is a key priority.



Strategies for safe navigation

The following are practical strategies for improving navigation safety, with a focus on the appropriate use of ECDIS.

Familiarisation of ECDIS

The company should ensure appropriate re-familiarisation training is provided to the bridge team on the operation and functions of the ECDIS and other navigational equipment when joining the ship - even if they are returning to the same ship.

The Nautical Institute has developed a useful checklist on ECDIS familiarisation -

<https://www.nautinst.org/uploads/assets/uploaded/d644ad96-c4ac-4ecc-8fda9f15fef17a7f.pdf>

Voyage planning

Appropriate procedures should be in place for the bridge team to ensure safe navigation.

Where ECDIS is used to plan a voyage:

- the voyage plan should be validated by the route-checking function, using applicable safety parameters, as well as a visual check of the intended tracks using the most appropriate scale for viewing.

- electronic navigational charts (ENCs) must not be over-scaled. Over-scaled ENCs will show a 'jail bar' pattern across them and/or display an over-scaled warning notice.
- appropriate procedures should be in place for alarms settings. Although it is important to set alarms to avoid information overload, it is even more important to understand these alarms before being disabled.

The voyage plan must be available for immediate use on primary and back-up navigation systems.

Use of Cross Track Limits and look-ahead functions

Cross Track Limits - is a vital tool which must be used correctly when planning and executing any voyage plan. Appropriate procedures should be in place to ensure crew are familiar with the cross track limits function. The cross track limits function provides an extra layer of defence for safe navigation and should vary for each leg of the voyage, depending on the proximity of navigational hazards. Cross track limits should be wide enough to provide flexibility for the OOW to conduct collision avoidance manoeuvres in all conditions.

Look ahead function

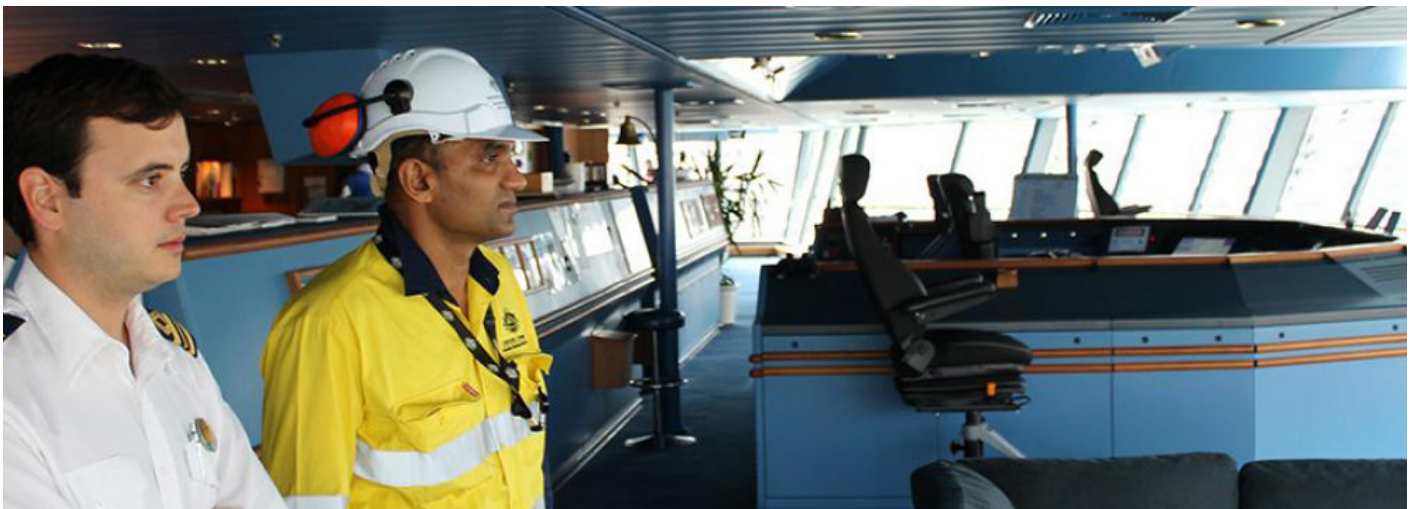
When set properly, the look ahead function will scan the chart ahead of the ship and provide warning of hazards to navigation. Appropriate procedures should ensure the look ahead function is set up to achieve a balance of avoiding too many alarms while allowing enough time for the navigator to manoeuvre the ship to safety.

Position verification

MSC.1/Circ. 1503 ECDIS – Guidance for Good Practice highlights that knowing the limitations of the equipment and identifying misrepresentation of information is essential for the safe use of ECDIS. The circular recommends verification through:

- Comparison of chart data and radar picture
- Checking the own ship's position by using other independent position-fixing systems
- The safety management system (SMS) should include procedures for the bridge team to verify the ship's position using alternate means.

AMSA staff member on the bridge with navigation officer (AMSA).





Conclusion

Navigation safety depends upon an effective SMS. A well implemented SMS is critical for managing training and familiarisation with the ship's navigation equipment such as ECDIS. This will address issues of misjudgement and overconfidence with using ECDIS, as well as technical training, inexperience and misuse¹. Lack of knowledge regarding the implications of ship specific ECDIS functionality can result in loss of situational awareness⁵. The consequences of this lack of understanding of what's going on, why and what's going to happen impedes decision making during navigation and can be catastrophic.

The SMS will also identify and address shortfalls in procedures such as voyage planning and position verification. An effective SMS should

ensure adequate opportunity for navigation officers to plan the voyage and for this plan to be checked and verified by a second member of the bridge team. It also should ensure navigation officers and watchkeepers are sufficiently free from fatigue to attend to the critical role of navigation safety.

The transition to ECDIS has come with challenges in maritime. ECDIS continues to be viewed in the same way as a standardised and automated paper chart, rather than as a technology that can contextualise information from various sources and in support of safe navigation. Therefore, going forward, different types of training (rather than generic type training and familiarisation), procedures and future human centred design work is required².

References

- ¹ Sánchez-Beaskoetxea, J., Basterretxea-Iribar, I., Sotés, I. (2021) "Human error in marine accidents: Is the crew normally to blame?" Maritime Transport Research, Vol. 2, 100016.
- ² UK MAIB/DMAIB (in press) Application and usability of ECDIS: A MAIB and DMAIB collaborative study on ECDIS use from the perspective of practitioners.
- ³ MAIB (2021) Report on the investigation of the grounding of the general cargo vessel Kaami on 23 March 2020. 7/2021, June.
- ⁴ Transport Malta (2018) Safety investigation into the grounding of the Maltese registered container ship Kea Trader on 12 July 2017. No. 14/2018.
- ⁵ Grech, M.R., Lutzhoft, M. (2016) "Challenges and opportunities in user centric shipping: developing a human centred design approach for navigation systems" OzCHI '16: Proceedings of the 28th Australian Conference on Computer-Human Interaction.

Companies must ensure adequate familiarisation and training continue to be provided for their crew to know their ECDIS, understand how the safety functions work, and always know what safety settings have been used to ensure the safe navigation of their ship.

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**TEN WAYS
TO LOOK AFTER
YOUR MENTAL
HEALTH AT SEA
AND HOME**

- 1 Share your problems
- 2 Eat healthily
- 3 Stay in touch
- 4 Learn to be comfortable in your own skin
- 5 Keep fit
- 6 Have a rest
- 7 Watch your alcohol intake
- 8 Ask for help
- 9 Do something you enjoy
- 10 Look out for others

