

# NAVIGATOR

THE

Inspiring professionalism in marine navigators

# ECDIS

*The future of navigation*



A free publication by **The Nautical Institute** in association with the **Royal Institute of Navigation**



## ECDIS explained

ECDIS is the future basis of navigation in the world's merchant fleet. It is essential that navigators of all ages and experience learn how to use ECDIS to make the best decisions possible.

Many ships today carry both paper charts and electronic charts. It is essential for navigators to recognise the difference between a generic (and unofficial) Electronic Chart System (ECS) and an Electronic Chart Display and Information System (ECDIS), which has been approved by the IMO as meeting the requirement of 'charts' as required by SOLAS. An official ECDIS consists of a type approved system, using official hydrographic data (chart info), and the entire installation must be approved by the vessel's Flag Administration. Crews using non-ECDIS systems for navigation will not fare well in court, should something go wrong.

New navigators just entering the shipping industry may adapt quickly to the use of ECDIS given their familiarity with computers and shore-based map services such as GoogleMaps. However, all navigators, regardless of their backgrounds, will have to adopt a professional ECDIS mindset to enable them to use the technology effectively. During this transition period, it's essential to understand the strengths and weaknesses of ECDIS. This presents an opportunity for navigators of all experience to work together to master the system.

One of the key differences between paper charts and electronic charts is how information is portrayed. With paper charts, cartographers decided how to show the information they felt navigators needed. However with electronic (vector) charts, all data/information is stored in a database, and it is the actions and decisions of the

mariner that decide what and how much information to show. This new ability to customise the chart display offers great possibilities if used correctly, as well as huge risk if used incorrectly.

As an experienced driver renting a car, you would expect to only need a short period of time to familiarise yourself with the controls and drive away safely. Unfortunately, ECDIS doesn't have the same level of standardisation, so it is even more important to have a sound basis of 'generic training' (IMO model course 1.27) and to be able to demonstrate full competence of familiarisation with onboard systems, based upon industry agreed standards, before you can 'drive away safely'.

The Nautical Institute has worked with its members and other industry stakeholders for years to identify critical ECDIS issues. Some guidance is contained in the books that we sell, but much more is available free to all users. For more information and resources visit [www.nautinst.org/ecdis](http://www.nautinst.org/ecdis).

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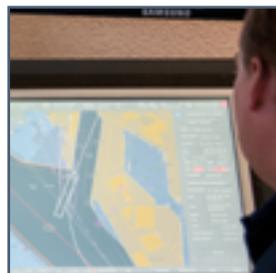
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If you would like to send us your response, comments or ideas about anything in this issue, or the next, please contact the editor at [navigator@nautinst.org](mailto:navigator@nautinst.org)

In the last edition of *The Navigator*, we looked at the topic of positioning. Now, we turn our attention to ECDIS and ask what the change from paper charts to more modern technology means in real terms for today's navigators.

We are always interested in hearing your views on the important topics discussed in this publication. If you would like to send us your response, comments or ideas, please contact the editor, Emma Ward at [navigator@nautinst.org](mailto:navigator@nautinst.org), or look out for the LinkedIn discussion. We look forward to hearing from you.

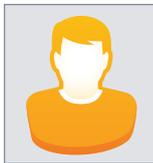
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“ A very important aspect of the change from paper charts to ECDIS is that of standards. As Master, I am responsible for ‘setting the bar’ onboard. If junior officers see that I view navigation and watch-keeping as a skill and take pride in how I undertake these, they will similarly follow suit. The change is inevitable. How we manage it is entirely up to us. ”

**Tim Spencer MNI**



“ I had never sailed on a vessel with ECDIS till March last year. Over a long 20 days of sailing, I familiarised myself well with it. On arriving in Brazil, I was made to shift anchorage ten times in seven days, due to local regulations. Believe me, that was the time I realised how useful ECDIS is to a navigator! ”

**G B Singh AFNI**



“ One of the perceived problems with ECDIS is that its use will lead to a degradation of traditional chart work and navigation skills. This need not be the case. All traditional navigation skills, which were previously taught by nautical colleges and practised for centuries by navigators, are possible using ECDIS. ”

**Kevin Vallance MNI**



“ Like any system, an ECDIS is not infallible. It has the same shortcomings that exist in any technical device. So, over-reliance may be dangerous. ”

**Captain Cem Akyol**



“ Change is the only constant in the maritime domain. Galloping technology mandates acceptance of change. ECDIS has definitely been an enabler for navigation safety, its pitfalls notwithstanding. We need to accept the change and thrive with it. ”

**Kamal Singh**



“ The easiest way to check [the accuracy of an ECDIS position] is to use the radar overlay, and if this is not available, to cross-check with radar ranges and bearings. The big advantage of ECDIS is that it shows your position at all times. Even if you constantly plot positions into paper charts during an approach, you will not see any set and drift problem as quickly as you can see it on ECDIS. ”

**Baerbel Beuse AFNI**



“ Electronic navigation is here; the charts and technologies are excellent and will only grow in usability. The next question is, how does the seasoned smart navigator incorporate ECDIS and these charts into his or her overall navigation work? ”

**John Carlisle MNI**

# A little learning: examining ECDIS education

**Captain Yashwant Chhabra AFNI** looks at the challenges created by the move from paper charts to ECDIS and examines how IMO training helps navigators make the most out of the technology available to them.

**B**uilt on the advent of modern electronics, ECDIS is bringing in a whole new level of performance by transferring all chart work elements onto an electronic display screen. This allows the seamless integration of Electronic Navigational Charts (ENC), GPS position fixing and other navigational tools, including radar, echo sounder, AIS and NAVTEX. Multiple functions are made available with just one click on the computer keyboard, a tap on an icon or the use of a mouse. Suddenly, the supporting tools needed to operate paper charts are history.

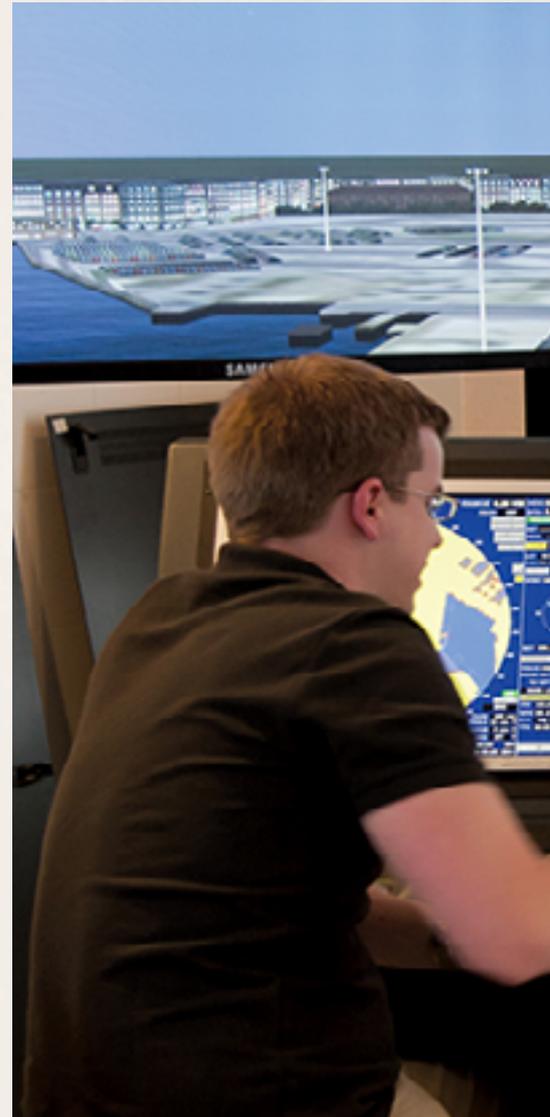
The additional capabilities of ECDIS are endless, from having reference materials like weather charts and tidal data readily available, to the ability to set pre-warning alarms for navigational hazards and incorporating record-keeping. The system is set to totally change the way navigation is carried out at sea, while making the whole process easier, safer and far more effective. At the same time, any process which can be carried out on a paper chart can also be done on ECDIS. Introduction of new technology does not mean that old skills are irrelevant!

## A new set of challenges

This major navigational change has brought about two extreme reactions from mariners. Some are reluctant to accept it, while others

embrace it as infallible. Neither of these approaches is completely correct. Recent years have seen several ECDIS-assisted navigational accidents and near misses. Analysis of these accidents suggests the causes are not system design failures, but are more likely to be due to operational failures, such as:

- Improper voyage planning, not using or incorrectly setting safety depth, safety contour or watch vector alarms or wrong inputs of vessels' data, such as draught
- Using inappropriate scale or display mode
- Not using the automatic route check facility
- Not carrying out visual checks or lookout
- Using ECDIS as an anti-collision tool; it is not meant for this purpose
- Not ensuring that ENCs are up-to-date, due to navigators not being clear on the automatic and/or manual updating procedures
- Improper use of radar and/or AIS overlay
- Inability to plot visual and/or radar fixes, (LOPs)
- Improper use of source data check on ENCs (CATZOC)

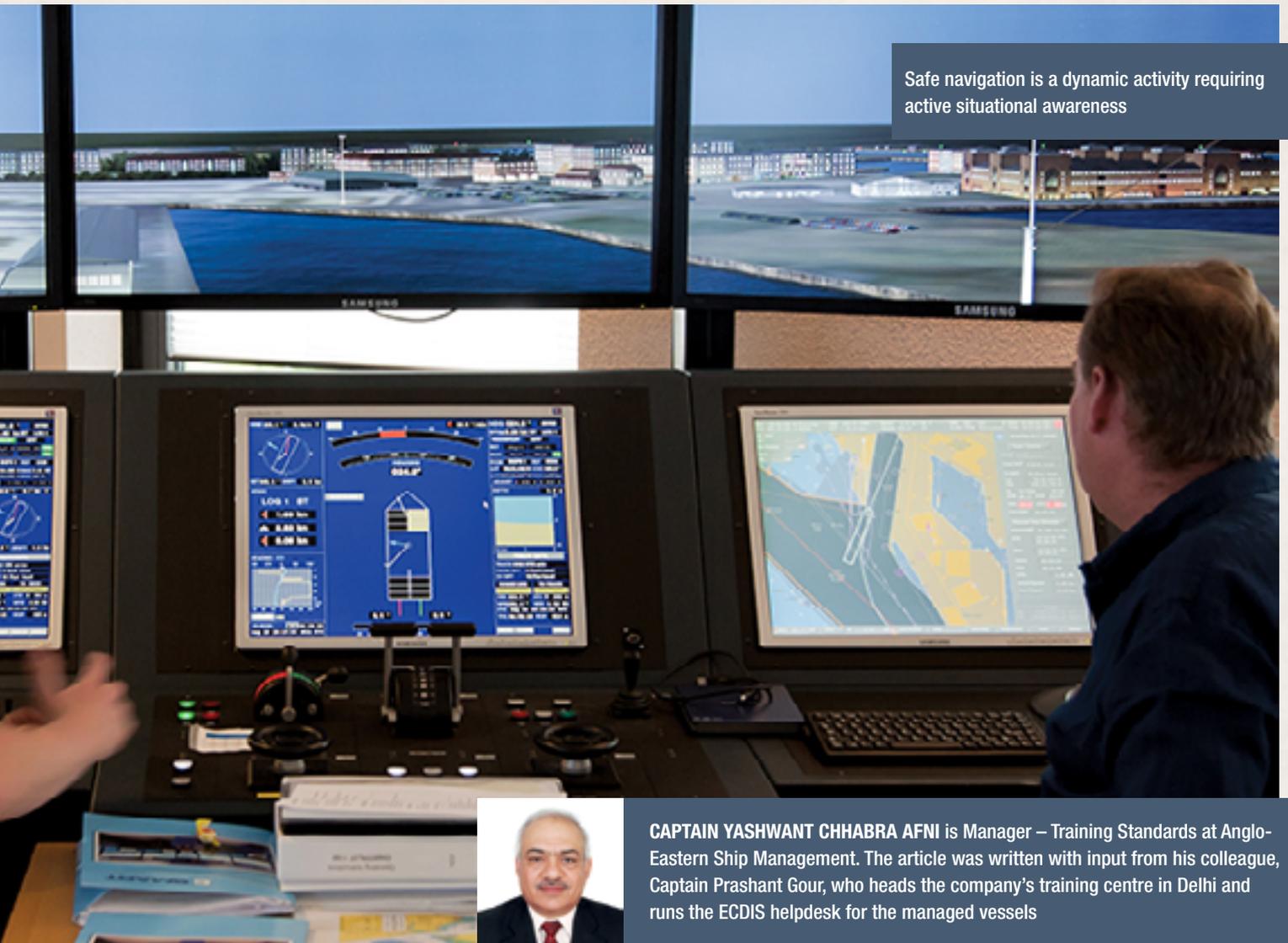


- Not being aware of contingency procedures for hardware and/or software failures
- Not being aware of back-up procedure when operating in areas where ENC coverage is unavailable.

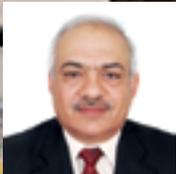
## Training requirements

These issues have been addressed by IMO, which has not only set minimum performance standards for ECDIS, but has also formulated guidelines on training. The current version is the 40-hour IMO Model course 1.27 of 2012. These courses are generic by design, and

**ECDIS IS SET TO MAKE NAVIGATION EASIER,  
SAFER AND MORE EFFECTIVE. BUT NEW  
TECHNOLOGY DOES NOT MEAN THAT OLD  
SKILLS ARE IRRELEVANT!**



Safe navigation is a dynamic activity requiring active situational awareness



**CAPTAIN YASHWANT CHHABRA AFNI** is Manager – Training Standards at Anglo-Eastern Ship Management. The article was written with input from his colleague, Captain Prashant Gour, who heads the company’s training centre in Delhi and runs the ECDIS helpdesk for the managed vessels

individual administrations should apply them in conjunction with local needs. However, it is important that students *demonstrate* all the competencies that are listed during the course, rather than just learning about them.

Completing the IMO Model course is only the first step. It must be followed by a structured, ship-specific ECDIS familiarisation for each shipboard ECDIS system on which navigating officers are expected to serve. In this context, it’s important to note that some flag states require this familiarisation to be completed before joining a vessel. It may also be expected best practice for organisations, such as OCIMF and, at times, a company’s own SMS. Any onboard familiarisation must be completed before an OOW keeps their first independent watch. This is why many organisations prefer OOWs to complete familiarisation before joining the vessel.

### A three-stage process

Mastering ECDIS is a three-stage process:

- The IMO Model Course, which should take a minimum of 40 hours and involve a demonstration of all the competencies covered in the model course
- Ship-specific equipment familiarisation
- Constant practice – just like any other form of training

The familiarisation stage is especially important, since different manufacturers have different designs and many incorporate features far in excess of those required by IMO standards.

### Using ECDIS safely

Any new system brings with it a new set of challenges. Using ECDIS can easily lull operators into a false sense of security. Too much automation in ECDIS can lead to over-reliance and complacency. Safe navigation is a dynamic activity requiring

active situational awareness. According to STCW, *“Officers of the navigational watch are responsible for navigating the ship safely during their periods of duty, when they will be particularly concerned with avoiding collision and stranding.”*

These requirements should always be borne in mind when using ECDIS, along with any other requirements in the company’s SMS.

Finally, integrated information on an ECDIS must always be cross-checked with both the individual equipment, and the time-tested requirement from rule 5 of the COLREGS: *“Every vessel shall at all times maintain a proper look-out by sight and hearing, as well as by all available means appropriate in the prevailing circumstances and conditions, so as to make a full appraisal of the situation and of the risk of collision.”*

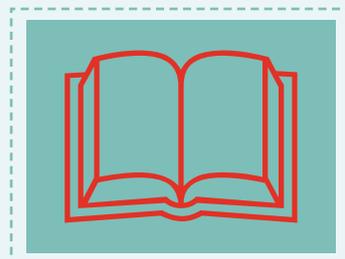
# Looks familiar?

No matter how good your ECDIS basic training is, when joining a new ship, you may come to the bridge for the first time and be faced with a fully integrated navigation system that is nothing like the one you trained on. Obviously, that is a long way from ideal. Here, members of The Nautical Institute's Seagoing Correspondence Group offer some suggestions on the importance of ECDIS familiarisation and how to achieve it, both onshore and once you have joined the vessel.

## What do you need to know?

There are a number of ways to become familiar with onboard ECDIS, and ways in which the company can assist with this. The Nautical Institute, in collaboration with the wider industry, has identified a list of tasks which need to be addressed when familiarising yourself with ECDIS. This list can be downloaded for free at <http://www.nautinst.org/en/forums/ecdis/ecdis-issues-guidance.cfm>, along with other useful articles.

In addition to the navigator's individual need to be fully familiar with the onboard ECDIS, the company also has a responsibility within the ISM Code (section 6) to ensure their navigators are familiar with ECDIS. Masters share this responsibility too, on both a corporate and personal basis.



## Read the manual

The most obvious process of familiarisation with onboard ECDIS functions is to read the onboard User Manual. It's important to be aware of these manuals and their contents, but some are more useful than others. Companies should consider summarising key tasks (in accordance with the industry recommendations) if necessary.

Some companies have identified critical operations, such as setting Under Keel Clearance or Man Overboard, and have documented these procedures on a laminated card attached to the equipment.

## Type-specific training

Many manufacturers provide 'type-specific' training at various locations around the world and these offer excellent opportunities to learn from specialist instructors. However, sending officers for type-specific training can be harder for fleets which have a wide range of ECDIS models, and officers will still require a brief period of onboard familiarisation when dealing with ship-specific installations.



## Internet/ computer-based training (CBT)

Many manufacturers have developed familiarisation guides for specific ECDIS models, while specialist training providers have worked in conjunction with them to establish Internet-based or computer-based familiarisation guides too. These tools can be excellent if they are specific to the hardware/software onboard, and can be used prior to joining a vessel or, at the very least, prior to assuming watch once onboard.

The ship may leave port in only a few hours; you may be due to be on watch and it may be dark, but you will need to master all these systems to navigate the vessel safely. You must be familiar with everything before the Pilot and Master rely on your expertise as they start to conn the vessel.

However, the ECDIS you received your generic training on, or even the various ECDIS systems you have sailed with in the past, may be very different from that on the ship you are joining. At the moment, there are more than 30 different ECDIS manufacturers. And each manufacturer will offer many variations of models and software upgrades that will differ in operational aspects.

Being competent in the use of safety tools, including ECDIS, is a key part of a navigator's duty – and a legal responsibility.



## Extended hand-over

Many companies recognise the requirements of ECDIS familiarisation and arrange extended hand-over periods. Such extended periods can last from a single day to an entire voyage, and allow a joining officer to become familiar with the features of the ECDIS, along with other safety-critical systems.



## Set up some scenarios

Practice scenarios are a useful tool to encourage effective ECDIS familiarisation. Crews outline a range of scenarios that require an in-depth understanding of the onboard ECDIS and challenge new and existing navigators to use the ECDIS to address such scenarios in an effective way.

One Master writes *"I have created a set of training modules which have been adopted by the company I work for and used fleet wide. They include practical exercises in familiar circumstances that continually increase in complexity and cover all aspects. Officers perform them on watch over a month and we can see the level of interest increasing as the exercises become more challenging."*



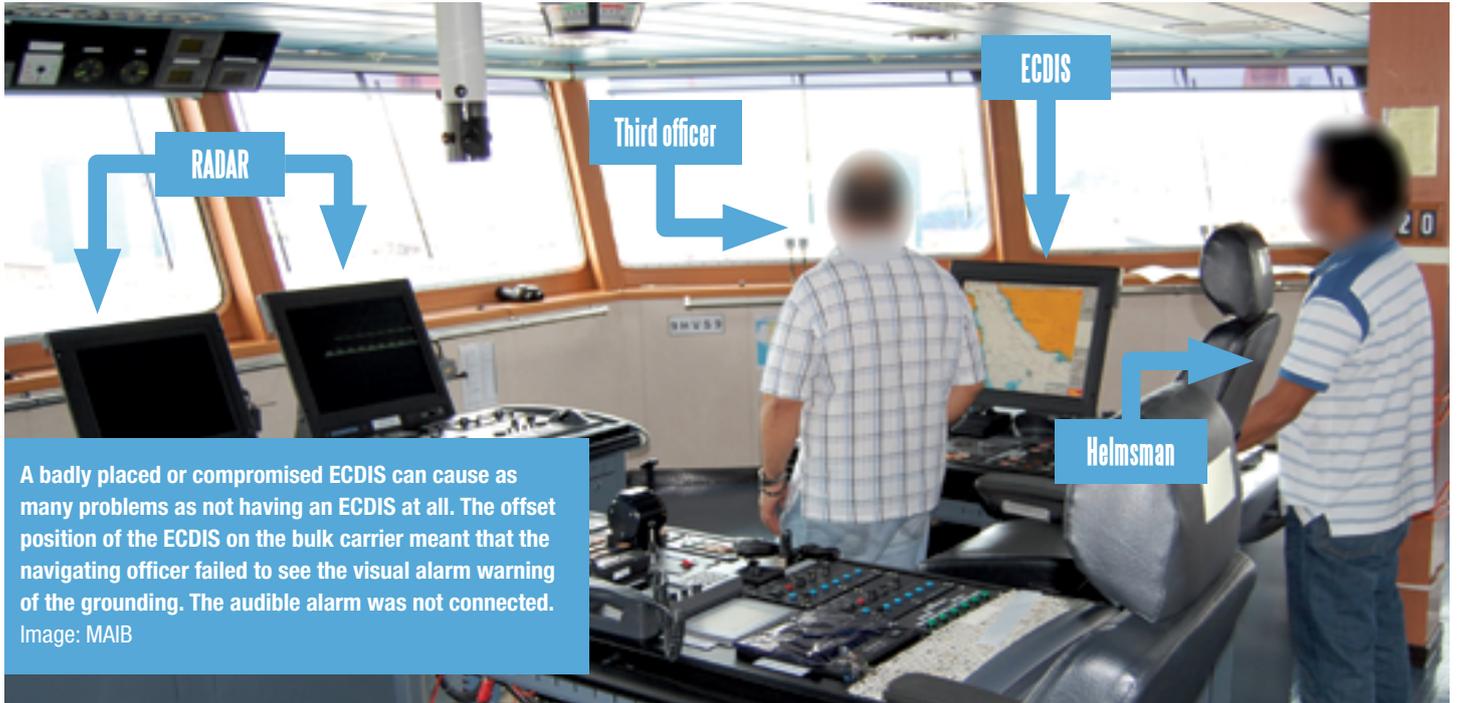
## Choose your champion

Some companies appoint 'ECDIS champions' within their fleets. These 'champions' can be navigators of any rank, and might be specific to a single ship or work across the whole fleet. They are given in-depth training in specific ECDIS models and versions, and are instructed to work closely with all officers to ensure that they are familiar with all ECDIS functions and capable of demonstrating competence to the Master and, potentially, inspectors.

## Looking to the future

Mariners from around the world have pleaded with the industry to make the process of familiarisation with ECDIS, and other technology, easier and more effective. The Nautical Institute is working towards this by encouraging manufacturers to provide 'familiarisation guides' for ECDIS in the same format as the industry recommended checklists, and for companies to demand such guides as part of the purchasing process. The Nautical Institute has also proposed to the IMO a future requirement for an S-Mode, or standard mode of operation, for all navigation displays that would require all manufacturers to provide a one-button operation to revert any navigation display to a default display. This display would have a default menu system where critical functions are controlled by a standard interface device.

# WATCHOUT

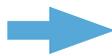


## ECDIS errors caused bulk carrier grounding

In this series, we take a look at maritime accident reports and the lessons that can be learned.

### What happened?

A bulk carrier was grounded, causing water ingress and damage to the hull plating. The incident happened when the navigator adjusted course to avoid collision with two vessels in the vicinity, but failed to check his own ship's position and projected track on ECDIS. The ECDIS was the official chart system (no paper) and the unit's audible anti-grounding alarm was not connected.



### Why did it happen?

The Master had handed over navigational duties to the third officer as the vessel entered a narrow strait on autopilot. A safety contour of ten metres had been set on the main ECDIS unit, but this was inadequate for the conditions, given the sailing draught of 10.63 metres. None of the bridge officers had received familiarisation training for the type of ECDIS fitted onboard, so they did not question the inaccurate contour setting.

The third officer adjusted course to avoid collision with a sailing vessel. As he did so, a second ship came into view, necessitating a further adjustment to starboard. The third officer was concentrating on avoiding the collision, and relying on the ECDIS to activate an alarm and warn him of any danger of grounding. The ECDIS unit did, in fact, pick up the risk of grounding as the bulk carrier moved towards shoal ground and activated a visual warning. However, the ECDIS display was set up so that the OOW had to face to starboard to see the screen. Because he was looking ahead at the other vessels, rather than at the screen, the officer did not see the alarm. The audible alarm was not connected and so failed to alert him.

Once he realised the grounding was imminent, the third officer alerted the Master, who attempted to rectify the mistake by ordering the wheel hard-a-port. However, this was not sufficient to prevent the grounding.



### The issues

- Over-reliance on equipment
- Lack of training
- Poor bridge layout
- Lack of support from the Master



### What changes have been made?

- The main ECDIS unit was repositioned adjacent to the starboard radar, making it possible to use the ECDIS while looking forward.
- The unit was reconnected to the functioning audible alarm.
- Training was arranged for relevant personnel to cover ECDIS familiarisation onboard the ship.
- Officers attended a bridge resource management course.

## A seafarer's life; seeing the world is the ideal basis for a lasting professional career

In this series, *The Navigator* speaks to current navigational personnel about their motivations, careers to date and thoughts for the future. In this issue, it's the turn of **James Spear**, a third officer serving on tankers in the USA.

### What interested you in a career at sea?

I was raised in Tampa, Florida, which has a strong maritime community, so it's something that I've been familiar with since I was young. The experience of seafaring, I believe, leaves an indelible mark on your life. So many writers, businessmen, and military leaders have been influenced by their time at sea. People such as Jack Kerouac, Jack London, John Paul Jones and Joseph Conrad have, at some point, gone to sea, and each has been lured by the promise of new experiences and opportunities. I suppose that's what helped pique my interest in a maritime career.

### What career path has led to your current position?

After graduating in 2011, I began sailing on international-flagged LNG carriers. It was a tremendous chance to experience how international shipping operates. To go to sea around the world with a myriad of cultures and nationalities was an unparalleled opportunity that I'm lucky to have experienced. Since 2013, I've been working on crude oil tankers that run between the US West Coast and Alaska.

### Where do you see your career going from here?

I hope to continue to sail and gain experience; upgrade my licence/CoC and see what opportunities arise. The more people I meet and speak to, the more I believe that experience at sea is an invaluable tool for the maritime professional, and I'm grateful to have worked for companies that recognise that. I believe things like onboard communications, increased training, shore-side opportunities, advanced education, and sustainable growth may become more central to a seafarer's career in the future. If the marine community can effectively integrate and



**Name:** James Spear  
**Current position:** Third officer, volunteer delegate for NAMEPA  
**Training:** State University of New York Maritime College

manage this change, it has the potential to grow even more in the future.

### What are the greatest rewards of your life at sea?

Seafarers have always had the reputation of being self-reliant and hardworking, independent and goal-oriented. The chance to work in an industry that promotes those values has been a significant reward. Furthermore, shipping more than just about any other industry, is the indispensable link in global trade. To be able to work towards a common goal with a diverse range of professionals around the world has been my greatest reward so far.

### Tell us about your work with NAMEPA?

NAMEPA, the North American Marine Environment Protection Association, is an industry-led non-profit organisation that works to address the challenges and opportunities in marine environmental protection. I started the first student chapter of NAMEPA while I was a cadet at SUNY Maritime College, and I currently serve as their Maritime Academies Coordinator while I'm ashore on vacation. NAMEPA hosts seminars, workshops, and initiatives to spread the message of "Save Our Seas," and it's particularly focused on marine environmental education.

I would encourage all maritime professionals to learn more about what we do at [www.namepa.net](http://www.namepa.net)

### What advice would you have for navigators using an unfamiliar ECDIS for the first time?

Training, training, training! ECDIS, like any technology, is only as good as its user's understanding. Effective, thorough formal training is critical with any new tool, especially one as complex as ECDIS. This can be supplemented by reading manuals, focusing on details, and cross-checking with other means of navigation. Also, I believe the integration of ECDIS in the worldwide fleet poses a perfect opportunity for mentoring between junior and senior officers. Familiarity and confidence with ECDIS can provide 'up-and-coming' junior officers with a means to contribute to effective communication and resource management through mentoring of senior officers, or vice versa.

**THE INTEGRATION OF ECDIS IN THE WORLDWIDE FLEET IS A PERFECT OPPORTUNITY FOR MENTORING BETWEEN JUNIOR AND SENIOR OFFICERS**



# WAYPOINT

Dr Andy Norris FRIN FNI

## ECDIS onboard: sizing up the options

Dr Andy Norris, an active Fellow of The Nautical Institute and the Royal Institute of Navigation, looks at ECDIS and explains why it is very different from the car sat nav system

Although not often said directly, it is clear from comments made that some people really do believe that there is not a lot of difference between an ECDIS and a car's sat nav. After all, they both show your current satellite position on an electronic chart, and both can display the proposed route ahead.

Of course, in reality, they are very different. Perhaps the most fundamental difference is that an ECDIS can still be used for safe navigation in the absence of satellite derived position – just try using a typical car's sat nav without a satellite positioning input! Mind you, it's surprising how many people actually think that ECDIS needs satellite positioning to be able to work at all. It certainly complicates things when that is not the case, but the lack of electronic position facilities similarly complicates working with paper charts.

Of course, another big issue with the standard vehicle sat nav is the small size of the display. That said, however, they are now getting surprisingly large in some top-end cars and can be equivalent to tablet computer dimensions in some cases. In fact, the use of tablet-based electronic charts is already permitted in the cockpits of civil airliners within the United States. So, is this the way that maritime should also be going? Some marine portable pilot units (PPUs) are already using such technology.

### One size does not fit all...

We need to look at the differences between the uses for aviation, marine and pilotage, let alone car sat navs. In the very first issue of *The Navigator*, I pointed out that an airline pilot is fundamentally a monitoring navigator, following pre-agreed routes and mostly at

altitudes assigned by air traffic controllers. For these reasons, the necessary chart information is relatively lacking in detail compared to that of a marine chart suitable for a 'navigating' navigator. Also, cockpit space on an airliner is limited, favouring a smaller display.

Marine pilots have to carry onboard their specialist equipment, and so a small PPU is essential. Importantly, once onboard, the pilot also has access to the vessel's own charting facilities, whether ECDIS or paper charts.

The larger display size of an ECDIS is essential to maintain adequate area awareness. In fact, an often quoted and valid negative point about ECDIS is that they are still small when compared to an equivalent paper chart. In the future, we will inevitably see larger displays introduced. They will have better resolution too, similar to that given by paper charts – and by quality tablet computers.

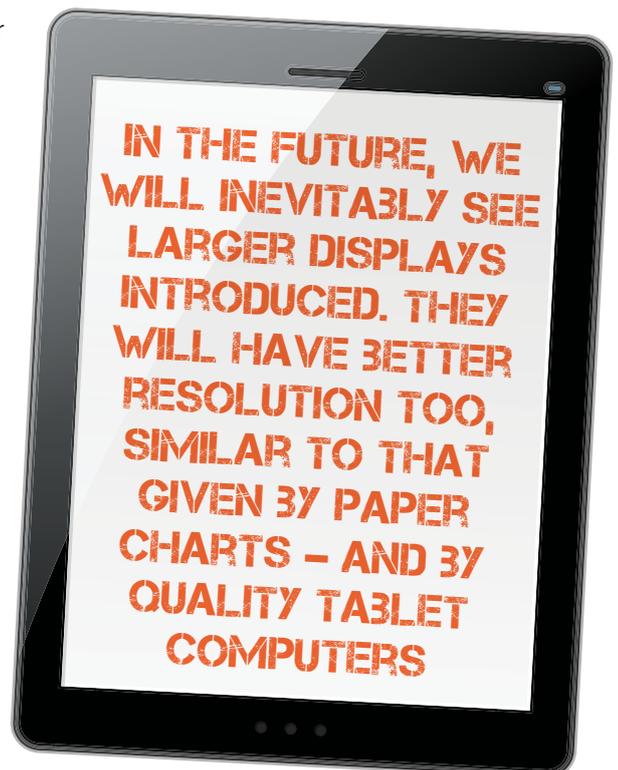
### ECDIS into the future

Exactly where such large displays should be positioned on a bridge will be interesting to see. In fact, the use of a specialist display seems to somewhat go against the still-developing concept of multifunction workstations, which can be configured to show any information, including ECDIS. It will certainly be fascinating to see what happens on new bridges over the next decade.

What does seem to be highly useful, and could

happen very quickly in comparison, is the adoption of tablet computers on the bridge to show useful navigation information when operating away from the main conning position, such as on the bridge wings. It is easy to foresee that both ENC and radar information could be made affordably available as a tablet app on a modern bridge set-up.

When adopted, we would always need to bear in mind the secondary nature of such information displays. In no way would they be a replacement for the formal use of ECDIS and radar, but they could be highly useful to aid the final navigational decisions that will still need to be verified at the main full-sized displays.



# TAKE 10

The focus has been firmly on ECDIS in this issue of *The Navigator*. Here are 10 key aspects to remember about this increasingly important technology

## 1

### Not all ECS are ECDIS

Electronic Chart Systems (ECS) is a generic term for systems that show charts electronically; most are not legal for navigation. An Electronic Chart Display and Information System (ECDIS) is a system approved by the IMO for navigation. Know what you're using!

## 2

### Be competent

All ECDIS users must have passed an approved course based on the IMO ECDIS Model Course (1.27 – 2012 edition). They must also demonstrate 'familiarisation' with the onboard system before taking a navigational watch.

## 3

### Be confident

Being competent is a legal requirement; being confident is showing professional pride. Continuous practice, self study, the use of scenarios are all useful ways to ensure confidence.

## 4

### Know your terms

Leading international maritime organisations have worked together to clearly identify key terms such as generic training and familiarisation, and what competencies these require. Download from The Nautical Institute ECDIS forum at <http://www.nautinst.org/en/forums/ecdis/>

## 5

### Get familiar

The industry ECDIS group has also identified a comprehensive list of ECDIS familiarisation tasks. These can be downloaded for free from the ECDIS forum (see no. 4). Many companies have incorporated this list into their SMS and onboard requirements.



## 6

### Be a champion

Many companies have found that identifying an ECDIS champion is an extremely effective way of promoting and ensuring ECDIS competence

## 7

### Size matters

The ship's ECDIS should provide a large display needed for looking ahead and making better decisions – but it is still vital to be aware of your surroundings



## 8

### Mentoring

ECDIS can provide junior officers with a means to contribute to effective communication and resource management through mentoring senior officers, and vice versa.

## 9

### Accidents

Happen when there is over-reliance on equipment, lack of training, poor bridge layout and lack of support from the Master.

## 10

### Managing change

A very important aspect of the change from paper charts to ECDIS is that of standards. Masters are responsible for 'setting the bar' and junior officers need to take pride in how they meet these standards. How we manage this is entirely up to us.

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## Industry Recommendations for ECDIS Training and Familiarisation

Leading international maritime organisations have worked together to clearly identify key ECDIS terms and competencies. Download FREE from The Nautical Institute ECDIS forum at <http://www.nautinst.org/en/forums/ecdis/>

## From Paper Charts to ECDIS – A Practical Voyage Plan

Captain Harry Gale FNI

Everything you need to understand the fundamental change from navigating by paper charts for navigating by ECDIS, including training, procurement, system management and passage planning. This theoretical knowledge is made real through contributions from sea-going members of The Nautical Institute.



Published: 2013 Price: £20 Ref: 0350



## ECDIS and Positioning – Dr Andy Norris FNI FRIN

Written especially for mariners, this book will help improve your understanding and approach to the use of electronic charts, and provide guidance on how to develop the mindset needed to use ECDIS safely and effectively.

Published: 2010 Price: £40 Ref: 0321

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