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Global Marine Practice

THE CHANGING TIDE OF RISK: EXPERT PERSPECTIVES ON THE MARINE INDUSTRY

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CONTENTS

INTRODUCTION

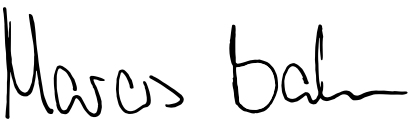
The current turbulent and unprecedented environment in the marine industry has spawned a period of continuous change. Emerging trends in disruptive technology, human capital, and market demand have forced the industry to re-examine some of the basic assumptions that have driven traditional risk conventions. As a result, companies in this sector now need to look afresh at the emerging risks they are facing.

The articles contained in this publication examine some of these crucial issues and aim to provide critical insight into the risks and opportunities facing maritime companies as they navigate through the profound transformation that is under way.

Several of these articles first appeared on BRINK – the digital news service of Marsh & McLennan Companies' Global Risk Center, managed by Atlantic Media Strategies. BRINK gathers timely perspectives from experts on risk and resilience around the world to inform business and policy decisions on critical challenges.

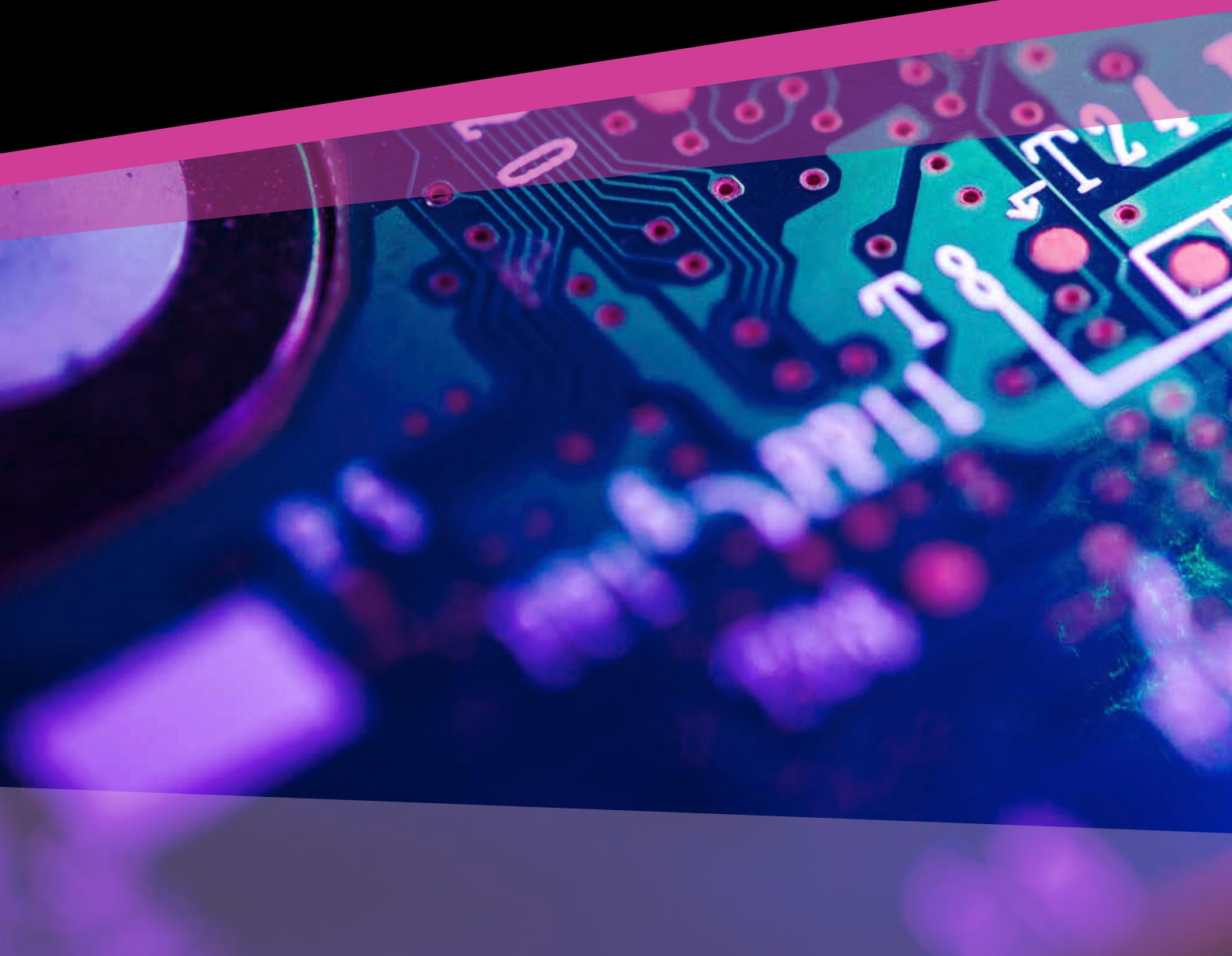
I hope you find the *The Changing Tide of Risk: Expert Perspectives on the Marine Industry* informative and valuable.

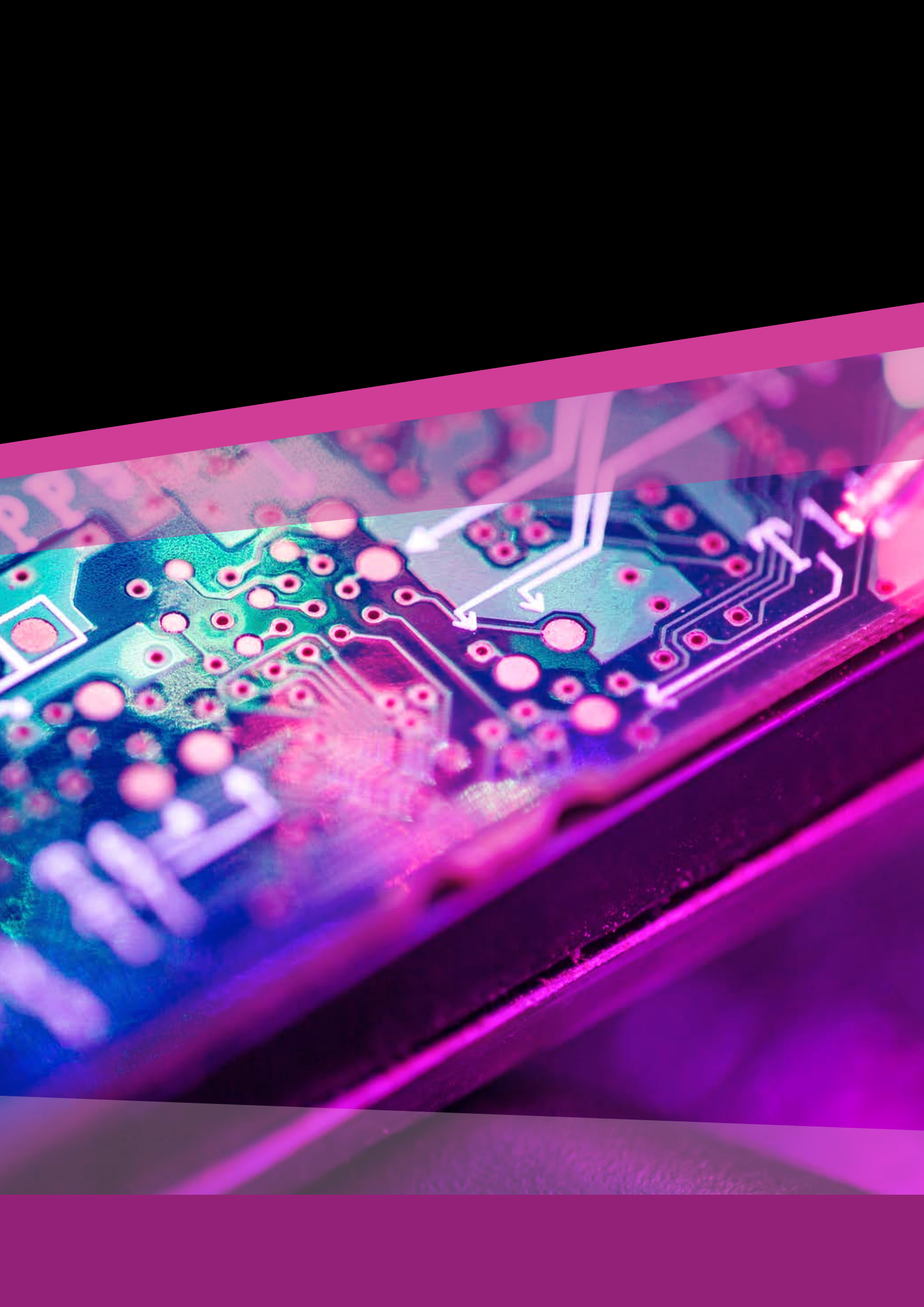
Yours sincerely,



MARCUS BAKER
Chairman
Marsh Global Marine Practice

DISRUPTIVE TECHNOLOGY





BLOCKCHAIN BUILDS TRUST IN MARINE SHIPPING WITH "SINGLE VERSION OF THE TRUTH"

While blockchain technology has the potential to eliminate many issues that the marine industry is facing, challenges stand in the way of its widespread adoption.

AUTHOR: JODY CLEWORTH, CEO OF MARINE TRANSPORT INTERNATIONAL

Disruption in the marine industry is spelled "blockchain." The technology promises to revolutionize container logistics by connecting the supply chain in a way the industry has never seen before, eliminating costly time-consuming processes, and creating trust and partnership in an industry where such principles can, at times, be misunderstood by providing the "single version of the truth" to all parties involved.

THE INTRODUCTION OF BLOCKCHAIN TECHNOLOGY IN SHIPPING

Blockchain is best known as the underlying foundation for the crypto-currency Bitcoin. But its ability to create "mutual distributed ledgers," which are self-governing, tamper-free, online databases that no one owns but that everyone has access to and can trust, has begun to make inroads to mainstream commerce, such as banking and insurance. It promises the potential for mass disintermediation of trade and transaction processing.

Container logistics is a US$4-trillion-per-year industry rooted in a byzantine world of legacy IT systems, massive amounts of data-entry-type paperwork, and milestone management processes. A study by Maersk, one of the world's largest shipping companies, said that, on average, about 30 people and organizations touch the shipment of a product using a shipping container.[1] That process alone resulted in more than 200 separate interactions, each requiring a different set of documents. This is typically done by humans interacting with multiple parties, whether that's with legacy computer systems, email, phone calls, or sometimes even faxes.

Each of those interactions represents a potential point of failure, vulnerable to illicit manipulation or simply human error.

The money spent processing documents is astronomical. Ibrahim Gokcen, chief digital officer for Maersk Transport & Logistics, said that his company "looked at the money that's spent on documents that are not digitized, the entities that need to be involved" and came away with a figure "going into the trillions of dollars."[2]

The introduction of blockchain in the marine shipping environment eliminates much of the problems in today's cargo logistics process. Each blockchain consists of records, called "blocks," which reference and identify the previous block using a cryptographic function. This forms an unbroken, verifiable chain of custody. Old transactions are preserved forever and new transactions are irreversibly added to the ledger. The beauty of this process is that it's distributed, meaning it can live on multiple computers at the same time, accessible to anyone with an interest in that particular transaction.

1 CoinDesk. "The World's Largest Shipping Firm Now Tracks Cargo on Blockchain," available at: http://www.coindesk.com/worlds-largest-shipping-company-tracking-cargo-blockchain/, accessed 9 May 2017.
2 Ibid.

BLOCKCHAIN EFFICIENCIES

We estimate that blockchain could save US$300 per container in terms of labor and the time and money spent processing associated documents. For an ultra-large container ship carrying 18,000 containers, the saving could amount to as much as US$5.4 million.

Blockchain can be a boon for smaller companies too. It can automate requirements for a specific product, such as how a container needs to be loaded following various regulations, based on linking to customs. So it could literally be a cut-and-paste exercise for most companies, which would enable smaller companies to be more agile within the global trade environment.

BLOCKCHAIN IN THE REAL WORLD

There are a lot of proof-of-concepts now in the works. At the Port of Antwerp, blockchain is being used in container security processes, but not for tracking the containers.[3] At the Port of Rotterdam, a consortium is involved in a two-year trial that will test blockchain applications for sharing logistical and contractual information between parties.[4] And Maersk ran a limited blockchain-based freight tracking trial earlier this year with a single client's shipment of goods from the Port of Rotterdam to the Port of Newark, New Jersey in the US.[5]

Our own system has now processed 27,000 containers in the UK.[6] The system increases supply chain visibility and health and safety within the supply chain. We do this by creating a cyber-physical representation in which a digital asset, such as the actual shipping container, is represented physically and digitally.

As the container moves along the landside supply chain, we are able to track its contents and provide versions of that information to regulatory agencies that need to see what's going on inside these containers, which aids in fewer inspections of the cargo. At the same time, we are able to provide almost-real-time track and trace through data analytics of how far a container is from the port and then complete specific milestones that need to be fulfilled before containers are loaded on board the vessels.

RISKS AND CHALLENGES OF BLOCKCHAIN

There needs to be a system of governance and consciousness that we apply when determining whether the technology should be deployed.

Relationships that are valued in the market today will look completely different in the future. Today, it's human-to-human selling or interaction, whereas tomorrow most of this information or the ability to create those relationships will be managed more by technology and by processes rather than human beings selling to each other. Blockchain would dehumanize the process of buying, selling, and perhaps operating.

But at the same time, there's a duty of care to ensure this technology is implemented in the right settings. For example, we don't need to create social economic issues in developing countries where jobs might be replaced by automation. But at the same time, in European and Western countries where we have a higher head-count cost, the technology can enable us to reduce those costs.

Blockchain will also allow human beings to collaborate with each other and create trust that has never been created before. It has a very wide-reaching potential that, if applied in its most holistic sense, would be extremely beneficial.

3 Portstrategy. "Ticking data boxes," available at: http://www.portstrategy.com/news101/port-operations/port-performance/ticking-data-boxes, accessed 9 May 2017.
4 Port Technology. "Port of Rotterdam Blockchain Project," available at: https://www.porttechnology.org/news/port_of_rotterdam_blockchain_project, accessed 9 May 2017.
5 "The World's Largest Shipping Firm Now Tracks Cargo on Blockchain."
6 Marine Transport International, available at: http://www.marinetransportint.com/, accessed 9 May 2017.

WHAT NEXT?

Wide-scale adoption of the technology could be hampered, however, if large industries and the people involved in supply chain management don't move beyond the current "proof-of-concept" trials out of apprehension over sharing data. Or worse, from fear of how it will change their business models. And that's the biggest risk of all: That the technology won't be used or that it will be used on a proprietary basis.

The beauty of the technology is that no one needs permission to implement the use of blockchain; there are no regulations — the field is wide open — we can simply go ahead and do it. But today, there's an inherent lack of understanding of the technology that is inhibiting a more widespread use of it.

THIS ARTICLE FIRST APPEARED ON BRINK.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ON THE HORIZON: THE POTENTIAL RISKS OF DRONE TECHNOLOGY IN SHIPPING

The use of autonomous (or "drone") technology has, so far, largely been limited to the operation of unmanned aerial systems (UASs) in our skies, and, more recently, the development of self-driving cars. It now appears the next frontier for this technology will be the seas, in the form of remotely controlled, perhaps one-day fully autonomous ships.

AUTHOR: MARSH

AUTONOMOUS TECHNOLOGY EXPANDING FROM SKY AND LAND TO THE SEA

To date, maritime companies have used autonomous technology to film corporate videos with UASs from the air, or to monitor on-board conditions and check for issues surrounding the ship. But this emerging technology has the potential to revolutionize the shipping industry in an altogether different way, if it is employed within the ships themselves.

While crewless, fully autonomous ships are yet to navigate global waters, a combination of rising transport volumes, growing environmental concerns, and an inevitable shortage of experienced and qualified seafarers has driven interest in this area. Steps have already been taken towards the use autonomous technology in shipping. Plans for the development of these ships have recently emerged, meaning we could see them in operation on the seas as early as the end of the decade.[1]

1 Hutt, Rosamond. "Remote-controlled and crewless: is this the cargo ship of the future?", *World Economic Forum*, available at: https://www.weforum.org/agenda/2016/07/remote-controlled-and-crewless-is-this-the-future-of-cargo-shipping/, accessed 9 May 2017.

POTENTIAL COST REDUCTIONS AND SAFETY ENHANCEMENTS

While the use of autonomous technology in shipping might be years away, it could have more immediate implications for the industry.

GREATER MONITORING OF VESSEL PERFORMANCE

New and emerging technology can be used in the marine industry to remotely monitor conditions of the cargo on board and help raise any issues more quickly, thus possibly reducing the litigation with cargo owners if cargo arrives damaged or ruined.

COST REDUCTIONS

These ships would require fewer personnel and less fuel to complete journeys. If a vessel is fully autonomous, it would eliminate the need for crew facilities – such as sleeping quarters – on board. This would lead to more space for cargo carriage, which would mean increased profitability for shipping companies using these vessels.

REDUCED RISK TO HUMAN LIFE

Without navigation and engineering personnel on board, these ships might also achieve the benefit of increased human safety, as the ship would be largely, if not entirely, controlled from a remote location. In addition, the possibility for human error, which is widely thought to be a contributing factor in more than 70% of all accidents at sea, has the potential to be reduced if systems are more automated.

While the use of autonomous technology in shipping might be years away, it could have more immediate implications.

CHALLENGES FOR THE MARINE INDUSTRY

Until this new technology has been tested, the risks cannot be comprehensively identified. The attitudes of regulators and insurers also remain uncertain; ultimately, they will play a vital part in the speed of its adoption.

Given the novelty of this technology, regulation has not yet been developed, meaning the accepted use of autonomous technology in shipping could still be some way off.

Worryingly, technology already in use is racing ahead and expanding in its vision and capabilities before regulating bodies can catch up. Regulation is already struggling to keep up with UASs, which have reportedly been used for illegal purposes, such as drug-trafficking and invasions of privacy, and can be used by pirates to "spy" on vessels.[2]

THE POSSIBLE RISKS POSED BY AUTONOMOUS TECHNOLOGY

If the relevant regulatory approvals are achieved and we begin to see the introduction of autonomous technology, the traditional and emerging risks these vessels pose will need to be carefully considered and mitigated by the ships' operators. A survey conducted by SAFETY4SEA among maritime stakeholders found that navigational risk, cyber security, and loss of communication were considered to be the greatest risks facing the development of fully autonomous ships (see FIGURE 1).

THE IMPACT ON TRADITIONAL RISKS

The way in which traditional risks, such as cargo liability, will be impacted will depend on the safety and reliability of the technology being developed. While the loss at sea of a vessel with reduced or no crew on board wouldn't put as many lives at risk, it could still mean the loss of the vessel and cargo, along with resulting wreck removal and clean-up costs.

Being controlled from a remote location raises several legal and insurance issues, and could have an impact on liability, should an incident occur. One of the key defenses within charter parties and within the Hague-Visby Rules (1968) that ship operators rely on when disputes arise with shippers is known as the "navigation defense," whereby the ship operator is not deemed to be held responsible for the actions of the Master, officers, or crew, provided the operator was unaware of the actions taken by the crew, and that those actions were outside the company rules. There have been attempts to remove this defense under later versions of the rules governing the carriage of goods by sea, but these have (to date) been strongly resisted by carriers. However, remotely controlled or fully autonomous ships without a crew on board could be viewed as a threat to operators in which "navigation defense" could be eroded or even removed.

It is likely that vessels using autonomous technology would be navigated by a captain located on shore; therefore, the possibility for human error remains. Until this technology is thoroughly tested, it is unknown whether a remotely controlled vessel would lessen or heighten the risk of collision. Captains would need to be thoroughly trained in navigating from a remote location using new systems and technology, and any data being used to support this would need to be reliable and up-to-date.

FIGURE 1: Risks Associated with the Use of Unmanned Ships
Source: SAFETY4SEA

Participants to SAFETY4SEA's "Smart Shipping Survey" listed the following as the top risks associated with the use of unmanned ships:

2 Belton, Padraig. "Do you have an AK-47 and can you swim?", available at: http://www.bbc.com/news/business-37257236, accessed 9 May 2017.
3 SAFETY4SEA. *Smart Shipping Survey*, available at: https://www.safety4sea.com/safety4sea-survey-reveals-industrys-smart-side/, accessed 9 May 2017.

NEW CYBER RISKS COULD EMERGE

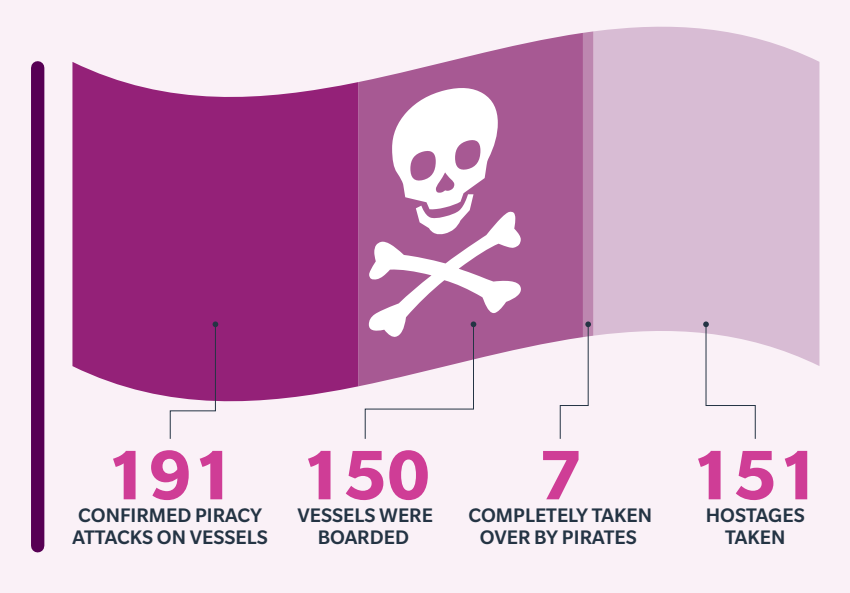
Along with the continuation of traditional risks, autonomous technology exposes the marine industry to vulnerabilities from cyber-attacks, system failure, and the possible evolution of piracy risks.

CYBER PIRACY RISKS

Maritime pirates have already begun to understand the potential to use this technology to assist in their criminal activities. The ability to see on board the vessels they wish to target for attack hugely increases the capabilities now offered to them.

A fully autonomous ship would lessen piracy risks in the sense that there would be no crew to take hostage. However, the ships would still have cargo on board and would carry considerable value, making them attractive targets. It can also be argued that having a human crew on board does offer some degree of protection, and that by removing the crew, the vessel could become a more attractive target as there would be less protection for the cargo. For example, out of the 191 piracy attacks noted by IMB in 2016 (see FIGURE 2), 22 were successfully prevented.[4]

FIGURE 2: Global Piracy Incidents in 2016
Source: International Maritime Bureau (IMB)



SYSTEM ERROR OR FAILURE

Relying on automated systems could result in errors or system failure following an electrical or cyber derangement, which could have severe consequences. The system may not pick up on an issue on board the ship, or an error or failure could cause sensors not to pick up on a danger or obstacle on or in the water. Safeguards and backup systems would need to be part of the overall design, in case primary systems fail or communications with the ship are interrupted.

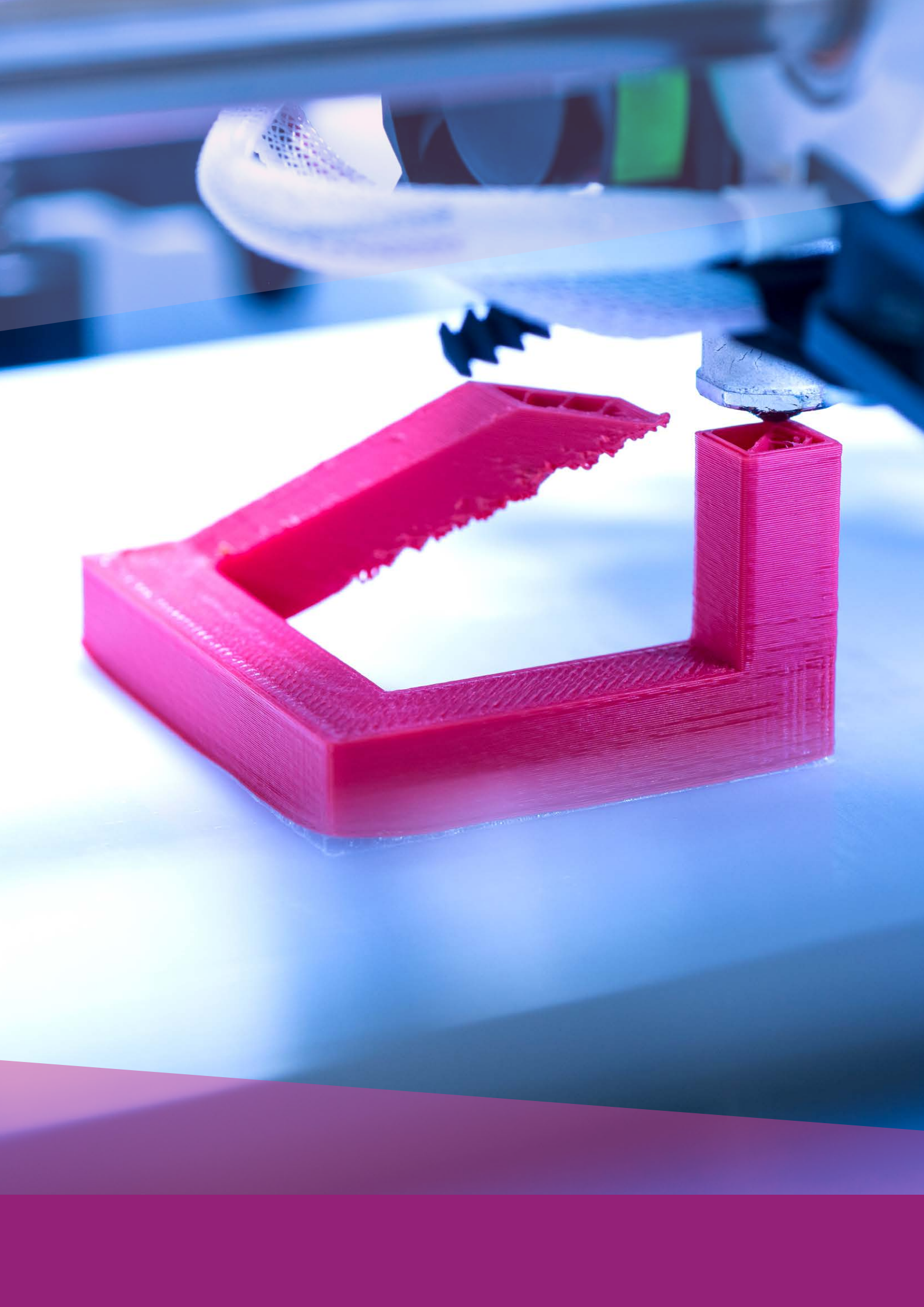
WHAT NEXT?

Autonomous technology presents no immediate threat to the marine industry, but its adoption may not be as far off as originally predicted. The attraction of possible cost savings, safety enhancements, and even an easing of the talent shortage facing the industry could prove enticing. However, the emergence of new risks and a continuation of traditional maritime risks will need to be carefully considered and mitigated if this technology is to prove successful.

The uncertainty of whether these ships will prove as safe as, or safer than, traditional cargo ships means that the full extent of the risks involved remains to be seen. If the technology is tested and found viable, the support of regulators and the insurance industry will be essential to the deployment of these ships in everyday commercial activities.

The support of regulators and the insurance industry will be essential to the deployment of these ships in everyday commercial activities.

4 International Maritime Bureau. "Sea kidnappings rise in 2016 despite plummeting global piracy," available at: https://icc-ccs.org/index.php/news/1218-imb-report sea-kidnappings-rise-in-2016-despite plummeting-globalpiracy, accessed 9 May 2017.



3D PRINTING: THE FUTURE IS NOW AT THE PORT OF ROTTERDAM

3D printing has the potential to revolutionize the way spare parts are produced in the marine industry. The Rotterdam Additive Manufacturing Lab (RAMLAB) is the first initiative of its kind, and could be the first step toward seeing this technology being more widely used in the future.

AUTHOR: VINCENT WEGENER,
MANAGING DIRECTOR, RAMLAB

Industrial spare parts are the lifeblood of the marine industry; the ability to supply these parts wherever and whenever they're needed — via industrial 3D printing — promises to revolutionize the marine environment.

The 3D printing industry is estimated to be worth US$10.8 billion by 2021.[1] The marine industry, which has so far been slow to adopt the additive manufacturing processes associated with 3D printing, stands to be among those industries with the most to gain.

A breakthrough report compiled by a group of Dutch interests completed in 2016, titled *3D Printing of Marine Spares*, led to the development of an innovative initiative within the Port of Rotterdam, known as the Rotterdam Additive Manufacturing Lab (RAMLAB). RAMLAB is laying the foundation for the 3D printing of metal parts for the maritime and offshore sectors, with the aim of creating an additive manufacturing ecosystem.

RAMLAB's ecosystem is made up of the full spectrum of additive manufacturing players, including hardware and software providers from the Netherlands and abroad, end users, education and knowledge institutes, testing facilities, certification bodies, and engineers. The goal is to build a complete digital manufacturing infrastructure within three to five years, with the ability to design, produce, and repair parts on demand.

EFFICIENT TECHNOLOGY

To make spare parts, 3D printing robots weld layer after layer of metal to create products up to 2x2x2 meters in size. The biggest advantage is speed: A traditional casting process can take six to eight months, but by using 3D printing, the same process can be accomplished within several weeks.

RAMLAB's machine is based on a technology called Wire Arc Additive Manufacturing (WAAM), which is currently the most suitable technology for the production of large metal parts.[2] It uses an electric arc as its heat source and steel wire as feedstock, has various technical advantages, and is much cheaper and less time-consuming, as it makes use of ready-made steel objects to be printed on. For example, the welding machine doesn't have to print the core of the object first, but only has to weld the blades, thus saving manufacturing time.

1 Hedstrom, Jess. "3D Printing Maritime: Military Vessels, Cargo Shipping and more," available at: https://www.sculpteo.com/blog/2015/10/12/3d-printing-maritime-military-vessels-cargo-shipping-and-more/, accessed 10 May 2017.

2 Wire Arc Additive Manufacturing. "ADDITIVE MANUFACTURING (AM)," available at: http://waammat.com/about/waam, accessed 10 May 2017.

BRINGING THE FUTURE TO THE PORT

RAMLAB has become the first maritime-orientated additive manufacturing lab in the world. A challenging task, because the field is new and largely untested. Yet the successful implementation of a 3D printing ecosystem will force ports to change.

There will be a change in function and opportunities for employment; however, filling the talent pipeline will be a challenge unto itself. The processes involved require skilled labor and higher educated persons.

THE 3D PRINTING NETWORK

To achieve its vision of manufacturing certified metal parts on demand through additive manufacturing, RAMLAB has built a network of partners that provide hardware, software, and guidance on certification of the process.

The lab also has a growing list of members that understand the potential of additive manufacturing. Every partner and member makes sure to share knowledge and input. For example, the machinery at RAMLAB is installed by its partner Valk Welding, a specialist in developing and delivering robotic welding systems.

FIRST PILOT COMPONENT

Recently, RAMLAB and partner Autodesk revealed the first pilot component to be made at the port. A ship's propeller was made using a hybrid manufacturing process combining wire and arc additive manufacturing using industrial robotic arms and subtractive machining and grinding techniques.

Autodesk, which has expertise in how to design and manufacture using both the latest additive manufacturing techniques and more traditional computer numerical control (CNC) and machining methods, has been in close collaboration during the ship propeller pilot project. The next step will be for a final, to-scale version to be manufactured and fitted to one of the partner's ships in the summer of 2017.

With the work being done at RAMLAB, the group hopes to accelerate the cross-industry adoption of hybrid manufacturing for making large-scale parts on-demand. The aim is to make the Port of Rotterdam not just an important gateway for Europe, but also a leader in the development of new manufacturing methods.

LESSONS LEARNED AND FUTURE USE

The pilot project run out of the Port of Rotterdam has provided several lessons learned for looking at the benefits expected in the near future, when additive manufacturing is mature and accredited as a legitimate production technology for marine parts.[3] The following trends were revealed:

Faster production: New parts can be prototyped (in nylon or other plastics) and fitted. Based on that design, a metal part can be 3D printed in a matter of days, whereas traditional manufacturing often takes weeks or even months. In light of the fact that, more often than not, ships are carrying cargo that is in need or perishable, a positive business case can almost always be made for 3D printing.

Less tooling and fewer investments required: Contrary to public opinion, 3D printing requires fewer investments in tooling and other production process-related costs. Instead of factoring in the amortization of an expensive 3D printing machine, making use of service providers can easily overcome these costs. In addition, no expensive molds are required, and cheap molds or dies can be produced by 3D printing, allowing for smaller manufacturing runs to be produced.

Optimization of design: Lightweight adjusted designs can lead to more efficient use. Quantifying potential efficiency gains often helps to make a positive business case. But customer demand needs to be very clear, and the added value of a better solution needs to be made tangible to have the proper discussion with a customer about the selection of the production technology.

The field is new and largely untested. Yet the successful implementation of a 3D printing ecosystem will force ports to change.

3 Port of Rotterdam. *Pilot Project: 3D Printing Marine Spares,* available at: https://www.portofrotterdam.com/sites/default/files/report-3d-printing-marine-spares.pdf, accessed 10 May 2017.

As exciting as these trends are, the reality of today's current environment precludes many of these benefits from occurring. Standardization, classification, quality control, and validation of design and product will all need to be addressed to reach a situation in which international governing bodies have the rules and regulations in place to use additive manufacturing in a similar manner as traditional manufacturing methods.

In view of the expected benefits, the pressure will be on the relevant authorities to create advances in this field in the near future.

THIS ARTICLE FIRST APPEARED ON BRINK.

As exciting as these trends are, the reality of today's current environment precludes many of these benefits from occurring.

INTERCONNECTED SYSTEMS PUT MARINE INDUSTRY AT RISK OF DISRUPTION

While the marine industry's use of interconnected systems has brought about tremendous benefits, such as greater efficiency, cost savings, and monitoring of systems, it has also brought considerable risk.

AUTHOR: MARSH AND BRINK

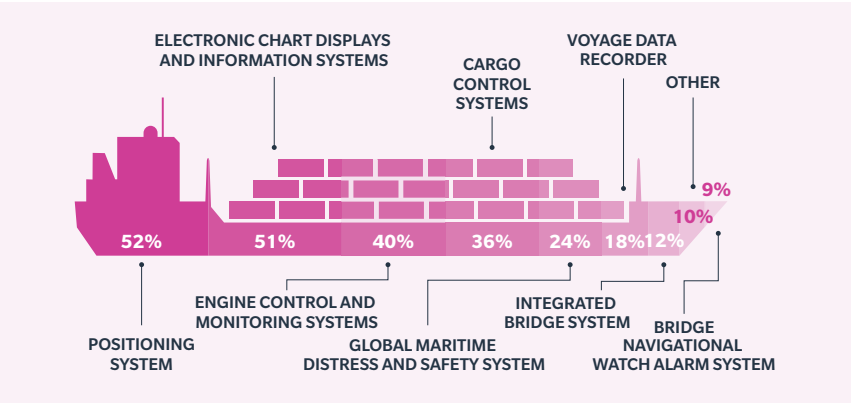
Significant weaknesses have been identified in the cyber security of critical technology used for the operation of modern commercial cargo vessels. Global positioning systems (GPS), automatic identification systems (AIS), and electronic chart displays and information systems (ECDIS) are all essential aids to navigation in today's modern ships; however, each has been identified as potentially vulnerable to a cyber-attack.

According to a 2016 maritime cyber security survey conducted by BIMCO and IHS Markit (see FIGURE 1), GPS and ECDIS were found to be the most vulnerable, with over half of all respondents stating these systems were the most susceptible to cyber-attacks.[1] Interestingly, engine control and monitoring systems were ranked the third highest risk for an attack suggesting that the industry is worried about potential issues around shipborne assets and their controls.

Given these concerns, cyber risk has become a board-level issue, with greater importance placed on mitigating the impact attacks could have on a company's reputation, safety, and finances.

1 BIMCO and IHS Markit. *2016 Cyber Security Survey*, available at: http://media.wix.com/ugd/9491c8_9c8341f06c134b86b53467ca63cbf849.pdf, accessed 4 May 2017.

FIGURE 1: Shipborne Systems Most Vulnerable to Cyber-Attack
Source: BIMCO and IHS Markit[1]



PROTECTION AND SECURITY

It is not only vessel navigation that has benefited from the introduction of new cyber technologies; propulsion monitoring systems, cargo handling, container tracking systems, and shipyard inventories are now all controlled using software to reduce costs and improve efficiency. However, the accessing, interconnecting, monitoring, and networking of numerous shipping systems have created new cyber risks, and previous events suggest that these systems might be vulnerable to attacks or disruption.

Example: Hackers working with a drug-smuggling gang infiltrated the computerized cargo tracking system of the Port of Antwerp to identify the shipping containers in which consignments of drugs had been hidden. The gang then drove the containers from the port, retrieved the drugs, and covered their tracks. The criminal activity continued for a two-year period, until it was stopped by Belgian and Dutch police.[2]

Example: The potential for pirates to carry out cyber-attacks is the latest threat they pose to the marine industry, as they could hack a marine company's system, enabling them to target, track, board, and take specific cargo ships, offload the cargo, and vanish quicker than the authorities can respond.[3]

2 BBC News. "Police warning after drug traffickers' cyber-attack," available at: http://www.bbc.com/news/world-europe-24539417, accessed 4 May 2017.

3 Harris, Stephen. "Tech-savvy pirates bring new threats to shipping industry," available at: http://www.propertycasualty360.com/2017/02/28/tech-savvy-pirates-bring-new-threats-to-shipping-i, accessed 4 May 2017.

Cyber security has already been addressed by the International Maritime Organization (IMO), which published guidelines on cyber risk management.[4] However, there is a common consensus that the industry needs greater education on the potential financial and operational consequences of a cyber-attack.

HOW IS THE INDUSTRY AT RISK?

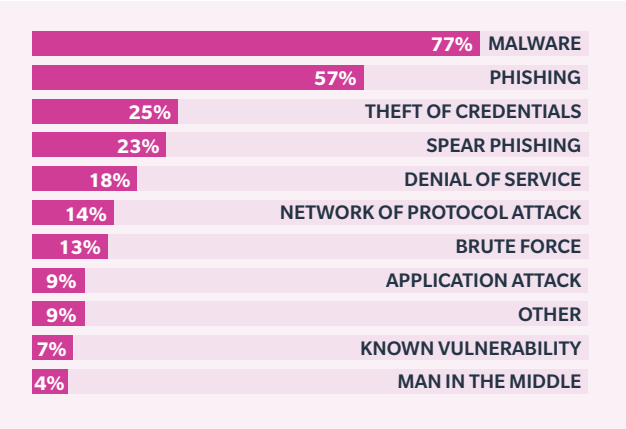
DATA BREACH OR LOSS

Cyber-attacks are usually driven by an attempt to gather company data due to its possible financial value and use for extortion. If data is breached or lost as a result of an attack, it could result in liability and business interruption losses. Cyber-attacks can occur from various sources, including hacks into the company's systems, malware being placed on computers, or even the loss of devices such as employees' laptops.

FINANCIAL RISK

The industry has seen financial losses from phishing attacks over the past few years. Phishing (also known as social engineering fraud) refers to a variety of techniques used by fraudsters to gain information. They deceive and manipulate victims into voluntarily performing actions which result in them giving out confidential information or transferring funds. For example, in 2014, a maritime company was undertaking a deal to order a seafloor mining vessel and had reportedly pre-paid millions of the charterer's guarantee. Unfortunately, the company was part of a phishing attack and unknowingly paid the funds into a bank account that belonged to a cyber criminal.[5]

FIGURE 2: The Nature of Cyber-Attacks on the Maritime Industry
Source: BIMCO and IHS Markit

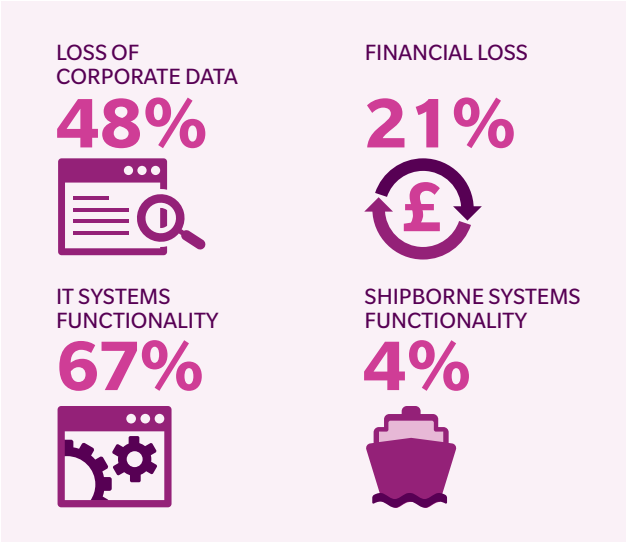


4 IMO. "Maritime cyber risk," available at: http://www.imo.org/en/OurWork/Security/Guide_to_Maritime_Security/Pages/Cyber-security.aspx, accessed 4 May 2017.

5 "Maritime Cyber Attacks: Changing Tides And The Need For Cybersecurity Regulations" in *Hellenic Shipping News*, available at: http://www.hellenicshippingnews.com/maritime-cyber-attacks-changing-tides-and-the-need-for-cybersecurity-regulations/, accessed 4 May 2017.

The 2016 maritime cyber security survey conducted by BIMCO and IHS Markit showed that the vast majority of those companies that had been subject to a cyber-attack had been attacked by malware, phishing, and theft of credentials (see FIGURE 2). This illustrates a trend in which cyber criminals are looking to gain access to corporate data and IT system functionality, as opposed to shipborne systems and functionality (see FIGURE 3).

FIGURE 3: Impact of Cyber-Attacks on the Maritime Industry
Source: BIMCO and IHS Markit



OPERATIONAL RISK

A cyber-attack can also be designed to bring operations to a standstill. For example, cyber-attacks on routing systems allow for the potential re-routing of cargo, enabling targeted trafficking and theft, which causes considerable operational delays for ports and third-party logistics companies.[6] Aside from disruption to services, there are inherent safety risks associated with cyber security through the compromise of computerized navigation and stability systems. Unfortunately, cyber criminals appear to be learning about the weaknesses of today's technology more quickly than their targets.

Cyber criminals appear to be learning about the weaknesses of today's technology more quickly than their targets.

6 K2 Intelligence. "Increased Cyber Attacks on Shipping and Logistics Highlights the Need for Preventive Strategy," available at: https://www.k2intelligence.com/en/insights/thought-leadership/increased-cyber-attacks-on-shipping-and-logistics-highlight-the-need-for-preventative-strategy, accessed 4 May 2017.

REPUTATIONAL RISK

A successful cyber-attack against a ship operator or any party in the shipping industry would inevitably lead to reputational damage for the victim and, potentially, the industry as a whole. In the current commercial climate of ferocious competition among maritime operators, a good reputation for prudent operations must be protected. If damaged, reputation can be a key "differentiator" in the battle for survival.

CYBER PIRACY EFFORTS

Wider internet connectivity is driving an increase in the use of cheaper and more portable smartphone devices in the industry. The use of such devices may initially save time for vessel, port, and terminal operators, but may also expose users to increasingly sophisticated criminal groups. These criminals may manage to successfully monitor communications between individuals, gaining hugely valuable information about goods, locations, and security processes, and could compromise expensive security systems. For example, a security system could be compromised if criminals learn that security points are going to be undermanned at a particular time and location.

Better connectivity has also given pirates the ability to monitor sources of information, such as the Aeronautical Information Service (AIS) websites, which track ocean-going cargo in real time. The possibility of unmanned aerial systems (UASs) being used by pirates for surveillance or carrying out attacks is also a growing concern to maritime security analysts.

VULNERABILITY FROM CREWS AND EMPLOYEES

Vessels are particularly vulnerable to cyber security threats when third-party personnel connect via remote access to undertake maintenance and security checks, or when crew connect directly to a ship's system with devices such as tablets and memory sticks.[7] The probability of a cyber-attack bringing down global trade routes is small. However, the exposure is growing, and more needs to be done to educate people and improve systems in the industry.

Shipping companies need to be aware of cyber threats from their own employees, who could strike back at the company if they are made redundant or bear a grudge against their employers. In addition, employees could unknowingly expose the company to a cyber-attack, and steps should be taken to train employees to recognize where cyber risks may stem from and how to prevent them.

In addition, international regulations, such as the recent Maritime Labour Convention 2006 (MLC 2006), have required vessel operators to provide online communication facilities and internet access for vessel crews to use, which could prove to be a weak link. Providing effective "firewall" security software to a vessel's crew to use on their personal devices and mandating its use while on board the vessel may help mitigate this issue.

THE MARINE INSURANCE INDUSTRY'S RESPONSE

Cyber risk and its potential impact on the marine industry is a looming concern for shipping companies and insurers. We have observed that marine insurers and reinsurers are increasingly reducing their dependence on the blanket Cyber Exclusion Clause (CL. 380),[8] and are instead asking more searching questions about the cyber security systems in place within individual companies. Cyber response plans are increasingly becoming part of the overall marine risk review and analysis, and marine risk engineers are increasingly looking at clients' abilities to detect cyber abnormalities and threats, incident response capabilities, and past breaches or near misses, so that engineers can incorporate specific recommendations into cyber response plans in overall risk mitigation.[9]

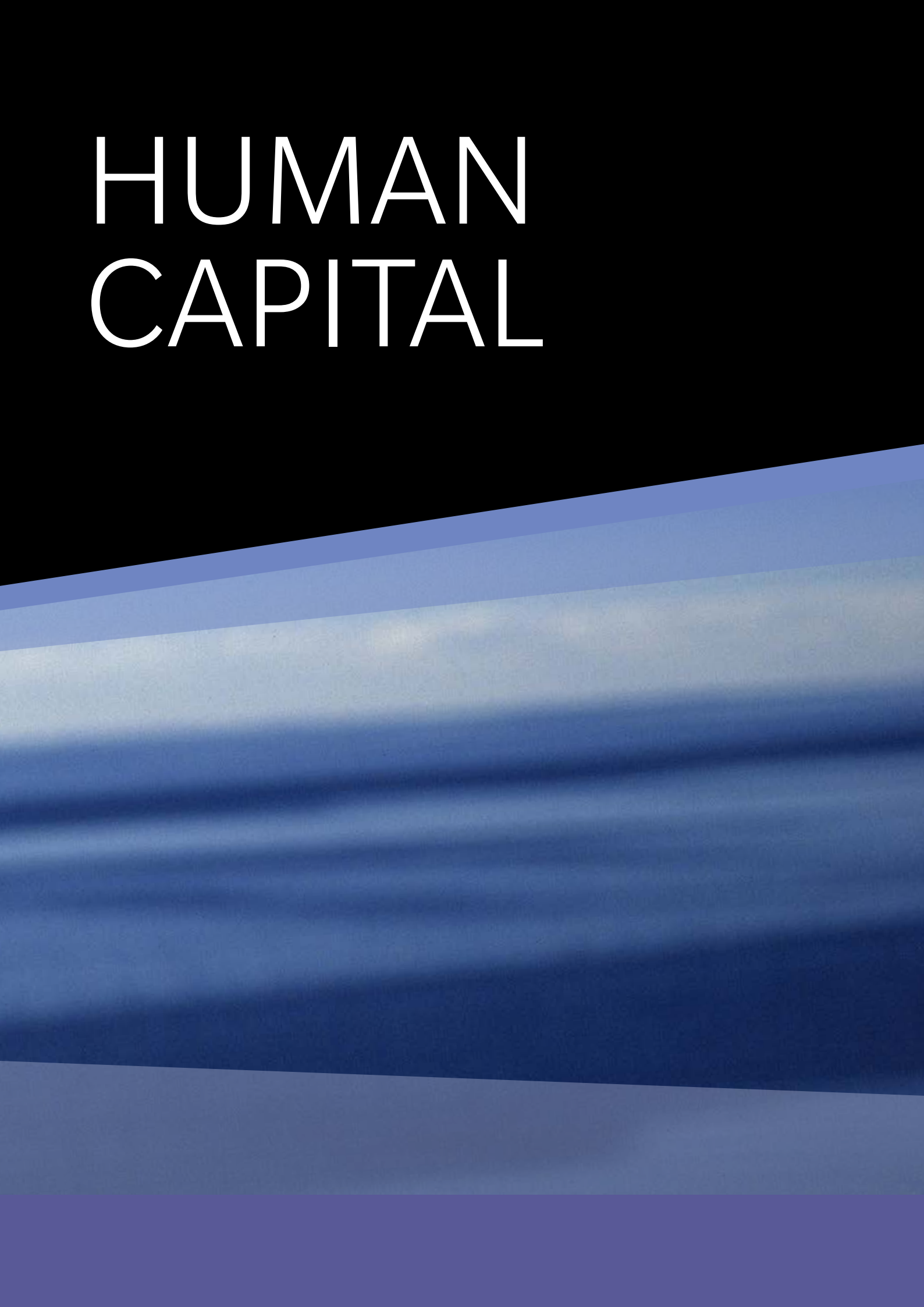
Although many questions remain, what does appear certain is that cyber issues will stay at the forefront of the industry for the foreseeable future.

7 Tomlinson, Kerry. "Even Cruise Ships Can be Hacked," available at: http://www.archersecuritygroup.com/even-cruise-ships-can-be-hacked-and-what-is-being-done-about-it/, accessed 4 May 2017.

8 Guy Carpenter. *Marine & Energy Market 1st January Renewal Report*.

9 Ayers, Erin. "Marine Insurers Face Cyber 'Unknown Accumulation' Risks," available at: http://www.brinknews.com/marine-insurers-face-cyber-unknown-accumulation-risks/, accessed 4 May 2017.

HUMAN CAPITAL



MARINE INDUSTRY FACES CHALLENGES FROM TALENT SHORTAGES

Demand for qualified seafaring professionals is increasing and appears set to rise further over the next decade. However, a shortage of new talent entering the industry, as well as difficulties retaining the talent already available, is becoming a pressing issue for marine organizations.

AUTHOR: MARSH

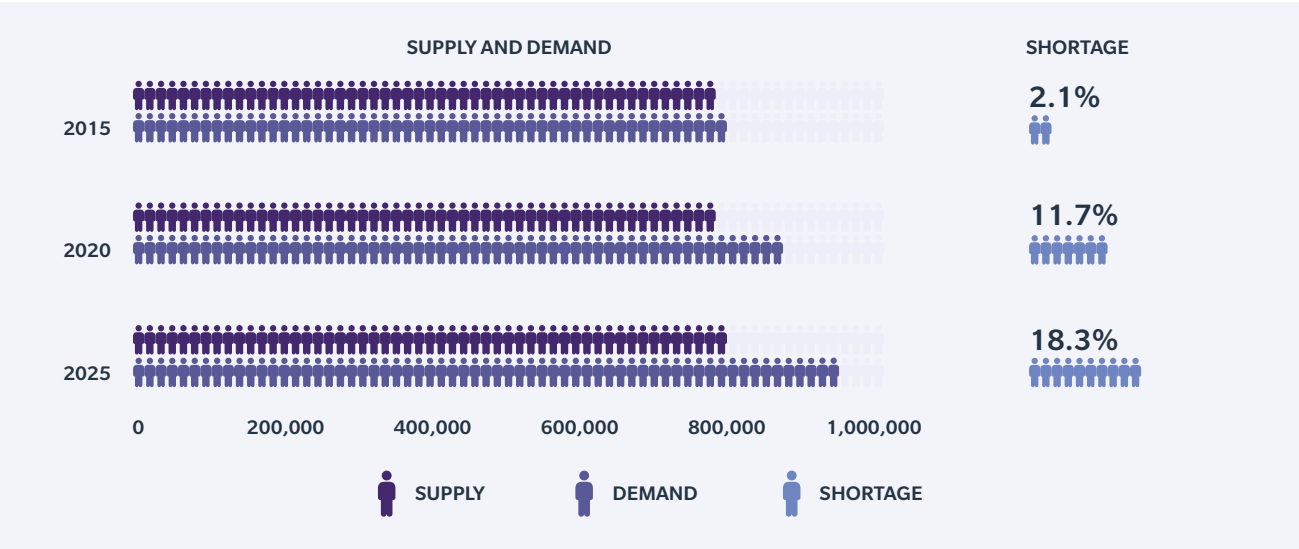
The world fleet grew by 3.1% in 2016,[1] and although this is the lowest annual growth rate in more than a decade, it still represents a need for more seafarers and officers. This, combined with a 2.1% growth in seaborne shipments and an estimated 10 billion tons of seaborne trade volumes shipped in 2015,[2] increases the burden on an already depleted workforce required to handle this growth.

It has been reported that there could be a shortage of as many as 147,500 officers by 2025.

CAN CURRENT DEMAND BE MET?

A study by BIMCO and ICS into labor shortages in the marine industry stated that there is currently a shortfall of about 16,500 officers to service the world merchant fleet (around 2.1% of demand). To make matters worse, it has been reported that there could be a shortage of as many as 147,500 (18.3%) officers by 2025 (see FIGURE 1).[3] Meanwhile, a UK Government report has predicted that the shortage of seafarers in the UK would to rise to 1,600 by 2021.[4] This is due to factors such as an aging workforce, a lack of skills diversity, existing labor being drawn to careers elsewhere, and a lack of interest from young professionals.

FIGURE 1: Estimated Global Supply and Demand of Sea Officers from 2015-2025
Source: BIMCO and ICS



1 Parry-Jones, Sarinka. "2016: Dissecting The Numbers Up And Down The Fleet," available at: https://live.clarksons.net/wfr2/News/Article/80558, accessed 8 May 2017.
2 UNCTAD. *Review of Maritime Transport 2016*, available at: http://unctad.org/en/PublicationsLibrary/rmt2016_en.pdf, accessed 8 May 2017.
3 BIMCO and ICS. *Man Power Report 2015*, available at: http://www.ics-shipping.org/docs/default-source/resources/safety-security-and-operations/manpower-report-2015-executive-summary.pdf?sfvrsn=16, accessed 8 May 2017.
4 UK Government. *Review of Government Support for Maritime Training*, available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/3697/independent-review-on-maritime-training.pdf, accessed 8 May 2017.

Some seafarer categories, such as ratings personnel, are relatively stable and even have a surplus workforce. However, areas such as chemical, liquid natural gas (LNG), and liquefied petroleum gas (LPG) carriers, as well as engineer officers are facing significant officer labor supply issues.[5] And it is not just seafaring personnel that are in short supply; roles based onshore in ports, terminals, and engineering have also experienced recruitment problems due to a depleted number of ex-seafarers. For example, ship superintendents – a role that requires experienced former seafarers – are in especially short supply.

Talent shortages are also an issue in the offshore support industry. Operating tugs, supply vessels, dredgers, and bunkering vessels all require considerable experience, as these vessels perform specialized tasks that support commercial cargo vessels at sea, such as helping them to berth, and keeping waterways and channels safe for navigation. Often operating in confined waters or close to other vessels, navigation skills are of paramount importance in these roles, which can only be performed safely with considerable experience.

The resulting environment of today's labor issues could be one in which there is not only a shrinking workforce, but also severe gaps in experience. The industry may need to work harder to attract new and retain existing talent to ensure that knowledge is transferred to future workforce generations.

The resulting environment of today's labor issues could be one in which there is not only a shrinking workforce, but also severe gaps in experience.

5 Allen, Andrew. "Shipping industry facing global shortage of 148,000 officers," in *Supply Management,* available at: https://www.cips.org/supply-management/news/2016/june/shipping-industry-facing-shortage-of-148000-officers/, accessed 8 May 2017.

WHAT IS CAUSING THE SHORTAGE OF TALENT IN THE INDUSTRY?

The marine industry appears to be becoming less attractive to new generations entering the workforce. Below are some of the factors that will likely exacerbate the talent shortage in the future:

AN AGING WORKFORCE

The marine industry faces an imminent challenge around the management of its aging workforce. Many jobs in the industry require specialized experience and expertise, but as an increasing number of seafarers enter retirement, they are taking a great deal of experience with them. For example, in Japan's shipbuilding sector, about half the workforce is aged 50-60, and there are few young professionals joining the industry.[6]

LACK OF RECRUITS

The marine industry is beginning to feel the pressure of not having a diverse workforce in terms of age and skill set. The UK Department for Transport (DFT), for example, forecasts a deficit of around 3,500 deck and engineering officers by 2021 in the UK alone.[7] Not only would this present serious issues for seafarer operations but also the future safety and security of ports, shipping, and maritime services that rely on a pool of transferable skills of former seafarers.

It is not just the lack of newly qualified maritime officer recruits that's causing issues; the marine industry is struggling to recruit experienced hires. A study by UK NEST found that the UK naval sector has a disproportionate number of retirees, causing skill shortages in specific roles. For example, there is a labor shortage for marine engineers aged between 35-45 years old.[8] If experience gaps are not addressed, considerable knowledge will be lost in the industry over the coming decades.

6 IHS. *Five trends shaping the global maritime industry,* available at: https://www.ihs.com/pdf/Global-Trends-Impacting-the-Maritime-Industry_235788110915583632.pdf , accessed 8 May 2017.

7 Department for Transport. *Transport Infrastructure Skills Strategy: building sustainable skills*, available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/495900/transport-infrastructure-strategy-building-sustainable-skills.pdf, accessed 8 May 2017.

8 UK NEST. *The Naval Engineering Workforce,* available at: https://www.uknest.org/wp-content/uploads/2015/10/Naval-Engineering-Workforce-Review.pdf, accessed 8 May 2017.

CAREER IMAGE

A career in the marine industry is often not perceived as "modern." The historical attraction of a life traveling the world can now be achieved in almost all industries. To help change the industry's image, companies must embrace technologically advanced systems and innovation; for example, the use of autonomous technology could broaden the career appeal to technology-focused professionals.[9] On the flip side, the increasing pace of technological change could be linked to older seafarers struggling to keep up with industry changes, exacerbating the problems of retaining experienced officers at sea.

HOW CAN THE MARINE INDUSTRY ATTRACT A MORE DIVERSE WORKFORCE?

Marine organizations have recognized the need for a more diverse workforce, but as yet this has not translated into actions to address the issue of officer retention. The industry is still challenged by the high rate of seafarer mobility between different shipping companies, combined with the early movement of ship officers to shore-based roles.[10]

To help tackle these issues, the marine industry has embraced new initiatives to attract talent. The International Maritime Organization (IMO) has launched campaigns including "Year of the Seafarer" in 2010 and "Day of the Seafarer" in 2016 to raise the profile of marine careers in the public domain.[11] Many organizations have been set up internationally with the objective of raising awareness in young people and providing educational opportunities to help stem a growing skills gap.

COMPETING FOR MARINE TALENT

Companies will find themselves competing for a smaller pool of talent in the coming years and will need to be proactive in their strategies of attracting new talent and retaining existing employees. Changing the approach to talent acquisition and creating a more talent-driven environment will be instrumental in facing the challenges to come. This may include:

1. Building a workplace culture for the future that readily embraces diversity, flexibility, innovation, and autonomy.

2. Placing greater emphasis on building a diverse pool of talent by identifying new opportunities for talent sourcing and skill matching, embracing the use of analytics in the process.

3. Reassessing HR operations to place greater emphasis on talent sourcing, talent retention, and career progression support.

4. Designing career frameworks to address the future succession needs of the organization to ensure knowledge transfer and help build more compelling careers to ensure retention.

As the marine industry gears up to face growing workforce shortages, new approaches to recruitment and retention will be needed. Those organizations that embrace innovation, diversity, and knowledge transfer now will be better placed to attract the required workforce of tomorrow.

Changing the approach to talent acquisition and creating a more talent-driven environment will be instrumental in facing the challenges to come.

9 *Five trends shaping the global maritime industry.*

10 Bhattacharya, Yogendra. "Employee Engagement as a Predictor of Seafarer Retention: A Study among Indian Officers" in *The Asian Journal of Shipping and Logistics,* available at: http://www.sciencedirect.com/science/article/pii/S2092521215000358, accessed 8 May 2017.

11 IMO. "Day of the Seafarer 2016," available at: http://www.imo.org/en/About/Events/dayoftheseafarer/Pages/Day-of-the-Seafarer-2016.aspx, accessed 8 May 2017.

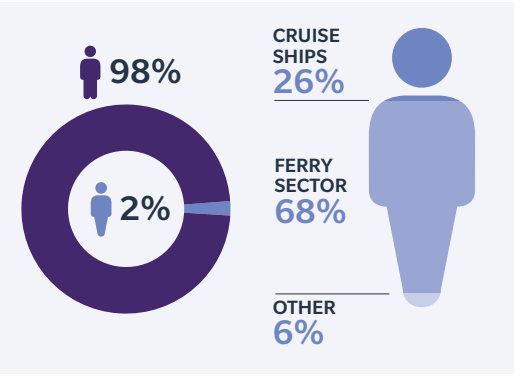
WOMEN IN SHIPPING: WHY GENDER DIVERSITY MATTERS

As the shipping industry faces severe talent shortages, the need to embrace gender diversity in the workforce has never been greater.

AUTHOR: MARSH

BIMCO and ICS estimate that 1.6 million seafarers are currently crewing vessels across the world.[1] Those seafarers make up of one of the world's most diverse workforces, with multi-ethnic, multicultural, and multilingual seafarers operating across international waters. However, despite how diverse and globalized this industry has become, it may come as a surprise how few women make up today's maritime workforce.

FIGURE 1: Percentage of Women Working Aboard Ships and Breakdown
Source: ILO and ITF



The International Transport Workers' Federation (ITF) estimates that only 2% of global seafarers are women.[2] Of those, approximately 94% are working in roles on cruise ships (26%) or in the ferry sector (68%).[3]

1 BIMCO and ICS. *Manpower Report 2015,* available at: http://www.ics-shipping.org/docs/default-source/resources/safety-security-and-operations/manpower-report-2015-executive-summary.pdf?sfvrsn=16, accessed 10 May 2017.
2 International Transport Workers' Federation. "Women Seafarers," available at: http://www.itfseafarers.org/ITI-women-seafarers.cfm, accessed 10 May 2017.
3 International Labour Organization. "Women seafarers: Fighting against the tide? As on land, so by sea: Women join the ranks of seafarers," available at: http://www.ilo.org/global/publications/world-of-work-magazine/articles/WCMS_081322/lang--en/index.htm, accessed 10 May 2017.

GREATER GENDER DIVERSITY CAN BENEFIT INDUSTRY

Greater gender diversity aboard ships provides many benefits, such as creating a more natural social environment, therefore reducing the sense of isolation often felt by many seafarers.[4] Furthermore, demand is increasing in the marine industry for qualified seafaring professionals, and is set to continue to increase over the next decade.[5] This, combined with a shortage of new talent entering the industry and difficulties retaining the talent that already exists, is becoming a pressing issue for marine organizations. As a result, the industry needs to recognize the role women can play in addressing the current and future labor and skill gaps by creating a larger, more diverse talent pool.

HOW CAN THE INDUSTRY ATTRACT FEMALE TALENT?

The industry is facing barriers in attracting more female talent due to its reputation and the current standards being employed. While industry organizations such as the International Maritime Organization (IMO) and International Labour Organization (ILO) have led several recent campaigns around the support and encouragement of women in the marine industry by addressing education and societal norms and values,[6] further work by individual companies to promote and support seafaring careers for women will go a long way in addressing gender issues in the industry.

4 SAFETY4SEA. "Celebrating Women in Shipping," available at: http://www.safety4sea.com/celebrating-women-shipping/, accessed 10 May 2017.
5 *Manpower Report 2015.*
6 Aggrey, H. *Women in the maritime industry: a review of female participation and their role in Maritime Education and Training in the 21st century,* available at: http://commons.wmu.se/cgi/viewcontent.cgi?article=1382&context=all_dissertations, accessed 10 May 2017.

CHANGING THE INDUSTRY'S REPUTATION

Shipping has traditionally been seen as a male-dominated industry, and the lack of gender diversity over time has, in itself, become a barrier as to why many women may have not considered it as a potential career. As a result, there is also a lack of female role models in the industry, providing little to no reassurance or point of reference for women considering a successful career in shipping.[7] A lack of female participation has allowed for negative prejudices and outdated gender norms to emerge, resulting in negative perceptions of the industry.

There are several steps that can be taken to reduce gender bias within the marine industry; however, changing the reputation of an entire industry takes time. One important way that the industry could work to ensure it is better prepared to attract and retain female talent is by working to change attitudes and make preparations for those women entering the industry to overcome any gender discrimination and bias.[8] For example, companies may implement continued development of on-board policies, appropriate training, and education around gender diversity and inclusion at sea. These, combined with the efforts of industry networks, are positive steps to ensuring safety and support is readily available for women entering the industry.

BUILDING GREATER CAREER AWARENESS

In line with general recruitment issues in the marine industry, a lack of awareness around shipping career options is making it difficult to attract female talent. Global maritime organizations and industry networks can take a lead in raising awareness in young women as to the potential careers in shipping. These organizations can help promote female seafarers through career fairs, workshops, and mentoring programs, inspiring and educating the next generation. The Women's International Shipping & Trading Association (WISTA) is a networking organization for women at management-level positions in the marine industry and currently has over 3,000 individual members from 40 countries. The IMO and associations such as WISTA are helping to promote regional business networking and skill-building opportunities within the industry. Such support networks will go a long way to helping to attract highly qualified women, enhancing career preparation, and driving more women seafarers into the industry.

INCREASING SUPPORT FOR TALENT

In many parts of the world, both men and women need improved support from their personal networks, family, and society in order to succeed in their marine careers. A lack of support, both in terms of the necessary skills learned through education and from society, has often discouraged women, as well as men, from considering a career in shipping.

Many seafarer roles require long stays at sea, which can make it difficult to balance work and family commitments. Family demands are often seen as a barrier for women wanting to enter the industry, and illustrate a need for the industry and society to address this much larger issue. There is also a need to address failures in family friendly working practices, and, even in some cases, implement basic maternity rights.[9] Improved benefits and greater flexibility in the workplace could be key differentiators in attracting a greater level of new talent.

SETTING INDUSTRY STANDARDS

One way of ensuring a safe, gender-diverse industry is by establishing best ethical practice and sharing these standards across industry organizations.[10] The IMO and other industry groups can be instrumental in voicing the issues the industry is facing and working collectively to resolve these. In addition, the industry can consider putting in place better standards addressing women's issues, such as health care and maternity leave.

In addition, ethical recruitment policies can ensure that an appropriate and fair selection of new cadets is taking place.[11] For example, organizations may look to revise their diversity and inclusion policies to ensure women are given equal chance of employment.

7 Mukherjee, Paromita. "7 Reasons There Are Fewer Women Seafarers In The Maritime Industry," in *Marine Insight*, available at: http://www.marineinsight.com/life-at-sea/7-fewer-women-seafarers-in-the-maritime-industry/, accessed 10 May 2017.

8 Pike, K. Broadhurst, E. Zhao, M. Zhang, P. Kuje, A. and Oluoha, N. *The Gender Empowerment and Multi-cultural Crew (GEM) Project Report*, available at: https://www.solent.ac.uk/research/documents/gem-full-report.pdf, accessed 10 May 2017.

9 SAFETY4SEA. "ITF: Women Seafarers," available at: http://www.safety4sea.com/itf-women-seafarers/, accessed10 May 2017.

10 *The Gender Empowerment and Multi-cultural Crew (GEM) Project Report*.

11 Ibid.

BUILDING A GENDER DIVERSE WORKFORCE

Maritime employers and industry leaders should consider ways to think and act differently in order to minimize the risk of insufficiently diverse organizations that fail to advance employees and compete successfully and sustainably in a global business environment. To break through the inertia and accelerate progress, organizations can engage with behavioral change on an individual level — beginning with leaders and progressing peer-by-peer to create real momentum for change.

A recent report from Mercer[12] outlined that women thrive when there is individual and organizational alignment — something achievable through what it has termed as a "6P" approach. This means that individuals within organizations may consider the following to address gender diversity issues:

- Have *Passion* to drive diversity.
- Make it a *Personal* priority.
- Show *Perseverance* over time.

Comparably, organizations need to:

- Rely on *Proof* before jumping to solutions.
- Install regular, robust *Processes* to ensure equity.
- Implement and support critical *Programs.*

Women have the potential to play a large role in the maritime industry in the future.

Mercer's report shows that women thrive when leave and flexibility programs are actively managed, and when their unique competencies are leveraged in high business-impact roles. They also thrive when there's a diligent pay equity process in place, and when promotion and performance management processes include a gender lens.

In addition, the report confirms that female representation increases when organizations understand and support women's unique health needs and offer gender-specific financial wellness practices.

Women have the potential to play a large role in the maritime industry in the future, particularly as it faces the need for greater diversity and shortages in the number of new recruits. By addressing existing industry stigma, promoting diversity, and providing greater support for women joining the industry, companies can ensure they are better placed to recruit talent and achieve greater gender equality.

12 Mercer. *When Women Thrive, Businesses Thrive,* available at: https://www.mercer.com/content/dam/mercer/attachments/global/glb-2017-davos-wwt-wef-summary.pdf, accessed 10 May 2017.

NEW DEMANDS

SHAPING THE LOW-CARBON FUTURE OF THE SHIPPING INDUSTRY

The role of shipping in greenhouse gas emissions is likely to undergo increased scrutiny in the near future, but there are several issues the industry will need to debate when deciding on the best strategy to become low carbon, while limiting the disruption it could face.

AUTHOR: ALASTAIR MARSH, CEO,
LLOYD'S REGISTER GROUP

As CEO of Lloyd's Register, I often reflect on how our role has evolved over our 257-year history. When we were founded in 1760, our role was to protect ships and their crews from the harsh marine environment. Although that role continues, we now also play a major part in protecting the environment from ships and their crews.

The greenhouse gas (GHG) emissions of shipping are a consequence of the carbon intensity of shipping's energy supply, the energy efficiency of shipping, and the demand for shipping. The Paris Agreement on climate change confirmed that it was not a question of whether climate change should be addressed, but a question of how, and it is clear that everyone will have to contribute.

Shipping is arguably the most carbon-efficient mode of commercial transport and is fundamental to the functioning of the global economy. International trade, the transport of bulk raw materials, and the import/export of everyday food and goods would simply not be possible without maritime transportation.

Global shipping, which transports around 90% of world trade, currently accounts for 2.3% of the world's total GHG emissions, compared to 2.8% in 2007. Total shipping emissions have been reduced by more than 10% during the same period. However, there will be no space in the carbon budget to allow even the emissions of shipping (currently approximately one gigaton per annum) to be ignored.

REDUCING CO2 EMISSIONS

The marine industry, through the International Maritime Organization (IMO), is firmly committed to playing its part in reducing emissions of CO2 and other greenhouse gases. The challenge the industry faces in reaching an absolute target is that shipping is the servant of world trade. The total emissions of shipping, as a sector, will therefore be determined, to a significant extent, by the expected long-term growth of the world economy (and population) between now and 2050.

Shipping is arguably the most carbon-efficient mode of commercial transport and is fundamental to the functioning of the global economy.

There are few certainties about the future of ship design and operation, and, by association, the wider system within which ships operate (ports, bunker suppliers and supply chains, trade, freight handling and logistics, etc.). One important uncertainty is how the regulatory landscape for the control of shipping's GHG emissions will unfold: Which incentives and levers might become important drivers of investment and operational decisions in shipping and when?

The designers, owners, and financiers of a ship designed today and launched around 2020 would probably want that ship to retain its commercial viability for several decades. How can we best think that through?

SCENARIOS FOR A LOW CARBON FUTURE

Low Carbon Pathways 2050[1] — a joint study by Lloyd's Register and Shipping in Changing Climates — sets the details of the regulatory debates to one side and answers the following question: Given the current best available evidence, what is a reasonable estimate of how shipping might be required to change and what does this look like?

Consistent with the Paris Agreement, the report gives particular focus on the technological and operational specifications of the global fleet and how these may change in relation to a given rate of decarbonization.

Three future scenarios for this initial study for the period 2015–2050 were identified to demonstrate varying options for decarbonization. The first, **High Hydrogen**, considers the availability of hydrogen, which is used in fuel cell technology, to demonstrate what can be achieved through technology and innovation; the second, **High Bio**, assumes a mid-range market penetration of biofuels in the shipping industry; and the third, **High Offsetting**, considers the impact of a market-based mechanism. These three future scenarios are compared to a business-as-usual (BAU) scenario with existing regulatory commitments.

The specifics of how shipping might change vary depending on the assumptions made. The scenarios cannot envisage the role that innovation might play in any transition, as they are limited to the mix of technologies defined as input assumptions. However, we can show that different scenarios have different consequences for the technology mix of the industry and that further work is needed if shipping is to manage its transition while maximizing resilience and minimizing the risks of technological obsolescence. Innovation can produce lower-cost alternatives, as well as help to reduce the cost or increase the performance of technologies that have already been identified.

However, one key finding is that most of the pathways will require a substitute for fossil fuel, because energy efficiency improvements alone will not be sufficient in the medium to longer term. Energy storage in batteries and renewable energy sources (wind and solar) will undoubtedly have important roles to play, but are still likely to leave a requirement for a liquid fuel source.

The results of the report show that, in the scenarios considered, shipping is likely to need to start its decarbonization imminently, and that the associated changes will be fundamental and require a lot of further work and development to minimize disruption.

This is important because, in all parts of the global economy, not just shipping, decarbonization starts with the low-hanging fruit. As stringency increases over time, increasingly high-cost mitigation steps are required. Therefore, while it might be tempting (given the timeframe in play) to try to ignore the cumulative nature and scale of shipping's decarbonization challenge for a bit longer, the report shows that this is not a sound strategy. The later we leave decarbonization, the more rapid and potentially disruptive it will be for shipping.

The later we leave decarbonization, the more rapid and potentially disruptive it will be for shipping.

1 Lloyd's Register. *Low Carbon Pathways 2050*, available at: http://www.lr.org/en/projects/low-carbon-pathways-2050.aspx, accessed 9 May 2017.

WHAT NEXT?

Following this initial study, we are convening industry roundtable discussions on the findings of the report and are facilitating the development of future possible scenarios in collaboration with the industry to create and share knowledge and tools that can contribute to reducing GHGs from shipping.

There are many issues to debate as the industry tries to consider what the strategy might be for handling the simultaneously inevitable and uncertain changes ahead. What is clear is that any future regulation needs to provide the right incentive to drive the change needed, and we hope that business strategies and consistent policies can be combined to reduce shipping emissions.

What is clear is that any future regulation needs to provide the right incentive to drive the change needed.

THIS ARTICLE FIRST APPEARED ON BRINK.

GREENER SHIPPING: REACHING A BALANCE BETWEEN REGULATION AND PROFITABILITY

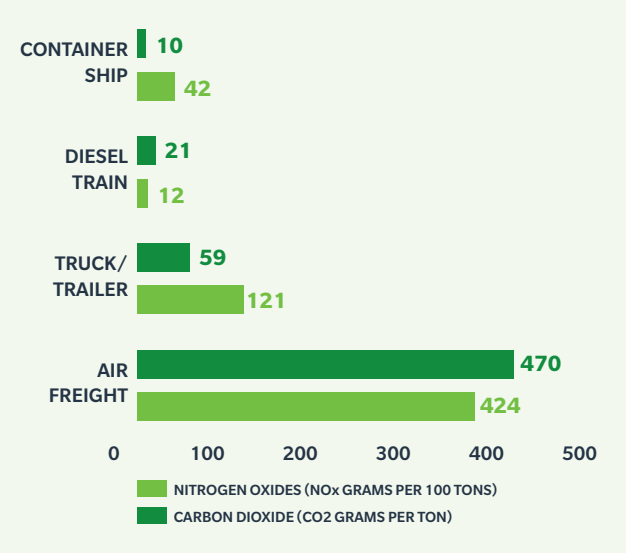
As the marine industry has grown in terms of fleet size and cargo-carrying capacity, it has offered a more efficient way of transporting goods around the world. But at the same time, environmental scrutiny on the industry has increased, presenting a threat to the profitability of shipping companies already under economic strain.

AUTHOR: MARSH

Today's marine industry environment is one that is competitive, very efficient, but somewhat economically strained. Adding to these challenges, regulators across the globe have begun to increasingly scrutinize the industry's environmental impact, leading to costly and difficult-to-implement regulations being put in place.

The environmental cost of transporting goods around the world has become an increasingly important measurement. Ship operators have highlighted the fact that shipping goods one kilometer by sea, assisted by technological advances in engine performance, emits less greenhouse gases (such as carbon dioxide (CO2), sulfur dioxide (SO2), nitrogen oxides (NOx), and particulate matter (PM)) than carrying the same goods the equivalent distance by road or by air (see FIGURE 1).

FIGURE 1: Grams of Pollutants Emitted from the Moving of Goods per Kilometer
Source: World Shipping Council[1]



However, this can be misleading, because the sheer volume of goods being transported daily by sea over long distances has not been taken into account. This has led to considerable political debate as to the amount of man-made greenhouse gas emissions and other pollutants that are generated by the marine industry. It cannot be denied that commercial shipping has contributed, at least some extent, to the "greenhouse effect."

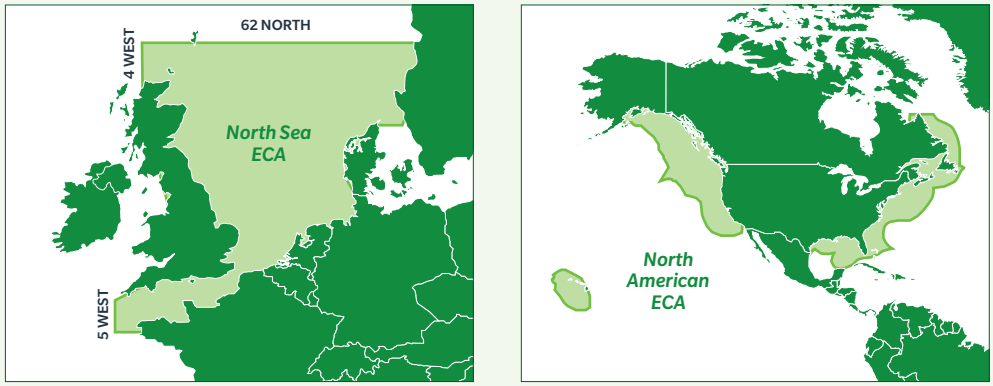
REGULATORS PLACE GREATER IMPORTANCE ON EMISSIONS

Increasingly tough standards of international regulation are being imposed regarding the exhaust gases produced by ships. A new set of technical and operational measures to increase energy efficiency and reduce emissions of greenhouse gases from international shipping were adopted by the International Maritime Organization (IMO) in 2011 (IMO, 2011, annex 19). The impact of this has been impressive. Despite a large growth in the world fleet, the amount of CO2 emitted by ships has actually reduced in real terms.[2]

While this is a positive step forward, similar goals for reducing SO2 emissions have been perhaps the most controversial area of environmental regulation on the industry, which has been driven by the Marine Pollution Convention (MARPOL). In effect from January 1, 2012, MARPOL annex VI was established to reduce SO2 thresholds for marine bunker fuels, with the global sulfur cap being reduced from 4.5% to 3.5%. The global sulfur cap is expected to be reduced even further to 0.5% from 2020.

1 World Shipping Council. "Carbon Emissions," available at: http://www.worldshipping.org/industry-issues/environment/air-emissions/carbon-emissions, accessed 11 May 2017.
2 UNCTAD. *Review of Maritime Transport 2016*, available at: http://unctad.org/en/PublicationsLibrary/rmt2016_en.pdf, accessed 11 May 2017.

FIGURE 2: The North Sea and North American ECAs with 0.1% SO2 Limits in Force
Source: Tiba[3]



However, it is evident that these limits were set before a proper analysis was done of the oil industry's capability to produce the required amount of necessary, but expensive, low-sulfur fuel in order to reach the targets.

A lack of adequate supply of low-sulfur fuel has regularly been reported by vessel operators as they seek to re-fuel their ships before entering the emission control areas (ECAs). To achieve the degree of low-sulfur fuel required, manufacturers have to engage in a longer refining process to remove the sulfur content. This process has brought about its own problems, with catalytic fines increasing in such low-sulfur fuels, causing engine problems and requiring expensive cleaning if engine breakdown is to be avoided. This puts into doubt whether the proposed reduction in global limits of SO2 to 0.5% by 2020 can be achieved, and it is possible that the implementation date for the global limit reduction from 3.5% will be deferred.

NOx emmissions are also being regulated. Under the MARPOL Convention, vessels will be classified by age into tiers and the extent of permissible NOx emissions will be increasingly tough, firstly for vessels built on or after January 1, 2011 (Tier II vessels), and then a 70% reduction in permissible NOx emissions for vessels constructed on or after January 1, 2016 (Tier III vessels). These requirements are expected to come into force under Regulation 13 of MARPOL annex VI in September 2017.

BALLAST WATER POLLUTION IS BECOMING AN IMPORTANT CONCERN

Great concern has been expressed by environmentalists over the use of ballast water by maritime vessels,[4] as, in the past, little thought had been given as to the difference in the location from where the ballast water was loaded and the one where it would be discharged. As a result, studies have shown that vessels were unknowingly carrying various species of plants and animals inside the ballast water that were native to where it was loaded.[5] When the ballast water was then discharged in another region, the vessels unwittingly introduced alien species to the water. In some places this has had a devastating effect on the eco-balance of those discharge areas.

Great concern has been expressed by environmentalists over the use of ballast water by maritime vessels.

3 Tiba. "The North European and North American ECAs," available at: http://www.tibagroup.com/pt/nova-sobretaxa-de-baixo-teor-de-enxofre, accessed 11 May 2017.

4 National Wildlife Federation of Canada. "What We Do to Stop Ballast Water Introductions of Invasive Species," available at: http://www.nwf.org/what-we-do/protect-wildlife/invasive-species/ballast-water.aspx, accessed 11 May 2017.

5 Miller, J. *The Princeton Companion to Atlantic History,* available at: http://bit.ly/2oYbdql, accessed 11 May 2017.

In response to the issues that these invasive species have caused, the Ballast Water Management (BWM) Convention was finally ratified in 2016, and will come into force on September 8, 2017. The convention will require ship operators to purify their vessels' ballast water through approved systems before discharging. However, such conventions can only be policed in the national waters of signatory countries, and the discharge of ballast water in international waters remains largely unregulated.

Shipowners, mindful that they need to ensure that the insurance cover for their vessels is not adversely affected, cannot ignore new regulations.

REQUIREMENTS TO RECYCLE SCRAPPED SHIPS ENTER INTO FORCE

Shipowners facing environmental challenges – especially those who operate fleets of aging vessels – may be tempted to scrap their older, less efficient, and environmentally unfriendly vessels. In doing so, they will find that environmental requirements also affect this decision. When it enters into force, the Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships, 2009 (the Hong Kong Convention), will effectively require a "green passport" for vessels. This will be issued when the vessel is constructed, with regard to the materials used in construction and how they are to be disposed when the vessel is ultimately scrapped. While this would help reduce the environmental impact of waste, it will create onerous requirements for the vessel scrapping industry as it works to meet them and will result in higher costs.

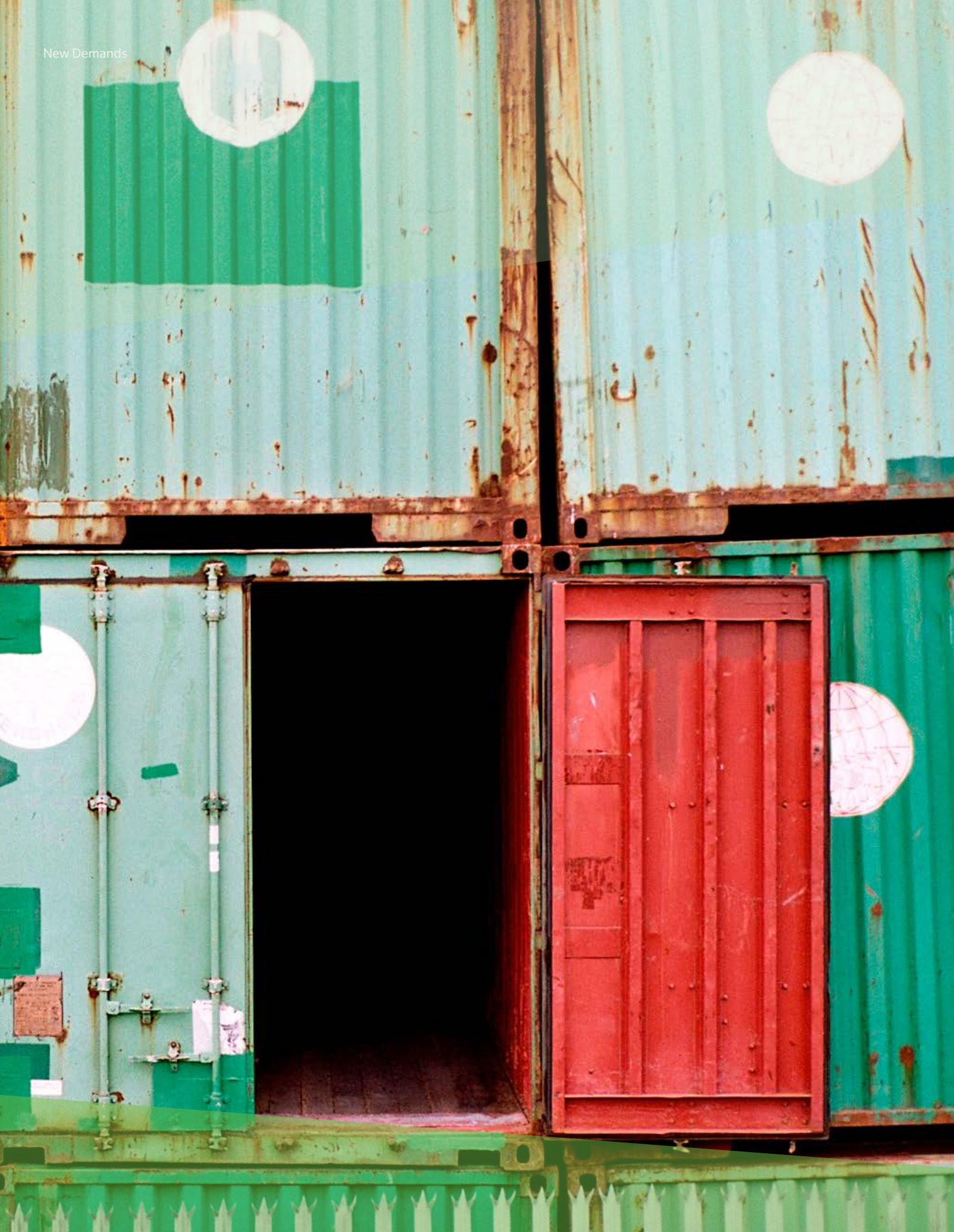
THE COST OF IMPLEMENTING REGULATION IS RISING

In order to comply with increasing and varying national, regional, and international limits of emissions, ballast water discharge permitted by vessels, and new requirements around recycling vessels, operators have to navigate through a sea of local legislation that will apply to their vessels in each place visited when sailing around the world. A ship's Master and engineers have to be aware of the need to have compliant equipment installed (at great cost by owners). There are several considerations, including the requirements made by the vessel's Classification Society, by insurers, and as mandated under international conventions to the specified correct settings for the location, in those areas of the globe, at the appropriate time. Failure to do so can result in hefty fines and/or the possible arrest of the vessel.

Shipowners, mindful that they need to ensure that the insurance cover for their vessels is not adversely affected, cannot ignore new regulations that come into force, as it could result in class withdrawal or suspension. Concerns are rising over the effects of infringing environmental laws that are becoming increasingly complicated and difficult to comply with. With finance agreements often requiring shipowners to comply with insurance terms and conditions at all times, it is becoming an increasing concern as to how they can keep their vessels compliant with a plethora of environmental regulations, while at the same time achieving tight timelines and ensuring their vessel crews are able to operate new, increasingly technical equipment.

CAN A BALANCE BE STRUCK?

Although commercial maritime shipping is the world's most environmentally efficient form of transport, the industry is being called upon to further improve the fuel efficiency and environmental footprint of its vessels. Ship operators have expressed enthusiasm for playing their part in reducing effects on the environment, but regulation is often being drawn up without adequate consideration of how, or even if, it can be achieved within the timescales set. In addition, new regulation will come with high price tags attached to the equipment that will have to be bought, the crew training that will have to be undertaken, and the penalties any non-compliance would incur, all at a time when ship operators are battling to survive in a ferocious commercial environment.



CARGO LOSS CONTROL: HOW TO MAKE A MILLION DOLLARS IN TWO HOURS

The marine industry faces billions in cargo theft each year, and how this is achieved can provide valuable lessons for the future.

AUTHOR: CAPT. JOHN DALBY, FOUNDER & CEO, MARINE RISK MANAGEMENT LTD.

Cargo loss control — three simple words. Often misused, little understood, yet worth billions of dollars a year as an industry.

Globally, 90% of all commodities and goods are shipped by sea. Most shipments are trouble-free and incur no losses. However, a small proportion do, and the losses are incredibly disproportionate when considering that the price tag of global cargo theft stands at an estimated US$50 billion annually, according to the National Cargo Security Council.[1]

There are a myriad of so-called losses that can be either physical (that is, some are stolen or mislaid and never arrive at their destination or were never shipped in the first place) or of a documentary nature — mistakes (deliberate or otherwise) in recording data on the shipping documentation, miscalculation, and/or mismeasurement. Almost all of these involve criminal intent and can be carried out with surprising efficiency and at small risk of detection.

ESTIMATED COST OF CARGO LOSS CONTROL

In the loss control world, we deal predominantly in bulk cargoes as these are the easiest and most profitable to manipulate (physically and by calculation and/or mismeasurement).

For example, consider a crude oil cargo (Brent Crude) of one million barrels — that's US$52 million at today's price that can easily be made to incur a loss (for either shipper or receiver, depending on whom the perpetrator is working for) of up to 2%. Not much in empirical figures, but that equates to a loss of a little more than US$1 million, literally at the stroke of a pen or misuse of a measuring instrument. Now multiply that by the number of oil shipments conducted annually — which accounts for nearly a third of global maritime trade[2] — and you'll see that my valuation of the worth of this industry may be massively understated by billions of dollars.

Other bulk cargoes like grains, ores, fertilizers, and refined products are subject to a similar degree of loss, although the methods differ from commodity to commodity, depending on their physical and chemical structure and storage methods. One major difference between liquid bulk and dry bulk cargoes is that the latter can be tested in terms of the quantity loaded by means of a draft survey. Unfortunately, that method, using the (supposedly neutral) ship owner data, is similarly open to abuse.

All that is needed in each case is a basic knowledge of physics and the ability to manipulate the instruments and gauges without being detected; an easy task in a busy tank farm, silo, laboratory, or on board the vessel.

1 Business Wire. "National Cargo Security Council Unveils Newly Expanded Certification Program for Cargo Professionals Combating Terrorism in the Air, Truck, Maritime and Rail Industries," available at: http://www.businesswire.com/news/home/20040720005336/en/National-Cargo-Security-Council-Unveils-Newly-Expanded, accessed 9 May 2017.

2 Planete energies. "Transporting Oil by Sea," available at: http://www.planete-energies.com/en/medias/close/transporting-oil-sea, accessed 9 May 2017.

LOSSES IN LIQUID AND DRY BULK CARGOES

In the case of liquid cargoes, all that is needed is a basic understanding of the relationship between temperature, density and/or specific gravity, and volume. Chemical composition and quality are also possible, more complex issues that are potential moveable feats. Once you take into account the comparatives, for example, the sample size of one liter being used as a representative sample for 160 million liters (one million barrels), then even the tiniest intervention will have a massive impact on the shipment as a whole. Put more simply, if the sample was interfered with sufficiently to make a 0.1% change in the declared volume (an easy thing to do by adjusting temperature and density/specific gravity) it results in the loss (or gain, depending on the vested interests) of 1,000 barrels or US$52,000. If the independent inspector is instructed (or "guided") to maximize covered insurance losses of just 2% — presto — 20,000 barrels have just magically disappeared, or appeared, as the case may be. In dollar terms, we're looking at a loss or gain in excess of US$1 million. And all it takes is about two hours of work.

In some cases of dry bulk cargoes, physical weighing occurs, but how accurate and recently calibrated is the weighing machine? Can its zero point be accurately and reliably tested? In others, a draft survey is relied on. Here the question becomes, "how accurate are the vessel's hydrostatic data?" or "how accurately have the draft marks been painted?" Has the basic parameter (tons per inch immersion or TPI) been tested and checked after each case of structural work carried out?

Even the tiniest intervention will have a massive impact on the shipment as a whole.

WHO STANDS TO GAIN?

The short answer is whoever employs the better "independent inspector" (by definition there is no such animal as an independent inspector as long as someone is paying for such services). The independent inspector working for the shipper will ensure that the (mis)measurements and (mis)calculations reflect a higher quantity shipped than is truly the case, whilst his "opponent" acting for the cargo buyer wants it to be understated. This principle holds true (but in reverse) at the port of discharge.

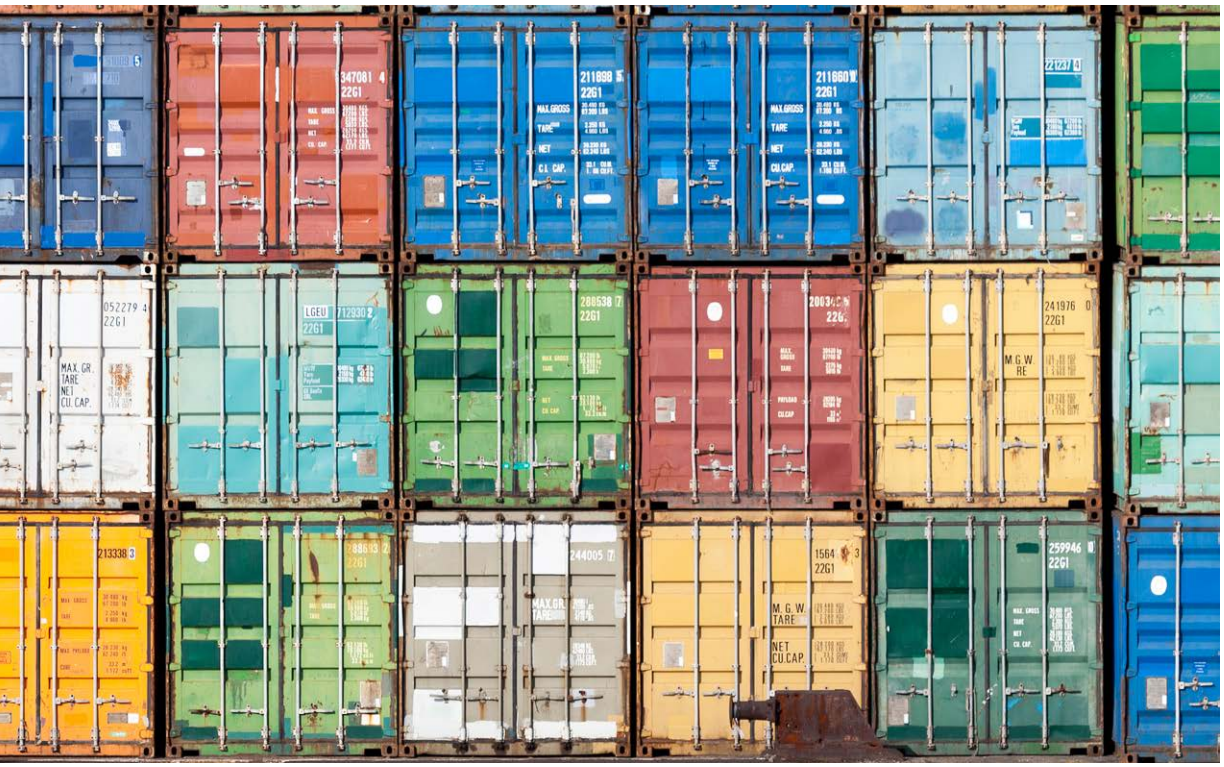
WHAT CAN WE LEARN FROM THIS?

This article is not intended to be a comprehensive course in cargo loss control techniques and practices. Rather, it is an attempt to highlight the ease with which — even in this age of sophisticated electronic equipment — the human machine can so easily and discreetly play the system.

Even in this age of sophisticated electronic equipment, the human machine can so easily and discreetly play the system.

Neither is it an encouragement of criminal activity or for taking advantage of a flawed system. It is simply an eye opener on another aspect of the vast reach of the world's illicit economy that passes largely unseen by the majority of the population, benignly ignorant of its impact and importance for the economy at-large.

THIS ARTICLE FIRST APPEARED ON BRINK.



WORLD TRADE BODES WELL FOR MARINE SHIPPING? THINK AGAIN

Global trade volumes may have grown in the first quarter of this year, but it remains to be seen whether this will be positive news for the maritime shipping sector, or if recent challenges will prevail.

AUTHOR: SIMON J. EVENETT, PROFESSOR OF INTERNATIONAL TRADE AND ECONOMIC DEVELOPMENT, UNIVERSITY OF ST. GALLEN, SWITZERLAND

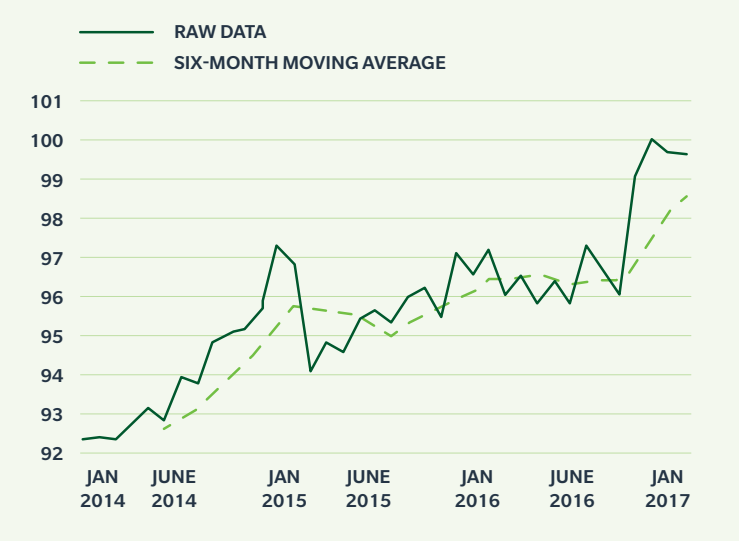
For the maritime shipping sector — with its sizeable overcapacity and sustained profit squeeze — news that global trade volumes grew at their fastest pace since 2010 at the end of this year's first quarter would have come as a welcome relief.

World economic growth and world trade growth typically go hand in hand. Perhaps the plateauing of world trade volumes — witnessed since the start of 2015 — is over and the relentless expansion in global commerce is on again? Unfortunately, we will have to put the champagne back on ice, at least for now.

WORLD EXPORT VOLUMES

An analysis of the latest global export volume data, published in late April 2017 by the reputed World Trade Monitor,[1] shows that almost all of the recent rise in volumes is due to a jump recorded in November 2016 (see FIGURE 1). Increases on a similar scale were not reported in the three subsequent months (the last for which data is currently available).

FIGURE 1: Trade Export Volumes, January 2014 to January 2017 (fixed base November 2016 = 100).
Source: World Trade Monitor.



As the six-month moving average indicated by the dotted line shows, the appearance of the end of the plateau of world trade is created entirely by the spike in recorded global export volumes in November 2016.

Worse, further analysis of the raw World Trade Monitor data reveals that the jump in world export volumes recorded in November 2016 is a historical anomaly.

The revival in export volume growth varies considerably across regions of the world economy. Compared to a global export volume expansion of 2.4% over the six months from September 2016 to February 2017, export volumes grew 0.1% in the eurozone, 1% in the US, 2.5% in emerging Asia, 7.9% in Japan, and a whopping 12.4% in Latin America. Other than Japan, the major poles of the world economy have seen feeble growth in export volumes. Simply put: To date, there has not been a broad-based recovery of world trade.

1 CPB Netherlands Bureau for Economic Policy Analysis. *CPB World Trade Monitor February 2017*, available at: https://www.cpb.nl/en/worldtrademonitor, accessed 9 May 2017.

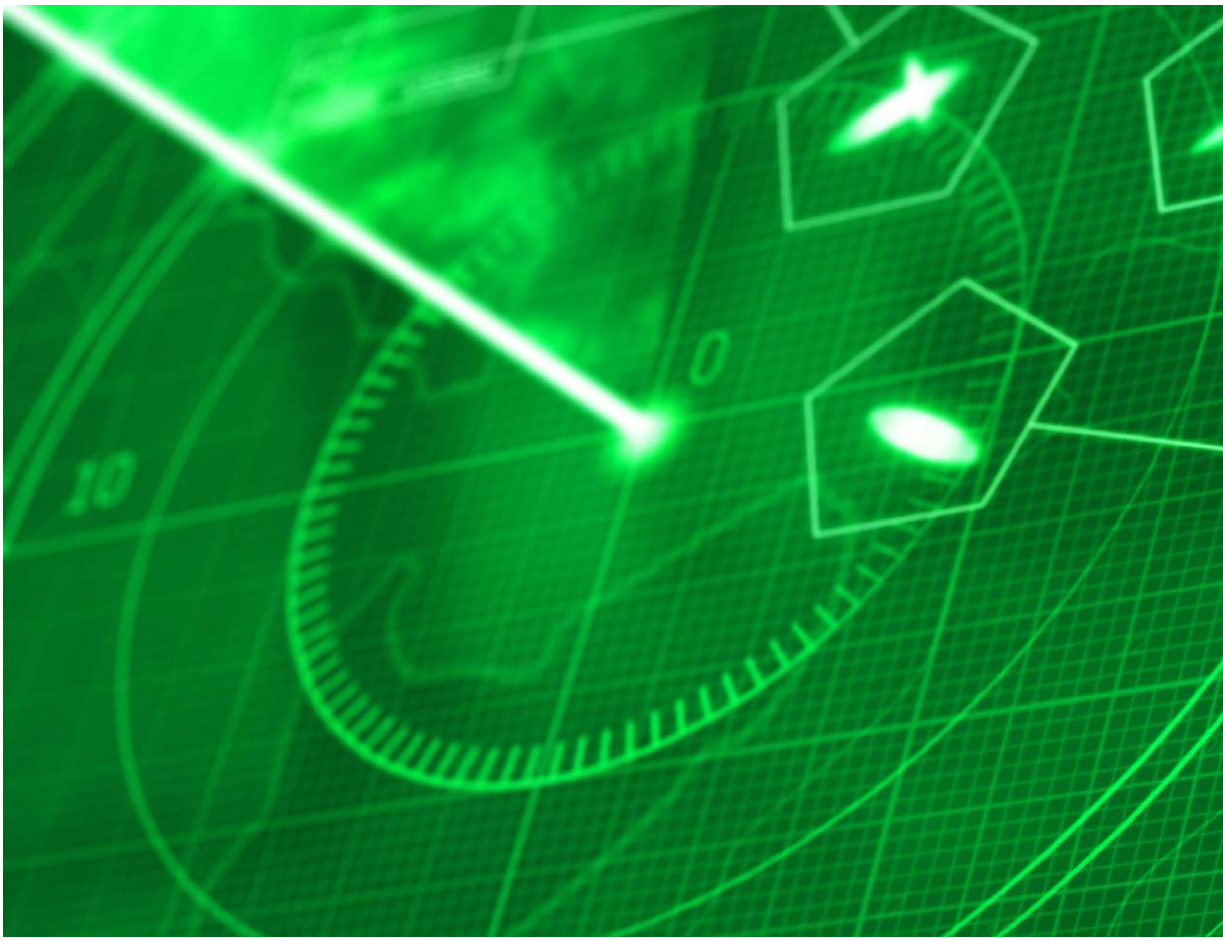
VOLUME TRUMPS PRICE

Although data on world trade volumes tends to get a lot of press, few articles report on developments in average world export prices. Such prices matter because they are an important determinant of profit margins from exporting. Moreover, falling export prices are likely to result in shippers and other transportation service providers facing more pressure from customers to lower charges.

The latest data on world export prices is not positive. The World Trade Monitor's index of global export prices is 20.5% below its peak. Looking at the data over time, much of the deterioration in export prices happened in 2015 and 2016. There is no comparable improvement in world export prices to match the strange jump in world export volumes in November 2016.

This is not just a commodity price or currency phenomenon; every major region of the world has seen export prices languish below previous peaks, with the shortfall ranging from 9.8% for US exporters to 45.9% for exporters from Africa and the Middle East. Excess capacity in heavily traded sectors, such as steel and aluminum, as well as the spread of government-provided export incentives have almost certainly reduced prices in global markets.

These findings are also important in light of the debate of the "global trade slowdown." Leaving aside the fact that global export volumes have stopped growing, some analysts have argued that slow global trade growth is because global demand levels — in particular, capital expenditure levels — have been weak. If indeed global economic growth has been picking up, then this proposition will be put to the test. Surely, faster economic growth should result in rising global export volumes and prices? If not, attention shifts to other explanations, including the growing stock of trade distortions introduced by governments and the changes in corporate strategy that such protectionism induces.



TRADE DISTORTIONS AND MARITIME SHIPPING

The impact of rising trade distortions on the maritime shipping sector is arguably mixed. Old-fashioned 1930s import restrictions — which, fortunately, we have not seen much of since the global economic crisis began — depress shipping volumes. So do government-imposed localization or "buy local" policies, which, in contrast, have spread markedly in recent years.

The Global Trade Alert team has documented 411 policy initiatives since the start of the global financial crisis that impose some type of localization requirement.[2] Fiscal incentives to exports have been even more pervasive. Although direct cash payments for manufacturing exporters are banned under World Trade Organization (WTO) rules, this has not stopped numerous governments from introducing many incentives to export through national tax systems. The impact of such incentives on the maritime sector is probably positive.

With the "Brexit" vote and the subsequent negotiations to come, along with the election of President Donald Trump in the US, there has also been a profound increase in uncertainty about trade policy, the future of certain trade agreements, and exchange rate policy. Long-held assumptions are being questioned, even in countries traditionally sympathetic to open borders and globalization.

It has become clear that few senior executives of large manufacturing firms are willing to shed much political capital defending free trade. With little opposition to populist trade policies in sight, on net, the current policy environment is unlikely to be supportive of a sustained revival of global trade growth in 2017 or 2018.

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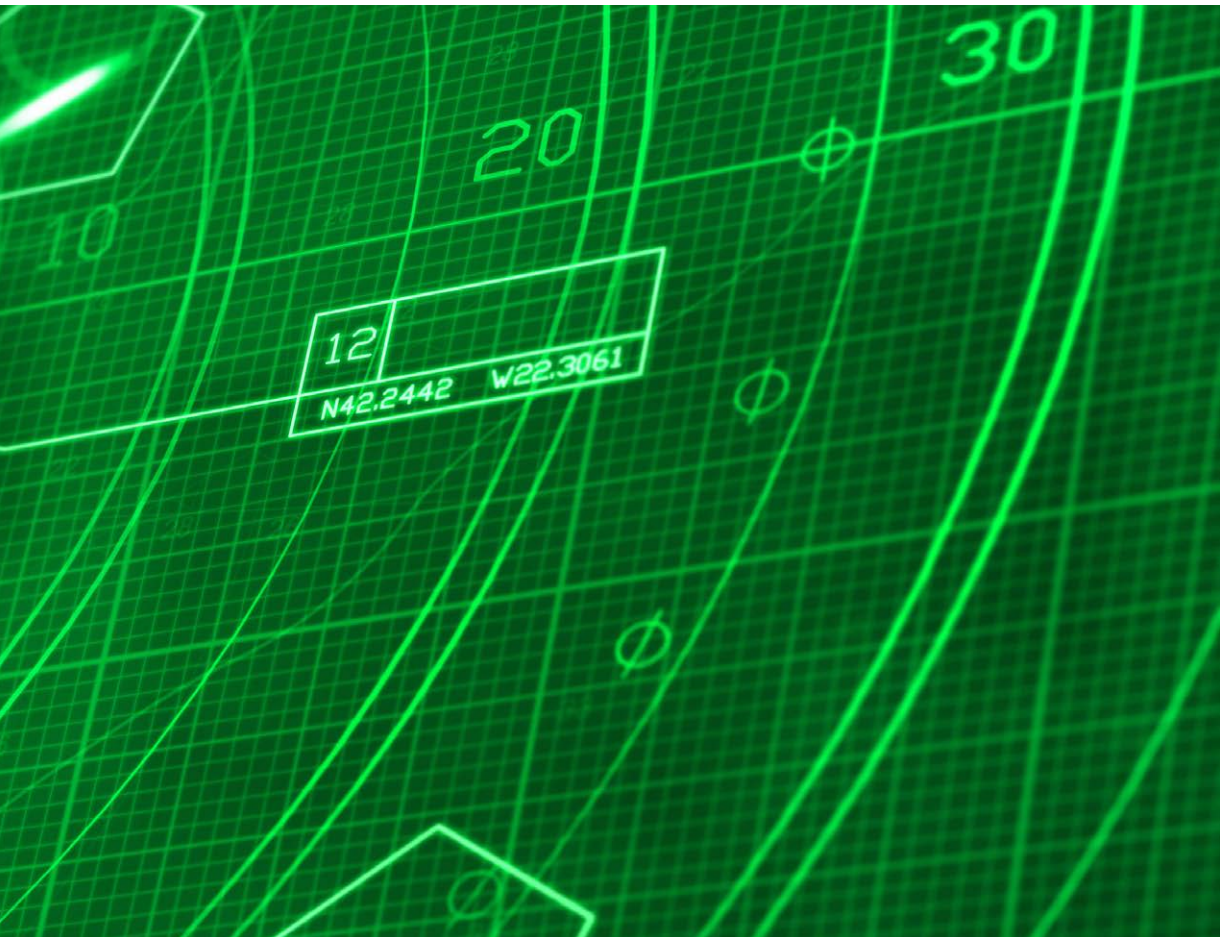
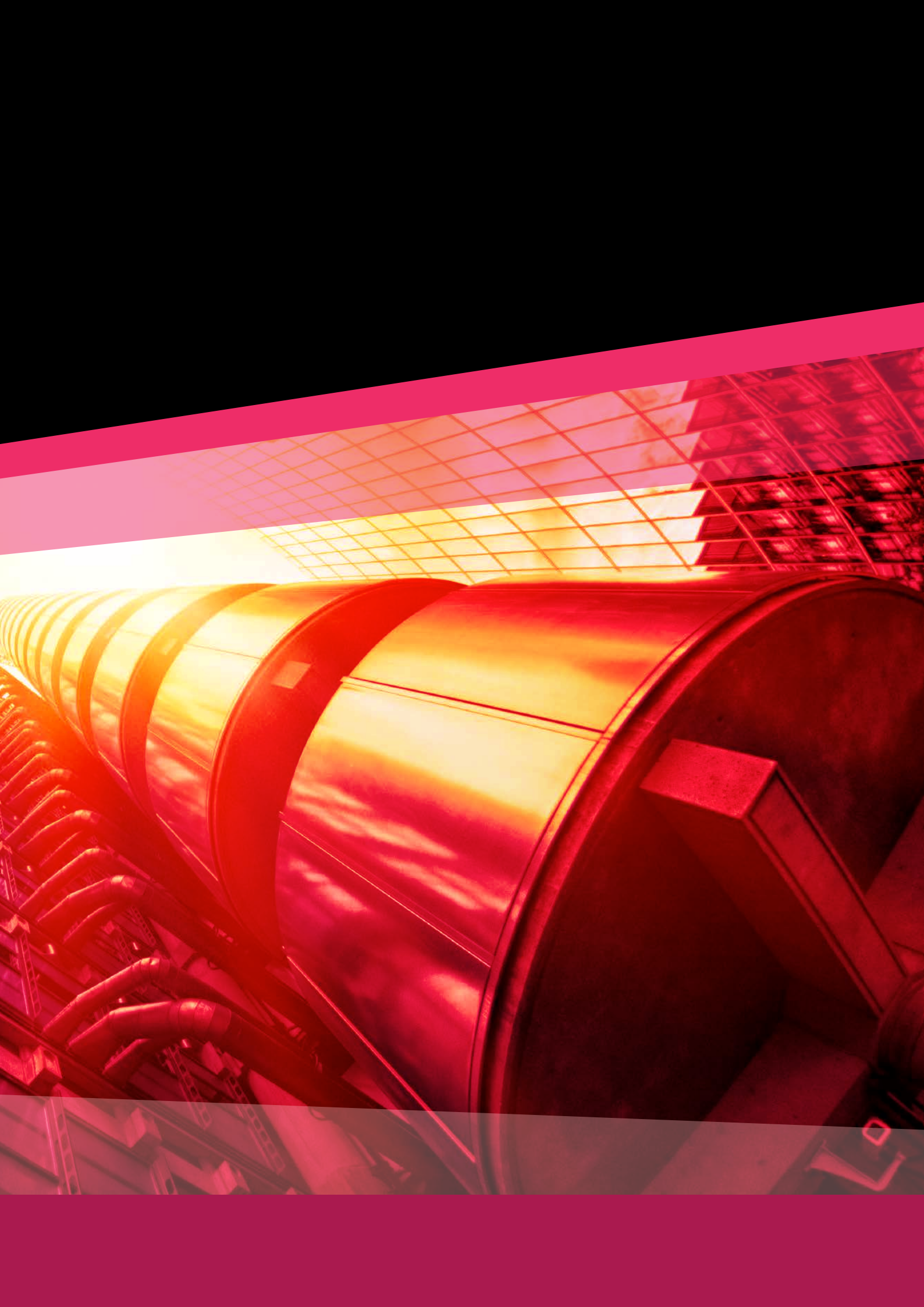


2 Global Trade Alert, available at: http://www.globaltradealert.org/, accessed 9 May 2017.

FORWARD INSIGHTS



ROUGH SEAS AHEAD FOR THE MARINE INDUSTRY IN 2017

As a risk consultant to the marine industry, Marsh is often asked where it sees the industry heading and what to watch out for over the course of the next 12 months. In this assessment of the industry, we examine the key concerns for container ships, bulk carriers, and oil tankers, as well as what to expect from the insurance market in 2017.

AUTHOR: MARSH

The year 2016 was a tumultuous one in the maritime world, reflecting the unexpected political and commercial headwinds that took place. Russia's increasing assertiveness, a rationalization of Chinese economic growth plans, further Islamic extremist attacks in Europe, the "Brexit" referendum result in the UK, and the election of Donald Trump as US President were examples of political/economic headwinds that did not have a direct impact on commercial shipping. However, the consequences of those events have already begun to take their toll on confidence in the sector.

Last year also saw the bankruptcy of Hanjin Shipping. While this could be viewed as a "Darwinian" adjustment, where the least efficient and least adaptive companies are becoming extinct, the Hanjin Shipping debacle could herald even greater concerns for the maritime shipping sector going forward.

As we look ahead to what this new global environment is likely to yield, there are some matters that will affect most sectors of the marine industry. Increases in bunker prices and international regulation, for example, would be felt throughout and the outlook for both is not positive.

The Hanjin Shipping debacle could herald even greater concerns for the maritime shipping sector going forward.

If bunker prices increase, which is likely to happen continuously over the course of this year, then this should be reflected in strengthening freight and charter hire rates to cover such costs. However, such strengthening in rates would be difficult in many sectors, where competition is fierce between operators with a surplus tonnage. Throughout 2017, we are therefore likely to see any profit margins for operators squeezed tighter, as costs increase but rates do not.

The coming into force of two international regulations during 2017 compounds the concerns of the industry, including the second stage of the Maritime Labour Convention (2006) and the Ballast Water Convention. Adding to these concerns is the possibility that the Annex VI of the 1997 Protocol to the MARPOL Convention will come into effect in 2020.[1] This is not only due to the costs that will be incurred when complying with these new regulations; there are questions as to whether the regulations can be fully complied with at all.

1 Reuters. "Lack of Preparation Risks 'Chaotic' Shift to Cleaner Shipping Fuel," available at: http://gcaptain.com/lack-preparation-risks-chaotic-shift-cleaner-shipping-fuel/, accessed 16 May 2017.

PREDICTIONS FOR THE FUTURE OF MARINE INDUSTRY SECTORS

The three main sectors of the marine industry will all face economic challenges throughout the remainder of 2017, partly as a result of an over-optimistic view that conditions will improve in the near future. This has led to over-capacity and strained financial results. Below, we look at some of the issues each sector is facing, and outline our predictions for the next year.

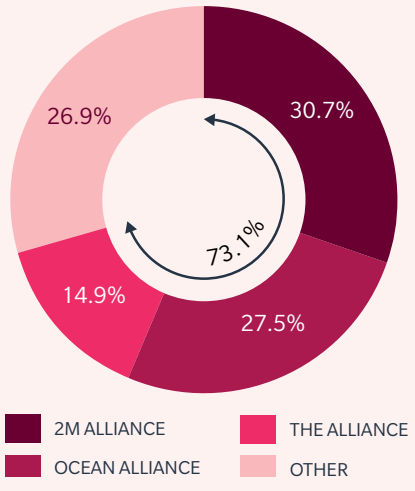
CONTAINER SHIPS

In our recent paper *Shipping Industry Vulnerable Following Hanjin Administration*, we warned that a possible "domino effect" could occur in the container ship sector following the collapse of Hanjin Shipping. This year, we began to see these effects take place in the industry. Consolidation in the container shipping sector has become an aggressive necessity, with well-known lines such as Hamburg Süd, China Shipping, and Neptune Orient Lines being swallowed up by larger ones, and active partnership arrangements – such as those between Hapag Lloyd and UASC, and between the three major Japanese carriers NYK, MOL, and "K" line – becoming a regular occurrence.

But more concerning for those in the wider industry is the formation of three new alliances, the "2M Alliance", the "Ocean Alliance", and "The Alliance", the sum of which now accounts for nearly three quarters (73.1%) of the global containership capacity (see FIGURE 1).

FIGURE 1: Container Ship Operators' TEU Share
Source: Alphaliner[2]

OPERATOR	ALLIANCE	TEU SHARE %
APM-Maersk	2M Alliance	16%
Mediterranean Shipping Co.	2M Alliance	14. 7%
CMA CGM Group	Ocean Alliance	11%
COSCO Shipping Co.	Ocean Alliance	8.3%
Evergreen Line	Ocean Alliance	4.9%
OOCL	Ocean Alliance	3.3%
NYK Line	The Alliance	2.9%
MOL	The Alliance	2.4%
K-Line	The Alliance	1.7%
Hapag-Lloyd	The Alliance	5.1%
Yang Ming Marine Transport	The Alliance	2.8%



2 Alphaliner. "TOP 100 Operated fleets as per 16 May 2017," available at: https://www.alphaliner.com/top100/, accessed 16 May 2017.

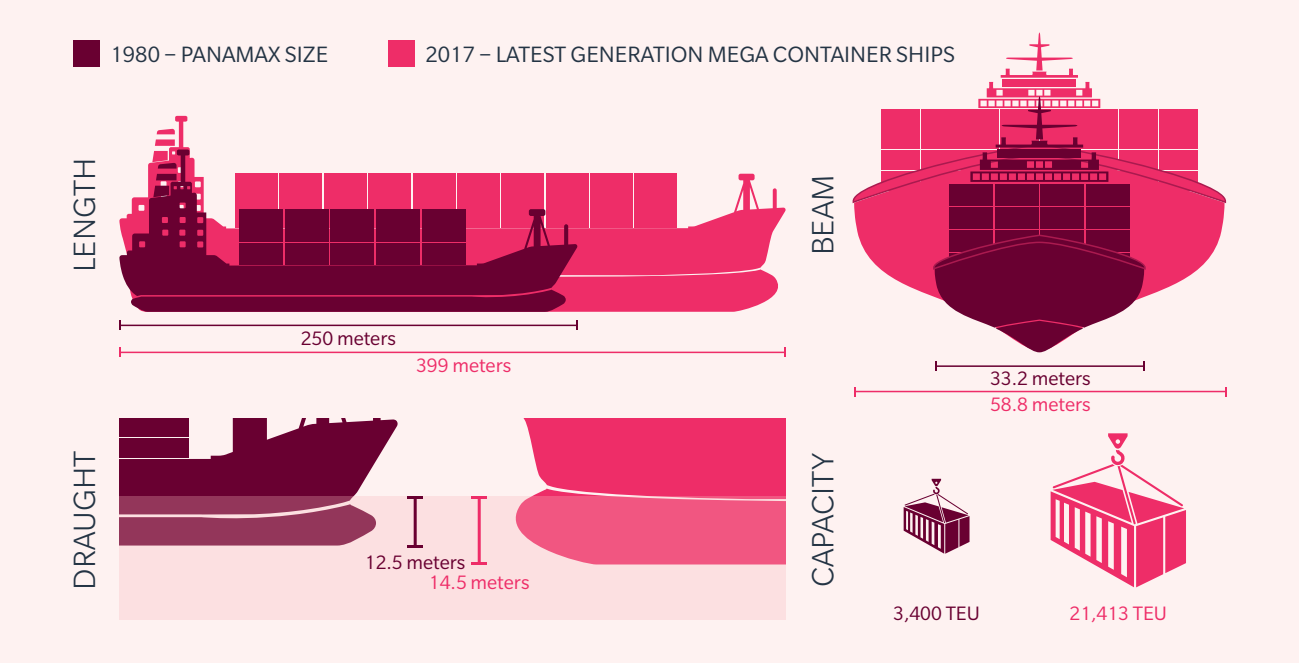
Many of the ports and terminals around the world are at least partially owned by ship operators, and therefore preferential treatment is given for the vessels of a particular alliance. This, coupled with aggressively low port tariffs being demanded by those alliances, will see ports and terminals struggle to maintain profitability. Further adding to these difficulties, the production of ever-larger container ships has meant terminal operators are often investing in new, larger, and more expensive gantry cranes in order to service these ocean behemoths.

Already we are seeing financial results from ports and terminals in major shipping countries reporting dramatic falls in profitability. Whether these lower-than-expected results are due to the aggressive demands of the "mega-alliances" or, more generally, the slowing of global economic growth is debatable.

However, we predict 2017 will remain a tough year for ports and terminals around the world, particularly those ports with dedicated container terminals and others with mutiple terminals that want to promote themselves as transshipment hubs, as the movement of goods between numerous quays can be expensive and inefficient.

We predict 2017 will remain a tough year for ports and terminals around the world.

FIGURE 2: Comparative Size of Large Container Ships 1980 – 2017
Source: Hofstra[3] and gCaptain[4]



The container shipping sector's over-optimistic ordering of new, bigger container ships has led to a large over-supply of capacity. Although the ordering of the latest generation of ultra-large container ships of 20,000 TEU or larger capacity may have stalled, this year will continue to see the delivery of ultra-large vessels that had already been ordered.

This will continue to add pressure on an already over-supplied sector, leading to an acceleration of scrapping the older, less-efficient vessels.

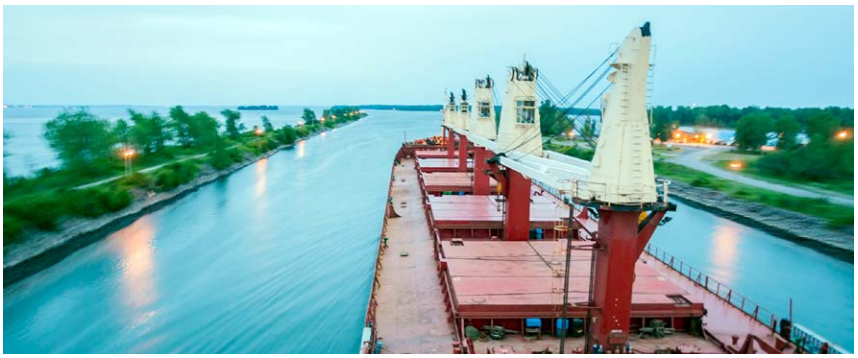
The largest cargo-carrying users of the Panama and Suez canals are container ships, therefore developments in these two waterways are bound to affect the world's fleet. With the advent of new lock systems capable of seeing 12,000+ TEU size container ships transit the canal, the old "Panamax" size vessels (4,500 TEU maximum) became outdated almost overnight. The Darwinian Theory of survival of the fittest and of "natural selection" is in evidence.

Already this year, a container ship with 4,250 TEU capacity that was built in 2009 has been sent to the scrapyard, because, even though it was only seven years old, it could not compete with the larger "neo-Panamax" vessels. For container ship operators of ships with 3,000 TEU – 5,000 TEU capacity size, 2017 will be a tough year. We can expect many more of these vessels being scrapped, and their operators struggling to survive, especially if they are not safely cocooned within one of the three major alliances.

3 Hofstra. "The Geography of Transport Systems," available at: https://people.hofstra.edu/geotrans/eng/ch3en/conc3en/containerships.html, accessed 16 May 2017.

4 gCaptain. "OOCL Hong Kong Breaks 21,000 TEU mark Becoming Worlds Largest Containership," available at: https://gcaptain.com/oocl-hong-kong-breaks-21000-teu-mark/, accessed on 16 May 2017.

BULK CARRIERS



The dry bulk carrier trade is the backbone of the marine industry, employing a greater percentage of the world's tonnage than any other type of vessel. According to Equasis, more than 34% of the entire world's gross tonnage is dedicated to the transport of raw, dry bulk cargoes, such as iron ore, bauxite, coal, and grain.[3]

The cargoes these vessels carry are the primary method of supplying the world's manufacturing industries, therefore providing the first indicators of global economic upturns and downturns. During the global financial crisis in 2008, freight rates for these vessels collapsed and have failed to recover substantially, even though demand in Asia, particularly in China, continued to increase.

While considerable attention was focused on Hanjin's container ship operations in 2016, the company was also a considerable operator of dry bulk carriers. The woes that led to the collapse of the company's container ship operations were exacerbated by an unhealthy dry bulk market throughout 2016. Earlier that year, we saw bulk shipping freight rates reach record-breaking lows, causing dire warnings of a wholesale collapse of the sector, with operators struggling to survive. Although the result was not as dire as originally predicted, there did appear to be a much healthier reassessment of newbuilding orders in the dry bulk sector.

By February 2016, we saw freight rates reach ruinously low levels, as an over-supply of tonnage weighed down on an already struggling industry. So far, 2017 shows little sign of substantial global economic recovery, and although the ordering of new tonnage has largely ceased, the delivery of already ordered tonnage will continue to depress the market. Increased scrapping of older tonnage is anticipated as a natural counter-balance to this oversupply. However, as we mentioned in *Greener Shipping: Reaching a Balance* (see page 37), the Hong Kong Convention will require shipowners to choose their scrapyards on criteria of environmental considerations rather than on prices offered.

Some analysts believe that the dry bulk market has already reached its worst possible nadir and that 2017 may be the year we start to see an improvement in the sector;[4] however, we fear that this may be over-optimistic for all but one specific size of vessel. In June 2016, the newly expanded Panama Canal lock systems were finally opened, allowing vessels of far greater size to transit the canal system. Bulk carriers of 80,000 to 150,000 DWTs ("neo-Panamax" size) will now be able to transit the canal, and we are likely to see these vessels increase due to their greater efficiency.

OIL TANKERS

Our expectation is that the price of crude oil will slowly increase this year.[5] Although that may mean that the oil industry will be boosted by higher oil prices, production will need to decrease in order to achieve this. The high volumes of oil being shipped by sea over the past two years — which has led to the lower oil prices — has been beneficial for tanker operators. After considerable vacillation, the Organization of the Petroleum Exporting Countries (OPEC) has reached agreement about reducing levels of oil production, but whether the oil industry follows this remains to be seen. Resumption in oil exports from Iran and the apparent preference for fossil fuels being indicated by the Trump administration in the US may undermine attempts to reduce production globally. Nevertheless, if production does reduce, the need to ship so much oil by sea will also diminish. Like other sectors, the oil tanker sector is extremely over-supplied, and with a raft of newbuilds due to come into operation this year, the freight rates for oil transportation are not likely to increase. By now, all pre-MARPOL tankers (that is, single-skinned oil tankers built prior to 1996) should have been sent to the scrapyard.

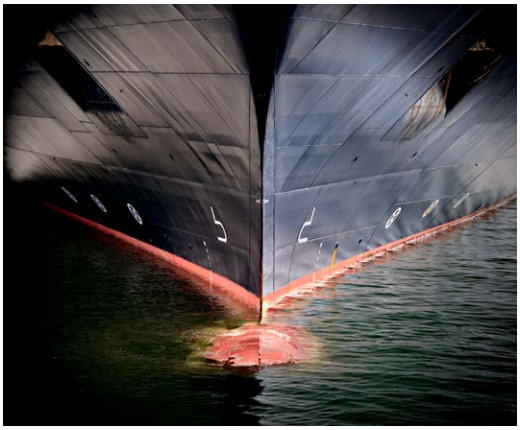
It cannot be denied that the mandated construction of double-skinned oil tankers, coupled with hugely increased penalties for oil spills, may have contributed to a reduction in major maritime oil spills. However, the repair to the industry's reputation from such improvements is one of the factors that has led to an over-optimism in the industry, fueling the ordering of new oil tanker tonnage.

3 Equasis. *The world merchant fleet in 2015*, available at: http://www.emsa.europa.eu/emsa-documents/latest/item/472-annual-statistical-report-on-the-world-merchant-statistics-from-equasisics-from-equasis.html, accessed 16 May 2017.

4 IHS Markit. *The maritime world in 2017*, available at: https://cdn.ihs.com/www/pdf/M_T-Perspectives-Q2-2017-MaritimeOutlook.pdf, accessed 16 May 2017.

5 Kemp, John. "Oil price forecast for 2017, 2018 rise as downside risks fall," available at: http://www.reuters.com/article/us-oil-forecasts-kemp-idUSKBN14X03G, accessed 16 May 2017.

CHALLENGES OF MARINE INDUSTRY REFLECTED IN INSURANCE



If over-capacity has been a common issue within the marine industry, then it is just as apparent in the marine insurance markets worldwide. By general agreement, marine insurance rates are currently at levels that cannot be sustained over a long period, yet they show little sign of increasing. The past three to four years have seen relatively few major catastrophe losses, and have been benign years for underwriters, which has done little to focus attention on the quality of tonnage being insured or the terms being offered. An ever-increasing level of risk retention by the non-traditional marine hull and cargo markets (rather than transferring those risks to the historical markets such as London, Paris, and New York) is an indication that the current level of losses are considered by those non-traditional markets to be sustainable. The entry of such new players into the market has further spread the available cover and increased competition and capacity to the point that we believe that a single marine catastrophe would not now be enough to see significant rate rises being consistently applied.

The protection and indemnity (P&I) market is similarly experiencing better results, with nearly all the major mutual associations (along with many of the fixed premium insurers) avoiding the need to impose general increases for the 2017/18 year. Indeed, some mutual clubs, being non-profit-making associations, are now giving returns of previous calls back to their members. While this is good news for hard-pressed shipowners, concerns about the effects of new regulation hitting the marine industry over the next few months and associated, perhaps unforeseen, risks are a concern.

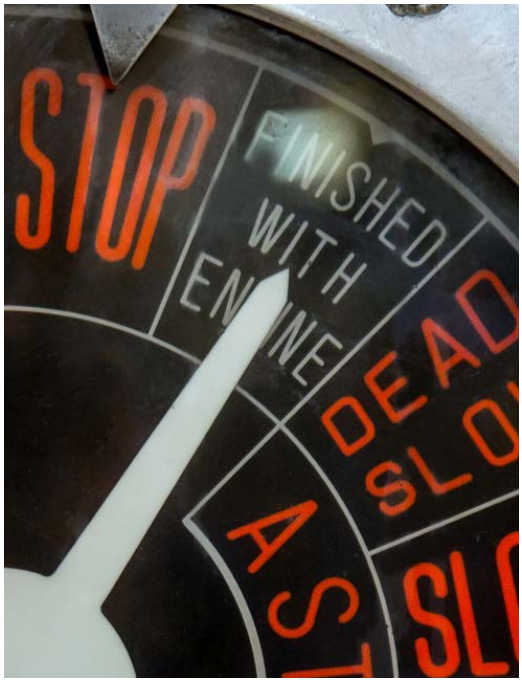
IS THE INDUSTRY HEADED FOR BETTER TIMES?

Since the financial crisis of 2008, the marine industry has been influenced by the belief that more positive and profitable times are just around the corner, which has resulted in the over-optimistic ordering of new ships and increased capacity. Although a more sensible approach has started to appear in the ordering of new tonnage, how long this will last remains to be seen.

Given this environment, the industry remains in a precarious position. Therefore, it is not only ship operators that are likely to find 2017 to be a difficult year, but also those along the supply chain, from ISO box manufacturers through to ports and terminals.

Many analysts have warned of "black swan" events; rare events that could not have been reasonably expected to occur, but which have the potential to cause exponential losses. In such an economically uncertain world as we face in 2017, one such event could precipitate others, and there has perhaps never been a time when having good insurance cover has been more necessary and its expense more justified.

It is not only ship operators that are likely to find 2017 to be a difficult year, but also those along the supply chain.



ABOUT MARSH MARINE PRACT

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MARSH'S GLOBAL MARINE PRACTICE

This report has been produced by Marsh's Global Marine Practice, which is at the forefront of brokering insurance and advising the maritime industry on risk and insurance issues.

Marsh's Global Marine Practice has a reputation for delivering insight and solutions for the challenges that our clients face. The practice comprises more than 600 marine specialists dedicated to serving the industry and managing premium volume in excess of US$3 billion.

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More than 100 years of marine operations...600 maritime specialists worldwide...US$3 billion in premium globally.

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- Designed and implemented a solution for multiple governments' war insurance issues following market changes/major losses.
- Pioneered the concept of social responsibility insurance.
- Helped shape the Athens Convention to enable the indemnification of liabilities imposed by that convention.
- Developed the first-ever open platform, online certificate, and account management system dedicated to marine cargo, www.marshcargo.com, now the global standard.

600 MARINE PROFESSIONALS

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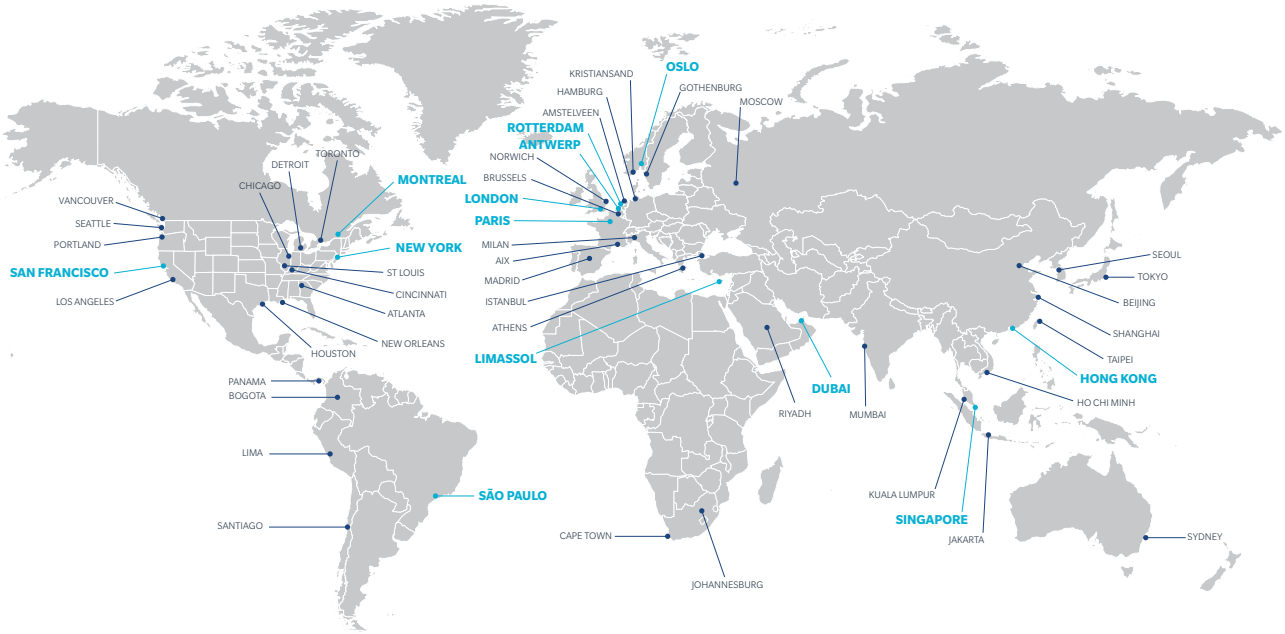
APPROXIMATELY US$3 BILLION PREMIUM ANNUALLY

GLOBAL EXPERTISE



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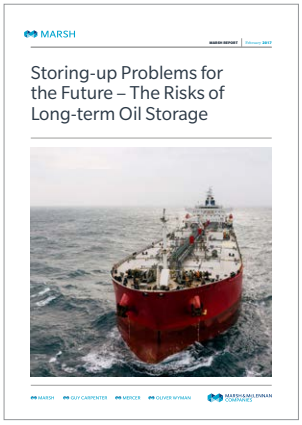
PLUMBING THE DEPTHS: HYDROGRAPHIC CONCERNS FOR MODERN-DAY LARGE VESSELS

Commercial vessels of enormous proportions are already plying waters around the world. This report discusses the hydrographic concerns for such large vessels.

NAVIGATING A SHIFTING RISK LANDSCAPE. EXPERT PERSPECTIVES ON THE MARITIME INDUSTRY.

Marsh's compendium of articles examines crucial risk issues for the marine industry as well as the opportunities available to those companies that can best position themselves to take advantage of them.



STORING-UP PROBLEMS FOR THE FUTURE – THE RISKS OF LONG-TERM OIL STORAGE

Market uncertainty has increased the attractiveness of long-term oil storage at sea. However, the risks associated with this may not have been properly considered.

ARTIC SHIPPING: NAVIGATING THE RISKS AND OPPORTUNITIES

Global climate change – specifically the melting of sea ice – presents opportunities and risks for international marine transportation networks in the Arctic.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Switching From Paper to Electronic Bills of Lading

HAS THIS LED TO AN INCREASE OF DOCUMENTARY FRAUD?

SWITCHING FROM PAPER TO ELECTRONIC BILLS OF LADING (EBOL)

The introduction of the electronic bill of lading has been hailed as a means of minimizing paper-based frauds. However, they are not without risk. Despite these efforts, however, there is much disquiet surrounding the usage of EBOLs.


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The Black Swan: The Unexpected in Ports and Terminals

THE BLACK SWAN: THE UNEXPECTED IN PORTS AND TERMINALS

This report explores the steps operators should take to best guarantee the future success of ports and terminals against black swan events.


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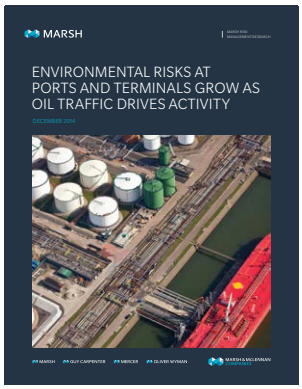
Shipping Industry Vulnerable Following Hanjin Administration

SHIPPING INDUSTRY VULNERABLE FOLLOWING HANJIN ADMINISTRATION

Our insurance briefing explores those likely to be affected and the insurance coverage issues of the Hanjin bankruptcy.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ENVIRONMENTAL RISKS AT PORTS AND TERMINALS GROW AS OIL TRAFFIC DRIVES ACTIVITY

DECEMBER 2014

ENVIRONMENTAL RISKS AT PORTS AND TERMINALS GROW AS OIL TRAFFIC DRIVES ACTIVITY

Even a small environmental issue at a port or terminal can cost millions, but the right risk-transfer strategies can protect operators' bottom line.

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Several of these articles appeared on BRINK – the digital news service of Marsh & McLennan Companies' Global Risk Center, managed by Atlantic Media Strategies. BRINK gathers timely perspectives from experts on risk and resilience around the world

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