THE DIGITAL WAVE

Transforming vessels into
floating offices and remote homes

Fiona Macdonald

CONTENTS

Seamless communications between vessel- and shore-based personnel improves decision-making to support safer and more efficient ship operations, while the ability for crew to communicate with friends and family, browse the internet, and stream entertainment promotes well-being on board.

FOREWORD

BEN PALMER, PRESIDENT, INMARSAT MARITIME,
A VIASAT COMPANY

The development of advanced digital technologies and high-speed communications networks is revolutionising maritime and offshore operations, with significant benefits for organisations and seafarers alike.

So critical is connectivity to modern maritime and offshore operations, in fact, that any outages can have a severe impact on efficiency, safety, and seafarer welfare.

Seamless communications between vessel- and shore-based personnel improves decision-making to support safer and more efficient ship operations, while the ability for crew to communicate with friends and family, browse the internet, and stream entertainment promotes well-being on board.

Yet while the industry's digital transformation is bridging the gap between ship and shore, it is also making vessels and their crew more vulnerable to the effects of sudden connectivity loss. So critical is connectivity to modern maritime and offshore operations, in fact, that any outages can have a severe impact on efficiency, safety, and seafarer welfare.

The enclosed report examines shipping's new digital wave through three key areas: emerging technology trends, the dynamics of life at sea today, and the importance of a cohesive and collaborative approach to data management. Drawing on an industry survey and interviews with various stakeholders, it aims to provide fresh insight into the impact and significance of connectivity at sea.

With ships increasingly functioning as floating offices, collaborative and always-on software is becoming indispensable to vessel operations. When the flow of information feeding the navigational system is interrupted, or the software that facilitates ship-to-shore data exchange is cut, onboard decision-making is compromised, with potentially drastic consequences for safety and efficiency.

If the modern vessel is the crew's office during working hours, it is their home during downtime. 89% of the seafarers surveyed for this report have access to the internet for both work and leisure, and 82% use digital tools to communicate with friends and family. Given crew spend up to nine months a year at sea, poor onboard connectivity and internet outages can exacerbate feelings of isolation and have a profoundly negative impact on mental health.

The transformation of ships into floating offices and homes is also seeing the emergence of a new maritime and offshore business model characterised by considerable investment in digital technologies. While these solutions facilitate data sharing between ship and shore, the industry's competitive and conservative nature means that many stakeholders continue to work independently from each other, limiting the ability to turn data into actionable insights and leading to siloed decision-making.

Ultimately, reaping the rewards and avoiding the potential pitfalls of shipping's new digital wave requires fast and reliable internet with consistent global coverage.

In contrast, by encouraging all relevant stakeholders to contribute to and manage available data, a cohesive and collaborative approach to data management increases the accessibility and accuracy of data across an organisation. This supports a centralised data management system, fosters innovation and agility, facilitates behavioural change for safety and operational efficiency, and reduces costs.

Ultimately, reaping the rewards and avoiding the potential pitfalls of shipping's new digital wave requires fast and reliable internet with consistent global coverage – including in hotspots and remote locations. As a longstanding partner to the maritime and offshore industries, Inmarsat is committed to supporting safe and efficient vessel operations and crew welfare through its industry-leading connectivity solutions.

INTRODUCTION

Several decades ago, a ship was just seen as a means of transport. It would carry its cargo from A to B and its navigation would be the responsibility of those onboard. Today, we've moved far from this concept.

Known as floating or remote offices, today's shipping industry is based on a new business model that relies heavily on digitalisation, connectivity, and collaboration.

This growing trend in digital technology is also contributing to a better and more balanced life for those at sea.

Thanks to advanced digital technologies and high-speed communications networks, ships have started to function as if they were offices or homes situated on water. Known as floating or remote offices, today's shipping industry is based on a new business model that relies heavily on digitalisation, connectivity, and collaboration.

Whether a vessel is three nautical miles or 300 nautical miles from land, high-speed bandwidth, collaborative, and always-on software make it possible for ships to communicate with shore-side teams in real-time. Crews are no longer having to make decisions by themselves when it comes to the operation of a vessel. Rapid data transfer back to land-based teams is
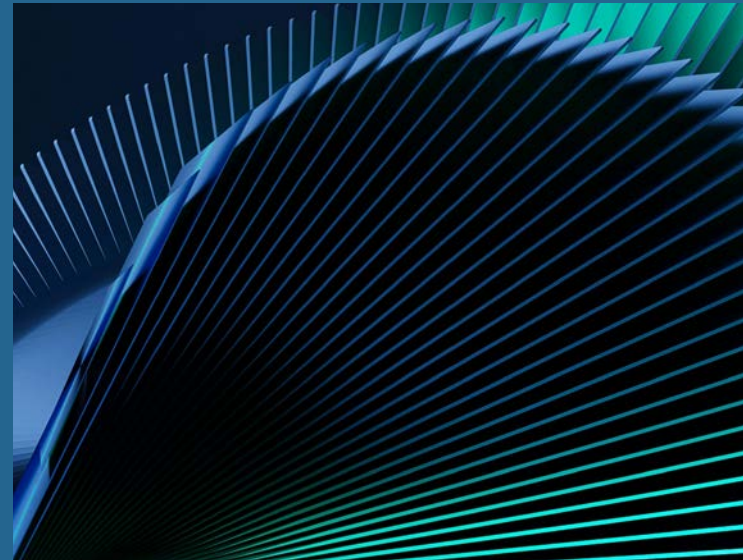
providing them with the support and insight from experienced shore-side individuals to make better decisions. Ultimately, this improves the safe and efficient performance of the ship.

This growing trend in digital technology is also contributing to a better and more balanced life for those at sea. A ship today is so much more than a vessel for transporting goods. It's home to seafarers, some of the most critical key workers of today. For months on end, they spend their days in remote and often challenging environments, and the only means of communicating with home is via phone, text, or video. But thanks to the advent of modern communications systems, seafarers can chat with friends and family, browse the internet, or stream videos, enabling them to maintain communication that is vital to their well-being.

It's clear that the use of data to connect ship and shore is climbing and the reliance on digital technology and communications is increasing. Since 2019, data usage on commercial vessels jumped more than threefold and has been increasing exponentially since.[1] The container shipping sector continues to grow rapidly, with the bulk sector less so. The industry's reliance on digital connectivity to enhance operating efficiency and safeguard crew welfare is at an all-time high.

While this is ultimately a positive step forward, bridging the gap between ship and shore, the consequences of sudden loss of connectivity are heightened. As dependency on digital tools increases, so too does the risk of not having access to them. The challenging and often isolated routes merchant vessels face means their dependence on seamless connectivity is critical. For large ships carrying a substantial amount of cargo, they cannot risk any blackouts. There is a growing need for both the merchant and offshore sectors to have collaborative and always-on software to avoid catastrophe.

This research undertaken in partnership with Inmarsat Maritime, a Viasat company, aims to provide a closer look at how crews and shore-based teams are using digital technologies today, and the connectivity that they are relying on for both work and leisure time. Taking into account the opinions of more than 160 people[2] from both the ship and shoreside, this report seeks to answer these three questions and provide fresh insight into the impact and importance of connectivity at sea.

> *It's clear that the use of data to connect ship and shore is climbing and the reliance on digital technology and communications is increasing.*

KEY QUESTIONS

The report asks three key questions:

1. WHAT ARE THE EMERGING TECHNOLOGY TRENDS?

Ships are increasingly being seen and operated as floating offices and homes, but how does the demand for data, collaborative, and always-on software play a critical role in facilitating this new model?

2. WHAT ARE THE DYNAMICS OF LIFE AT SEA TODAY?

Seafarers are relying on digital technologies and connectivity to fulfil their roles and responsibilities, and to switch off during leisure time. What does a typical day at sea look like today?

3. WHY IS A COHESIVE AND COLLABORATIVE APPROACH TO DATA MANAGEMENT CRITICAL?

The ship as a floating office concept not only relies on digitalisation and connectivity but also on data sharing and collaboration. Why is a cohesive approach to data management so important for decision-making today?

---

1   Thetius & Inmarsat Maritime (2022) The network effect
2   From surveys and interviews completed by Thetius

EMERGING TECHNOLOGY TRENDS

Data, digitalisation, and connectivity are three of the most used buzzwords in the maritime industry and for good reason. They are playing a critical role in facilitating ship operations.

> *Ships are starting to be viewed as floating offices and remote homes as they make use of high-level bandwidth capacity to function as seamlessly as if they were on land.*

Ships are starting to be viewed as floating offices and remote homes as they make use of high-level bandwidth capacity to function as seamlessly as if they were on land. As a result, ships today are reliant on greater data, and collaborative and always-on software.

This section explores three emerging technology trends observed today:

▶ Ships as floating offices

▶ The increasing need for collaborative software

▶ The growing reliance on always-on software
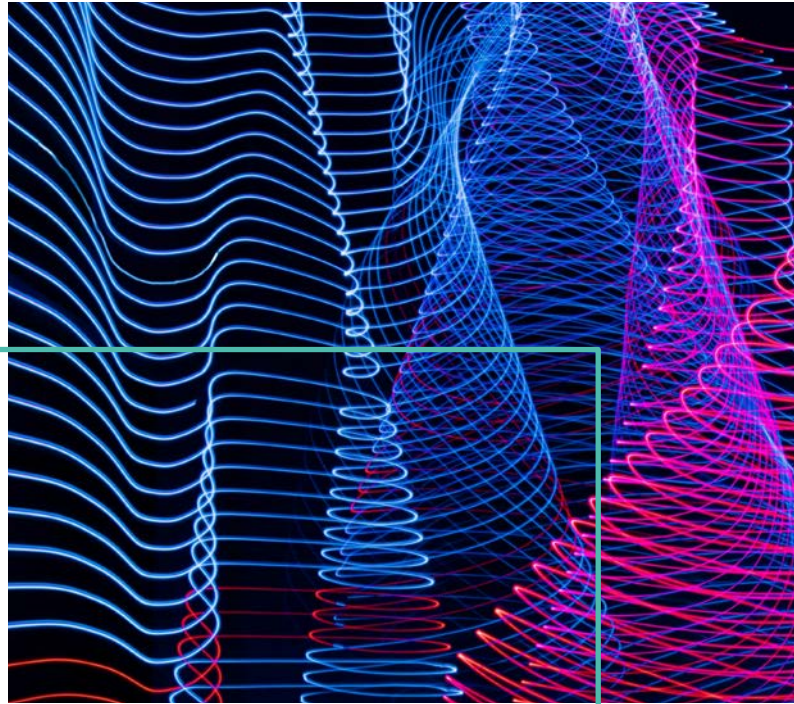
SHIPS AS FLOATING OFFICES

THE FLOATING OFFICE OF TODAY

A 24,000 TEU container ship, 400 metres long and 61 metres wide, is completing its voyage from Europe to Asia. It's currently somewhere in the South China Sea. The weather is bad, the vessel is burning additional fuel because of it, the threat of piracy is high, and while there's no land in sight, the shipping lanes are busy. It's a hotspot for accidents.

To complete the voyage as safely and efficiently as possible, the vessel is relying on numerous technologies and digital solutions. Electronic Chart Display and Information Systems (ECDIS) and Global Navigation Satellite Systems (GNSS) are helping the captain and crew plan, adjust, and navigate a safe passage. Sensors that monitor the performance of the vessel and its equipment rely on the Internet of Things (IoT) to transfer data to the bridge and to shoreside teams. The bridge team is looking at

the user interface (UI) of a piece of software that indicates how well the ship is performing and why. If the fuel performance is low, the crew will be alerted and adjust the voyage path or operation of the ship to combat this.

Continuous and remote monitoring of the ship and its equipment helps to alert crew to equipment that requires attention, minimising the likelihood of it underperforming, or worse, failing. This also helps to minimise excessive fuel consumption. Other technologies, such as virtual reality (VR) and augmented reality (AR) are combined with artificial intelligence (AI) to connect shore-based engineers with the onboard crew to diagnose machinery issues and deliver support to the crew to fix them.

As part of this research, Thetius asked shipowners, operators, managers and seafarers about their current and anticipated future use of digital technologies. We wanted to find out how this is changing as vessels become more like floating offices. When it comes to AI, VR, and AR, most said they believe such technologies to play a beneficial role, with statements such as, "AI has a better chance of analysing the data and finding the problems associated with the engines and other working components," and, "These technologies are revolutionary as training will be delivered through visual and audio aids so experiential learning can be done while in classrooms," and "I believe that they will become far more integrated into day-to-day operations."

However, some were also keen to point out that they are wary of too much reliance on such modern and advanced technologies. One respondent said of AI, "It can support our roles, but there's a danger if we use it too much we will become dependent." Another said, "The use of AI is very dangerous," and "AI can help but it can reduce the natural ability of a human."

In addition, cloud-based programmes are storing and managing vast amounts of data. Traditional paper-based methods are still used, but less frequently as automated data input, sharing, and transfer are at play, facilitating ship performance transparency among multiple stakeholders.

Below deck, seafarers are browsing the internet, listening to podcasts and music, and communicating with family and friends back home. They might also be training from the comfort of their cabins thanks to online video streaming services.

In addition, unwell or injured crew are accessing medical care almost as easily as they would on shore. Thanks to the connectivity onboard the vessel, those at sea are connected with doctors on land in an instant, rather than having to wait until the ship docks. This is a technology known as telemedicine and is already proving critical in saving lives at sea.

"Our vision is to make our ships an extension of our business network. The current obstacles will be non-existent in the future," said one ship operator who completed our survey.
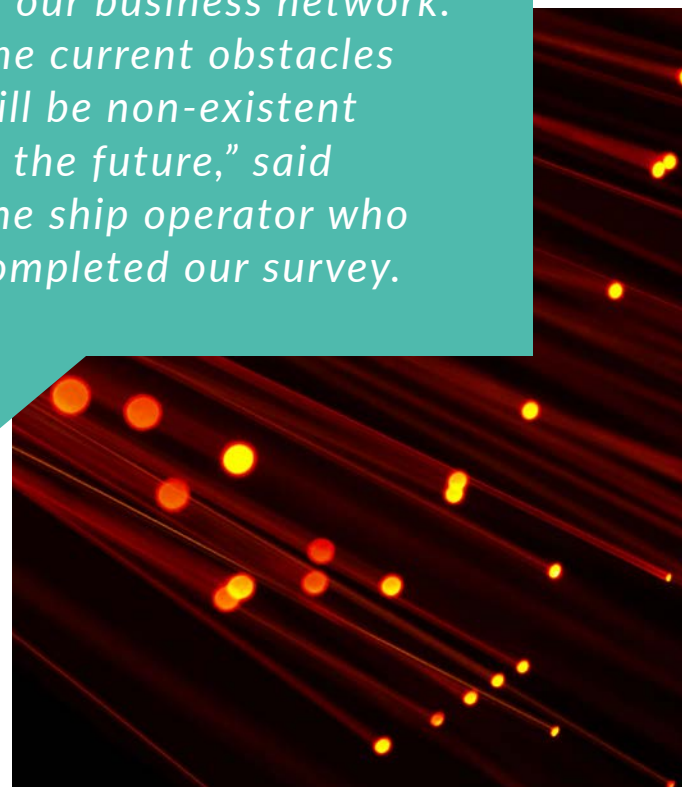
Despite the unique environment in which the vessel operates, it's clear that its day-to-day operations require modern digital tools and technologies in much the same way a land-based office does. Onshore offices use digital tools to handle documents, share data and information to facilitate collaborative working, and manage the performance of staff and operations. At sea, it's increasingly becoming the same. This is the 'floating office' concept.

"For me, the floating office concept means that we have upwards of 100 Mbps bandwidth, good latency, and a proper SLA behind it. If we have that, we can move away from these isolated vessels that we have today and integrate them seamlessly with our onshore and cloud infrastructure."

NETWORK REQUIREMENTS

Essentially, the floating office requires seamless integration of systems, people, and processes. It's a concept that sees a move away from operating and managing vessels in isolation and instead integrates systems and processes with onshore and cloud-based infrastructure to enable a seamless, high-speed, uninterrupted flow of information. The main challenge today is that achieving this 400nm offshore isn't always that easy. It requires low latency bandwidth to eliminate lag time and enable real-time data transfer between ship and shore, which is essential for rapid decision-making.

Today, however, there are compression and Software-Defined Wide Area Network (SD-WAN) technologies available that can significantly reduce latency over GEO and in multi-orbit environments. This is a game-changer for vessels as they become floating offices as it facilitates network resilience and maximises uptime, improving performance of applications such as video conferencing and cloud access. SD-WAN optimises and prioritises business-critical traffic. What this means is that while data may take different routes, their journeys will be optimised to start and finish at the same point.

For the ship as a floating office concept, this is a critical development. It enables data to rapidly find the best and most efficient route, but also enables businesses to access their network applications from various physical and remote locations.[3]

---

3   Inmarsat and Bestpath (Apr, 2023) How SD-WAN provides strategic advantage through rapid and consistent scalability

DIGITAL DEMANDS

A trend observed as part of the 'ship as a floating office concept' is that the demand for digital tools and applications increases as ships get closer to shore. 67% of owners and operators surveyed confirmed an increasing reliance on digital tools and applications as vessels approach the shore.

Congestion tends to heighten as ships get closer to shore and the risk to vessel and cargo safety is increased.

Various reasons for this were cited by the respondents. It's largely to do with the increasing use of data-heavy applications. Congestion tends to heighten as ships get closer to shore and the risk to vessel and cargo safety is increased. To ensure safe and collision-free sailing, ships rely more on navigational applications that use accurate and reliable real-time data transmitted between vessels and the port. Several respondents noted that advanced navigational equipment often needs updates from the shoreside and requires greater connectivity to do this.

Moreover, as ships get closer to shore, the information exchanged between vessel, port authorities, and terminal operating systems (TOS) is heighted to ensure accurate berth planning, pilotage, tug assistance, and efficient arrangement of cargo handling requirements.

Three clear trends have emerged relating to cost, operations, and crew psychology:

▶ **Cost -** the closer to shore ships get, the lower the cost of cellular networks & VSAT connectivity compared with satellite connections used in the open ocean.

▶ **Operations -** as vessels sail closer to shore, communication between ship and shore becomes more critical for coordinating port calls, cargo handling and logistics. Using specialised applications can streamline these processes but they often require high data consumption in an open ocean environment. Their deployment is sometimes left until the vessel nears the shore where data is cheaper and more accessible.

▶ **Crew psychology -** our seafarer survey indicated that as ships get closer to shore, crew rely on the internet to download entertainment tools, which are critical for morale and well-being. They also use the opportunity to get in touch with family and loved ones.

"The use of digital tools and applications onboard a vessel changes when the vessel is closer to shore, driven by factors such as improved connectivity, access to local services, regulatory considerations, and safety requirements," said one ship operator.

While this latest research suggests that the demand for "office-related" connectivity increases as ships get closer to shore, the available capacity isn't always enough to meet demand. This leads to competition between applications and sometimes connectivity blind spots. One ship operator told us that blind spots occur in congested waters near to ports where vessel performance often deteriorates. This leads to operational inefficiencies and increases stress for the crew onboard as it becomes difficult for them to exchange information with the port.

GREATER RELIANCE ON REMOTE OPERATIONS

The ship as a floating office concept also requires a greater reliance on remote operations. 63% of owner and operator survey respondents said they rely more on remote operations as the vessel gets closer to shore and navigation becomes more complex. Remote operations can provide additional situational awareness and improve traffic management via the deployment of advanced decision support systems that can analyse large volumes of data from various sources.

"Having data sent from ship to shore in a timely manner is critical to safe and efficient vessel operations," Dain Detillier, Executive Vice President, LNG Operations at Harvey Gulf International Marine.[4]

---

4   This quote was taken from a panel discussion as part of Inmarsat Maritime's 'Connected Future' seminar held in December 2023

COLLABORATIVE SOFTWARE

WHAT IS COLLABORATIVE SOFTWARE?

Collaboration is important in many industries and operations today, but for shipping it's critical. It's easy to think that a ship operates in isolation, miles away from land or other industries. In reality, it's far from that. Today, a vessel's physical location is irrelevant as software, data, and connectivity enable it to connect with virtually anyone at any time.

Many stakeholders are involved in a vessel's voyage, and information is flowing constantly between ship and shore. Enabling relevant stakeholders to see what's happening and why is necessary to plan and navigate safe and efficient voyages, assess and manage operations, conduct maintenance procedures, train and assess crew, procure new or replacement equipment, or monitor and order bunkers. Collaborative software can provide a single source of truth and ultimately close the communication gap between ship and shore.

Both ship and shore-based teams must have access to information in real-time for the software to be truly collaborative.

Enabling relevant stakeholders to see what's happening and why is necessary to plan and navigate safe and efficient voyages.

Examples of collaborative software include, but are not limited to:

▶ **Email** - charterers, operators, brokers, agents, and whoever needs to see what's going on with a vessel and why can do so via collaborative email platforms.

▶ **Crewing tools** - provide all relevant stakeholders with information on crew schedules and performance.

▶ **eLearning** - collaborative eLearning platforms enable organisations and their crew to access training tools from wherever they are, even offline.

▶ **Ship and voyage management tools** - enable invested stakeholders to understand why a vessel is operating the way it is and provide visibility of why certain decisions have been made. For example, if a vessel adjusts its route due to bad weather conditions but arrives later in port than expected, all parties can see in real-time what is happening and why.

▶ **Maintenance and technical management** - collaborative software enables crew to log maintenance tasks, report issues, and share information about equipment status. Collaborative software facilitates remote diagnosis from shore-based teams, and sometimes even remote maintenance thanks to video streaming between ship and shore.

THE ROLE OF COLLABORATIVE SOFTWARE

One offshore vessel operator we spoke with as part of this research underlined the importance of collaborative software, particularly when conducting remote operations. "We probably have about 325 users all needing to look at the same information and see what's happening on that vessel," he noted. "We have offices in Norway, Singapore, Louisiana, and Brazil and getting everybody to pull up the same screen, look at the same information, and diagnose the problem on the vessel has been invaluable to us. We now probably do around 80% of our maintenance remotely without going to the vessel," Ron Welles, C-Comm Manager at Edison Chouest Offshore explained.

Collaborative software requires a reliable network. For example, data on propeller performance or equipment status is collected by sensors and stored by onboard systems. It's then transferred to other systems onboard the ship, such as the bridge. Or it might be transferred to shore-based teams for expert analysis. Either way, the storage and transfer of data are facilitated by a combination of the vessel's network and collaborative software. This supports operational transparency and increases visibility between relevant stakeholders.

It is important to note that this growing flow of data opens up the vessel and its network to increased cybersecurity vulnerabilities.

Ultimately, this enables mission-critical decision-making that improves the efficiency, performance, and safety of a voyage.

Collaborative software also plays a critical role in enabling the ship and shore to make use of the same network. Shared networks drive real-time data exchange to facilitate the tasks previously discussed, while cloud-based solutions allow both ship and shore-based teams to access the same systems and data in real-time. SD-WAN-enabled solutions are important for a shared network, particularly where traffic demands are high, such as when the vessel nears shore.

Collaborative software also plays a critical role in enabling the ship and shore to make use of the same network.

With multiple applications such as ECDIS, AIS, radar all relying on the same network, reliable, secure, and good signal strength and coverage are essential to ensure all critical systems that are relying on it, can. The offshore sector in particular heavily relies on low latency for remote inspection and surveys, which are increasingly being deployed to minimise travel and other costs associated with the physical presence of an engineer onboard.

It is important to note that this growing flow of data opens up the vessel and its network to increased cybersecurity vulnerabilities. Recent research by Thetius[5] found that in the shipping sector alone, companies are now forking out, on average, $3.2 million in ransom payouts. But this risk runs deeper than the financial and operational concerns. There is widespread worry that reputation will be impacted and the effects will be long-term.

Protecting systems from unwanted infiltration is critical, but often there's a long list of actions to complete.

Integrating cyber security measures into systems as they are built, a concept known as cyber secure by design, ensures a proactive approach to cyber security management.

Most systems will not be significantly impacted if they switch off for a few seconds, and many can tolerate being off for a few minutes. However, software that is 'off' for more than a few hours can cripple ship operations and catalyse financial and reputational risks.

ALWAYS-ON SOFTWARE

WHAT IS ALWAYS-ON SOFTWARE?

One of the emerging trends of the industry today is the need to have software that is always-on. This means software that is operational and accessible without significant downtime. Most systems will not be significantly impacted if they switch off for a few seconds, and many can tolerate being off for a few minutes. However, software that is 'off' for more than a few hours can cripple ship operations and catalyse financial and reputational risks. The need for software to be always-on depends on its specific use and application.

---

5   Thetius (Oct, 2023) Shifting tides, rising ransoms and critical decisions

The ongoing disruption in today's satellite industry, including much higher bandwidth, lower latency, fierce competition, and falling costs enable new scenarios that the maritime industry so far could only dream of. Dr. Dominik Pfeiffer, Director of Fleet IT at Hapag-Lloyd told Thetius that, "With significantly improved connectivity, vessels will become floating offices which are seamlessly integrated with IT systems onshore and in the cloud. A reliable high-speed Internet connection will allow us to move critical IT functions like email or identity and access management to the cloud, instead of maintaining it on all vessels. This will realise cost savings for us. Remote inspections by means of video streaming will partially replace costly travel to vessels. Furthermore, crews will get access to the whole range of IT services that were hitherto only available onshore, and will eventually share the same IT experience like their colleagues in the office."

However, he added, "Since the crews need the critical applications at any point in time in order to do their work, these systems need to be always-on. With these high availability requirements in mind, we carefully observe new high-speed products that are emerging in the market. I expect that floating offices will become reality within this decade".

Software that is classed as always-on usually incorporates fault tolerance mechanisms. This means the system can continue to operate correctly even if some components fail. Redundancy is a common approach, where multiple instances of critical components are run to ensure the failure of one does not impact the overall system.
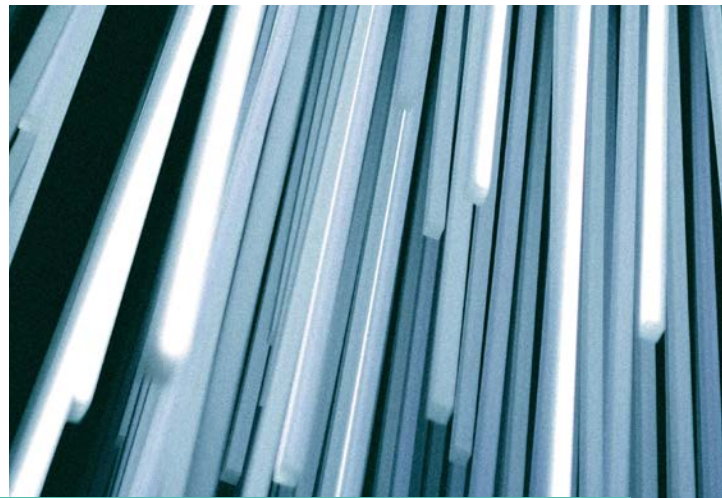
"We could lose out on major opportunities to reduce fuel waste and lose out on benchmarking and best practice sharing," said one ship operator when asked about how a lack of connectivity onboard would affect their vessel.

Consider what could happen if information feeding the navigational system suddenly stops. How does the vessel know if its passage plan is safe? The risk of collision is just too high. What happens if software that facilitates data exchange between ship and shore is cut? How do experts onshore communicate with shipboard crew to assess equipment issues? Or what happens if a crew member is sick and needs access to medical advice? Telemedicine is used frequently today to help those on ships to access medical guidance from onshore doctors. Without this, seafarers' lives could be at risk.

But it's not just these safety issues to worry about. The operational efficiency of the fleet also depends heavily on always-on software. For example, the energy and fuel efficiency of a vessel is monitored by sensors and software. The network is relied upon to transfer this data between systems onboard the ship and back to the shore for high-level analysis. Ultimately, this enables fuel performance improvements to be taken for a more energy efficient and financially optimised voyage.

Other use cases for always-on software include regulatory compliance. If a ship cannot provide a record of necessary data, such as environmental reporting data, it could find itself inadvertently breaking maritime laws. This is not the vessel's fault, but could cause a headache for all stakeholders involved.

These situations are magnified by the shipping giants of the world. Companies like Maersk, Hapag-Lloyd, and CMA CGM, to name a few. These players tend to be the first movers, adopting new technologies and leaping into the digital world before anyone else. But while they reap the rewards of being more digitally connected, they are also at greater risk if their systems shut down. For instance, for those who are highly reliant on data-driven decision-making facilitated by digital technologies and high-level connectivity, having poor or zero service could be beyond catastrophic. Losing the continuous flow of data to which decision-makers have become accustomed could catalyse an avalanche of poor decision-making. In challenging waters or congested areas, the damage could be irreversible.

A solid and reliable network ensures that onshore teams, software developers, and OEMs can access data for onboard equipment at the drop of a hat, facilitating remote diagnostics and predictive maintenance.

It's not just ship performance where always-on software has a major role to play. Crews are increasingly relying on always-on software to communicate with home or relax during downtime. This is explored in greater depth in the following section.

In addition, software needs to be accessed by remote users. A solid and reliable network ensures that onshore teams, software developers, and OEMs can access data for onboard equipment at the drop of a hat, facilitating remote diagnostics and predictive maintenance. There is a growing opportunity for remote maintenance today thanks to the availability of more and more data, but unless data exchange is supported by a reliable network, the value it can bring to optimising vessel and voyage operations is limited.

To maintain continuous operation, it's crucial to ensure redundant communication systems are in place.

THE NEED FOR UBIQUITOUS CONNECTIVITY

For software to be always-on, there are specific connectivity requirements that are needed. High-speed bandwidth maximises uptime and transmission speeds, particularly at congestion hot spots. Low-latency facilitates seamless real-time data exchange, and redundant communication systems enable continuous communication, so if one system fails, another is there to step in and provide ongoing communication.

"The lack of connectivity wouldn't completely prevent a vessel from functioning as a floating office or home but it severely limits its effectiveness. It would impact functionality. Basic operations would be possible but there would be a limited use of advanced technologies," one survey respondent stated.

To maintain continuous operation, it's crucial to ensure redundant communication systems are in place. This could mean having multiple satellite systems or a combination of satellite and other communication technologies to ensure continuous connectivity, even if one system fails.
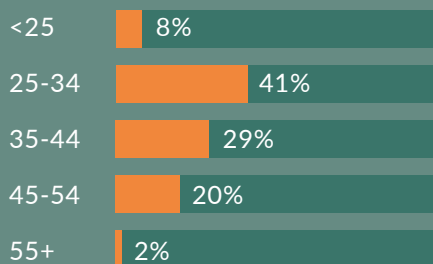
In some situations, communication to and from the software is cut because of network overload.

This can happen in congested areas like ports where many ships and people are trying to access the same network and it simply doesn't have enough capacity to fulfil all demands being placed on it.

inmarsat

SEAFARER SURVEY RESULTS

DEMOGRAPHICS

What is the age range today?

Age	Percentage
<25	8%
25-34	41%
35-44	29%
45-54	20%
55+	2%

How is the gender split today?
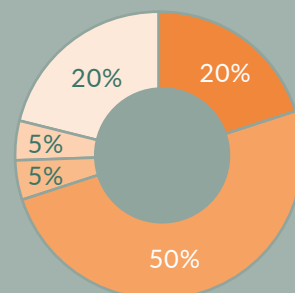
97% 2%

1% Preferred not to say

HOW MUCH INTERNET ACCESS DO SEAFARERS HAVE FOR WORK AND LEISURE?

88% of seafarers have internet access for work and leisure

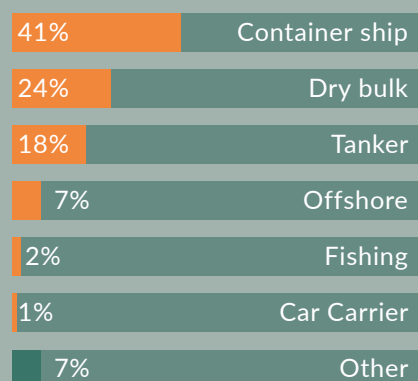**12%** of seafarers have internet access only for work

DO SEAFARERS FEEL THAT THEY HAVE RECEIVED ADEQUATE TRAINING ON DIGITAL TECHNOLOGIES?

- 20% — 20% — 50% — 5% — 5% — 20%

- Strongly agree
- Agree
- Disagree
- Strongly disagree
- Are impartial

WHAT TYPES OF VESSELS ARE THE MAJORITY OF SEAFARERS WORKING ON TODAY?

Percentage	Vessel
41%	Container ship
24%	Dry bulk
18%	Tanker
7%	Offshore
2%	Fishing
1%	Car Carrier
7%	Other

WHAT IS THE RANK OF SEAFARERS ONBOARD TODAY?

Percentage	Rank
13%	Captain
13%	First Officer
13%	Third Officer
11%	Second Officer
7%	Chief Engineer
6%	Second Engineer
6%	Third Engineer
4%	Cadet
4%	Fourth Engineer
3%	Chief Cook
3%	Engineering
17%	Other
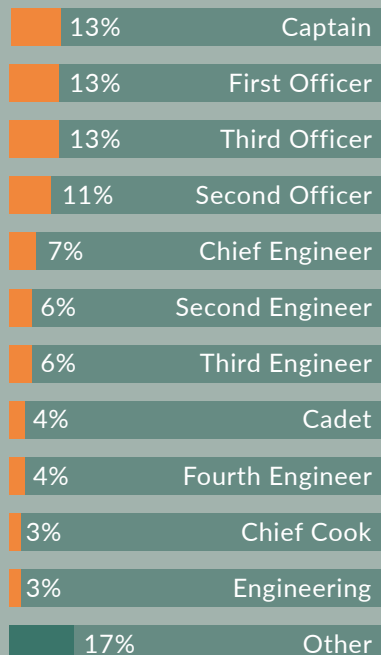
HOW ARE SEAFARERS SPENDING THEIR LEISURE TIME ONBOARD TODAY?

80% said they spend their time communicating with friends and family

70% said they spend their time browsing the internet

64% said they spend their time on video calls

54% said they spend their time watching films

12%

of seafarers said they are only able to access the internet for work, not for leisure.

INTERNET ACCESS:

12% of seafarers said they still only have access to the internet for work and not for leisure.

THE USE OF DIGITAL TECHNOLOGIES TO COMPLETE TASKS:

The average time seafarers spend using digital tools while working onboard is 5 hours per day.

THE IMPACT OF INTERNET OUTAGES OR SLOW CONNECTIVITY ON WORK TIME:

Many of the seafarers who responded to our survey said slow or no connectivity heightened stress and anxiety. The following comments were made by seafarers when asked how internet outages affect them:

▶ "It gives me stress and anxiety."

▶ "It kills my leisure time, so I can't take proper rest."

▶ "Loneliness and fatigue."

▶ "We faced internet outages for about 2 weeks when we were in the Pacific Ocean (Australia to Brazil). Due to this, we couldn't communicate with our family and loved ones thus leading to mental trauma."

▶ "Depression."

▶ "A seafarer's leisure time is limited to his WRH. If he happens to have an outage during his rest hours it will reflect as absent-minded or he will be unable to focus on his next work hours."

▶ "This is the only time we have for our family."

▶ "Very upsetting" and "Very bad" were also comments received by multiple seafarers.

▶ "Safety management systems fail to operate correctly."

However, some seafarers explained that backup methods reduce the impact of slow or no connectivity. Seafarers who responded to our survey said:

▶ "Very little impact as vessel has alternative means of communications."

▶ Comments like "Nothing much", "Not much", "Nothing big, just have to wait for it to reconnect", "None" were also received by seafarers when asked about the impact of blackout.

TRAINING:

▶ **70%** of seafarers said they agree or strongly agree that they have received adequate training for using digital technologies for their work.

98%

of seafarers said they rely on smartphones during their leisure time.

SMARTPHONES AND SOCIAL MEDIA:

▶ WhatsApp, Email, WeChat, and Facebook Messenger are the digital platforms most frequently used by seafarers today.

▶ **98%** of seafarers said they rely on smartphones during their downtime.

▶ **80%** of seafarers said social media is a primary online activity for them during their downtime.

ACHIEVING A WORK-LIFE BALANCE:

There were mixed opinions on the current work-life balance onboard. When asked about how satisfied they are with their work-life balance, the majority suggested they weren't satisfied or dissatisfied.

Comments on how they would improve the balance were largely focussed on having more facilities onboard and better/faster access to the internet. Some comments from seafarers include:
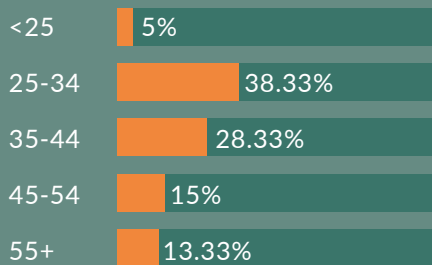
▶ "Providing good facilities for crew, such as larger cabins, good gym, table tennis room, larger recreation rooms, better victualing allowance, good internet connectivity, full-fledged telehealth service, mental health 24hr hotline, wellness & welfare apps, shore leave in every port"

▶ "Faster WiFi because we are used to social media and streaming/gaming in the 21st century, and we are used to high-speed data on land"

▶ "Have more video calls with my family and friends"

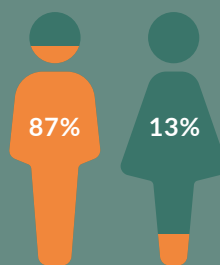▶ "Talk with friends"

▶ "More shore time"

▶ "More rest time"

SHIPOWNER AND OPERATOR SURVEY RESULTS

DEMOGRAPHICS

What is the age range today?

Age	%
<25	5%
25-34	38.33%
35-44	28.33%
45-54	15%
55+	13.33%

How is the gender split today?

87%   13%

63% said the reliance on remote operations increases as vessels near shore

67% said the use of digital tools and applications changes when the vessel is closer to shore

82% believe there will be a greater reliance on certain applications within the next five years

93% said it is extremely or very important to have on a vessel with always- on connectivity today

55% said cyber security is critically important to them

89% said that connectivity for their crew during downtime is extremely or very important to them.

DIGITAL PLATFORMS AND SOFTWARE USED FOR WORK:

The main digital applications owners, operators, and managers rely on today include, MS Office Suite, ChatGPT, CRM and ERP software, navigation software like NAVIS N4, and ship management systems, simulation software like Ansys, asset monitoring applications like Maximo, QMS, transport and logistics software like Primavera, dashboarding software like Power BI, IMO- and SOLAS-required applications for regulatory compliance, Inmarsat Fleet Hotspot.

## COLLABORATIVE SOFTWARE USED FOR SHIP-TO-SHORE COMMUNICATION:

The main collaborative software owners, operators, and managers use on ships today include, Zoom, Email, Whatsapp, fleet management systems, Microsoft Azure, Shipsat to manage broadband and satellite connection, cybersecurity services like Cisco, VHF radio.

What drives the change in use of tools and applications when the vessel nears shore?

▶ "Local regulations"

▶ "Port calls or passing through territorial waters require additional reporting."

▶ "Improved connectivity, access to local services, regulatory considerations, safety requirements."

▶ "When closer to shore, communication between ship and shore becomes more critical for coordinating port calls, cargo handling, and logistics."

63%

of shipowners and operators said they strongly agreed or agreed that they have received adequate training for using digital technologies at work, with only 3% somewhat disagreeing.
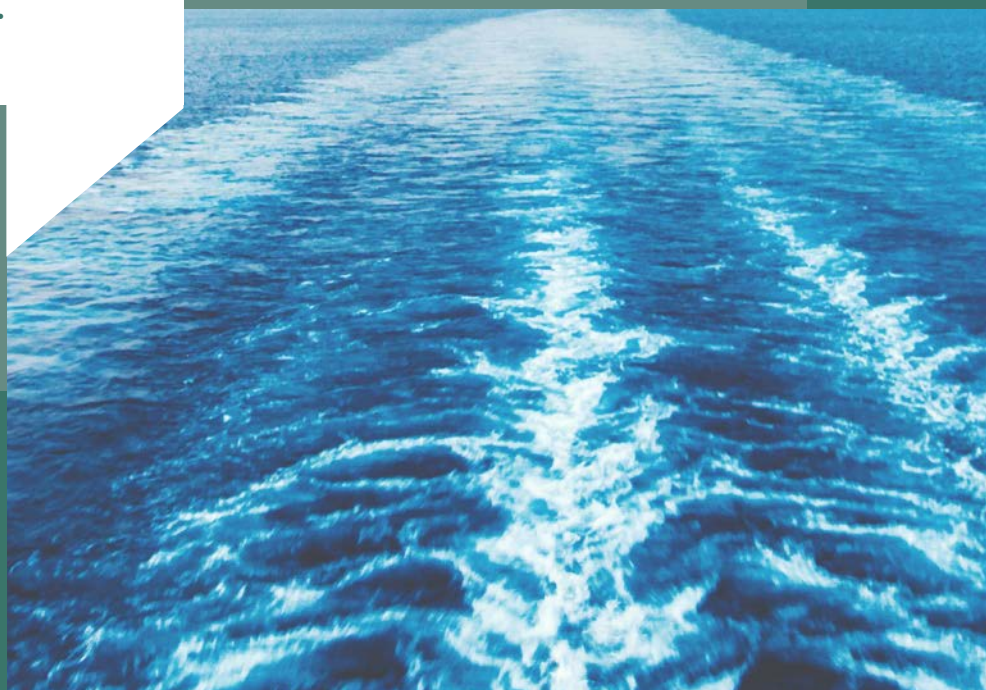
63% said the reliance on remote operations increases as vessels approach congested areas.

83% said they anticipate a greater reliance on digital applications within the next five years.

"Limited access to information and resources hinder training and personal development and reduces well-being opportunities."

83%

said they anticipate a greater reliance on digital applications within the next five years.

HOW DOES LOSS OF CONNECTIVITY IMPACT OPERATIONS?

▶ "It can delay all communication."

▶ "My quality of life would suffer."

▶ "Devastating."

▶ "It cripples the vessels because automation of our systems saves us time and errors."

▶ "Limited access to information and resources hinders training and personal development and reduces well-being opportunities."

▶ "Could lose out on major opportunities to reduce fuel and waste."

▶ "It has a major impact on operations."

HOW WILL AI, VR, AND AR CHANGE SHIP OPERATIONS?

▶ "They will make operations more profitable and save time."

▶ "Automatisation for tasks, reports, and data mining."

▶ "AI has a better chance of analysing the data and finding the problems associated with engines and other working components."

▶ "It will be revolutionary as training will be delivered through visual and audio aids."

▶ "A ship that relies on AI, AR, and VR makes it easier to determine locations and reduce human labour."

▶ "Things will improve, and incidents will reduce."

HOW DOES A LACK OF CONNECTIVITY PREVENT A SHIP FROM FUNCTIONING AS A FLOATING OFFICE?

▶ "When connectivity is low, progress is low."

▶ "All external communications with third party, company, and internal communications are all dependent on Internet connectivity. Lack of connectivity can have a commercial and welfare impact."

▶ "Limitations in accessing our regular online tools."

▶ "Loss of communication with shore. The expectation from both shipboard and shore staff is for constant movement of information."

89%

said that connectivity for seafarers is important or extremely important for their downtime and overall morale.

CYBERSECURITY:

9. On a scale of 1-10 (with 10 being critically important), the average number chosen was 9 in terms of how important cyber security is to ship owners and operators.
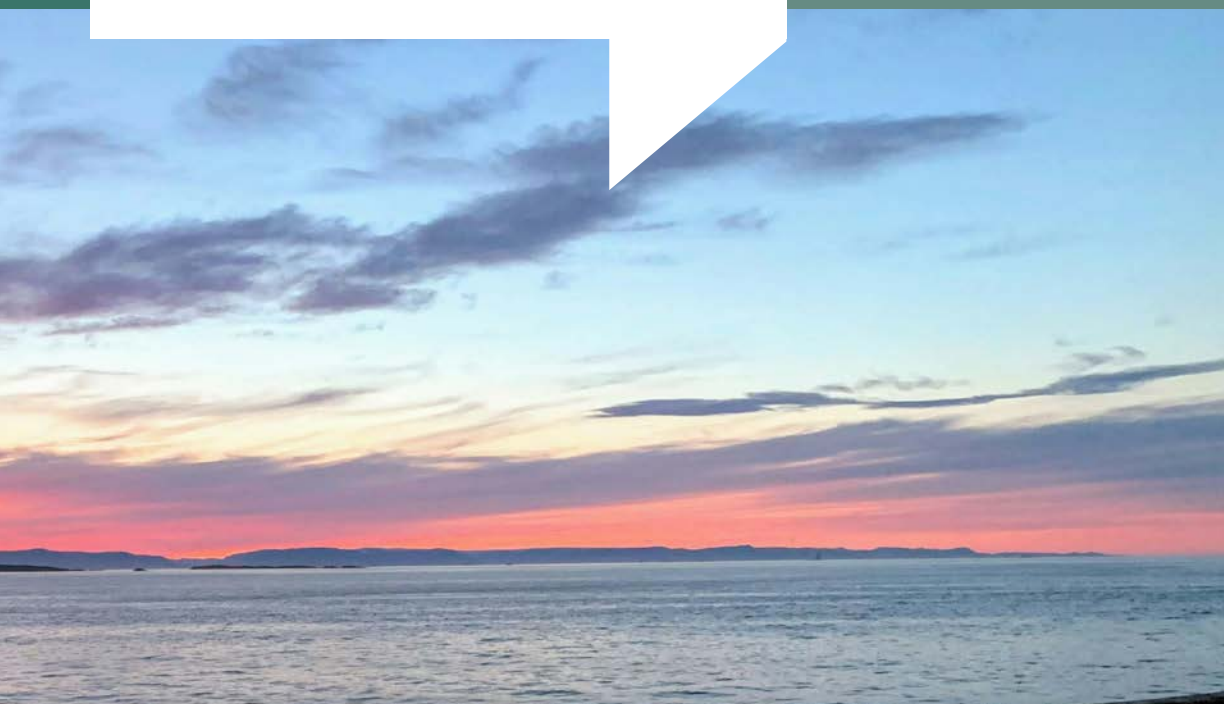
89% said that connectivity for seafarers is important or extremely important for their downtime and overall morale.

Reliance on digital tools is evolving to encompass a broader range of smart technologies.

LIFE ONBOARD A FLOATING OFFICE

The life onboard a vessel today is very different from what it was a decade or two ago. As ships become increasingly, digitalised, and connected, they are operating more and more like floating homes and offices.

Our survey results indicate that today, 88% of seafarers who responded have access to the internet for work and leisure, while 12% have access to the internet purely for work purposes. The survey results also showed that on average, seafarers are relying on digital tools for around five hours per day. A handful of respondents said they were using it for between 8-12 hours and some even suggested it could be as much as 16. The connectivity needs of many vessels today aren't dissimilar to those of small and medium-sized businesses.

83% of owners and operators anticipate a greater reliance on digital applications within the next five years.

On a merchant ship today, around 20-25 people are likely to be onboard. These will be split between the deck department and the engineering department, both of which will be on or off watch at various times. On offshore vessels, numbers vary significantly depending on the type of vessel. Platform supply vessels (PSVs) and anchor handling tug supply (AHTS) vessels are likely to have a crew size ranging from 10 to 30, whereas offshore construction vessels (OCVs) can require a crew of 50 to over 100 personnel due to the complex operations they complete. Floating production, storage, and offloading (FPSO) units are among the largest offshore vessels and can require a crew of 100 to 200 people.

"The new-generation crew members are all tech savvy. They are more adaptable using digital tools. There are few old-school sailors still around who find it difficult to migrate," one survey respondent stated.

Those at work use connectivity to gain insight into ship performance and improve operational efficiency. Those on rest time also rely on connectivity to call family members, watch movies, or browse the internet. Whether at work or play, seamless connectivity is essential.

This section explores how seafarers are spending their time today, the digital technologies they rely on, and the levels of connectivity they require to support these activities.

## BYTES AND INSIGHTS: HOW THE DECK DEPARTMENT IS USING DATA

Deck crews are increasingly relying on data and connectivity to complete their daily tasks and make better decisions both for safety and efficiency. It is estimated that a modern ship generates over 20 gigabytes of onboard data every day,[6] and they need just as much to function.

For example, digital twin technology, while still emerging in 2024, has the potential to revolutionise efficiency, safety, and maintenance practices for deck crews onboard ships. Digital twins can be used to create virtual replicas of ship components and systems, which can be utilised for simulations and training, allowing crews to familiarise themselves with ship layouts, equipment, operations, and navigation scenarios in a risk-free virtual environment.

Our research indicates that on deck, crew are increasingly using smart ship technologies such as Integrated Bridge Systems (IBS) and Energy Management Systems (EMS) to utilise real-time data sets to optimise route planning and manage energy consumption, respectively. Connectivity is essential for smart ship technologies, as it facilitates continuous accurate data transmission and allows for integration with IoT devices, as well as leveraging cloud-based analytics and enabling remote access and monitoring.

To support the safe navigation of the vessel, charts and real-time GNSS data is paramount. In addition, for maintaining a safe passage, advanced weather forecasting and updates expected in weather patterns and conditions are essential in making informed decisions and anticipating any adverse weather

---

6   Marine Digital (accessed 2024) Data mining on ships: What does it take to leverage Big Data in maritime logistics?
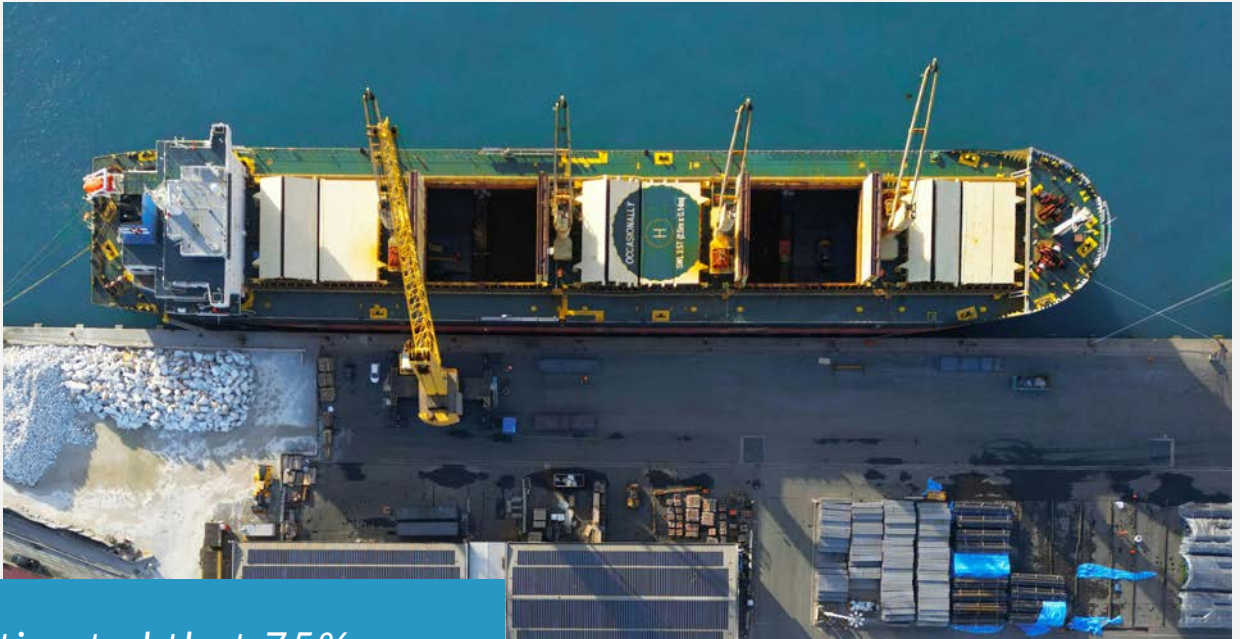
It is estimated that 75% to 96% of accidents at sea can be attributed to human error, whether it be fatigue, poor communication, lack of training, inadequate knowledge, or inattention.

on route. Live environmental data when coming into port, navigating narrow channels or fairways aid in increasing live situational awareness of the real-time conditions during manoeuvres. Not to mention the numerous compliance supporting platforms, vessel optimisation solutions and administrative support tools that play a key role in the day-to-day operations of a deck department.

APPLICATIONS: CURRENT AND FUTURE TRENDS IN THE DECK DEPARTMENT

The dependence on digital tools and connectivity on ships has significantly increased over the years, transforming traditional maritime practices into the 'cyber-physical realm'[7]. Very Small Aperture Terminal (VSAT) technology continues to gain traction in the maritime industry, enabling high-speed broadband connectivity for vessels of all sizes.

It is estimated that 75% to 96% of accidents at sea can be attributed to human error, whether it be fatigue, poor communication, lack of training, inadequate knowledge, or inattention.[8] According to the Swedish Club, about 80% of all vessel collisions take place in congested waters, which include areas close to ports, coasts, rivers, and canals.[9] Collisions are largely down to a lack of situational awareness.

Over the last year, Thetius IQ has shown an increase in the development and implementation of AI systems onboard

7   Kinthaert, Leah (2017) Digital transformation: how will it change the seafarer's role?
8   Rothblum, A.M. (2000) Human error and marine safety
9   Safety4Sea (2021) The extra eyes on board: AI powered marine collision avoidance

ships.[10] Crew are expected to make use of them to improve situational awareness. This is also the case of ML, AR, and VR, which are used to apply algorithms, and enhance training and simulation. AI aids in supporting not only an increased awareness but also helps to minimise fatigue and human error, assisting the crew in responding to real-time data, detecting targets, and making collision-avoidance decisions in more than ample time.

Satellite-delivered weather-routing software prioritises and plots the most efficient and safe routes rather than the fastest, accounting for the latest forecasts for winds, waves, and currents. These are integral in fuel-efficient voyages and help crews optimise fuel consumption and ensure timely arrival while avoiding severe weather conditions. This requires strong connectivity so that accurate data is transmitted between ship and shore, enabling the crew to make logical and safe choices.

AI aids in supporting not only an increased awareness but also helps to minimise fatigue and human error, assisting the crew in responding to real-time data, detecting targets, and making collision-avoidance decisions in more than ample time.

These digital tools are now indispensable for modern maritime navigation, allowing deck crews to respond to changes and enhance operational safety. For example, the crew can use weather-routing systems proactively to analyse the effects of weather conditions on the ship and decide whether to take one route versus another. Ship navigators can calculate the most efficient route, even if it covers a greater physical distance, and adjust the course accordingly. For example, if there is a strong current running against the direction of travel, the crew may decide not to use a full-powered engine because this could cause damage to the propeller shafts. They may then choose to sail only half-powered rather than risk causing decreased performance or even losing control of the vessel.

10 Thetius IQ (accessed Apr, 2024) Intelligence database

Early detection of issues within the ship's mechanical systems and engine is critical for the safety of the vessel and crew and to monitor efficiency, recognise abnormalities, and optimise performance.

BYTES AND INSIGHTS: HOW THE ENGINEERING DEPARTMENT IS USING DATA

Early detection of issues within the ship's mechanical systems and engine is critical for the safety of the vessel and crew and to monitor efficiency, recognise abnormalities, and optimise performance. Improving operations through digitalisation and increased connectivity requires access to reliable data. The engineering department needs information and data from most onboard machinery in order to support smooth maintenance schedules and handle services and repairs.

They require accurate fuel and lubricant consumption data, as well as real-time and historical engine performance parameters like speed, temperature, pressure, fuel flow, and exhaust emissions. To effectively control emissions and comply with MARPOL regulations, this data helps support increased accuracy in recording, monitoring, and reporting of environmental parameters in line with this environmental protection policy.

An inventory of spare parts and supplies and details of procurement and storage are necessary for an efficient maintenance schedule that is key to ensuring the availability of resources and minimising downtime in repairs. By having easy access to important information and data, the engineering department can effectively manage the ship's machinery and systems, guarantee the fulfilment of regulations, and address technical challenges that arise during the voyage. For example, if the engineering department encounters a technical issue with a propulsion system component during routine maintenance, they will request remote assistance from the equipment manufacturer, who provides guidance and troubleshooting support via a secure video conferencing platform. Without the necessary connectivity to facilitate this, the ship would either need more experts onboard, incurring additional costs, or there would be increased downtime while a solution was found.

AI algorithms analyse real-time sensor data from ship machinery to detect anomalies and predict potential failures before they occur.

APPLICATIONS: CURRENT AND FUTURE TRENDS IN THE ENGINEERING DEPARTMENT

Maritime vessels are deploying an increasing number of Internet of Things (IoT) devices and sensors to monitor vessel operations, including engine performance, fuel consumption, environmental conditions, and cargo status. According to a report by IoT Analytics, the number of connected IoT devices in the maritime industry is expected to reach over 20 million units by 2025.[11]

With an increasing amount of data being collected onboard a vessel, the need for autonomous data analysis and storage infrastructures, and the improved connectivity at sea to allow their efficient use, is essential. In Condition Monitoring and Predictive Maintenance systems, AI algorithms analyse real-time sensor data from ship machinery to detect anomalies and predict potential failures before they occur. This helps to reduce downtime and the cost of repairs, and engineering crews can respond proactively in scheduling maintenance.

An example is Wartsila's Condition-Based Maintenance System, which works to alleviate the exorbitant expenses and operational disruptions associated with conventional maintenance practices. Remote monitoring and diagnostics allow shore-based engineers to monitor performance and provide remote support to a ship's crew, like ABB Ability Remote Insights. Connectivity is essential for real-time data transmission between ship and shore in remote diagnostics so that information reaches both sides quickly and accurately. The global remote monitoring market is projected to reach USD 15.9 billion by 2026[12], a growth that is driven by the increasing adoption of remote monitoring solutions to improve vessel maintenance and reduce downtime. According to a study by Lloyd's Register, predictive maintenance enabled by remote monitoring technologies can result in cost savings between 10% and 40% compared to reactive maintenance practices.[13] Because of the huge benefits involved, strong connectivity that enables these systems to work efficiently and continuously is vital.

In coordination with fuel economy and voyage optimisation, Energy Management Systems (EMS) are used to manage energy consumption. For example, DNV's ECOInsight supplies fully automatic emission reports and consumer usage from systems like cargo pumps and gas generators, creating actionable data reports and analytics for the engineering department. This software and applications help to expedite the decision-making process by enabling engineers to preempt and avoid issues at sea, rather than fixing them as they occur. These real-time data-driven insights and recommendations enable engineers to make advanced decisions to optimise ship operations, enhance safety, and reduce environmental impact.

---

11   IoT Analytics (2023) State of IoT 2023

12   MarketsandMarkets (2022) Predictive maintenance market by component, deployment mode, organisation size, vertical and region- global forecast to 2026

13   OE Digital (2019) Predictive maintenance

CREW DOWNTIME

Merchant seafarers can spend up to nine months to a year at sea, often living in confined spaces isolated from friends, family, and normality. In recent years, there has been a push for vessels to be seen not only as floating remote offices but as a 'home from home' because a healthy and happy crew is vital in this demanding industry.

Digital technology has the power to recreate bonds between seafarers and their support networks back home, as well as boost human performance and assist established human roles. With limited downtime, having good connectivity improves seafarer's quality of life and often their quality of work. During hours of rest, crew members can prioritise connecting with family and friends through email, video and phone calls, instant messaging, and social media. Additionally, they may use streaming services for entertainment. They may browse the internet and read news articles to stay informed and entertained. They can also use downtime to participate in online training, explore ports, rest, play sports and use the onboard gym, or socialise in the common areas.

Digital technology has the power to recreate bonds between seafarers and their support networks back home, as well as boost human performance and assist established human roles.

APPLICATIONS: CURRENT AND FUTURE TRENDS IN CREW DOWNTIME

A recent market research study by Inmarsat found that connectivity is crucial for seafarers during downtime. Crew members use entertainment apps to watch television or listen to music and podcasts. Common applications include YouTube, Netflix, Amazon Prime, and Spotify. They may also use gaming apps on their smartphones or laptops. Social media apps are widely used to stay connected with friends and family.

Our survey found that 64% of seafarers who responded spend their downtime video calling, which requires a more reliable connection than instant messaging services like WhatsApp. Applications like Facebook, WeChat, Telegram, and Instagram are used to share photos and videos and send voice and text messages. Crew who enjoy reading may use e-book readers such as Kindle or Apple Books to access digital books and magazines.

inmarsat

Overall, a healthy onboard environment is sustained by having affordable and fast connectivity, allowing more digital quality time with family and friends, as well as assisting the crew in completing their daily tasks.
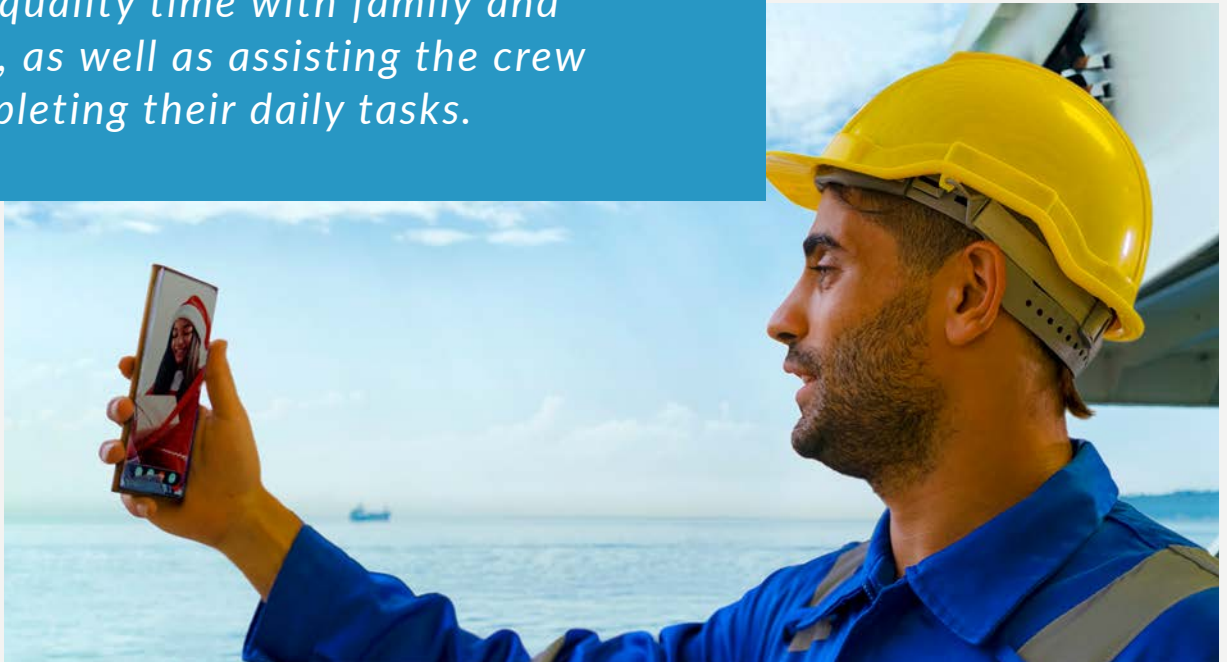
These applications require a stable and secure connection to support use. While satellite internet can be slow or unreliable, new services such as Inmarsat's Fleet Hotspot provide a high-speed connectivity service with a dedicated crew bandwidth so they can have the freedom to use their own devices with 99.9% availability. With a direct link between crew happiness and retention, the provision of always-on connectivity: stable and fast internet access, to the next generation of seafarers is crucial. Most research participants emphasised the negative mental toll that having poor connectivity and internet outages has, resulting in being unable to catch up with family or stay connected to the outside world, as well as internal communications between crews and ships also suffering and daily duties being completed less efficiently.

The consensus of the survey was that work-life balance at sea would be greatly improved with faster and cheaper connectivity to alleviate negative impacts on downtime and unnecessarily increasing work time.
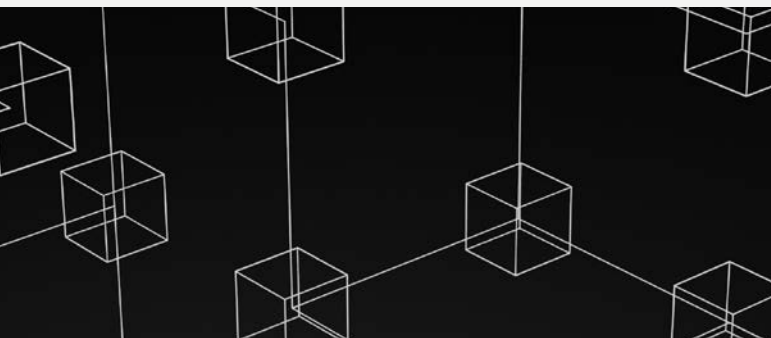
Overall, a healthy onboard environment is sustained by having affordable and fast connectivity, allowing more digital quality time with family and friends, as well as assisting the crew in completing their daily tasks. Connectivity offers a lifeline in helping ease social isolation and improve mental health.

> *Collaboration across departments and between ship and shore is essential today to provide the seamless flow of information that is required to make data-driven decisions.*

The deck department works closely with shore-based weather services and route planning centres to obtain forecasts and navigational guidance. This helps crews optimise routes for fuel efficiency and safety. Collaboration with shore-based procurement teams and suppliers is also vital to manage inventory, order supplies, and replenish consumables needed for operations.

The engineering department communicates with shore-based technical support and equipment manufacturers to obtain technical guidance and troubleshooting. Remote diagnostics facilitate real-time communication between onboard engineers and shore-based experts.

Both deck and engineering departments maintain constant communication with shore-based personnel via various channels, such as emails, phone calls, messaging apps, and satellite communication systems to relay operational updates, request assistance, and exchange information. Each department works closely with shore-based regulatory authorities and classification societies to ensure compliance with maritime regulations, safety standards, and environmental requirements, as well as shore-based training institutions and certification bodies to carry out crew training and competency assessments where required.

The coordinated efforts between the deck and engineering departments and shore-side crews support safe, efficient, and compliant vessel operations. Digital tools and improved connectivity play a crucial role in facilitating this seamless collaboration and data sharing between onboard and shore-based teams.

FROM SHIP TO SHORE: WHY IS COLLABORATION KING?

It's not just the teams on a vessel that need to collaborate, or those on shore. Collaboration across departments and between ship and shore is essential today to provide the seamless flow of information that is required to make data-driven decisions.

Digital health management and the use of AI-based systems that provide real-time data are effective solutions as they allow both the deck and engineering departments to collaborate and have a better perspective on technical and forecasting conditions that ships and ports are experiencing.

Autonomous assistive systems that are designed to monitor, maintain, and test the ship's equipment and external conditions make identification, diagnosis, and rectification of problems more cost-effective and predictable by reducing the friction between actions required and the processes involved in having experts physically situated onboard the ship.

A COHESIVE APPROACH

Investment in digital technologies is rife, and the capabilities of modern and advanced solutions are significant. Generating and sharing data between ship and shore is critical to enhance decision-making.

WHY IMPLEMENT A COHESIVE DATA MANAGEMENT STRATEGY?

As ships increasingly become seen as floating offices and homes, the emergence of a new business model is clear. Investment in digital technologies is rife, and the capabilities of modern and advanced solutions are significant. In theory, this means that generating and sharing data between ship and shore to enhance decision-making is relatively straightforward. But as an industry that is both competitive and conservative, stakeholders often continue to work independently from one another. This can limit the ability to turn data into actionable insights and lead to decisions made in silos.

WHAT IS COHESIVE DATA MANAGEMENT?

Put simply, a cohesive approach to data management encourages all relevant stakeholders to contribute to and manage the available data. In doing so, the accessibility and accuracy of data across an organisation increases and security is improved. Ultimately, a cohesive approach to data management enhances decision-making and operational efficiency.

CENTRALISED DATA MANAGEMENT

Centralised data management supports the vast quantity of data flowing between ship and shore and provides a single source of truth. It enables relevant stakeholders to access the same data and gain a better understanding of why an incident happened or a vessel burned more fuel, for instance.

For Ron Welles, C-Comm Manager at Edison Chouest Offshore's Marine Technologies, this is necessary to get all of their vessels uniformly running as an organisation and not as individual vessels. According to Mr Welles, this approach cuts administrative overheads and supports information sharing, enabling all vessels to run as a single unit.

A cohesive approach ensures that all data across the organisation is harmonised and accessible through a unified framework. As vessels are operated more and more remotely, this is crucial for providing a single source of truth, which is essential for accurate reporting, analytics, and decision-making.

Moreover, a centralised data management system can help to protect the crew in the event that something goes awry. According to Mr Welles, recording and reporting data means that if an incident happens on a vessel, which inevitably it will, the information is recorded and stored in a system that all necessary stakeholders can access. This protects the crew member/ members from being blamed for something that was out of their control.

A cohesive approach ensures that all data across the organisation is harmonised and accessible through a unified framework.

So, as ships become more and more like floating homes and offices, why is a cohesive approach to data management necessary?

▶ It supports a centralised data management system.

▶ It fosters innovation and agility.

▶ It facilitates behavioural change for safety and operational efficiency.

▶ It reduces costs.

A cohesive and collaborative approach to data management also helps to break down data silos and encourage people to move away from a siloed mindset.

INNOVATION AND AGILITY

A cohesive and collaborative approach to data management also helps to break down data silos and encourage people to move away from a siloed mindset. No longer are they purely concerned with how they will use the data in front of them, but they now consider how it might be useful for other departments in trying to achieve their goals. By engaging more people in the process, more ideas and different viewpoints are brought to the table.

Innovation through collaboration is fundamental to maritime informatics, according to researchers from the University of Sweden.[14] This is a concept that encourages data sharing to develop and implement new types of shipping analytics with the ultimate goal of improving ship performance and overall business via digital means.[15]

DATA-BASED BEHAVIOURAL CHANGES

A cohesive approach to digitalisation and data management can also play a part in driving behavioural change onboard ships. Live monitoring of a vessel means that behaviours onboard can be detected and onshore teams alerted in real-time. Say a vessel is operating at a higher speed than the shoreside team believes it should be. They will be alerted and can question the vessel's crew about this. If there's a reason for it, no problem and the vessel will carry on with its operations. But if there's no valid reason, the crew can be asked to slow the speed and operate with more efficiency in mind. This is an approach taken by Seacor Marine.

Dain Detillier, Executive Vice President, LNG Operations at Harvey Gulf International Marine, explained during a recent conference that they are implementing behaviour-based safety programmes. Crew can now submit safety concerns via their iPads to the shore-based safety department. These are reviewed, and the top three that come in will be targeted during that quarter. He believes that as connectivity increases, AI-based cameras will record behaviours and send alerts to the bridge so that behaviours can be notified and rectified in real-time.

---

14   Lind, M et al (Mar, 2021) Collaborative innovation within the maritime sector: the path to grow back better

15   UNCTAD (Mar, 2021) Collaborative innovation within the maritime sector: the path to grow back better

REDUCING COST

One of the problems today is that there are so many digital technologies and solutions in the market. It's difficult to determine if and how an exciting new technology will help solve a problem, or whether it's an unnecessary investment. There are many digital technologies that do similar things, so choosing the right one for your operations is key to avoiding over-investment and achieving your goals. Collaboration within an organisation enables different departments to understand how and why a solution might be used and encourages conversation on whether some systems are redundant or could be replaced. This ultimately reduces the need for multiple, overlapping technologies and platforms, lowers maintenance costs, and optimises the overall IT expenditure.

This is important for the 'ship as a floating office' concept. As the number of digital technologies onboard increases, naturally, the expenditure is higher. By collaborating on data management, different stakeholders and users can better understand the role digital technologies play across all departments, not just their own, and make collaborative decisions on future technology investments.

WHAT IS REQUIRED TO SUPPORT A COHESIVE DATA MANAGEMENT STRATEGY?

It's clear why having a cohesive approach to data management is key to operational efficiency and crew well-being. But what is required to support this strategy?

Thetius' research has found the following to be helpful in supporting a cohesive approach to data management:

▶ A common data language

▶ Ubiquitous connectivity for both operations and crew well-being

▶ Secure and safe connectivity

▶ Globally approved systems

▶ A willingness to share data

For collaboration to work, people and systems have to speak the same data 'language'.

No matter who they are supplied by or what they are used for, these systems are required to communicate with each other and with shoreside teams or port authorities, to enable remote monitoring and decision-making.

A COMMON DATA LANGUAGE

For collaboration to work, people and systems have to speak the same data 'language'. This requires turning various sources of data and information into a common language, ensuring all parties can access, understand, and use the data for decision-making.

With ships operating as remote offices, they are increasingly reliant on systems that are purchased from various vendors. No matter who they are supplied by or what they are used for, these systems are required to communicate with each other and with shoreside teams or port authorities, to enable remote monitoring and decision-making. Without a shared language, accurate and reliable data exchange and interpretation is near impossible.

UBIQUITOUS CONNECTIVITY

When we are at home or in the office, we don't think about connectivity. We open our inboxes, send emails, and stream videos and music without thinking twice. On the odd occasion, a power cut strikes or our phone provider goes down. Suddenly, there's no internet and no access to communication platforms. Tonight's plan of catching up on the latest Netflix box set or video calling a family member is aborted.

As ships become increasingly like floating homes and offices, having connectivity that is always there is becoming an assumption. High-speed, reliable bandwidth runs seamlessly in the background, facilitating mission-critical operations and allowing crew to turn to it during downtime.

> *"The expectation from both shipboard and shore staff is for constant movement of information. If this is not met then there is a hindrance in vessels being considered floating offices and homes."*

Operational support

On the operational side, connectivity is heavily relied on to support computers and communication, but it's also necessary for monitoring data that is exchanged with the crew onboard and the shoreside. One offshore operator told us, "In the different management systems used by vessels, there's so much that the crew will find an issue with. They might want to raise an issue with a filter, for example, so what they'll do is open up a maintenance ticket and this starts the conversation between the crew and the onshore team. There will be a lot of back and forth between ship and shore. The vessel isn't going to be able to function safely without this communication system working, at least not in our company...I'd give it a maximum of three days without safety being seriously compromised."

Another employee of a shipping company told us, "When the connectivity ratio is low the progress is low," when asked about how loss of connectivity would affect their operations. Another said, "All ports and terminals are moving into digital records," which if connectivity is minimised will affect the communication between ship and shore.

Another said, "The lack of connectivity wouldn't completely prevent a vessel from functioning as a floating office or home, but it severely limits its effectiveness. It would impact functionality. Basic operations would be possible but there would be a limited use of advanced technologies. This would hinder communication and collaboration and cause decision-making challenges. It would also impact crew well-being."

The other aspect is that today, as seafarers' daily tasks are so heavily dependent on communication with shore, the sudden lack of it creates an even bigger issue than it did a decade ago when the internet wasn't relied on nearly as much. "Crew just weren't as dependent on it in the past. They were manned differently and had different responsibilities, so people weren't so dependent on it. Today when something happens, even your best engineers or your best captains just become dependent on it. And that's your first thought when something happens. 'It's okay. I can talk to the shore office, and they'll tell me what to do.'

Taking this approach to enable them to see ways they could make voyages shorter, or find new ways of remotely accessing the vessels to see if they could carry out maintenance services without having to put a technician on a plane.

But what happens if the ubiquitous connectivity is no longer there? For various reasons, the network may slow in speed, buffer, and cause stilted or delayed data transmission.

As a result, real-time data transfer is hindered, uptime is reduced, and the ability to operate a safe, efficient and compliant vessel is squandered. More so, this could have a detrimental impact on crew morale if they are unable to access services they would normally enjoy during their downtime. Not only are these concerns for the operation of the vessel, but if the speed or uptime doesn't meet the terms of the Service Level Agreement (SLAs) or Committed Information Rate (CIR), legal ramifications might incur. SLAs also might cover remote IT support, software updates, and maintenance. Poor connectivity hampers these services, affecting vessel operations and possibly leading to unmet service levels.

Beyond the immediate operational and financial impacts, failing to meet SLA standards due to connectivity issues can damage the reputation of both the service provider and the shipping company. This could affect future contracts, partnerships, and customer trust.

Real-time or near real-time data exchange is key to ensuring both the ship and the shore are looking at the same data.

Then they realise they can't and they're just not sure what to do. You're so used to having a bunch of people to talk to and a lot of support and when you lose that support after a while, it's something that the crew really feels," an offshore operator told us.

Ubiquitous connectivity is also critical for real-time data exchange. Real-time or near real-time data exchange is key to ensuring both the ship and the shore are looking at the same data. Coming at it from the offshore perspective, Ron Welles, Edison Chouset, told us that his company turned to near real-time data management systems that retrieved real-time data from the vessels and sent it to shore, enabling both the ship and shore teams to view the exact same data.

> *80% of seafarers that participated in the survey said they spend their leisure time communicating with friends and family, while 70% said they spend time browsing the internet.*

Crew welfare

It is also critical to draw attention to the need for ubiquitous connectivity to support the needs of the crew.

During Inmarsat's Connected Future seminar, Ron Welles, C-Comm Manager Offshore's Marine Technologies, spoke about a fuel resupply mission in Antarctica where connectivity was key to getting crew onboard. He explained that they were told they wouldn't be able to get crew on the vessels unless "We could provide them with the facility to keep in touch with their families." As a result, they turned to Inmarsat's service and, according to Mr Welles, two-and-a-half years later, it's one of the most successful jobs they've ever completed in Antarctica.

This example is one of many that showcases the difficulty companies are facing in recruiting and retaining crew. According to Kyle Pemberton, Manager of Engineering, SEACOR, the industry is having to pull from a finite group of mariners and connectivity is absolutely essential to entice fresh talent.

The survey results speak for themselves. 80% of seafarers that participated in the survey said they spend their leisure time communicating with friends and family, while 70% said they spend their downtime browsing the internet. Both require seamless connectivity. The frustration of not being able to FaceTime a family member is not something many of us on land have to deal with. For many seafarers who do not have access to the connectivity they desire, it's a common occurrence. Today though, fast and reliable internet access for crew is paramount, and it's playing a role in whether they decide to join and remain onboard.

Secure and safe connectivity

It's no secret that cybersecurity is a growing topic of concern in the maritime industry. The more technology and connectivity onboard a vessel, the greater the flow of data and the wider the opportunity for cyber criminals to infiltrate. In any security breach, people, property, and the environment are at risk. Kyle Pemberton, Manager of Engineering, SEACOR, said that they are actively removing the people aspect through seamless connectivity, enabling property and the environment to be fully focussed on.

There is also a growing pressure on vendors to implement cyber protection at the earliest opportunity when developing their digital solutions. Harvey Gulf International Marine uses a lot of systems from Finnish tech manufacturer Wärtsilä, and according to Dain Detillier, Executive Vice President, LNG Operations, they're hot on having remote access to the systems to see exactly what's going on.

"It's crazy that you can have a ship 100 miles offshore in the Gulf of Mexico and a guy in an office in the Netherlands can tap into the system and open and close valves. It's crazy that we have this technology today to do that, and it's only going to increase. We have to ensure that the systems are cybersecurity protected," Dain Detillier, Executive Vice President, LNG Operations, Harvey Gulf International Marine.

Cooperation through the industry is important because if one shipping line has an incident, it's not just their problem. It's something the whole industry has to deal with, Ron Welles from Edison Chouest Offshore noted. ISO standards and class standards, must be followed, and everyone sharing information and making sure we are all protecting the industry is incredibly important.

A willingness to share data

Despite the increase in data generation, there is some way to go in sharing data and improving transparency, which is necessary to drive value creation and support innovation and agility. Much of the data generated today in maritime and other industries remains locked up and managed in silos. Research by the EU suggests that 80% of industrial data isn't used, and creating the conditions required to encourage this data to be shared will require an additional €270 billion in EU gross domestic product (GDP) alone by 2028.[16]

One of the reasons for this is that there are still misconceptions about what data ownership means.[17] Sharing it feels like risky business. But in the last few years, we have seen a push to move away from this and begin more collaborative data management. IMO Secretary-General Arsenio Dominguez recently told ICS Shipping that, "We are not all at the same level and do not all have the same capability. So we need early movers that can share experience with others to bring everyone to the stage where we all contribute."[18]

One marine transportation company, Seacor Marine Holdings, also recently confirmed its commitment to building a data-sharing environment.[19] The idea is to work with vendors to build a group to facilitate better data sharing to support sustainability and operational efficiency.

According to the Smart Maritime Council, for shipping companies to access the right digital services and maximise the value of their data, it is important that limitations are not placed on their ability to access the raw data produced by their shipboard equipment.

According to the Smart Maritime Council, for shipping companies to access the right digital services and maximise the value of their data, it is important that limitations are not placed on their ability to access the raw data produced by their shipboard equipment.[20] The council recommends several best practises, including that, "Raw data produced by shipboard equipment belong to the equipment over, that equipment manufacturers should not place unreasonable limitations on the equipment owner's ability to access this data, and that the equipment manufacturers should provide the equipment owner with access to the codebooks that define the raw data".[21]

16   European Commission (Feb, 2023) Data Act: Commission proposes measures for a fair and innovative data economy

17   Thetius (Oct, 2023) Common interest

18   ICS (Feb, 2024) Arsenio Dominguez: Evolving IMO for future challenges

19   Offshore Engineer (Feb, 2024) OSV owners reap the rewards of data sharing

20   Smart Maritime Network (Dec, 2022) Data ownership and access in maritime

21   Smart Maritime Network (Dec, 2022) Data ownership and access in maritime

CONCLUSION AND RECOMMENDATIONS

The shipping industry has shifted from a traditional model, where ships were merely transport vessels, to a highly digitalised and interconnected system. Ships are becoming increasingly like floating offices and homes, and the demand for advanced technologies and high-speed connectivity that support a fully connected and integrated maritime environment continues to grow.

However, the increased dependence on digital tools and connectivity also raises concerns about the potential consequences of connectivity loss. For ships to truly become the floating offices of the future, a seamless exchange of data, operational transparency, and proactive and informed decision-making is key. Uninterrupted remote communication, and collaborative and always-on software supported by a seamless internet connection are essential enablers of the ship as a floating office concept.

As this research has found, the dependency on connectivity and communications continues to grow. While ultimately this provides greater access to mission-critical information, the increasing reliance on it means that when it's not available, the impact is huge. In operational terms, irregular or interrupted connectivity can severely limit communication capabilities, restrict data access, and complicate even simple administrative tasks. Closer to shore, the access to connectivity is there, but the capacity becomes

In operational terms, irregular or interrupted connectivity can severely limit communication capabilities, restrict data access, and complicate even simple administrative tasks.

constrained as a multitude of vessels and applications rely on the network. As a result, some applications may face restrictions, which in congested shoreline waters has even wider safety and operational implications. This warrants a push for more seamless and affordable connectivity in the open waters to enable consistent availability and reduce the surge of applications relying on it near shore.

RECOMMENDATIONS

01

CHOOSE A CONNECTIVITY PARTNER THAT DELIVERS FULLY MANAGED, SEAMLESS, RELIABLE AND GLOBAL CONNECTIVITY SERVICE

It might seem obvious, but having a network that operates seamlessly in the background without constant thought is essential if a crew is to operate a productive, efficient, and safe vessel as a floating office.

Securing a network that provides effortless connectivity and consistent user experience whether in open waters or close to shore is essential to avoid becoming capacity-constrained.

Despite the high-level connectivity that is available today, it has become clear from our surveys and interviews that a lack of seamless and always-on connectivity is a barrier for many completing their daily tasks.

There is still a struggle to secure the kind of connectivity that many at sea have come to rely on and expect. As the research has found, there is a growing trend for vessels to rely more on connectivity and digital applications as they get closer to shore. In many cases, applications end up fighting for capacity as the vessel nears shore. Securing a network that provides ubiquitous connectivity and consistent user experience whether in open waters or close to shore is essential to avoid becoming capacity-constrained. Connectivity that runs in the background without having to think about when to use it and when to hold back is necessary for maximum productivity and a critical step in the 'ship as a floating office' journey.

It might seem obvious, but having a network that operates seamlessly in the background without constant thought is essential if a crew is to operate a productive, efficient, and safe vessel as a floating office.

inmarsat

Systems that are globally approved, integrable and 'talk' to other systems are necessary to enable a vessel and its crew to communicate with its surroundings as easily as a land-based office team would.

03

INVEST IN COLLABORATIVE SOFTWARE

As this research has uncovered, collaborative software is fundamental to facilitating operations today that enable vessels to function as floating offices. Collaborative software is essential for real-time communication and coordination between ships and shore-based teams, as well as among various stakeholders involved in shipping. Today there is still an enormous amount of data locked up in various software and systems that has the potential to generate business advantages but remains unused. Collaborative software enables information to be shared and used by different departments to enhance data-led decision-making. Moreso, collaboration is one of the building blocks of innovation. Ensuring that all relevant stakeholders have real-time visibility is crucial for informed and data-driven decision-making.

02

OPT FOR SYSTEMS THAT TALK TO ONE ANOTHER

A vessel in the open ocean relying on a network to operate safely and efficiently cannot do so if it cannot communicate with other ships and shore. Systems that are globally approved, integrable, and 'talk' to other systems are necessary to enable a vessel and its crew to communicate with its surroundings as easily as a land-based office team would.

Collaborative software is essential for real-time communication and coordination between ships and shore-based teams, as well as among various stakeholders involved in shipping.

Managing cyber risk involves managing people and raising awareness of the cyber risks that are likely to grow. The opportunities for hackers can be limited by opting for systems and services that are cyber-secure by design.

04

CHOOSE SYSTEMS THAT ARE CYBER SECURE BY DESIGN

As ships transform into floating offices, the deck department, the engineering department, other departments, and crew onboard require consistent and reliable internet access more than ever. It is important to acknowledge that as the number of departments relying on the network increases, the greater the opportunity for cyber criminals to infiltrate. Managing cyber risk involves managing people and raising awareness of the cyber risks that are likely to grow. The opportunities for hackers can be limited by opting for systems and services that are cyber-secure by design.

REFERENCES

E

European Commission (Feb, 2023) Data Act: Commission proposes measures for a fair and innovative data economy

I

ICS (Feb, 2024) Arsenio Dominguez: Evolving IMO for future challenges

Inmarsat and Bestpath (Apr, 2023) How SD-WAN provides strategic advantage through rapid and consistent scalability

IoT Analytics (2023) State of IoT 2023

K

Kinthaert, Leah (2017) Digital transformation: how will it change the seafarer's role?

L

Lind, M et al (Mar, 2021) Collaborative innovation within the maritime sector: the path to grow back better

M

Marine Digital (accessed 2024) Data mining on ships

MarketsandMarkets (2022) Predictive maintenance market by component, deployment mode, organisation size, vertical and region- global forecast to 2026

O

OE Digital (2019) Predictive maintenance

Offshore Engineer (Feb, 2024) OSV owners reap the rewards of data sharing

R

Rothblum, A.M. (2000) Human error and marine safety

S

Safety4Sea (2021) The extra eyes on board: AI powered marine collision avoidance

Smart Maritime Network (Dec, 2022) Data ownership and access in maritime

T

Thetius (Oct, 2023) Common interest

Thetius (Oct, 2023) Shifting tides, rising ransoms and critical decisions

Thetius & Inmarsat Maritime (2022) The network effect

Thetius IQ (accessed Apr, 2024) Intelligence database

U

UNCTAD (Mar, 2021) Collaborative innovation within the maritime sector: the path to grow back better