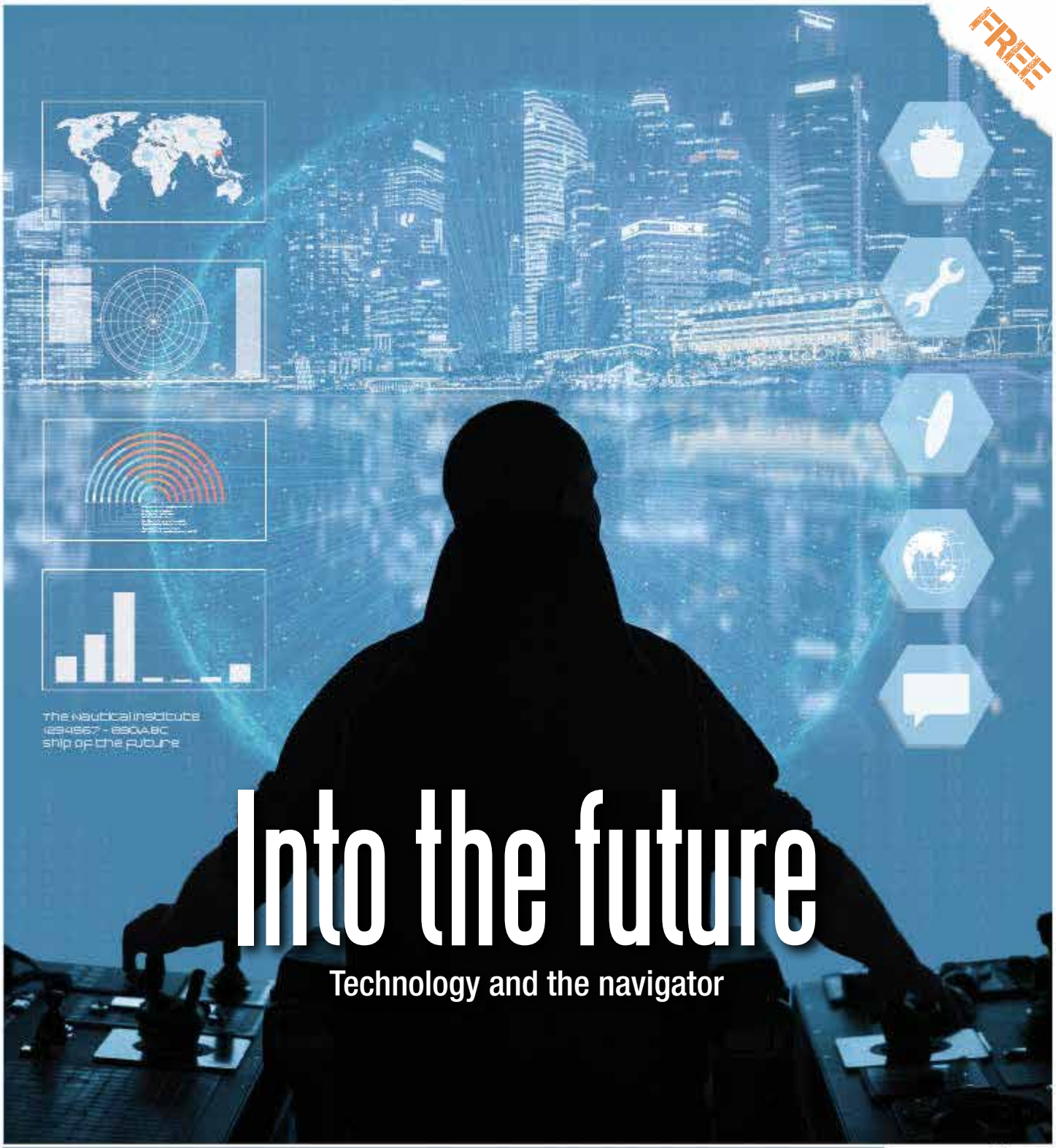
June 2020 Issue no. 24

THE NAVIGATOR

Inspiring professionalism in marine navigators

FREE



Into the future

Technology and the navigator

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

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NAV BRIEF

David Patraiko FNI
Director of Projects, The Nautical Institute

Into the future

In all walks of life, new technology is applied with the best intention of improving a given situation. Sometimes this works, sometimes it doesn't. Often, it's hard to tell.

Ships' bridges are no different. The installation of new technology has been rapid over the last few decades and the pace of change will continue to accelerate. Navigators will need to learn how to use these new systems and understand their strengths and weaknesses. They will also have to balance their use with existing tools so that the best combination of human skills and technological powers result in the best performance.

In this issue, we explore some of the new technologies that are being trialled and will likely become common on ships in the next few years. Professional navigators will need to prepare themselves to understand these new systems and how to make best use of them. As an industry, we will also have to think about how we assess the effectiveness of these systems, how we can encourage useful feedback and how that feedback can be used for continual improvement.

Traditionally, systems like radar have been 'fit and forget'. As we go deeper into the digital age, change and improvement will need to become continuous. It is important that technology helps the user, rather than makes their life more difficult, and we look at how those at sea can play their part in making sure this happens.

Although the technology to enable autonomous vessel operations already exists for some craft, mariners are unlikely to be replaced any time soon. Most existing ships have been designed to be operated by humans, and the regulatory process to enable more autonomous operation is only just being explored at the IMO. Therefore, for at least the next few decades, we will need mariners and machines to work together to best effect. This will require navigators to think about the systems they use and how they can be improved. Some recent research by The Nautical Institute (published in the March edition of *Seaways*) indicated that navigators welcome new technology in areas such as improved target detection and reducing the administrative burden. This can assist them in their assessment and management of situational awareness. However, the purpose of this technology needs to be clear and it must be reliable and trusted.

The Nautical Institute is involved in a number of development areas, providing user feedback on design and helping articulate user needs. Navigators are encouraged to write to us with thoughts on system design and use to enable continuous improvement.

As always, please share this edition of *The Navigator* with your bridge teams, discuss the issues raised amongst yourselves – and let us know the results.

INSIDE THIS ISSUE

A Nautical Institute project sponsored by IFAN & Trinity House

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ALL AT SEA

Emma Ward

We welcome your news, comments and opinions on the topics covered in *The Navigator*

If you would like to get in touch with us, please contact the editor, Emma Ward at navigator@nautinst.org, or look out for the LinkedIn discussion. We look forward to hearing from you.

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We welcome your news, comments and opinions on the topics covered in *The Navigator*. We reserve the right to edit letters for space reasons if necessary. Views expressed by letter contributors do not necessarily reflect those held by The Nautical Institute

Believe it or not, this is the 24th issue of *The Navigator*. It doesn't seem like nearly eight years have passed since our very first issues rolled off the printing presses back in October 2012. How the world has changed since then! The global spread of Covid-19 has resulted in our lives changing in ways we would have never thought possible even a few months ago. We hope all our readers are staying safe in these strange times. Due to the global restrictions placed on us right now, it may take more time than usual to distribute printed copies this time round. However, we are very much available digitally and would urge you to tell everyone where they can find this latest edition of *The Navigator*, ready to read online or download as a PDF from *www.nautinst.org/resource-library/publications/navigator.html*.

Looking ahead to more positive times, we're very excited about producing our 25th issue of *The Navigator* towards the end of this year. One of our favourite things about *The Navigator* is hearing back from our readers, and we would love to include lots of stories about how the magazine has impacted upon your professional life and boosted your career. Perhaps you've been inspired to pursue a new area in your CPD. Have any of our 'take ten' tips prompted a change in behaviour in the bridge of your vessel? Or has your rise up the ranks been accompanied the whole way by *The Navigator* and its thought-provoking content?

Do get in touch and let us know how *The Navigator* has influenced you over the past eight years. We look forward to hearing from you!

Emma Ward
Editor

The piece on situational awareness published in February 2020 was expository. The message I learnt is that situational awareness is a skill that requires experience and most of all total commitment. I will be going to college for my Chief Mate's licence in the UK, and it's my aim to see how I can pass on this insight to my colleagues there.

John Ajah,
Third Officer
LNG River Niger

It's really a small world that has enabled me to see the copy of this publication that I brought onto *MT Eastern Liberty* during my apprenticeship year still displayed on the bridge in the exact location where I left it. Now that I have become a fully-fledged Second Officer on the same vessel, it remains perfectly intact and is still being used during our discussions whenever we have navigational audits. I hope this story inspires my fellow seafarers to continue pursuing their dreams in this ever-changing maritime industry.

Niel Borja,
Second Officer
M/T Eastern Liberty

I'm managing to stay positive amidst the Covid-19 pandemic when we can't go ashore, can't change crew, but we can read *The Navigator!* Thank you for this very helpful issue about how assessments in the workplace promote professionalism and offer room for growth. Kudos to us all!

Laarni Espinosa

Find us on social media and let us know what you think #NautInst

Into the future: the technology of tomorrow

David Patraiko, Director of Projects for The Nautical Institute, charts the future of maritime technology – and points out some areas of likely risk

There are a number of new technologies which are beginning to come into use on board ship – and while you might not encounter them for a few years, they will become increasingly common as the fleet is updated and renewed. Some of these technologies provide more data to help make decisions – for example, LIDAR (like radar but uses laser light) improves target detection and identification. Likewise, optical technologies are being evolved to augment human sight.

Other new developments aim to make the most of this improved input. Decision support systems, for example, help amalgamate and analyse data from various sources for activities such as collision avoidance. They might serve as a useful check for human decisions – or may in the future even replace them, although this day is likely a long way off (see page nine for more information). While this research might one day lead to a role for navigators ashore, for the moment it is important to learn to make the most of them while at sea. There are many more examples of technologies that are likely to affect the way navigators work in future:

Decision Support Systems (DSS)

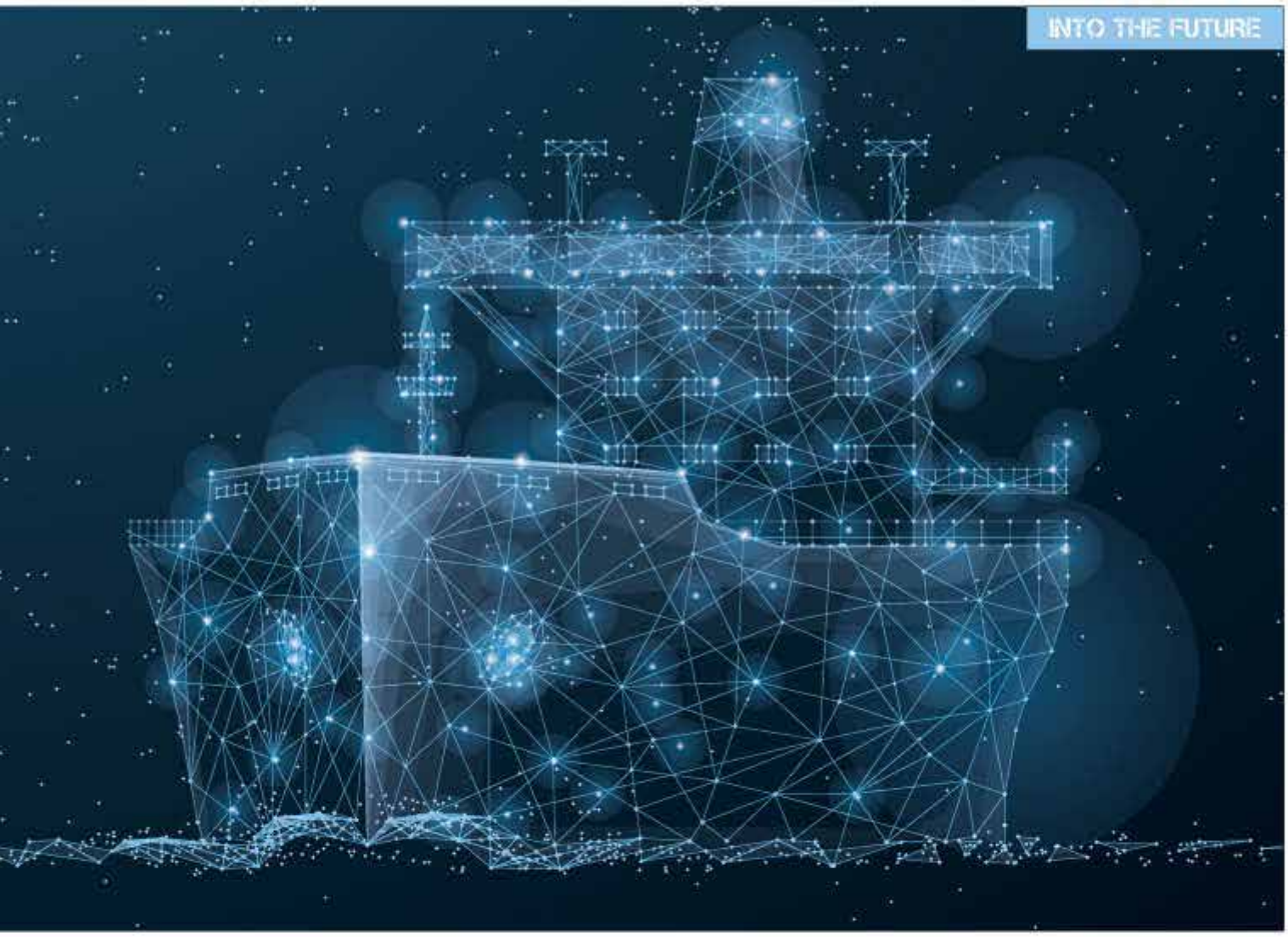
DSS utilise input from a number of sources, including computer systems, sensors and human operators, combining and processing this information to give an overview that helps humans to make decisions. They can help manage situations where there is so much data that there is a risk of the operator being overwhelmed – or not being able to process the raw data in the first place.

Common examples in shipping are weather routing, where a shore-based team with extensive meteorological data and knowledge might be able to offer specific and bespoke advice to mariners on what optimum routes will result in better fuel consumption, reduced weather damage and optimal arrival times. Another example might be a collision avoidance system that uses computer algorithms to identify radar, AIS and possibly optical inputs and compares them with the Colregs to 'suggest' possible decision to be made to avoid a collision.

While DSS can be very useful, mariners must understand the basis on which decisions are made. This includes the type of inputs being used, and the strengths and weaknesses of each of those inputs. In terms of weather routing, for example, does the advice recognise all the parameters including traffic and the best practice of seamanship? In terms of collision avoidance, does the system have a full view of the situation, including small craft that may not have AIS? Does it recognise underkeel clearance (UKC)? As we progress into the future all these systems will get smarter – but mariners will need to be aware of the background against which the advice is given, and the impact of either following or overriding it.

Artificial Intelligence (AI)

Artificial Intelligence, often referred to as machine learning, is where computers learn for themselves, initially with significant help by humans. Popular examples involve audio and visual recognition. Many of you will have 'smart speakers' where you can ask a computer to answer a question or carry out a simple command. You may have noticed that these systems become better and more accurate the more you use them. That's because they



are designed to learn how to interpret your voice and your preferences. Any improvements are not made by humans; this is the software itself 'learning' and improving from previous input.

In the context of shipping, a common AI application is image recognition. There are a number of watercraft that use optical tools to 'view' their surroundings, but how do they know what they are looking at? In the first instance they view a buoy, boat, ship etc… and have no idea what it is or what reactions are required. However, human operators spend thousands of hours 'teaching' the system to understand what it is looking at. As a result of all this input, eventually the system 'learns' what is what and how to identify objects. This type of technology has been very successfully proven with autonomous cars and even with medical diagnosis. In shipping terms, such 'intelligent systems' will particularly support mariners in poor visibility – though they will also be useful in good visibility to alert seafarers to things they should have noticed and perhaps didn't.

As AI systems develop, mariners will need to understand their benefits and limitations. There will be opportunities for skilled mariners to be involved in their development and regulation. The Nautical Institute has, however, been clear that teaching an AI system should never be allowed to distract officers on watch!

Automation

Maritime Autonomous Surface Ships (MASS) is the IMO term for ships that operate with reduced or no human involvement on board. The way in which MASS should be introduced, regulated and controlled is currently being debated at the IMO (see page nine for more information). While this may take years to conclude, the reality is that there are already thousands of autonomous craft navigating every day. These are mostly small vessels working in controlled 'trial' environments and in niche operations, such as military or research. This is an evolving field, though, and one which will continue to grow, offering both disruption and opportunities.

There are various levels of autonomy, from direct remote control of individual vessels to fleet swarm operations. All of these present their own opportunities and risks. Given the current investment in ships designed to be operated by humans, it is unlikely that the world fleet will be replaced or converted to MASS in the short or even medium term. However, the level of automation on manned vessels will increase as more and more tasks have computer input.

As increased levels of automation are adopted it will be important to clarify what role the associated technology plays in the process. Will it replace human activity – for example, automatic plotting on ECDIS? Will it augment human abilities, as advanced target detection technology does now, or will it work in collaboration with humans, like decision support systems?

Needs of the user

Wherever technology takes us, it is important that it is developed with the needs of the user in mind. To enable this, mariners will need to continuously assess their relationship with automated systems – and give feedback to their companies and The Nautical Institute (you can do this by emailing us at navigator@nautinst.org) about what works and what doesn't.

My bad? Don't jump to conclusions

Margareta Holtensdotter Lützhöft, a master mariner and an expert in Human Centred Design, discusses the importance of speaking up in the face of technology that is not quite 'fit for purpose'

Have you made a mistake today? Did you think to yourself, 'That was my fault, I made an error'…? Perhaps you kept pressing the wrong button on an instrument, or you struggled with a certain checklist or procedure? Do you inwardly curse at the screen when you cannot find the information you need?

All these situations are symptoms of something far greater. Granted, humans make mistakes; we already know that. We have known it for a long time – and we are still using terms like 'human error' and trying to train seafarers to stop doing it.

Do you think it has worked? Is it time for a new perspective and a new approach?

Why do we simply accept bad design and dysfunctional procedures that make it easy to make mistakes? One answer is 'professional pride'. Most seafarers are problem solvers at heart and revel in getting things to work, perhaps by designing solutions or workarounds. Another answer is that there seems to be no one to tell. Or if there is someone, they don't listen.

What if…?

What if, the next time you try to use something that fights back, you think, 'How could this have been done better?' Was it really your mistake that was the problem, or could the piece of equipment that you were using have been designed to better support the way we work and think? Be critical and constructive when considering changes to the technology you are using, but don't be negative.

Next time you are involved in a navigation assessment, for example, consider each of the procedures. Are there any stages that do not match the way you work, or that are not compatible with the ship you are working on? If so, let the company know what you think could be improved and how.

Are there aspects of your ship's system that are not adequately covered by company training or familiarisation? If so, don't just shrug and pass it off as, 'somebody else's problem'. Let someone know, the Master or the company.

Never assume

When you work with a technical system and its range of electronics, don't just assume that you are undertrained or inexperienced if you come up against problems. These systems, tools and aids are something that can and should work with you.

Consider what could be changed to support you and your colleagues. Seafarers can influence change if they can get their message through to the right people. Not sure the company will listen? Let The Nautical Institute know, by getting in touch via *The Navigator*. We will try our hardest to get your feedback and suggestions to the right manufacturer or standards body.

It is very common for bridge and engine control room electronics to be designed without any input from a seafarer, or indeed anyone who has been on a ship. Your involvement could drive changes to ensure that technology works in concert with the seafarers and is fit for purpose, namely, the work being performed on board ship.

Unless somebody does it, nobody does it

Does it really matter if you provide feedback or not? Small design changes can have huge implications for the future of technology on board, especially if they are included early on. Think of all the solutions and innovations that exist 'out there' in the wider world. How can we get to know about them and put them to good use in our industry?

There are many examples of amazing design that has been adapted to human needs in different ways. A prime maritime example is the Nacos Platinum integrated bridge control system. This was developed with a user-centred design approach that evolved over a two-year period. It addressed a multitude of user issues, such as making charts easier to use, and standardising views and modes. A cross-disciplinary team was engaged from conception right through to implementation, and, crucially, seafarers were involved in the iterative testing throughout. Results speak for themselves.

So, in conclusion, yes, errors in technology design do matter. No, it is not always your fault. Speak up and share your opinions with the 'powers that be' on how to improve the equipment you are using every day. Start today by contacting The Nautical Institute with your thoughts and ideas.

About the Author

Margareta is a professor in the Department of Maritime Studies at Western Norway University of Applied Sciences. She has a particular interest in the Maritime Safety Research programme

WATCH-OUT

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

Erroneous ECDIS chart settings lead to grounding

What happened?

A chemical tanker ran aground on a marked and charted sandbank in the early hours of the morning. The OOW was following a passage plan that had already been programmed into the ECDIS by another officer who was not fully familiar with the system. This plan was not checked prior to departure by the Master or by the OOW before he started his watch.

The OOW on duty was monitoring the tanker's position solely against the intended route on the ECDIS, which was displaying an inappropriate chart scale for the location. This gave an inaccurate view of the vessel's intended passage, and did not indicate the shallow water close to the sandbank. Furthermore, the audible alarm on the ECDIS was not working, so neither the OOW nor the deck cadet acting as lookout were warned in enough time to avoid the ship grounding

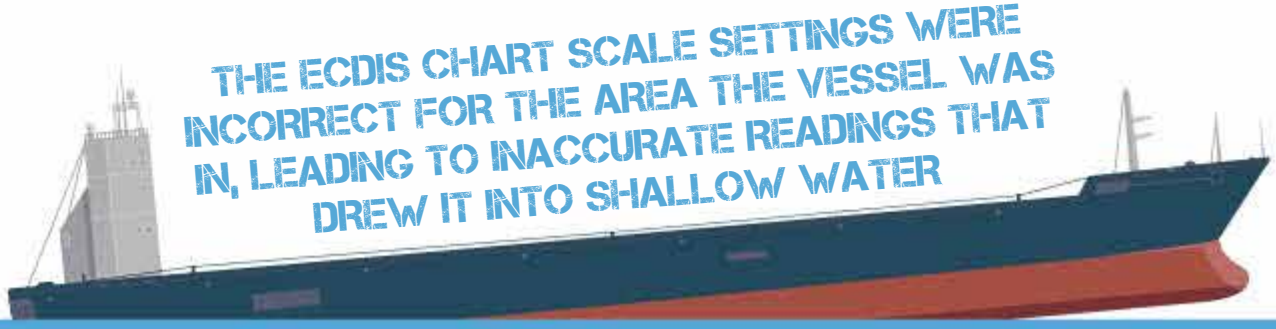
It took the OOW a full 19 minutes to realise what had happened. The vessel sustained superficial damage and remained grounded for three hours.

Why did it happen?

- The passage plan was not correctly entered, due to unfamiliarity with the system being used. It was not checked after entry.
- The OOW relied too heavily on one single means of navigation and failed to check the passage plan inputted into the ECDIS.
- The ECDIS chart scale settings were incorrect for the area the vessel was in, leading to inaccurate readings that drew it into shallow water.
- The audible alarm on the ECDIS was not operational, which meant that the OOW and lookout were not warned about the ship's impending grounding.

What changes have been made?

- Recommendations have been made aimed at improving and standardising the use of ECDIS as a primary means of navigation.
- Improved training around situational awareness, watch-standing and teamwork on the bridge has been implemented.
- Recommendations have also been made to the ECDIS manufacturer in question aimed at improving its functionality and ensuring safeguards are in place to reduce the likelihood of similar incidents occurring in the future.



You can read the full accident investigation at https://bit.ly/2WsCznt

The Nautical Institute's Mariners' Alerting and Reporting Scheme (MARS) - *https://www.nautinst.org/resource-library/mars.html* - comprises a fully searchable database of incident reports and lessons, updated every month. If you have witnessed an accident or seen a problem, email Captain Paul Drouin at mars@ nautinst.org and help others learn from your experience. All reports are confidential – we will never identify you or your ship.

The technology revolution

Self-confessed 'techie' and keen Nautical Institute student member **Imtiaz Khan AMNI** shares his opinions about maritime technology and talks about living a life full of 'adventure and thrills' at sea

Name: Imtiaz Khan AMNI
Current Position: Cadet
Vessel: *Akij Pearl* / Bangladesh Maritime Academy

What interested you in a career at sea?
I was not interested in a normal office desk job like my father had. Since my childhood I have always been fond of adventure and thrill. So, after passing out from my college, I decided to go to sea and work in big merchant ships, traversing huge waves and sea sprays, carrying necessary goods for people waiting on the shore.

What career path has led to your current position?
I joined the only government maritime training academy in my country – Bangladesh Marine Academy. When I joined, it had just started a new course which offered two years' regimental training, plus education at academy campus and a minimum 12 months sea-time. My studies will ultimately lead to a Bachelor (Hons.) degree in Maritime Studies.

Where do you see yourself going in the future?
Currently I am attending preparatory courses for the OOW Class-3 exam while also pursuing my Bachelor's degree. Once I have finished my studies, I see myself as a prudent Officer of the Watch in a renowned company, which will value me for my sense of responsibility and efficiency. I also eventually see myself in command of an ocean-going vessel as Master and would like to work as a maritime pilot to serve my country.

How has technology affected shipping as we know it today?
Technology has brought about a revolution in shipping. The number of accidents at sea has reduced to a great extent because of the use of technology. For example, ECDIS has made it easier for OOWs to carry out passage planning, passage monitoring, early warning of different risks etc.

I favour combining both technology and traditional methods in my work. For example, on my first ship we used both paper charts and ECDIS in conjunction with each other. This is because there is always a feeling of risk at sea around what will happen if there is a total loss of power, or if the electronics stop working properly.

I have great admiration for the different international organisations and entities who are working behind technological advancement and autonomous shipping. Done correctly, this will make our jobs on board ship a lot easier than before.

How do you make sure that you keep your skills up to date with the technology that you use in your job?
Personally, I am proud to call myself a techie! Recently, I attended a project on digital marketing. I try to stay active on social media and the internet. I also read maritime blogs and publications about maritime technology, so that I am always up-to-date with recent thinking on the subject. I am also pleased to be a member of The Nautical Institute, which has a lot of resources to keep its members up-to-date on technology and the wider maritime and shipping world.

Dr Andy Norris FRIN FNI

Anticipating autonomy at sea

Dr Andy Norris, an active Fellow of The Nautical Institute and the Royal Institute of Navigation, looks at how autonomous technology might develop in the future – and how it is already changing things today.

The development legislation to regulate Maritime Autonomous Surface Ships (MASS) has been on IMO's main agenda since 2018. Interim guidelines for the trials of autonomous vessels have already been agreed. However, work is expected to continue for some years before detailed standards can become readily available.

Among other things, the legislation sets out levels of autonomy that define how far a vessel is controlled by a human, and how far by a remote user or even by artificial intelligence.

Importantly for today's navigators, the first three degrees of autonomy all continue to need fully-qualified navigational staff to ensure the vessel's safety, whether they are based on board or in a remote location – but who will also need some additional skills to keep pace.

The four degrees of autonomy currently being considered by IMO are:

1. **Ship with automated processes and decision support.** Seafarers are on board to operate and control shipboard systems and functions. Some operations may be automated
2. **Remotely controlled ship with seafarers on board.** The ship is controlled and operated from another location, but seafarers are on board
3. **Remotely controlled ship without seafarers on board.** The ship is controlled and operated from another location. There are no seafarers on board
4. **Fully autonomous ship.** The ship's operating system is able to make decisions and determine actions by itself.

Regulating equipment

The first degree of autonomy is mostly aimed at ensuring that the increasingly intelligent equipment being fitted to new and existing vessels is suitably regulated. These systems can make an automated analysis of aspects of the total situation, taking into account information from multiple sources, such as radar, AIS and charted data. They can even have some understanding of the Collision Regulations. In the near future, sophisticated optical sensing equipment will also be introduced to aid the human view from the bridge. These types of system will allow vessels to be navigated autonomously in certain situations – but always with an overview by qualified human navigators.

QUALIFIED MARITIME NAVIGATORS STILL APPEAR TO HAVE A LONG AND INTERESTING CAREER IN FRONT OF THEM - EITHER AT SEA OR WITH EVER-INCREASING OPPORTUNITIES TO BECOME LAND-BASED

Control from land

The second and third degrees of autonomy are for vessels designed to be navigated and controlled from the land by fully-qualified personnel, assisted by appropriate levels of automation. It is obviously highly important for the control centre to have a full and complete optical view from the vessel at all times, as well as continued access to all conventional navigation-related sensors.

The main difference between the second and third degrees of automation is the way in which action can be taken when the remote operator is unable to maintain appropriate control of the vessel. On second-degree systems, the qualified onboard human navigator would immediately move to the vessel's emergency manual control position.

For the third-degree level, a special onboard system would automatically take over. The vessel's control centre would initiate appropriate emergency measures, inform the relevant authorities and help decide upon the best solution to rescue the situation. Huge technological sophistication would be needed to ensure that the vessel remained entirely safe while awaiting either the renewal of normal remote operator control or rescue by a physical recovery operation.

Ensuring safety

Fully autonomous ships will need to be able to navigate at least as safely as well crewed conventional vessels, even when encountering emergency situations. This will undoubtedly become achievable in time; however, we are apparently many years away from being able to demonstrably meet the emerging IMO requirements for such an innovation.

Qualified maritime navigators still have a long and interesting career in front of them – either at sea or with ever-increasing opportunities to become land-based.

TAKE 10

Ten terrific facts about the future of maritime technology

1
Stay current
New technology is changing the world rapidly; keeping abreast of evolving capabilities will make it easier for you and your colleagues to make the best use of it.

2
Plan ahead
Continuous Professional Development (CPD) is about identifying what you want to learn, learning it and then reflecting on how it has helped you and informed your decision about what to learn next. This can apply to learning about new technologies. Find out how The Nautical Institute can help in this area by visiting www.nautinst.org/career-development.html

3
SWOT up on your tech
As with any area of life, technologies old and new all have strengths, weaknesses, opportunities and threats (SWOT) – try to understand as many of them as you can to gain a fuller picture.

4
Be critical…
…but not cynical. It's good to question systems and the advice and support they offer, but remain open and positive to their potential benefits too.

5
Don't get lost in the data
Many systems use 'big data' (analysing vast amounts of data) to arrive at conclusions faster than humans can. These results can be very useful but they can often overlook subtleties, particularly when human issues are involved.

6
Garbage collection
Always be mindful of the quality of data that is being used – and produced. Systems that use poor data will return poor advice: a simple case of garbage in / garbage out.

7
Feedback matters
Some systems offer great improvements, some cause frustration. Don't suffer in silence (as mariners often do). Rather, try to let your company and manufacturer know. Your feedback could help improve the next version.

8
Need and want
Increased data can be a good thing when it comes to making decisions – or a bad thing if it leads to information overload. Consider what amount of information you actually need, as opposed to what you might want (but might not actually be useful). How can you filter this down?

9
Mentoring
Learn from everyone, particularly when it comes to technology; someone younger or more junior than you might be in a great position to mentor you and help you learn about advances in technology.

10
Version control
Hardware, software and data change rapidly and must be updated on a regular basis. Always check that you are current and have a procedure for keeping everything up to date.

LIKE OUR TOP 10 TIPS?

Find more in your own language at www.nautinst.org/NavInspire

#NavInspire

WIN AN IPAD

Just post a picture of you with your *Navigator* on Twitter, including the hashtag **#NAVsnap**, or send us a message on Facebook with your photo attached (www.facebook.com/thenauticalinstitute) and tell us the name of your ship or your college, if you have one. Let us know if you're a member of The Nautical Institute, too (everyone gets entered in the draw, whether you are a member or not!) Or send us the information in an email!

AND THE WINNER THIS ISSUE IS...

Our Navsnap winner for this issue is Graeme Smith MNI. Graeme is a Mooring Master, and this photo was taken during an STS operation offshore from Aruba. "Why work just one ship if you can work two?" he asks.