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A FAIR FUTURE FOR SEAFARERS?

How will seafaring change in the coming decades and how should the welfare sector adapt to the change?

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...action needs to be taken now to ensure that the welfare frameworks are put in place. As this report recommends there needs to be a global solution to welfare needs as the current delivery models are struggling to cope with demand now, let alone in the future.

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FOREWORD

At exactly this time last year and in collaboration with the authors of this report we launched Welfare 2.0, a report that was designed specifically to look at the role of technology in improving crew welfare and safety onboard.

I am delighted to say that the report turned out to be so much more than just words on a page. It was actually the catalyst for us to collaborate with Thetius and Shell Shipping and Maritime to develop an Open Innovation Challenge, which led to 50 startups across the globe applying and the selection of a solution that is now live on a tanker and already collecting data that will enable innovative ways to manage onboard fatigue and ultimately improve life for those on board.

Proof if ever needed that technology has a vital role in improving crew welfare.

> *2050 may seem a long way in the future, the vessels that carry the seafarers will start to be built by the end of this decade and action needs to be taken now to ensure that the welfare frameworks are put in place.*

This report looks in-depth at the seafarer of 2050, including the type of work they will undertake, the vessels they will serve on and the trades they will facilitate. Although it may seem a long way in the future, the vessels that carry the seafarers will start to be built by the end of this decade and action needs to be taken now to ensure that the welfare frameworks are put in place. As this report recommends there needs to be a global solution to welfare needs as the current delivery models are struggling to cope with demand now, let alone in the future.

However, as we are all fully aware the Covid Pandemic and the resulting crew crisis continue to put a firm spotlight on seafarer mental health and the introduction to this report illustrates the horrendous circumstances that some seafarers are finding themselves in and the pressure that welfare organisations are finding themselves under to provide services to more and more seafarers.

Through our continued collaboration with charities, welfare associations and owners and managers we have put in place a number of initiatives to assist including supporting a number of Mental Health helplines, but we are fully aware that the current framework and its ability to support the seafarer of the future is not fit for purpose and this is the reason we have commissioned the authors to look into the welfare needs of the future seafarer and what needs to change to support them.

I thank the authors for their hard work putting this together and canvassing seafarers and charities and welfare organisations on their thoughts. We welcome your opinions and look forward to collaborating with many different organisations in creating a welfare framework that works for the demands of future seafarers.

Ronald Spithout

President, Inmarsat Maritime

EXECUTIVE SUMMARY

This report aims to explore the changing role of seafarers over the coming three decades and reconcile those changes with the role the welfare sector plays in supporting them.

Though 2050 appears to be a long way off, the scrap and build rates of ships mean that many seafarers in 2050 will be sailing on ships that were built in 2030, just nine years away.

It is likely that ships in 2050 will be sailing with high levels of automation and the role of individual seafarers will have changed significantly. Though 2050 appears to be a long way off, the scrap and build rates of ships mean that many seafarers in 2050 will be sailing on ships that were built in 2030, just nine years away.

Many of the technological shifts we have seen in other industries over the last two decades will be realised in the maritime industry in this time. This includes levels of automation following a similar pattern to aviation. The number of people involved in operating a ship will likely reduce and the role of officers will move to monitoring an automated operation.

The generation of seafarers who will be sailing in 2050 is being born into a world where eSports are as popular as regular sports, work and school can be conducted remotely, and the internet can provide everything, from entertainment to food, on-demand.

Improvements in 3D printing, a changing climate, and a rapidly growing population in Africa, mean that trade routes will likely look very different in 2050. Whether they are operating by crew on board or from a shore control station, ships will be going to very different places.

These changes could create a wide range of issues for the seafarers of tomorrow including human issues such as isolation and loneliness, task issues such as skill fade and mental underload, equipment issues such as a lack of standardisation, safety issues such as extreme weather events, and legal issues such as abandonment.

Combined with shorter port stays and less access to and from vessels, protecting the vulnerable and delivering welfare services will require a change in the current delivery model.

Adapting to these changes will require the industry to transform its approach to training and welfare. This includes an increased emphasis on professional development to enable individuals to keep pace with changing technology. Soft skills will also become increasingly important as crews get smaller. But a raft of new technologies such as virtual and augmented reality are making high quality training cheaper and easier to access.

Welfare services will not be immune from the changes outlined in the report. It is likely we will see two populations of seafarers emerge, including a relatively small number of highly paid specialist professionals and a larger number of low paid workers conducting maintenance

operations. Combined with shorter port stays and less access to and from vessels, protecting the vulnerable and delivering welfare services will require a change in the current delivery model.

Based on the changes required, the authors recommend that a global seafarer advocacy organisation is established to support individual seafarers and lobby for improved funding and welfare standards. Further, it is recommended that a strategic review of local seafarer services is conducted to ensure frontline resources are used as effectively as possibly. Lastly, a change in the delivery model to focus more on digital services and community engagement ashore is also recommended.

INTRODUCTION

On the 28th of January 2021, an asphalt tanker was waiting at anchor for instructions after being sold for scrap. Shortly after having lunch in the mess room, one of the 13 crew members onboard disappeared. The master raised the general alarm and the crew conducted a search of the vessel. The missing crew member was found dead in the ship's boiler room, having taken his own life.

...anecdotal evidence tells us that in 2020, the number of seafarer suicides and attempted suicides has skyrocketed.

In the master's report of the incident, he wrote that before his death the crew member had made several requests in writing to be sent home. Citing COVID-19 restrictions, his employer refused the requests. At the time of death he had been onboard for 13 months.

Other crew members on board the vessel reported that, in their view, the ship was not seaworthy and that the ship was running on emergency bunkers. At its last port state control inspection, the ship had 14 deficiencies including issues with accommodation, fire safety and cargo handling equipment. The ship was not detained.

In the days that followed his suicide, the victim's body had to be kept in the vessel's freezer, because COVID-19 restrictions meant that local authorities would not arrange for it to be moved ashore and repatriated. It took a week and a half for the local authorities to arrange for a public official to visit the ship.

The victim was just 23 years old.[1] [2]

The story above is sadly not unique. Although it is extremely difficult to get accurate figures, anecdotal evidence tells us that in 2020, the number of seafarer suicides and attempted suicides has skyrocketed. Though not a perfect indicator, mentions in the press of seafarer suicide rose by 42% in 2020 compared to 2019.[3]

Further, though the rate of mental health issues among seafarers is roughly in line with the general population, at around 25%, the mental health outcomes for seafarers are much poorer. In the general population, the rate of suicides as a percentage of all deaths is 1.5%. At sea, the rate of proven suicides as a percentage of all deaths is nearly four times

1   Seafarer Commits Suicide Aboard Asphalt Tanker off UAE, Maritime Executive, 2021

2   Tragic seafarer suicide on asphalt tanker vessel off UAE coast, Human Rights at Sea, 2021

3   Analysis by Thetius, sources Google News, Meltwater, 2021

This report intends to reconcile the changing role of the world's 1.6 million seafarers, with the current and future provision of welfare services.

higher at 5.9%. These numbers were recorded before the pandemic and they exclude unexplained deaths such as man overboard or missing persons cases. The real and up to date numbers are likely to be much higher.

The crewing crisis of the last year, and the subsequent rise in suicides by seafarers are both symptomatic of welfare issues that exist across the global maritime industry. This is despite the fantastic work of hundreds of organisations that exist to improve the lives of the world's seafarers.

These welfare issues exist as a backdrop to a rapidly changing industry. The rise of digital technologies and automation mean that one of the world's oldest professions is set to change more in the next 30 years than it has in the last 300.

This report intends to reconcile the changing role of the world's 1.6 million seafarers, with the current and future provision of welfare services. In this report we will explore the seafarer of 2050 and the issues they are likely to face in their work, how the welfare needs of the seafaring population may change based on this future scenario, and how the industry and training institutions can adapt. Further, we will explore how the world's seafarer welfare organisations may be affected by this changing environment and make some specific recommendations that are aimed at helping the sector to continue to have a positive impact on the lives of those they serve.

THE SEAFARER OF 2050

To understand the world of the seafarers of 2050, we must first examine the ships they will be working on, the lives they will lead, and the future global trading environment.

The seafarer of 2050 will likely work in a much smaller crew, but have greater interaction and engagement with teams of people ashore. They will sail on ships with a high level of automation that will likely be sailing new trading routes to serve the world's shifting demographic dynamics. Most importantly however, they will have grown up in a world where digitalisation and connectivity are no longer a novelty to be admired, but a given and minimum standard.

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SHIPS IN 2050

When the Nokia 3310 was launched it was hailed as the very best of cutting edge technology. It had a massive 1kb of memory, a 900 mah battery and a groundbreaking 1.5 inch monochrome screen. After launching in 2000, the phone was an instant hit and sold 126 million units over the next five years.

Fast forward to today, and the spec of the Nokia handset feels less exciting. The iPhone 11 Pro has 4,000 times more memory, four times the battery power, and a 6inch fully retina display that can play 4K video. As well as this, the iPhone has four camera lenses, a fingerprint scanner, and the ability

2050

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to connect to high speed internet, all of which was science fiction at the time of the Nokia's launch.

When we consider the future of seafaring, 2050 seems a long way off. But the average age of the world's merchant fleet is 21 years.[4] This means the average merchant ship was built at the same time that the Nokia 3310 was launched. Many seafarers today are sailing on ships that were built in a time before the iPhone existed, before broadband was rolled out to homes and businesses, and before Facebook, Twitter, or YouTube had even been invented.

Unless there is a drastic change to the scrapping and renewal rates of the world's merchant ships, it is reasonable to assume that in 2050, seafarers will be working on ships that were built in 2030, just nine years from now. Many of the technological shifts we have seen in other industries over the last two decades will be realised in the maritime industry in this time. This makes industries such as aviation a great place to look to understand what changes to expect.

In aviation, automation has reduced the number of people in the cockpit. First the flight engineer disappeared, then the navigator followed; however, we still have pilots. Between takeoff and landing, automated systems manage the plane but the pilots are always on standby in case something goes wrong.

By 2050, we will likely have a mix of ships with different levels of autonomy. It is important to note however, that autonomous and unmanned are two different concepts. Though the role of a seafarer may change a great deal in the next three decades, it is highly unlikely that the world fleet will be entirely unmanned. Even the most modern ships need maintenance and ships don't earn money when they are laid-up. Because of this, it will likely cost less for shipowners to have maintenance teams on board, particularly on ocean passages.

4   Review of Maritime Transport 2020, UNCTAD, 2020

> *With improved connectivity, remote monitoring, remote-control ships and remote pilotage will become more widespread.*

Because they're within range of assistance if something fails, coastal ships may be monitored remotely, carrying only a maintenance team. On deepsea ships, this will be more complicated.

Just as we have unmanned machinery spaces (UMS) today, by 2050 unmanned bridges may follow the same pattern, with a duty officer on-call in case of alarms. In areas of heavy traffic, like Singapore Strait, or on high-risk vessels like cruise ships, the bridge may well be manned just as today's UMS spaces today are manned for similar transits. In this case, the watch officer will fill a role similar to that of today's dynamic positioning (DP) operators. To balance the increased workload of maintaining the ship with a smaller crew, automated record-keeping and consolidated paperwork will reduce the administrative burden.

With improved connectivity, remote monitoring, remote-control ships and remote pilotage will become more widespread. Rather than seafaring being the on-board shift work we know today, it could be a normal nine-to-five job spread across time zones. This is already becoming a reality, with companies such as Seafar offering a ship management service for remotely operated and unmanned vessels. The Belgian startup has developed a state of the art control centre in Antwerp, where a team of shore-based operators provide support to crewed vessels and remotely control unmanned vessels up to 135m in length, sailing in coastal and inland waters.

With improved port technologies reducing port turnaround times and low crewing levels making shore leave impractical, those who physically go to sea in 2050 will spend most of their time on board. Better living conditions help to mitigate the challenges of being stuck on a ship, but strong people skills are just as important.

WORK IN 2050

As well as considering the technology available to the next generation of seafarers, it's important to consider the seafarers themselves. A 30 year old ship's officer in 2050 will have only been born last year. Generation Z, who were born between the late nineties and mid-2010s, have grown up as digital natives. But generation Alpha, are not just growing up as digital natives, but as a generation of people who are so fully immersed in digital technology that the analogue world is foreign to them.

The seafarer of 2050 will grow up with stories of a phone being something that can only make voice calls, of a car being something you had to drive yourself, and of a time when TV was broadcast on a fixed schedule. They will have been educated in a school that offers as many virtual classes as it does physical classes, and they will likely enter the workforce at a time when remote working has moved from novelty to normality.

Further, they will grow up in a world where professional computer gaming is more popular than professional sports. This year, more people are forecast to tune into live eSports matches like League of Legends and Dota than they are to tune into Major League Baseball or NBA basketball matches.[5] The rise of competitive gaming brings with it cultural shifts that will change how people spend their time, how they choose to learn, and the careers they want to pursue.

2050

Automation will doubtless change many aspects of life at sea, but for those who remain at sea many of these changes will be for the better.

Automation will doubtless change many aspects of life at sea, but for those who remain at sea many of these changes will be for the better. Seafaring has always been a hazardous profession. Between 2003 and 2012, seafarers were 21.6 times more likely to die in workplace accidents than those in the general workforce ashore.[6] As automation takes over the dull, dirty and dangerous tasks, from watchkeeping to tank inspections,[7] seafarers will be free to focus on the safer and more interesting tasks.

In the future, going to sea is more likely to be a stepping-stone to a career ashore. With smaller crews, fewer people will have the opportunity for practical seagoing experience; those that do may find their skills are more in demand when they are ready to transition into shore-based roles such as shore control stations. With high-demand for seafarers ashore, it is possible they will no longer be forced to choose between family and career.

5   With Viewership and Revenue Booming, Esports Set to Compete with
     Traditional Sports, Syracuse University, accessed 2021

6   Roberts, S. E., Nielsen, D., Kotowski, A., & Jaremin, B. (2014). "Fatal accidents and injuries
     among merchant seafarers worldwide." Occupational Medicine, 64(4), 259–266.

7   Gardner, N. (2021). "Current and future uses of artificial intelligence in the maritime industry." Thetius.

TRADE IN 2050

As well as considering the ships and the people, it's important to also look at the wider world the industry will be working in. Geopolitical forces have always shaped the shipping industry. With the push for decarbonisation and the rise of populism, countries and businesses may be motivated to shorten their supply chains. This could have several effects on shipping, including changes in trade routes, and common ship types.

While the growth in the carriage of goods by sea shows no sign of slowing,[8] trade patterns will change. First, economies of scale will lead to fewer and larger deep-sea ships, and a resurgence in coastal and short sea shipping. This is already apparent: in the last 50 years, container ships have tripled in size, and increased from 1,500 teu to 24,000 teu,[9] while short sea shipping has been slowly climbing in Europe since at least 2009.[10]

From a climate perspective, as the Arctic opens up and adverse weather becomes more common in the tropics, ships may take advantage of the Northern Sea Route and Northeast and Northwest Passages, with all the challenges that entails.[11]

Improvements in additive manufacturing, also known as 3D printing, will make local manufacturing more cost-effective. This will likely reduce the volume of manufactured goods carried by sea; however, under this scenario the transport of raw materials will continue, leading to an increase in the proportion of bulk carriers in the world fleet.

2050

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If well-managed, Africa's fast growing young population could be an opportunity for both the continent,[12] and for shipping. In the past, China and Korea experienced similar demographic youth bulges that led to improvements in the ratio of the non-working-age to working-age population, rapid economic growth, and the rise of the middle class.[13] People with disposable income, such as the growing African middle class, are more likely to go on cruises,[14] and more likely to buy consumer goods.[15] This will certainly affect the shipping industry, and the seafarer.

8   Department for Transport. (2019). "Maritime 2050: navigating the future."

9   Allianz. (2020). "Safety and Shipping Review 2020." Allianz Global Corporate & Specialty.

10   eurostat. (2021). "Maritime transport statistics - short sea shipping of goods."

11   Bekkers, E., Francois, J. F., & Rojas-Romagosa, H. (2017). "Melting ice Caps and the Economic Impact of Opening the Northern Sea Route." The Economic Journal, 128(610), 1095–1127.

12   Yifu Lin, J. (2012). "Youth Bulge: A Demographic Dividend or a Demographic Bomb in Developing Countries?" World Bank Blogs.

13   Buchholz, K. (2020). "The Rise of the Asian Middle Class." Statista Infographics.

14   Cruise Market Watch. (n.d.). "Market | Cruise Market Watch." Retrieved 12 June 2021.

15   European Commission. (n.d.). "Growing consumption." Retrieved 12 June 2021.

87%

Between 1976 and 2002, 87% of reported suicides at sea happened on deep-sea ships.

Human issues

Despite some parallels with aviation, the ocean poses unique problems. The seas dwarf even the biggest ships, and humans are social animals. Between 1976 and 2002, 87% of reported suicides at sea happened on deep-sea ships. The researchers blamed, "... recent reductions in crewing numbers...".[16] As automation reduces crews, seafarers' isolation will only increase. The COVID-19 pandemic brought seafarer mental health issues to the fore; lack of social contact or shore leave exacerbates the problem.[17] No one yet knows how long COVID-19 quarantine measures will continue for, or how the world will react in future to a similar outbreak.

Further, bullying and harassment is a known problem at sea, and most targets feel unable to report it on board. With smaller crews, the seafarers of 2050 will face not just less opportunity for on-board socialising, but also less opportunity for on-board support if they're targets of bullying, harassment or assault.

Another key issue to consider is demographics. If nothing changes, 22% of the world's population will be over 60 by 2050;[18] in more developed regions, this proportion will be even higher.[19]

ISSUES FACED BY FUTURE SEAFARERS

Just as recent changes in the maritime industry mirror past changes in aviation, it's likely that the problems will too. Broadly speaking, these problems can be split into four categories: human, task, equipment, and safety issues. In addition, seafarers face, and will continue to face, legal and political issues that are unique to the maritime industry.

16   Mellbye, A., & Carter, T. (2017). "Seafarers' depression and suicide." International Maritime Health, 68(2), 108–114.

17   Maritime & Coastguard Agency (MCA). (2021). "MIN 656 (M) Understanding the long-term impacts of the COVID-19 pandemic on seafarer wellbeing."

18   Kanasi, E., Ayilavarapu, S., & Jones, J. (2016). "The aging population: demographics and the biology of aging." Periodontology 2000, 72(1), 13–18.

19   Department for Transport. (2019). "Maritime 2050: navigating the future."

> *Without active effort to maintain and practice what will be by then "old-fashioned" skills, the seafarers of 2050 will rely on training rather than experience when their systems fail.*

50% of UK seafarers in 2020 were between 40 and 61; deck ratings are even older, with 70% in this age group. In addition, projections to 2026 show the number of UK-certified deck and engineering officers falling.[20] [21]

As the current seafarers "age out" and retire, or move to shore-based roles, fewer active seafarers will have first-hand experience of manual systems. Without active effort to maintain and practice what will be by then "old-fashioned" skills, the seafarers of 2050 will rely on training rather than experience when their systems fail.

From a welfare standpoint, older seafarers and retirees need a higher level of support and medical care. As the older demographic increases, seafarer welfare systems will need to adjust.

Task issues

With increased automation, aviation noted safety improvements, but also identified automation as a "causal or contributing factor" in several incidents and accidents. Over time, pilots' skills declined due to lack of practice with manual controls, but they overestimated their ability to "...take over and safely maneuver the aircraft in situations when automation fails, particularly given the likelihood of unanticipated distractions in the cockpit during a system failure."[22]

In addition, seafarers supervising automated systems could experience "mental underload", making them slow to respond to sudden changes such as alarms or equipment failures.[23] Lack of situational awareness, overconfidence in systems, and skill fade threaten reliability and performance in automated systems, which could impact safety[24] on manned autonomous vessels.

Every new navigation aid leads to a new category of accidents. VHF-assisted collisions followed VHF radio, and radar-assisted collisions followed radar.[25] More recently, ECDIS-assisted groundings followed the introduction of electronic chart display integrated systems (ECDIS).[26] While automation improves safety under normal conditions, it seems almost inevitable that a new category of accidents will emerge.

20   Department for Transport. (2017). "UK Seafarer Projections: 2016 to 2026."

21   Department for Transport. (2021). "Seafarers in the UK Shipping Industry: 2020."

22   Elias, B., (2019). "Cockpit Automation, Flight Systems Complexity, and Aircraft Certification: Background and Issues for Congress" Congressional Research Service,

23   Young, M. S., & Stanton, N. A. (2002). "Attention and automation: New perspectives on mental underload and performance." Theoretical Issues in Ergonomics Science, 3(2), 178–194.

24   Endsley, M. R., & Garland, D. J. (2000). "Situation Awareness Analysis and Measurement (1st ed.)." CRC Press.

25   Letulle, R., (1966) "Electronic Aids to Navigation and Their Basis as Fault in Marine Casualties," 12 Vill. L. Rev. 160.

26   Lusic, Z., Bakota, M., & Mikeli, Z. (2017). "Human Errors in ECDIS Related Accidents." 7th International Maritime Science Conference.

> *When it works well, technology makes life easier; repairs and maintenance are another matter. Aviation gets around this with standard equipment: a pilot or engineer trains to operate or maintain a specific aircraft. Unfortunately, the maritime industry shows no signs of following aviation's lead.*

When it works well, technology makes life easier; repairs and maintenance are another matter. Aviation gets around this with standard equipment: a pilot or engineer trains to operate or maintain a specific aircraft. Unfortunately, the maritime industry shows no signs of following aviation's lead.

Today's seafarers face an ever-changing and ever-growing conglomeration of equipment from different manufacturers, each with different interfaces, different spare parts, and different maintenance requirements. Every ship is different, and every ship has a unique combination of equipment. Since the industry shows no signs of standardising, the seafarer of 2050 will face more advanced equipment, but the same problem.

The ocean is a harsh environment and maintenance and repair cannot be automated. While much of it could be carried out in port, this will come at a cost. Maintenance at sea is more cost-effective than delaying the ship. By 2050, seafarers won't face only the familiar maintenance tasks of chipping, painting, greasing and cleaning, but also electronics, computers and cybersecurity.

Equipment issues

In May 2021, the IMO completed its regulatory scoping exercise for marine autonomous surface ships (MASS), and started discussing the creation of a new Code to regulate them.[27] The regulatory scoping exercise identifies the regulatory barriers to MASS adoption; the next step is to discuss the best way forward. Some of the ships of 2050 will be built in 2030. Even if member states can agree on how to regulate MASS, it's unlikely that a new Code or Convention will be in force by 2030. Just as today, the seafarer of 2050 will face a mixture of technology, including different levels of autonomy.

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27   International Maritime Organization (IMO). (2021, May 25). "Autonomous ships: regulatory scoping exercise completed."

Safety issues

Smaller crews are more cost-effective for companies, until there's a problem. With fewer crew and more specialisation, there are fewer people to cover for a sick or injured crew member, fewer crew to respond to emergencies, and less redundancy. In 2021, we have several officers in each department; in 2050, we could have just one or two, with some ratings for maintenance. In that situation, if the medical officer or electro-technical officer (ETO) is injured, who will take over?

Compared to the twenty years from 1980 to 1999, extreme weather events nearly doubled between 2000 and 2019.[28] Even if the push for environmental awareness and decarbonisation is successful, this trend is likely to continue for the foreseeable future.[29] For the seafarer of 2050, an increase in events like storm surges and tropical revolving storms (typhoons, cyclones) comes with obvious risks and challenges.

Related to climate change is habitat destruction. Most pandemic diseases, such as Spanish Flu, HIV, SARS and COVID-19 are zoonotic, meaning they come from animals.[30] As habitats are destroyed, animals are forced into ever closer contact with humans, increasing the opportunity for pathogens to make the jump.[31] Indeed, influenza pandemics have become more frequent since 1889.[32] For the seafarer of 2050, epidemics and pandemics may be more common, and repeats of the 2020 crewing crisis cannot be ruled out.

> *In 2050, on-board emergency response may be automated, or it may pivot to protecting the crew rather than the ship. In any case, it's difficult to see how a crew smaller than five could handle a serious emergency at sea without assistance or serious technical changes.*

Today's shipboard fire teams consist of at least two people; a rescue boat should have at least two crew, with one person on deck to retrieve the boat. Today's coastal ships can have crews as small as four or five. These crews already struggle to manage certain on-board emergencies if a crew member is injured or missing.

In 2050, on-board emergency response may be automated, or it may pivot to protecting the crew rather than the ship. In any case, it's difficult to see how a crew smaller than five could handle a serious emergency at sea without assistance or serious technical changes.

28   UN Office for Disaster Risk Reduction (UNDRR). (2019). "Human Cost of Disasters 2000–2019."

29   Richardson, K. (2017). "What will our climate look like in 2050?" Science Nordic.

30   Pike, B., Saylors, K., Fair, J., LeBreton, M., Tamoufe, U., Djoko, C., Rimoin, A., & Wolfe, N. (2010). "The Origin and Prevention of Pandemics." Clinical Infectious Diseases, 50(12), 1636–1640.

31   Aguirre, A. A. (2017). "Changing Patterns of Emerging Zoonotic Diseases in Wildlife, Domestic Animals, and Humans Linked to Biodiversity Loss and Globalization." ILAR Journal, 58(3), 315–318.

32   Smil, V. (2012). "Global Catastrophes and Trends: The Next Fifty Years." The MIT Press.

Legal and political issues

A 2010 survey by Nautilus International,[33] a seafarers' union, found that 92% of respondents were worried about criminalisation of the maritime profession, 66% said the fear of criminalisation had an impact on their feelings about working at sea, and 17% had been directly involved in a legal action.

As laws change around vessel autonomy, seafarers will have more options for shore-based roles within the industry; if criminalisation is still a fear in 2050, seafarers may be deterred from actually going to sea.

Another major deterrent for many seafarers is the risk of abandonment. Between 2004 and August 2020, there were 438 reported cases of abandonment, affecting 5,767 seafarers. This number has been rising for years.[34] Despite provisions in the MLC requiring compulsory insurance to cover seafarer abandonment, wages, and repatriation, on 4 June 2021, there were 329 open, undisputed cases.[35]

"Abandonment occurs when the shipowner fails to fulfil certain fundamental obligations to the seafarer relating to timely repatriation and payment of outstanding remuneration and to the provision of basic necessities of life, inter alia, adequate food, accommodation, and medical care."[36] —IMO

Abandonment does not affect just seafarers— it affects the families who rely on them. As port and flag states may make the situation worse,[37] abandoned seafarers and their families rely on charities and each other for support and survival.[38]

Abandonment happens out of the public eye, and companies get away with it because the industry is invisible. If the maritime industry is invisible today, how visible will it be in 2050, with more automation and smaller crews?

It is impossible to predict the political or maritime security situation in 2050; however, piracy, armed robbery, organised crime, slavery and terrorism have been a problem throughout human history. They are still a problem today, and this is unlikely to change in the foreseeable future. In addition, war, economic inequality and climate change will continue to drive an ongoing refugee crisis that will pose a problem for seafarers and maritime trade, just as it does today.

33   Nautilus International. (2011b). "Criminalisation of Seafarers."

34   Bakhsh, N. (2020). "Seafarer abandonment cases at record high." Lloyd's List.

35   International Labour Organization (ILO). (2021). "Abandonment of Seafarers database."

36   International Maritime Organization (IMO). (2020, August). "Seafarer abandonment."

37   Adams, B. P. (2021, April 22). "Stranded sailor allowed to leave abandoned ship after four years." BBC News.

38   Sailors' Society. (2021, May 19). "Abandoned."

THE ROAD TO 2050: HOW WILL THE INDUSTRY ADAPT?

B etween now and 2050, we'll see significant changes in the maritime industry, from MASS and related automation to changes in training and working conditions for those in the industry. Seafarers and seafarer welfare organisations will need to adapt to the new and ever-changing problems that result.

Regulations for autonomous shipping will need to address the issues identified in the IMO Regulatory Scoping Exercise.

Though the IMO's regulatory scoping exercise was a key first step to the full adoption of autonomous technology, the MASS Code will take time to write. In the meantime, each country is going its own way with MASS regulation. Regulations for autonomous shipping will need to address the issues identified in the IMO Regulatory Scoping Exercise. As well as training and the roles, this includes the legal responsibilities and authority of seafarers and shore-based vessel operators.

THE IMO HAS IDENTIFIED FOUR DEGREES OF AUTONOMY:

01: Ship with automated processes and decision support: Seafarers are on board to operate and control shipboard systems and functions. Some operations may be automated and at times be unsupervised but with seafarers on board ready to take control.

02: Remotely controlled ship with seafarers on board: The ship is controlled and operated from another location. Seafarers are available on board to take control and to operate the shipboard systems and functions.

03: Remotely controlled ship without seafarers on board: The ship is controlled and operated from another location. There are no seafarers on board.

04: Fully autonomous ship: The operating system of the ship is able to make decisions and determine actions by itself.

Source: International Maritime Organisation (IMO). (n.d.). *"Autonomous shipping."* Retrieved 30 May 2021.

TRANSFORMING TRAINING

By 2050, smaller crews, alternative fuels, wind-assisted ships, and more complex on-board technology will be the norm. This combination means that the seafarers of 2050 will need a higher level of technical training than seafarers today. Even in 2021, small crews have more interdepartmental cooperation and less job-demarcation than large crews. In 2050, seafarer training will likely reflect this, with less specialisation, more flexibility, and more emphasis on continuous professional development (CPD).

> *By 2050, smaller crews, alternative fuels, wind-assisted ships, and more complex on-board technology will be the norm.*

Enabling technologies

Fortunately, these technology developments are likely to come with the increased digitalisation that is enabled by widespread adoption of high speed internet at sea. In a fast-changing world, internet access will facilitate on-board CPD. Unlike aviation, we're unlikely to see a high level of equipment standardisation between ships, so seafarers in all departments will have to rely on a combination of shore-based technical support and a higher level of technical training.

By 2050, emerging technologies such as artificial intelligence (AI),[39] 3D printing, and extended reality (XR)[40] will be part of daily life, both ashore and at sea. Improved connectivity on board already makes it possible to link seafarers with specialists ashore and deliver live video training that can be streamed to hundreds of seafarers on board different ships at the same time. As the cost of these technologies comes down, its use will become more widespread. In conjunction with augmented reality (AR) and AI, specialist engineers will be able to guide seafarers in maintaining, fault-finding and repairing equipment. Seafarer training will therefore likely focus on making the best use of the assistive technologies. Just as celestial navigation is taught as a fallback navigation method today, we could see the basics of electronics and manual fault-finding taught as a fallback in 2050.

As the role of seafarers onboard moves to one that is more focused on monitoring, they will have less opportunity to practice and develop hands-on skills. Virtual reality and advanced simulation will help to bridge that gap. By 2050, VR will be affordable enough to use as a routine part of on-board CPD. Even today, organisations such as Ocean Technology Group are pioneering the use of VR headsets to make better maritime training that is safe and affordable for the industry. AI-based adaptive training systems[41] and competency assessment will be able to identify gaps in seafarers' knowledge and skills, and deliver personalised, targeted training material. Seafarers will waste less time revising familiar material, while still improving and maintaining their skills.

> *As the role of seafarers onboard moves to one that is more focused on monitoring, they will have less opportunity to practice and develop hands-on skills.*

Whether between those on board or when talking with shore stations, language barriers and misunderstandings will still exist; however, accurate real-time translation technologies will help to minimise these and simplify professional communication.

Under STCW, seafarers must complete refresher training for certain skills every five years. For other skills, such as keeping up-to-date with the latest technology, it's left to the company or the individual seafarer. While some large companies proactively provide on-board continuous professional development (CPD) programs, many do not.

39   Gardner, N. (2021). "Current and future uses of artificial intelligence in the maritime industry." Thetius.

40   Gardner, N. (2021). "Brief guide to extended reality in the maritime industry." Thetius.

41   Tech, D. O. (2020, November 12). "How AI and Adaptive Learning is shaping the Classrooms of future." Day One.

45%

A recent Nautilus survey found that 45% of current seafarers don't believe STCW is fit for purpose.

Professional development

As the pace of technological change continues to increase, CPD will become an essential part of everyday work, not an additional task to be completed during time-off. Using technologies such as virtual and augmented reality for training,[42] either on board or at home will reduce the time spent travelling to and from training centres, while still making it possible to keep skills up-to-date.

But it's not just the seafarers. Remote monitoring stations will need to be staffed, and pilots will need to train on remote pilotage. Because shipping is international, states will need to agree on the procedures for interacting with remote monitoring stations or pilots. The pilots, seafarers and staff will also need to be trained on these procedures. Today, virtual reality platforms such as VASCO, developed by UK maritime training startup Kilo Solutions, allow trainees in different places to interact in the same virtual space, providing an essential shared training and practice environment. This type of training will become even more important as the industry increasingly shifts to shore based operations.

The Standards of Training and Certification for Watchkeepers (STCW) convention regulates seafarer training; however, it's not keeping up with the pace of technological change.[43] A recent Nautilus survey found that 45% of current seafarers don't believe STCW is fit for purpose.[44] The same study identified several essential skills for the future including general IT systems and networking; system-specific training; better academic and soft skills; multi-discipline seafarers; and cyber security. As well as the skills delivered to seafarers, STCW makes little allowance for the changing way we like to learn. It is becoming increasingly common, particularly among younger generations, to learn skills via apps and games rather than in a traditional classroom setting.

To bridge the gap between training and reality, some flag states have begun to provide a higher level of seafarer training, as do many shipping companies. For example, the Isle of Man Registry has worked with local startup Tapiit to create an app to live stream training classes to all seafarers on Isle of Man registered vessels.[45] This creates a multi-tiered system of qualifications; however, it also offers a route for companies, colleges and states to work with manufacturers and other organisations to ensure appropriate, if non-standard, seafarer training.

42   Gardner, N. (2021). "How will advanced simulation impact maritime training?" Thetius.

43   International Chamber of Shipping. (2020). "A review of the STCW Convention 2020."

44   Nautilus International. (2020). "STCW Survey 2020."

45   Isle of Man ship registry becomes first flag state to launch seafarer welfare app, Isle of Man Ship Registry, 2020

The need for soft skills

Enabling a safe working environment where seafarers can thrive goes beyond simply the development of hard skills. Soft skills, such as emotional intelligence, communication and critical thinking, also have an incredibly important role in the future of seafaring. Living with others in an isolated community is hard. Through the last year we have all had some understanding of the impact that comes with being isolated for a prolonged period of time. In 2021, we're only just starting to discuss mental health and soft skills for seafarers. For the smaller crews of 2050, this will be even more important. While it is possible to learn and improve these skills, in 2050 they will likely play more of a role in seafarer selection.

Today's seafarers are self-selecting: anyone who can pass the exams and has no disqualifying medical conditions can go to sea. In the future hi-tech world of small crews, it is possible that interpersonal skills will be as important as technical skills. The combination of integrated departments and smaller crews will make teamwork indispensable.

Even if only for remote monitoring, language and communication will be a higher priority. We already see problems with in-person handovers between people on the same ship. The challenges of remote handovers between strangers in different time zones bear thinking about. But at least those people will be able to go home at night. Future training will need to focus more on resilience, cross-cultural communication and understanding, negotiation, self-care, and dispute resolution techniques. Mental health first aid and awareness must become part of the standard medical training for seafarers, not just an add-on.

Between shift work, vibration, and machinery noise, fatigue is endemic in the maritime industry. Autonomous systems and automated administration will allow more time for rest, in theory helping to reduce fatigue.

ADDRESSING WELFARE NEEDS TO 2050

COVID-19 reminded us that pandemics are inevitable.[46] [47] After a slow start, the pandemic has demonstrated that telemedicine is a cost- and resource-effective way to connect patients and medical professionals.[48] As digitalisation at sea improves, the combination of AI and connected medical devices could help doctors ashore to better guide patient care at sea.[49] Increased digitalisation means seafarers will be able to access online mental health care, support communities, and even AI support bots.[50] This means that, over the next few decades, seafarers should be able to maintain and develop ongoing relationships with appropriate medical professionals in the same way that their counterparts ashore do.

Between shift work, vibration, and machinery noise, fatigue is endemic in the maritime industry. Autonomous systems and automated administration will allow more time for rest, in theory helping to reduce fatigue. Fatigue monitoring and management systems will likely replace the manual recording

46   Gallagher, P. (2020, July 1). "World could face another pandemic 'within 5 to 8 years' according to scientist who predicted coronavirus." Inews.co.uk.

47   World Health Organization. (n.d.). "An R&D Blueprint for Action to Prevent Epidemics." Retrieved 4 June 2021

48   Stokel-Walker, C. (2020, October 6). "Why telemedicine is here to stay." The BMJ.

49   Norman, A. (2018, January 31). "Your Future Doctor May Not be Human. This Is the Rise of AI in Medicine." Futurism.

50   Browne, D. (2020, June 27). "Do Mental Health Chatbots Work?" Healthline.

The aim of the system is to explore the viability of allowing the master to manage watchkeeping hours based on the actual fatigue level among the crew, rather than an entirely fixed schedule. Though programmes such as this are in their early stages, it is likely we will see a progression to a more risk-based approach to managing issues like fatigue as we move towards 2050.

The Seafarers International Research Centre's (SIRC) Social Interaction Matters Project found that, "Social interaction can improve the mental and physical health and well-being of seafarers."[51] Shared spaces on board will need to be designed to encourage social interaction,[52] and connectivity should enable crew to stay in contact with friends and family ashore. As well as being used for training and maintenance, connected XR systems will improve on the video calls of 2021, allowing seafarers to interact with friends and family in a shared virtual space.[53]

Though social interactions are often positive, bullying and harassment have been around forever. Unfortunately, they are well-known and poorly managed problems at sea,[54] with many seafarers unwilling or unable to report. Indeed, reporting through official channels can make things much worse.[55] [56] In 2050, while harassment is unlikely to disappear, it should be easier for seafarers to report such problems to and access support and advice from independent bodies or charities online, rather than being left to fend for themselves.

As well as improvements in day to day welfare, we will also likely see improvements in emergency response by 2050.

of rest hours by tracking indicators of stress and fatigue. These systems, such as the one developed by US computational neuroscience startup Senseye, can alert supervisors if it detects fatigue or stress levels that could impact performance or safety, or provide an early indication of a developing mental health problem.

Currently, UK startups Eupnoos and Workrest are taking this concept one step further in a joint project with Shell Shipping and Trading and Inmarsat to develop and test an intelligent fatigue management system that uses wearable technology to track fatigue.

As well as improvements in day to day welfare, we will also likely see improvements in emergency response by 2050. The use of artificial intelligence to track ships is already popular, with companies such as UK startup Geollect providing tracking and intelligence services to ship operators, insurers, and governments worldwide. Working along the

51   Pike, K. (2020). "Social Interaction Matters (SIM)." International Seafarers' Welfare and Assistance Network (ISWAN).

52   ISWAN. (2021, April 1). "Social Interaction Matters – What works well on board?"

53   vTime. (n.d.). "vTime - Reality Reimagined." Retrieved 4 June 2021

54   ICS-ITF. (2016, January). ICS-ITF Guidance on Eliminating Shipboard Harassment and Bullying.

55   Knaus, C. (2017, May 31). "Sage Sagittarius inquest: 'death ship' crewmen were victims of foul play, coroner finds." The Guardian.

56   Stanley, J. F. (2021, June 4). "Cadet Geveza's death exposes shipboard sexual harassment." Gender and the Sea.

> *Whatever the cause, when incidents at sea happen it often falls on those onboard to take legal responsibility. The threat of criminalisation is already driving seafarers ashore.*

THE CHANGING ROLE OF WELFARE SERVICES

There is no doubt that in 2050, seafarer charities will continue to support abandoned, imprisoned, sick, stranded and struggling seafarers, and give them a voice, just as they do today. Welfare can be defined in two ways. First, as help given, especially by the state or an organisation, to people who need it, especially because they don't have enough money. Second, as the physical and mental health and happiness of an individual.

In 19th century England, welfare was managed by charities and volunteers; education, healthcare, and social services were all covered. Over time, the government took these over, with the exception of provision for seafarers. Seafarers today depend on charities and employer goodwill for their welfare, just as they did two centuries ago. The question lurking in the background is: why must many seafarers today rely on charities for essentials that shore-based professionals take for granted?

The Maritime Labour Convention (MLC) entered into force in 2013 and was widely hailed as "The Bill of Rights for Seafarers". It sets out the basic conditions for seafarers' living and working arrangements. Unfortunately, the COVID-19 pandemic proved that the MLC is not enforceable. States and companies have repeatedly ignored their MLC obligations throughout the pandemic, while seafarers have been required to uphold their end of the deal. In the absence of welfare leadership from governments, seafarers have no choice but to rely on charities and non-governmental organisations (NGOs).

There are hundreds of seafarers' centres around the world today. Often known as "Missions", they are run by around a dozen major charities or charity groups who operate

same lines as AMVER[57] and MASTREP,[58] future AI-driven tracking platforms may be able to automatically identify vessels likely to be in distress, pirates, slaves,[59] refugees,[60] and other vessels of interest.

Whatever the cause, when incidents at sea happen it often falls on those onboard to take legal responsibility. The threat of criminalisation is already driving seafarers ashore. Without better protection, recruitment and retention will become more of a problem. As the laws and conventions develop around legal structures for vessel autonomy, the shipping industry, states and international organisations will need to think about legal protections to protect seafarers from criminalisation, and an enforceable right to fair treatment in the event of an incident.

57   AMVER. (n.d.). "Automated Mutual-Assistance Vessel Rescue System." Retrieved 6 June 2021

58   Australian Maritime Safety Authority. (n.d.). "Modernised Australian Ship Tracking and Reporting System." Retrieved 4 June 2021

59   Bladen, S. (2021, May 18). "Satellites can reveal risk of forced labor in the world's fishing fleet." Global Fishing Watch.

60   Pham, K. H., Boy, J., & Luengo-Oroz, M. (2018, October 1). "Data Fusion to Describe and Quantify Search and Rescue Operations in the Mediterranean Sea." IEEE Conference Publication

With increased automation comes smaller crews, less opportunity for social interaction and less social support on board. Automated ports make for shorter turn-around times and less opportunity for shore leave, despite the MLC.

worldwide and hundreds of charities who operate at a local level. Though they are often affiliated to religious groups, the Missions are the front line of welfare delivery to seafarers worldwide, regardless of religion, race, nationality, gender or culture.

Funded by a combination of donations and grants, the Missions and other maritime charities provide support for all aspects of seafarer welfare, from counselling, communication with family and friends, facilitating shore leave, arranging necessities for abandoned seafarers, providing support for hospitalised seafarers, and more. In addition to the welfare charities, some shipping companies subscribe to private employee assistance services and programs and telemedicine services that go above the legal minimum requirements.

With increased automation comes smaller crews, less opportunity for social interaction and less social support on board. Automated ports make for shorter turn-around times and less opportunity for shore leave, despite the MLC. We already know these factors have a negative impact on seafarer mental

health and wellbeing.[61] Even today, time-consuming or expensive administrative barriers can make even a trip to the local Mission impossible or impractical, leading many Missions to close down.[62]

As the reduction in crew and reduction in shore leave progresses, charities may need to pivot to delivering most or all of their services on board or online rather than at seafarer centres ashore. One such example is the Mission to Seafarers' Chat to a Chaplain. Developed during the pandemic, this online service can connect a seafarer to a chaplain in a chat session instead of arranging an in-person visit.

There are two major problems with moving to digital delivery. The first is connectivity. For seafarer charities to pivot to delivering online support, all seafarers will need internet access. Fortunately, this is already spreading. Between 2015 and 2018, internet access at sea doubled, or even tripled in some sectors.[63] By 2050, with increased demands coming for data transfer also coming from automation, connectivity will be the rule rather than the exception.

The second problem is funding. In many countries, seafarers are invisible.[64] Unless there is a maritime disaster, most people ashore never question where their consumer goods come from; in most cases, this changes only when they meet a seafarer. This invisibility poses a barrier to sustainable funding and delivery models for maritime charities. For maritime welfare charities to continue to provide the support the industry needs, they must rapidly adapt to the changing environment that is 21st century shipping.

61   Roberts, SE; Marlow, PB. (2005) "Traumatic work related mortality among seafarers employed in British merchant shipping, 1976-2002." Occup Environ Med. 62(3): 172–180

62   Birkett, H. (2017). The death and rebirth of seafarer centres | Chamber of Shipping. UK Chamber of Shipping.

63   Futurenautics Ltd., KVH, & Intelsat. (2018). "Crew Connectivity 2018 Survey Report." Futurenautics Ltd.

64   The Mission to Seafarers. (2021, February 24). "The invisible workforce."

REDESIGNING WELFARE FOR THE 21ST CENTURY

Though it is incredibly well intentioned and absolutely necessary, the industry's reliance on welfare services is also a problem that needs to be addressed. As discussed previously, no other modern profession relies so heavily on a network of charitable organisations just to function. More importantly, no other industry is so reliant on the work of charitable organisations to undertake basic welfare duties that would ordinarily be the responsibility of an employer in a shore based organisation.

As we look ahead to 2050, two populations of seafarers will likely emerge. First, if the promises of automation are realised, a small number of highly trained, highly skilled, and highly valued workers will be required to act as vessel operators. This role will probably combine deck, engineering, and electro-technical disciplines, with the individual mostly engaged with systems and situational monitoring with the occasional need to intervene. It is also likely that this role will involve some combination of work in remote operations centres ashore and work that is physically located on a vessel.

The second group will likely be engaged solely in vessel maintenance, carrying out relatively low skilled but dangerous work for less pay. It is possible that, rather than traditional crewing structures, we will see teams of people acting as riding gangs only when a vessel needs maintenance. Today, the use of riding gangs is growing and they are often employed casually with low pay on contracts that exist outside of collective bargaining agreements.[65]

Though there has always been a financial divide between officers and ratings, seafaring has traditionally been a great tool for social mobility.

Though there has always been a financial divide between officers and ratings, seafaring has traditionally been a great tool for social mobility. It is quite possible today for an individual seafarer from a poor background to join the profession as an ordinary seaman or wiper, and in time work their way to a captain or chief engineer's role. Under this scenario, with a smaller number of highly skilled roles for hybrid ship's officers, the gulf between the top and bottom will only grow, decreasing social mobility within the industry and increasing the likelihood that those
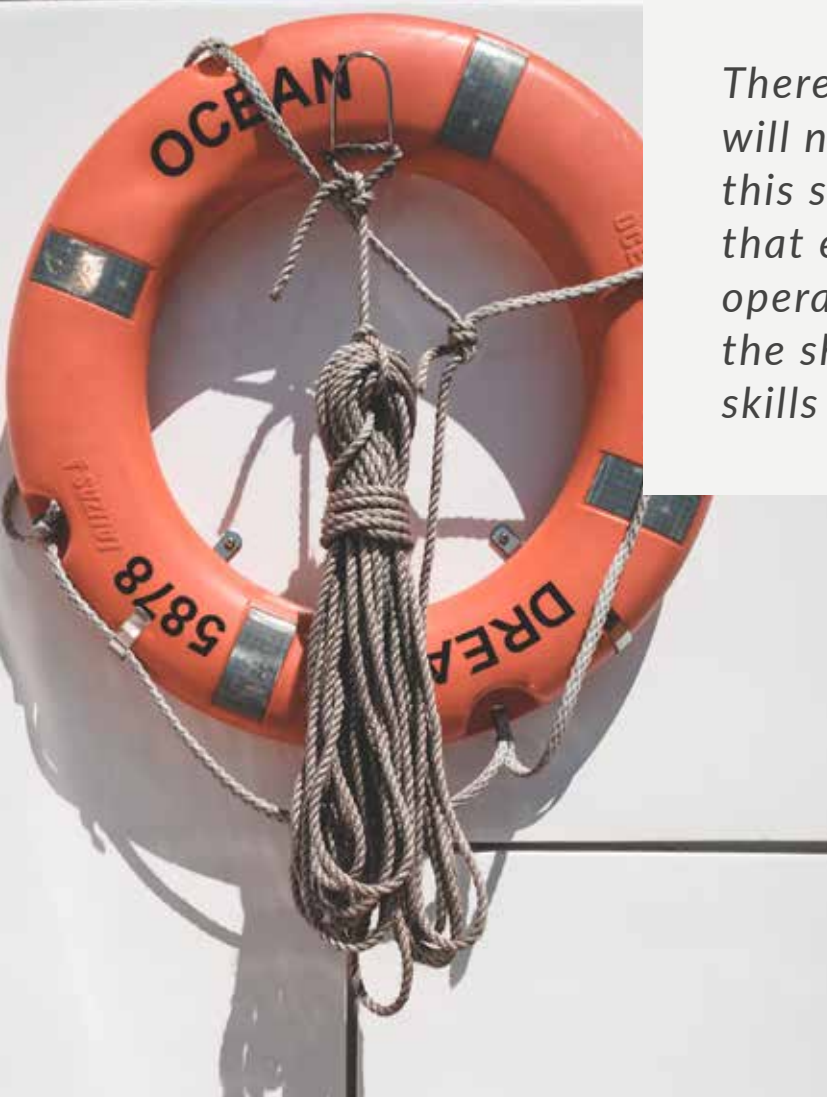
There is no doubt that industry will need to invest heavily in this skills shift and ensure that everyone involved in the operation or maintenance of the shipping fleet has the hard skills they need to do the job.

Addressing the skills shift

Though there will likely be fewer seafarers per vessel in future, growth in global trade makes it equally likely that the workforce requirements for the industry will remain stable or grow. That said, the skills requirements of that workforce will look very different in future, with a smaller number of people being trained to take overall responsibility for a ship, whether remotely or onboard.

There is no doubt that industry will need to invest heavily in this skills shift and ensure that everyone involved in the operation or maintenance of the shipping fleet has the hard skills they need to do the job. But there will almost certainly be a significant number of seafarers, particularly those in the latter stages of their career, who are left behind by the change.

This will create a challenging environment for the welfare sector, where some of the most needy seafarers are no longer onboard ships, but instead destitute ashore. Long term, overcoming this will require the welfare sector to invest in re-skilling and upskilling those individuals to ensure they are equipped to deal with the changes, possibly pursuing relevant work, whether in or outside of the industry ashore.

As well as investing in skills for those who struggle with a transition to a more automation-heavy industry, there will be an

at the bottom of the industry will become trapped in relative poverty or face abusive practices from unscrupulous employers.

This creates a number of questions for the organisations that make up the maritime welfare sector. How can we ensure that individual seafarers are able to keep pace with the knowledge and skills they need to thrive in this changing environment? How can we protect the rights and interests of the poorest maritime workers? How should welfare provision be delivered and funded in future?

Protecting the vulnerable

Whether through abandonment, legal issues, or welfare issues on board, for many seafarers there will come a time when they need someone to speak for them. All of the maritime welfare charities and unions offer some kind of advocacy service for seafarers. During times of need this can be a vital lifeline for individuals who are in trouble, and for their families waiting at home.

Unfortunately, it is likely that we will see a continuation of the already growing trends of abandonment and criminalisation. In cases like this, it is those who are already vulnerable who are most likely to be targeted. Managing this will require a more coordinated approach to advocacy that is able to bring together the efforts of maritime charities, unions, and state actors. This will be increasingly important, not just for the proper handling of individual cases, but also to speak for the collective and to attempt to raise standards across the entire industry.

2020 showed the collective ineffectiveness of the entire shipping industry, including charities, corporates, unions, and even international bodies such as the IMO, to act as a voice for the needs of seafarers during a crisis. Governments around the world have repeatedly failed to act on the crew change crisis, which still exists at the time of writing. There is a clear need for more lobbying power and increased coordination when it comes to advocating for the rights of seafarers as a whole.

This issue goes beyond providing a voice in a crisis. Even more important is the ability to advocate for the improved quality of employment standards, better welfare standards on board, and better protections for seafarers from legal and abandonment issues.

Overall, a more holistic approach to knowledge and skills will be required in future, with more focus and emphasis placed on helping everyone in a seafaring community, including family members, to develop skills.

ongoing need to invest in softer skills that impact the overall wellbeing of those at sea. This includes life skills such as helping individuals and families understand financial management and security. Often, for seafarers who are away nine months of the year, this is as much about equipping family members such as a spouse or children with the right skills as it is about equipping the seafarers themselves.

Overall, a more holistic approach to knowledge and skills will be required in future, with more focus and emphasis placed on helping everyone in a seafaring community, including family members, to develop skills. This includes the soft and hard skills needed to ensure the security and wellbeing of a family both whenever an individual is at sea, and after they have moved ashore.

A new delivery model

Shore leave for seafarers visiting ports has been in decline for decades. This trend has unfortunately been accelerated by the stringent quarantine rules created by the ongoing pandemic. Even after COVID-19 ends, it may be some time before the rules are relaxed again. This, coupled with the fact that port call optimisation is one of the answers to solving the industry's carbon emissions problem, means that shorter port stays with less access to shore leave will become the norm.

Unfortunately, this trend, which as discussed previously will likely be exacerbated by higher automation and smaller crews, threatens the current provision model for welfare. Seafarer centres, seafarer transport, and welfare visits to the ship are predicated on there being some level of access, either for chaplains to go on board or for seafarers to get ashore. Though it will vary wildly between different ports and ships, it is important that the welfare sector as a whole is able to adapt to welfare provision that is delivered with little to no physical contact with the seafarers themselves.

A positive trend in all of this that shows no sign of slowing down is growing access to the internet for those who are at sea. This will likely be accelerated further by increased bandwidth demands of automation. For the first time, this makes it possible to move to a digital-first approach to the delivery of welfare services. This could include the increased use of digital tools such as messaging services or video calls for advice and guidance and online tools for skills development. This approach will make it easier to connect chaplains and frontline welfare teams wherever they are in the world to seafarers in need at any time in any location.

Not being able to physically interact with seafarers while they are on board does not however put them entirely out of reach. Taking a more holistic approach to the welfare of seafarers and protecting the most vulnerable, may require a shift in focus away

...port call optimisation is one of the answers to solving the industry's carbon emissions problem, means that shorter port stays with less access to shore leave will become the norm.

from the delivery of welfare services within ports and towards the delivery of welfare services in seafaring communities ashore. In this context, the seafaring community also includes spouses and children as well as the seafarers themselves.

In conjunction with the growth of digitally delivered services at sea, this may require the development of physical support centres in major seafarer population centres such as The Philippines, China and Ukraine. This will enable engagement with the entire seafaring community and allow welfare service providers to take a more proactive and preventative approach to evolving welfare issues.

Unfortunately, there are no easy answers to the question of funding services. Under MLC, member states who have ratified the convention should be responsible for ensuring that welfare facilities and services are provided in appropriate ports, and determine how they are to be financed.[66] Unfortunately, these aspects to the convention are not mandatory, and very little has changed since its introduction.

However, after a significant lobbying effort from international charities and the national seafarer welfare board, the New Zealand government announced an amendment to the Maritime Transport Act to fund seafarer centres. By the middle of this year, government levies charged to visiting ships will be used to fund the ongoing development and operation of the ten seafarer centres in the country.[67] This sets a precedent for developed governments around the world to follow, and demonstrates the power of a coordinated approach to lobbying for sustainable funding for seafarer services.

It is highly likely that the combination of reduced shore leave for seafarers and the rise in digital delivery will make some centres redundant. There is no doubt that there are synergies that can be found across the multitude of different charities that operate services in similar geographic areas to reduce costs or coordinate on improved delivery. Simultaneously, there needs to be a coordinated approach to lobbying for proper government and industry support for seafarer welfare services, wherever they are delivered in the world.

...there needs to be a coordinated approach to lobbying for proper government and industry support for seafarer welfare services, wherever they are delivered in the world.

66   Guidelines for implementing the Welfare aspects of the Maritime Labour Convention, ITF, ICS, 2006
67   Govt fulfilling commitment to improve seafarer welfare, Wood, New Zealand Government, 2021

CONCLUSION AND RECOMMENDATIONS

By 2050 we will likely see a range of ships with different levels of automation. Because of the pace of renewing the fleet, changes to life on board will happen over a period of decades rather than years. That said, there is little doubt that we will see fewer seafarers working on board ships, with many aspects of the role being automated or moved ashore. But there will always be a need for ships to be properly maintained and so it is unlikely that the world fleet will become completely unmanned any time soon.

This creates a range of issues for the industry to tackle in the next 29 years, from skill fade to poor standardisation and beyond. There is no doubt that the industry will need to adapt to these changes. This includes transforming training to focus much more on continuing professional development over and above the minimum legal standards, and using tools such as extended reality to enhance learning.

As the training needs of the industry change, so too will the welfare needs. Safety, fatigue, and harassment are all issues that are unlikely to go away, though their management may be improved in the coming years. The trends of seafarer abandonment and criminalisation continue to grow, and it is unlikely, without major changes to MLC, that the issue will abate. Lastly, the rise in connectivity and the decline in proper shore leave means that access to welfare services will likely become more digitally focused than physical.

Because of the pace of renewing the fleet, changes to life on board will happen over a period of decades rather than years.

This presents a range of issues for the welfare sector. The three recommendations below are intended to answer questions including how best to equip seafarers and their families with the skills they need to thrive, how best to advocate for those in need across the industry, and how to fund and deliver critical services to seafarers wherever they are in the world.

01. ESTABLISH A GLOBAL SEAFARER ADVOCACY ORGANISATION TO SUPPORT INDIVIDUAL SEAFARERS AND LOBBY FOR IMPROVED FUNDING AND STANDARDS

Every welfare organisation, whether they operate seafarer Missions or provide remote advice and guidance services, has to take on advocacy issues. Whether they are supporting seafarers abandoned by a vessel's owner, helping handle a repatriation issue, or helping a family deal with a criminalisation case.

Beyond providing pastoral support on the front lines, properly supporting these cases takes a huge amount of vital resources. They usually require legal and diplomatic expertise, and are often resolved through a combination of network, influence, and persistence. There is a clear need for a more coordinated approach, where resources are pooled into a single body that can leverage legal expertise, and lobbying power to advocate for the rights of seafarers in individual cases.

Additionally, there is a clear need for the industry to get better at lobbying for the rights of seafarers as a whole. This includes pushing for improvements to welfare conditions across the world fleet and for the proper funding of welfare services to seafarers from industry and government. Achieving this will require a coordinated and systematic approach to gathering evidence on welfare issues as they evolve. This will only become more important as those who actually work on ships become even less visible through increased automation.

As a profession, seafaring should not have to rely on the work of charities to function effectively. The ultimate aim of any welfare organisation should be to make itself redundant by ensuring that the intended beneficiaries are no longer in a position to require their services except in exceptional circumstances.

Creating long term improvements for seafarers across the industry requires a coordinated approach that leverages the best of the individual welfare organisations. By representing the entire sector's views on the international stage, coordinating lobbying for long term funding, and enabling better advocacy activity, a single body that is made up of representatives of the whole welfare sector will be far more effective at creating change than any one welfare charity could be.

Creating long term improvements for seafarers across the industry requires a coordinated approach that leverages the best of the individual welfare organisations.

02. CONDUCT A STRATEGIC REVIEW OF LOCAL SEAFARER SERVICES AROUND THE WORLD

There is no doubt that port welfare services will continue to be critical in the years and decades to come, but equally there is no doubt that access to ships will become more challenging and that resources should be focused on delivering services in other ways.

The seafarer welfare sector has evolved over centuries, with different faiths, religious groups, national organisations, and international charities all developing services individually over time. There is a great deal of friendly cooperation that exists between these groups, but there are also significant overlaps of welfare services in certain geographies.

Over time, as the provision of in person welfare services becomes more challenging, there should be a strategic review of the delivery of local welfare services. In line with recommendation one, this is about taking a more coordinated approach across the sector to enable the best possible provision of services and ensure that the maximum number of seafarers can benefit from the available resources across welfare organisations.

This may mean the reduction of services in some areas and an increase in others. It may also mean, with the decline in shore leave, that more focus is placed on geographies with a large number of seafarers passing through for crew changes such as Singapore and Dubai. Or it may mean a more intelligence-led approach to welfare visits, meaning a smaller chaplaincy team made up of multiple organisations can cover a larger geography in a coordinated way.

There is no doubt that port welfare services will continue to be critical in the years and decades to come, but equally there is no doubt that access to ships will become more challenging and that resources should be focused on delivering services in other ways.

03. INCREASE THE DEVELOPMENT OF DIGITAL SERVICES AND DEVELOP SERVICES THAT CAN BE DELIVERED WITHIN LOCAL SEAFARING COMMUNITIES

As well as investing in digital outreach for those who are onboard, the creation of seafarer support centres for those who are ashore should not be neglected, and a new model for welfare that focuses on preventative and proactive measures should be provided locally to seafarers and their families.

In line with recommendation two, if port welfare visits are forced into decline through lack of access, the method of delivery for front-line services needs to change. There is already a great deal of progress being made on the development of digital chaplaincy, welfare and advice services. As internet connectivity at sea improves, the demand for digital services will grow.

This will require more resources to be put into digital service delivery. But with the right systems and training in place, people that currently staff physical port welfare services could deliver the same pastoral support and advice digitally, whether by phone, video call, or chat.

Further, the use of digital tools to enable learning and skills development should be leveraged to help seafarers and their families to access education that can enrich their lives. There is a vast and growing range of free or very low cost education products that exist today outside the maritime industry. Helping seafarers of any rank, any nationality, and any economic background to access this education and learn the skills needed to provide financial, health, and wellbeing security for their families should be prioritised as a long term goal for welfare organisations. Digital tools are a fantastic enabler for doing this at scale.

That said, digital tools can only reach so far. There will always be a need for physical interaction and support for seafarers and their families. As access to ships gets more difficult, welfare organisations should look to seafaring communities as a source of beneficiaries. Seafarers and their families tend to be clustered around coastal cities, ports, and near major training centres.

As well as investing in digital outreach for those who are onboard, the creation of seafarer support centres for those who are ashore should not be neglected, and a new model for welfare that focuses on preventative and proactive measures should be provided locally to seafarers and their families.

REFERENCES

1.   Seafarer Commits Suicide Aboard Asphalt Tanker off UAE, Maritime Executive, 2021

2.   Tragic seafarer suicide on asphalt tanker vessel off UAE coast, Human Rights at Sea, 2021

3.   Review of Maritime Transport 2020, UNCTAD, 2020

4.   Mellbye, A., & Carter, T. (2017). "Seafarers' depression and suicide." International Maritime Health, 68(2), 108–114.

5.   Maritime & Coastguard Agency (MCA). (2021). "MIN 656 (M) Understanding the long-term impacts of the COVID-19 pandemic on seafarer wellbeing."

6.   Kanasi, E., Ayilavarapu, S., & Jones, J. (2016). "The aging population: demographics and the biology of aging." Periodontology 2000, 72(1), 13–18.

7.   Department for Transport. (2019). "Maritime 2050: navigating the future."

8.   Department for Transport. (2017). "UK Seafarer Projections: 2016 to 2026."

9.   Department for Transport. (2021). "Seafarers in the UK Shipping Industry: 2020."

10. Elias, B., (2019). "Cockpit Automation, Flight Systems Complexity, and Aircraft Certification: Background and Issues for Congress" Congressional Research Service

11. Young, M. S., & Stanton, N. A. (2002). "Attention and automation: New perspectives on mental underload and performance." Theoretical Issues in Ergonomics Science, 3(2), 178–194.

12. Endsley, M. R., & Garland, D. J. (2000). "Situation Awareness Analysis and Measurement (1st ed.)." CRC Press.

13. Letulle, R., (1966) "Electronic Aids to Navigation and Their Basis as Fault in Marine Casualties," 12 Vill. L. Rev. 160.

14. Lusic, Z., Bakota, M., & Mikeli, Z. (2017). "Human Errors in ECDIS Related Accidents." 7th International Maritime Science Conference.

15. International Maritime Organization (IMO). (2021, May 25). "Autonomous ships: regulatory scoping exercise completed."

16. UN Office for Disaster Risk Reduction (UNDRR). (2019). "Human Cost of Disasters 2000–2019."

17. Richardson, K. (2017). "What will our climate look like in 2050?" Science Nordic.

18. Nautilus International. (2011b). "Criminalisation of Seafarers."

19. Bakhsh, N. (2020). "Seafarer abandonment cases at record high." Lloyd's List.

20. International Labour Organization (ILO). (2021). "Abandonment of Seafarers database."

21. International Maritime Organization (IMO). (2020, August). "Seafarer abandonment."

22. Adams, B. P. (2021, April 22). "Stranded sailor allowed to leave abandoned ship after four years." BBC News.

23. Sailors' Society. (2021, May 19). "Abandoned."

24. Gardner, N. (2021). "Current and future uses of artificial intelligence in the maritime industry." Thetius.

25. Gardner, N. (2021). "Brief guide to extended reality in the maritime industry." Thetius.

26. Tech, D. O. (2020, November 12). "How AI and Adaptive Learning is shaping the Classrooms of future." Day One.

27. Gardner, N. (2021). "How will advanced simulation impact maritime training?" Thetius.

28. International Chamber of Shipping. (2020). "A review of the STCW Convention 2020."

29. Nautilus International. (2020). "STCW Survey 2020."

30. Isle of Man ship registry becomes first flag state to launch seafarer welfare app, Isle of Man Ship Registry, 2020

31. Gallagher, P. (2020, July 1). "World could face another pandemic 'within 5 to 8 years' according to scientist who predicted coronavirus." Inews.Co.Uk.

32. World Health Organization. (n.d.). "An R&D Blueprint for Action to Prevent Epidemics." Retrieved 4 June 2021

33. Stokel-Walker, C. (2020, October 6). "Why telemedicine is here to stay." The BMJ.

34. Norman, A. (2018, January 31). "Your Future Doctor May Not be Human. This Is the Rise of AI in Medicine." Futurism.

35. Browne, D. (2020, June 27). "Do Mental Health Chatbots Work?" Healthline.

REFERENCES

36. ISWAN. (2021, April 1). "Social Interaction Matters – What works well on board?"

37. vTime. (n.d.). "vTime - Reality Reimagined." Retrieved 4 June 2021

38. ICS-ITF. (2016, January). ICS-ITF Guidance on Eliminating Shipboard Harassment and Bullying.

39. Knaus, C. (2017, May 31). "Sage Sagittarius inquest: 'death ship' crewmen were victims of foul play, coroner finds." The Guardian.

40. Stanley, J. F. (2021, June 4). "Cadet Geveza's death exposes shipboard sexual harassment." Gender and the Sea.

41. AMVER. (n.d.). "Automated Mutual-Assistance Vessel Rescue System." Retrieved 6 June 2021

42. Australian Maritime Safety Authority. (n.d.). "Modernised Australian Ship Tracking and Reporting System." Retrieved 4 June 2021

43. Bladen, S. (2021, May 18). "Satellites can reveal risk of forced labor in the world's fishing fleet." Global Fishing Watch.

44. Pham, K. H., Boy, J., & Luengo-Oroz, M. (2018, October 1). "Data Fusion to Describe and Quantify Search and Rescue Operations in the Mediterranean Sea." IEEE Conference Publication

45. Roberts, SE; Marlow, PB. (2005) "Traumatic work related mortality among seafarers employed in British merchant shipping, 1976-2002." Occup Environ Med. 62(3): 172–180

46. Pike, K. (2020). "Social Interaction Matters (SIM)." International Seafarers' Welfare and Assistance Network (ISWAN).

47. Birkett, H. (2017). The death and rebirth of seafarer centres | Chamber of Shipping. UK Chamber of Shipping.

48. Futurenautics Ltd., KVH, & Intelsat. (2018). "Crew Connectivity 2018 Survey Report." Futurenautics Ltd.

49. The Mission to Seafarers. (2021, February 24). "The invisible workforce."

50. Seafarers and the Issue of Riding Gangs, Smita, Marine Insights, 2019

51. Guidelines for implementing the Welfare aspects of the Maritime Labour Convention, ITF, ICS, 2006

52. Govt fulfilling commitment to improve seafarer welfare, Wood, New Zealand Government, 2021

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ABOUT THETIUS

Founded in London in 2019, Thetius exists to enable innovation in the maritime industry. We help leading innovators, investors and corporates in the maritime industry to understand and prepare for the future through research, advisory, and talent services.

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