

# Horizons.

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Connecting tomorrow's thinking to the challenges of today.

## WHAT'S ON THE HORIZON FOR:

Decarbonisation	05
Offshore	14
Innovation	36

## Decarbonisation.

ICS president Esben Poulsen shares his views on the need for R&D funding for zero-carbon advancement.

The 4th Propulsion Revolution. 05

## In focus.

Yee Yang Chien, MISC President and Group Chief Executive Officer, explains the MISC's pragmatic approach to perpetuation.

Words into action. 06



## IMO 2020 switchover.

We examine the fuel challenges that have been overcome so far and take a look at how Greek shipowners have handled the switchover. We also analyse the developments and future requirements for safety and environment regulation.

Has the shipping industry met the mark? 08

Recalibrating for a new source of uncertainty. 12

## Leadership.

Hear from Elina Papageorgiou, LR's new Marine and Offshore President for UK and Ireland.

Beyond borders. 24



## Offshore.

We analyse the role classification societies can play in helping the offshore industry with its decarbonisation challenges and evaluate the safety, operational efficiency and compliance challenges of using remote technology.

Measuring the carbon footprint of offshore production. 16

Our offshore orbit. 20

Remote technology: the changing road ahead for risk-based inspection. 22

## Gas.

In a growing LNG sector, longstanding experience and expertise is more valuable than ever.

Maximising opportunities in LNG. 26



## Significant ships.

The world's largest heavy-lift crane vessel has delivered notable firsts in capability and compliance.

Sizing up Sleipnir. 28

## Safety.

How focusing on high potential risks, not simply the outcomes, can significantly improve an organisation's safety performance.

Close calls. 30

## Mercy Ships.

Learn how LR is using its expertise and people to support the charity's vital work.

Supporting the Mercy Ships mission. 34



## Naval focus.

We take a look back at the commissioning ceremony of HMS Prince of Wales.

Joining the royal fleet. 36

## Innovation.

Find out how Singapore-based Portcast uses innovative technology to improve maritime cargo predictability.

Bringing next-generation cargo predictability to the shipping industry. 38

## News.

Catch up on the latest developments at LR from our teams around the globe.

What's happening in our world. 40

## Meet the team

Work on this issue of Horizons started in early January, weeks before the world started witnessing the fallout from Covid-19. We have endeavoured to ensure all the content is as timely as possible but acknowledge that the impact of this situation on world shipping is rapidly evolving and there is much uncertainty ahead.

In this issue, Head of Brand & External Relations Nicola Good speaks to MISC President and Group CEO, Yee Yang Chien, about his company's vision for decarbonisation. Viv Lebbon collaborates with LR's offshore experts to look at the industry's carbon footprint and how remote technology is changing risk-based inspection. Paul Carrett works with Naeem Javaid to evaluate the early response to the IMO 2020 switchover. Our designer for this issue is Kaz Kapusniak.



Nicola Good



Paul Carrett



Viv Lebbon



Paul Bartlett

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# Testing times.

Maritime is resilient – we will get through the Covid-19 outbreak by working together.



**These are challenging times for all of us. We had expected that the 2020s would be a transformational decade, but none of us ever anticipated that this year would start with such a severe test. The Coronavirus (Covid-19) pandemic is affecting daily activity across the world as governments seek to mitigate the impact of the virus. For many of us in maritime and beyond, routines in both our personal and business lives have been forced to change as efforts to contain the spread of this disease require us to stay home, limit contact and do things differently.**

Like many of you, our focus is on the health and safety of our industry, our people and ensuring the critical supply chains of goods and energy provided by our industry remain robust. Doing this will mean the world is in a better place to beat this virus.

We remain committed to supporting our marine and offshore clients and have implemented work plans and practices to ensure business continuity while

prioritising safety. To protect our people and your people, we have introduced further protocols to assess the risks of specific jobs before work starts and in certain circumstances, we have agreed to postpone non-critical work.

Inevitably, vessels scheduled for routine or unscheduled drydocking, or repairs, have been affected but we are working with clients to reschedule these or undertake them remotely in appropriate circumstances. In recent weeks, we have welcomed many more requests for remote surveys as more of our customers explore the capability of remote technologies.

We have already learnt some early lessons from the actions taken in those nations first afflicted. Our colleagues in China and South Korea have already demonstrated that plan approval and office-based duties can be successfully maintained with our office-based teams working from home. In both of these countries, we are almost back to business as usual

for surveys in ports, repair yards and the new construction shipyards. We hope the rest of the world will be able to recover as quickly.

As more regions are required to self-isolate, the model we used in North Asia is being rolled out to our teams around the world. We are confident that we will still be able to support your business needs. Our site surveyors, our Ship Emergency Response Service (SERS) colleagues and experts in fuel analysis and testing are ready to assist and are contactable via the usual methods. Please don't hesitate to get in touch to talk through any challenges you may face. We will endeavour to find solutions.

We understand the stress Covid-19 is placing on your business and your teams and we are here to help. We will all get through this testing time together.

**Nick Brown**  
Marine and Offshore Director,  
Lloyd's Register

# Future performance depends on today's decisions.

Collaborate with us as a strategic partner to enable the transition to a cleaner, safer and more sustainable world.

Engage with us at [www.lr.org](http://www.lr.org)



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## The 4th Propulsion Revolution.

To deploy new zero-carbon technologies and propulsion systems on the scale that commercial shipping requires to achieve IMO goals, we need a collaborative R&D programme.

**Transformation is all around us and, as we look to the next decade and beyond, we can see that the world is changing fast. Key to this change is the ground-breaking agreement on CO<sub>2</sub> emissions, “The Paris Agreement for Shipping”, brokered at the International Maritime Organization (IMO) in 2018. The strategy sets out to halve GHG emissions from shipping by 2050 and provides a clear signal to industry and governments alike.**

This important signal represents more than a mere change in the way a ship moves through the ocean. It also represents the catalyst for a fundamental transformation in the business of shipping, something that we at the International Chamber of Shipping (ICS) call the “4th Propulsion Revolution”. As a leading international trade association for merchant shipowners and operators, representing all sectors and trades, and more than 80% of the world merchant fleet, ICS takes its role in shaping the future of shipping very seriously. Indeed, this is why we started the thinking around the 4th Propulsion Revolution.

Rather than waiting to see what happens, we have worked with the other major shipowner associations to submit a proposal to the IMO to form the world's first collaborative shipping R&D programme to help eliminate CO<sub>2</sub> emissions from international shipping.

The proposal includes core funding from shipping companies across the world of about USD 5 billion over a 10-year period.

The IMO GHG reduction goals will require the deployment of new zero-carbon technologies and propulsion systems, such as green hydrogen and ammonia, fuel cells, batteries and synthetic fuels produced from renewable energy sources, as early as the next decade. However, as of today these technologies do not exist in a form or scale that can be applied to large commercial ships, especially those engaged in transoceanic voyages. The reality is that we can't afford to wait if we are to decarbonise the shipping sector and catalyse the deployment of commercially viable zero-carbon ships by the early 2030s.

The R&D Fund will be financed by shipping companies worldwide via a mandatory R&D contribution of USD 2 per tonne of marine fuel purchased for consumption by shipping companies worldwide. This will generate about USD 5 billion in core funding over a 10-year period.

To be clear, the fund does not act as a Market Based Measure (MBM) or “carbon tax”. Its purpose is simply to accelerate development of low-carbon and zero-carbon technologies and fuels that will be needed in the commercial maritime sector.



**If we are to deliver a sustainable transition that ensures a robust future for the shipping sector, we need to act, and we need governments to support what is an innovative proposal.**

If we are to deliver a sustainable transition that ensures a robust future for the shipping sector, we need to act, and we need governments to support what is an innovative proposal.

**Esben Poulsen**  
President of the International Chamber of Shipping

# Words into action.

Yee Yang Chien, MISC President and Group Chief Executive Officer, tells Horizons about the leading shipping conglomerate's pragmatic approach to perpetuation.

Words: Nicola Good

**The attention of shipping is firmly locked on sustainability. Not only did the International Maritime Organization declare “Sustainable shipping for a sustainable planet” as its world maritime theme for 2020, but everywhere you look, headlines and conference agendas are focused on the industry’s need to decarbonise and how this drive will shape vessel and infrastructure investments in the decades ahead. But what does this really mean in practice?**

The man at the helm of MISC Berhad, Yee Yang Chien, is quick to point out that sustainability means different things to different people. He stresses that the Malaysian group’s leadership see decarbonisation as a subset of sustainability with the latter being inextricably tied to its operational philosophy.

“For us, it’s about trying to perpetuate our very existence as a commercial entity. It’s how we derive our commercial livelihood and assure our place within the entire maritime ecosystem,” he tells Horizons, referencing the many stakeholders that this encompasses – from shipowners, ports, financiers, shipyards and engine makers, among others.

“The challenge is how do we perpetuate this ecosystem? We need to make sure we can replace whatever we take from the ecosystem. If we keep taking and don’t put back, the ecosystem will die. This drives what we do for the environment and the decisions we make when it comes to our

investments, as well as the way we treat our people, partners, vendors and customers. It’s all about keeping things going – perpetuation – but hopefully doing so in such a way that we leave things for the next generation in a better state than we found them.”

The MISC President and Chief Executive acknowledges that there are many ways to tackle decarbonisation within the maritime industry, but it requires “putting beliefs into action”. “It’s more than just agreeing that something should be done and then sitting back and waiting for someone else to drive the bandwagon. We don’t believe in that.”

The need to show leadership and work with like-minded people is behind MISC’s long-standing membership of the Global Maritime Forum (GMF), which launched the Getting to Zero Coalition last September, and has spurred the creation of the Poseidon Principles that will apply climate change criteria to ship finance.

The GMF “is not a regulatory body. It’s not meant to be political. It’s meant to be a gathering of leaders from across the entire maritime ecosystem so they can share ideas and find common ground,” says Yee, who has been in his current role since the start of 2015. “It’s a place where we can talk about our concerns on certain topics and show leadership on the way forward for the industry.

“We are trying to create a movement. Instead of people saying, ‘Hey, I’m tired of waiting for the regulators to say we

must do something’, or ‘I’m tired of being told what to do by the regulators’, we are trying to encourage the industry to take the initiative as we all know it will be to the benefit of maritime in the long term.”

Referencing the joint development project where MISC is working on an ammonia-fuelled tanker with partners that include Lloyd’s Register (LR), Samsung Heavy Industries and MAN Energy Solutions, Yee stresses that the key motive for initiatives like this is to encourage others to follow suit.

“It’s like dropping a pebble and waiting for the ripples. The industry is beset with competition and fragmentation and this is accompanied with all sorts of challenges. At times like this, others benefit from examples of leadership. That is what we are trying to do and, given the IMO’s targets on greenhouse gases (GHG), we believe we have to start this now.”

The Malaysian group has a fleet of more than 100 owned and in-chartered Liquefied Natural Gas (LNG), petroleum and product tankers, 14 Floating Production Systems (FPS), as well as two LNG Floating Storage Units (FSUs), so there can be no denying it has maritime muscle and its decisions around fleet investment are closely watched.

Yee admits he is a major supporter of LNG as a bunker fuel and points to how MISC took a lead with its LNG-fuelled Aframax tankers at a time when there was still much scepticism about whether LNG was the right choice of fuel, given some of the concerns about supply and infrastructure.

“We moved ahead because we see LNG as a transitional fuel on the journey to the net zero carbon solutions,” he says. “Do you wait for 2030 or do you do something now? We decided to put words into action and you can see from the number of yard enquiries and orders of LNG-fuelled tonnage that many big industry names are supportive of it.



## On leadership

“As a CEO, you quickly realise that you cannot juggle every ball simultaneously. You need to learn to manage your time. Time is the biggest asset in any industry. You quickly find out that you can drop some balls and things don’t break. And some balls just resolve themselves. It’s ok to drop a few balls – the world is not going to end.”

## On decision-making

“My best and worst decisions have always been around people. The challenge is getting the right people in the right place and as a leader you are the ultimate resource manager. Dealing with people is subjective. There is no formula for selecting the right people for the right role. So much relies on your gut. I just try to get it right more often than I get it wrong. It’s always the toughest thing for me when I get it wrong.”

## On autonomous vessels

“Man and machine must co-exist. Machines should not replace humans but support them. Autonomy will make the shipping ecosystem safer and more cost effective. In time there will be fewer humans on board, but this relies on connectivity and has cost implications. It is possible and will happen – but the technology must be commercially viable. The question is: ‘Do we want a fully autonomous vessel?’ We know planes can fly without pilots, but would you get onboard a plane without a pilot?”

## Life advice for one’s younger self

Believe in yourself and recognise that it is okay to make mistakes. It’s also okay not to know what you want to do. Give yourself time to find your passion and then build your life around it. For the first 10 years of my working life, I wasn’t sure about what I was passionate about. I only discovered that in my thirties.



**We need to make sure we can replace whatever we take from the ecosystem. If we keep taking and don’t put back, the ecosystem will die.**

“LNG will be the future for now. If I have to justify the investment, I do this on the basis of a 25-year ship life. Surely LNG is relevant for some portion of this life? You will get your payback from using it as a transition fuel. Every ship we order now will be LNG-fuelled – it comes at extra cost, but it is an important step to getting to net zero.”

The quest for sustainability has also shaped decisions around the group’s core focus and governs its approach to partnerships. A drive to “build scale, capacity and capability” within specific segments, saw the group exit from dry bulk

and containers more than a decade ago and home in on the energy sector.

Yee believes that the needs of both sides must always be recognised during business negotiations. In all partnerships, if one side is winning, one side is losing, and such an imbalance can compromise the existence of a partner as well as safety across the industry, he tells Horizons.

“Negotiate hard, but always make sure there is something left on the table for the other party. If you are happy with what you have got, don’t squeeze the other side for the

sake of it because that could compromise the partners ability to do business. It is our duty to perpetuate safety in the industry and this requires financial sustainability, he explains, pointing to how maritime has been asked to do more for less in recent years and take on more risk. “This is not healthy – it is a one-way passing of risk. Risk needs to be balanced,” he adds.

Yee’s background may be in finance – he has double-degrees in Financial Accounting/Management and Economics, from the University of Sheffield in the UK – but for him having impact doesn’t always have to be numerically measured. Rather it is a question of how you make those around you feel.

“Our people make us who we are, and they will take us where we haven’t been before. You need to ignite passion in people as this promotes energy and drive. My biggest joy is when someone comes up to me and says you have changed my life – either because I pointed to an opportunity, shared some advice or simply spent some time with them. Success is about your legacy and the little footprints you leave behind.”

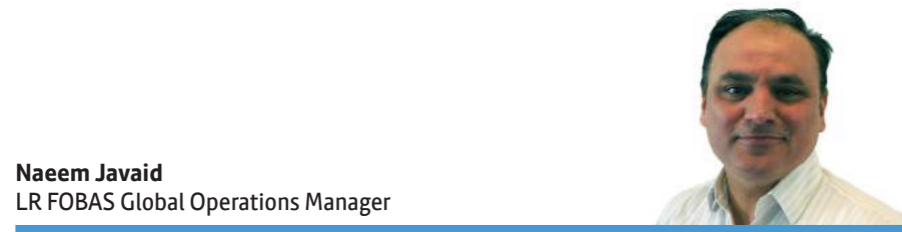


## Industry leaders join forces on ammonia-fuelled tanker project.

MISC, Samsung Heavy Industries, Lloyd’s Register and MAN Energy Solutions to work collaboratively on addressing shipping’s decarbonisation challenge. Read more on page 36 or at <https://www.lr.org/en/latest-news/industry-leaders-join-forces-on-ammonia-fuelled-tanker-project/>

# IMO 2020: has the shipping industry met the mark?

The LR Fuel Oil Bunker Analysis and Advisory Service (FOBAS) team examines existing fuel challenges and provides recommendations to prevent issues with VLSFOs.



**Naeem Javaid**  
LR FOBAS Global Operations Manager

**Marine fuel and its availability, safety, quality, variance, switchover and enforcement has dominated conversations in the shipping industry in recent years as it looked to switch over to using 0.50% very low-sulphur fuel oils (VLSFOs). Since the IMO announced fuel emission limits in 2008 with MARPOL Annex VI regulation 14.4.3, the industry showed scepticism about how this could be achieved. However, two months since its mandatory compliance on 1 January 2020, the industry has shown its well-known resilience and generally concluded 'so far so good' without any major issues. Although it's still very early to fully assess the impact of this change, based on initial data we can objectively**

**assess some concerns raised while others will likely resolve themselves.**

### Decline in high-sulphur fuel oils

Since August 2019, in fuel analysed by LR, we have seen a continuous decline in high-sulphur fuel oils (HSFO) from 85% to just under 10%. The gap is mainly filled by higher viscosity VLSFOs, which differs to an initial market anticipation that most fleets would switch over to distillates rather than opt for VLSFOs due to concerns around quality. With some 100 countries, 400 ports and over 350 suppliers already delivering VLSFO around the world, the availability of VLSFO looks promising. This is perhaps unsurprising

with the higher price margins that VLSFO can command.

### Fuel quality

While availability of VLSFO looks promising, the situation is very different when it comes to the quality of fuels available, both in terms of the wide variability in composition and the rise in the number of off-specification fuels. On average 4% of HSFO fuels were off-specification and this number has been almost consistent over the past decade. Furthermore, 80% of these off-specification results were due to a slight variance in viscosities: water content, densities, catfines and stability of fuel. These issues could mostly be managed by the ships; with slight adjustment to fuel treatment systems, these fuels would be suitable to be consumed onboard ships safely.

When comparing the HSFO off-specification data with that of VLSFOs, it appears that 80% of off-specification fuels are mainly due to two critical parameters – sulphur content and the stability of fuels. The high numbers of VLSFO with sulphur above the limit is worrying. However, given we are only a couple of months into 2020, the slight sulphur exceedance could be due to cross-contamination attributed to the use of the same supply chain. With time, these issues are expected to decrease. In the first few months of 2020, we've already seen a sharp decline in the sulphur exceedance incidents from 8% to just over 2% of total VLSFOs supplied. If we compare this to 2018 data, 0.10% fuels for Emission Control Area operations had a non-compliant rate of around 4%.

Figure 1: Distribution of fuel type analysed by LR FOBAS.

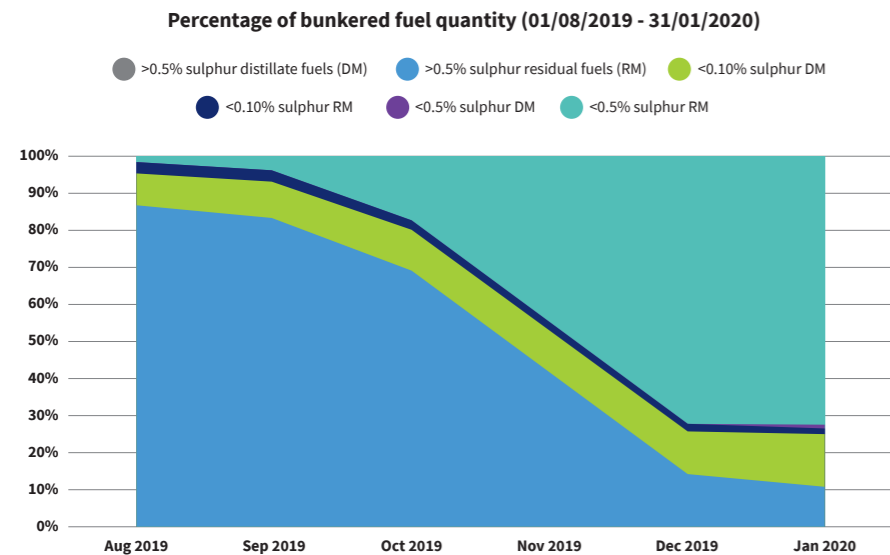
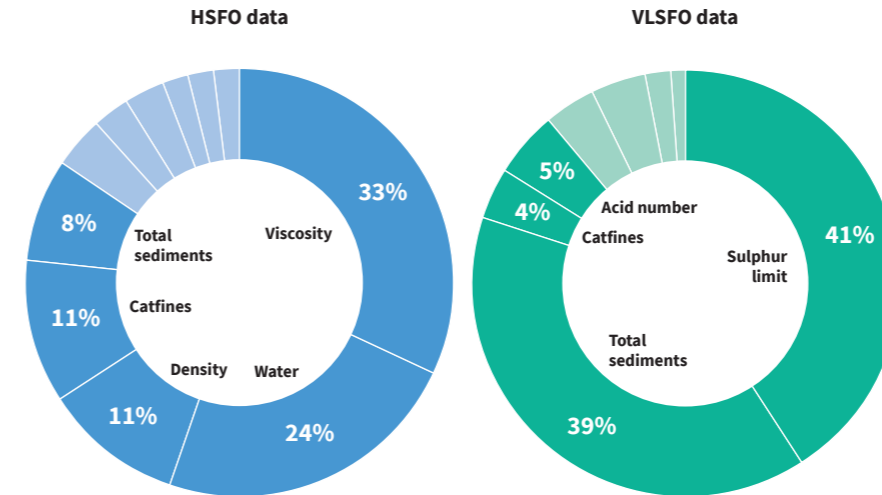


Figure 2: Off-specification distribution HSFO compared to VLSFO.



However, the high sediment results in VLSFOs remains a concern. Due to its criticality and high volume of cases LR has tested, the class society has issued three bulletins to alert clients about the VLSFO stability issues. High sediments could be due to dirt in fuel or inherent instability of the fuel. Fuels with high sediments tend to cause sludging and filter-blocking problems during use. The data is also indicating that the VLSFOs are more paraffinic in their composition and so by nature they have limited inherent stability, due to their increased thermal sensitivity. In addition, we have seen a number of ships reporting unusual sludging and filter blocking issues when using these fuels.

Even though we have completed the transition, there is still some normalising yet to be achieved and with this high trend of such critical parameters, we are anticipating that the supply chain will take corrective actions, otherwise the frequency and intensity of off-spec claims would make it difficult for suppliers to continue.

### Crew awareness: viscosity and density levels

Our VLSFO data shows the viscosities of these fuels ranging from 3 centistokes (cSt) to 500 cSt, with 75% between 20-180 cSt. Similarly, the densities vary between 840 – 1010 kg/m<sup>3</sup>. These variances in viscosities and densities, potentially between each bunker, demand a better emphasis on ensuring a greater knowledge of the fuel loaded and checking whether any changes in the fuel system heating or cooling are required from storage to combustion. Based on client feedback received to date,

it seems that the majority of the ships tested have enacted suitable preparations of their fuel systems and ensured their crew's awareness on the importance of addressing these variances. Importantly, this has paved the way for a relatively smooth implementation of these VLSFOs.

VLSFOs have a higher proportion of waxier components in their composition, which has increased the pour point of such fuels. As a result, this has increased the overall average pour point of the fuels. Some 85% of HSFOs had a pour point less than 6°C. However, only 14% of VLSFOs have a pour point of less than 6°C. For instance, a large number of VLSFOs have a pour point between 15-30°C (as shown in Figure 4).

This overall higher pour point has resulted in operational difficulties, specifically in colder ambient conditions, for ships that did not consider or include these issues in their risk assessment. This has prevented some ships from being able to heat fuel, which has caused fuel solidification in tanks, making it difficult for ships to re-liquify fuel without going through a lengthy and costly process.

### Crew awareness: handling temperatures

It's well-known by the industry that lower densities and higher pour points are indicative of VLSFOs being more paraffinic than HSFOs. This is also indicative of the higher percentages of wax components in the fuels, which require more attention to the storage and handling temperatures. This characteristic is particularly important where the viscosities of the fuel are less than 80 cSt @ 50°C. To treat such fuels, purifier manufacturers recommend lower temperatures. However, with some waxes having a high melting temperature, if these temperatures are not reached the wax can fall out during purification, causing excessive sludging.

For clear and bright distillates, the Cold Filter Plugging Point (CFPP) can address temperatures that a set filter size will start blocking. However, there is no test for darker, lower viscosity, more paraffinic fuels. LR's FOBAS team has developed a test method called Sediment Waxing Precipitation Point (SWPP), which gives an indication of the temperature that needs to be maintained to avoid issues with wax crystals forming sludge deposits during purification. Results

Figure 3: High sediments off-specification on Total Sediment Potential (TSP> 0.10%mass) distribution VLSFO.

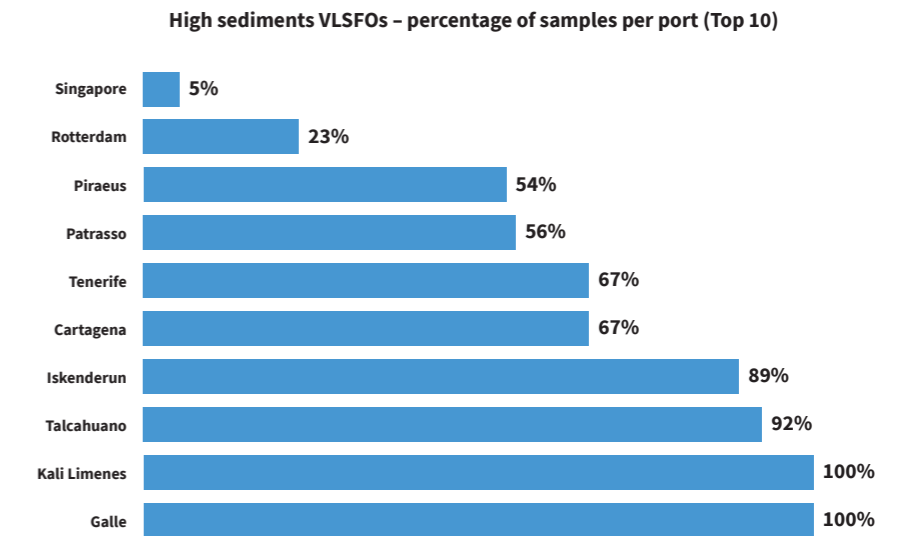


Figure 4 : Pour Point distribution January 2020 in degree C

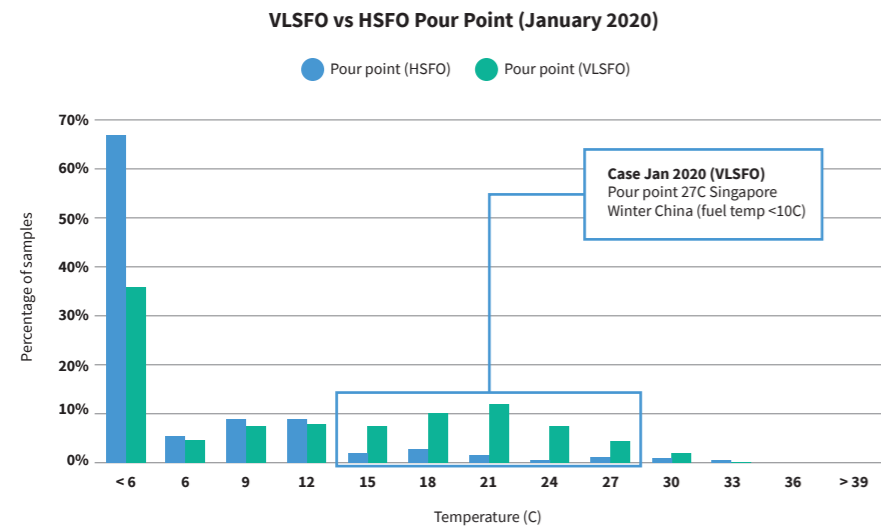
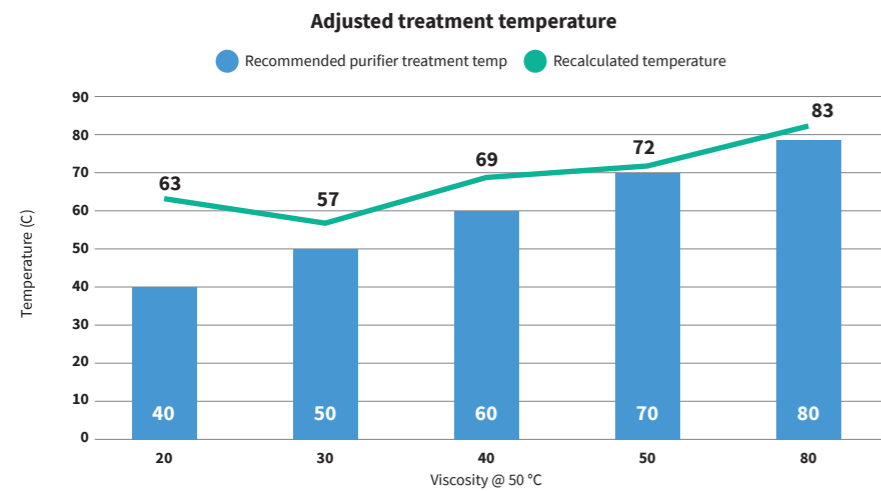


Figure 5: Purification temperature (OEMs recommended vs FOBAS advised)



from tested data suggest that on average an approximately 20°C increase in purification temperature is required for fuels with a viscosity at 50°C of 20-80 cSt.

According to our data, while more than 85% of marine fuels have switched over to VLSFOs, the level of reported problems have been much lower than initially anticipated. This is partly due to shipping's determined approach to embrace this change through preparation, knowledge gathering, sharing and joint industry initiatives and collaboration between a variety of industry stakeholders.

The VLSFO issues highlighted in this article were anticipated and should have been captured within a ship's specific Ship Implementation Plan (SIP). This would have included a thorough risk assessment to identify any ships-specific constraints and ensure these were covered in the bunker purchasing clauses. For those ships experiencing difficulties in handling these wider variances in quality of VLSFOs, we suspect this is partially due to lack of preparation, forward planning of the new bunkers and a poor understanding of the ships' system capabilities.

The issues raised demonstrate the greater need for training. Throughout 2019 and this year, LR has provided extensive classroom-based training and an [online course](#) to help the shipping industry implement this step change smoothly and safely. Finally, although the VLSFO is available on the market today and we did not expect to see the same level of unanticipated quality variance/issues, it is still early days, so a cautious approach is still required and SIPs should continue to be maintained by crew.

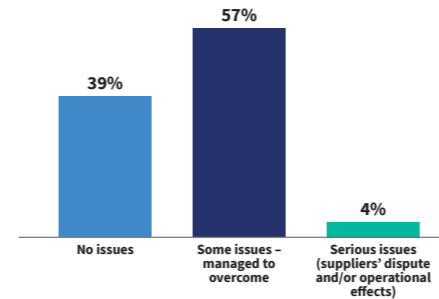
### Key recommendations:

- **Procurement:** select suppliers carefully. It's important to assess how much control suppliers have on the bunker supply chain, both up and downstream. The **LR Fuel Finder** can assist shipowners and crew with understanding fuel quality available across the globe.
- **Stakeholders:** based on the risks identified in SIPs, shipowners should be prescriptive with their bunker quality T&Cs to ensure ship constraints, such as minimum preferred viscosity and pour points. Discussing the ship's requirements with other stakeholders such as charterers, suppliers can help to match the product quality to the ship's requirements.
- **Bunker information before supply:** we would encourage shipowners to seek full standard quality data from suppliers. This information will help the decision-making process: deciding on bunkers, designating tanks, load quantity etc.
- **Feedback:** to help the wider industry build knowledge on issues with VLSFOs, and prevent further issues occurring and reduce operational problems, we would encourage shipowners and crew to share their experiences by emailing us at [fobas@lr.org](mailto:fobas@lr.org). Operational issues/observations should also be discussed with suppliers and fuel testing providers. This will help accelerate industry learning and understanding about formulations of VLSFOs, which will also assist suppliers to tighten scrutiny on the blend components, improving the overall integrity of the bunker supply chain.

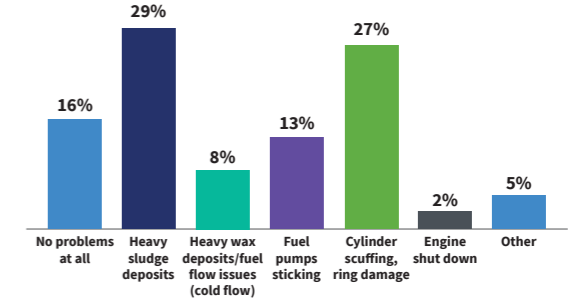
## Early response: How Greek shipowners have navigated the switchover.

At a recent seminar in Greece we polled attendees about the 2020 fuel switchover – the delegates collectively operate over 1130 vessels.

1. How has the switch over from HSFO to VLSFO gone for your fleet/ ships?



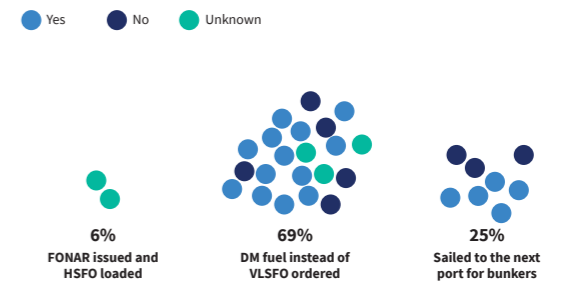
2. Have you experienced any of the following or other issues since using VLSFO?



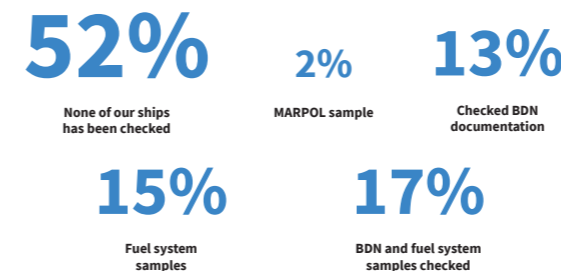
3. Have any of your ships experience non-availability of the 0.50% fuel grade?



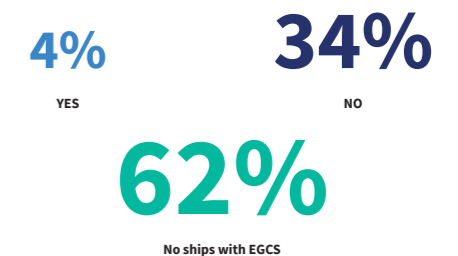
4. If yes please choose one of the following



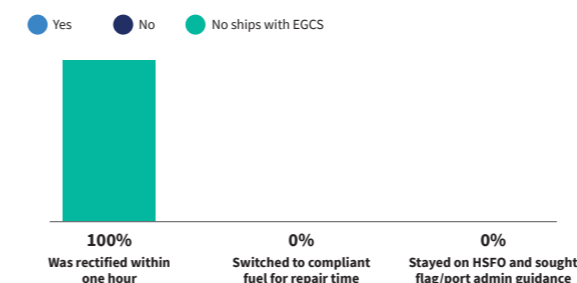
5. Have you any experience in PSC/sulphur inspectors coming on board?



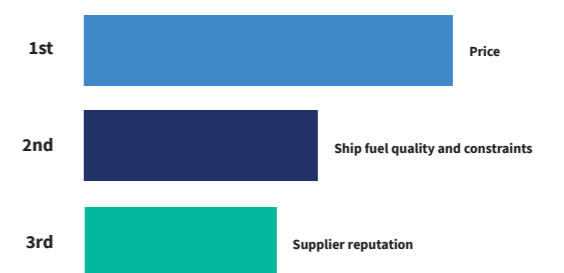
6. Have you had any EGCS failure that rendered the ship to be operating in a non-compliant state?



7. If yes, how did you handle the issue?



8. Select which order of priority your bunker purchaser will consider when ordering bunkers?



# Life after IMO 2020: Recalibrating for a new source of uncertainty.

Matthew Williams, LR's Principal Specialist for Strategic Regulatory Projects, examines developments and requirements for safety and environment regulation from now up to 2025.

**The 2020 Sulphur Cap has attracted substantial industry focus in the past few years; rightly so given the preparations needed and the uncertainties arising from delayed regulatory decisions and in-sector compliance relying on out-of-sector changes in fuel supply chains. Yet while much of the industry may have been focused on the immediacy of the impact of reductions in sulphur oxides emissions, the regulatory system for shipping has firmly shifted its focus to carbon and other GHG emissions.**

Life after 2020 brings with it the familiar, continuous process of evolving IMO instruments and introducing new or amended requirements for the industry to comply with. This regulation-as-usual activity comes at a cost, but the fundamentals of ships and shipping largely continue as normal. However, the focus on addressing carbon and other GHG emissions also means the potential need to employ unfamiliar tools in the regulatory system for shipping to incentivise its next substantial transition.

This article provides an overview of the developments in regulation in the safety and environmental domains, specifically, any mandatory requirements coming into force or application between now and 2025. It highlights two areas of uncertainty within the context of regulation-as-usual: cyber security risks and short-term measures for reducing the carbon intensity of ships. It then looks at a particularly significant source of uncertainty in the next decade: how will the regulatory system incentivise the uptake of alternative low and zero-carbon fuels?

## Regulation-as-usual

### Cyber risk management

Adopting digital technologies to enhance the safety and efficiency of ships remains an opportunity for owners and operators in all sectors and trades. However, the benefits of this technology comes with risks that need to be managed to ensure continued safety of ships, personnel and cargo, and to protect the return on investment made in such technology.

Cyber safety and security risks are made more complex by the pace of change in malicious threats and the potential for multiple, concurrent losses of availability and integrity of safety-critical functions.

Companies should be prepared to identify and safeguard against cyber safety and security risks arising from the use of information and operational technology in safety critical functions, as well as growing connectivity between ships and shore-based networks. While this should already be an operational norm for companies taking advantage of the opportunities of digital technology, cyber risk management should be incorporated into approved safety management systems ready for the first annual verification of the Company Document of Compliance after 1 January 2021.

To help our clients address cyber threats, LR acquired award winning cyber security specialists Nettitude in 2018 and now offers a wide portfolio of cyber security assurance services to support customers

## Environment

2010	2020	2021	2024	2025	TBD
<b>MARPOL Annex VI (SOx):</b> • 0.5% m/m sulphur limit • Carriage ban • Fuel safety	<b>MARPOL Annex I (Oil):</b> Damage stability for existing tankers and gas carriers deadline	<b>MARPOL Annex VI:</b> EEDI Phase 3 (Tranche 1)	<b>BWM Convention:</b> Final retrofit deadline	<b>MARPOL Annex VI:</b> EEDI Phase 3 (Tranche 2)	<b>Hong Kong Convention:</b> • 15 States • 30.21%
<b>MARPOL and NTC 2008:</b> Electronic Record Books	<b>MARPOL Annex II:</b> NLS cargo residues and tank washing	<b>MARPOL Annex VI:</b> Fuel sampling points			
<b>MARPOL Annex VI:</b> EEDI Phase 2	<b>IBC Code:</b> • Toxic vapour testing • High viscosity cargoes	<b>MARPOL Annex VI:</b> Short-term measures			
<b>EU Ship Recycling Regulation:</b> Inventory of Hazardous Materials (IHM)	<b>MARPOL Annex IV:</b> Existing passenger ships sewage storage or treatment deadline				
	<b>MARPOL Annex VI (NOx):</b> Tier III emissions control				
	<b>BWM Convention:</b> Commissioning testing (early application expected)				

with everything from training and crew awareness through to penetration testing, red teaming etc. Find out more at [www.lr.org/en/cyber-security](http://www.lr.org/en/cyber-security)

### Short-term measures

The Energy Efficiency Design Index (EEDI) has been driving technical efficiency improvements in new ships since 2013. Its role will continue for the foreseeable future as it is explicitly identified in the levels of ambition in the Initial IMO Strategy for Reduction of GHG Emissions from Ships (Initial IMO Strategy). Amendments are expected to be adopted this year to bring forward EEDI Phase 2 for certain ship types and work by the IMO continues to develop a future EEDI Phase 4.

This new phase is unlikely to commence before 2029 and will apply to new construction ships, which can be expected to be in operation until 2050. Reduction rates will be informed by the data collected by the IMO Data Collection System (IMO DCS) and the 4th IMO GHG Study due to be finalised in July 2020. Equally significant, however, is the consideration of technology readiness of alternative power sources and energy carriers and how to address emissions beyond carbon dioxide. While EEDI has achieved progressive reductions in installed power, with more innovative energy efficiency technologies at the margin, EEDI Phase 4 is expected to need to deliver a significant increase if it is to provide a carbon intensity standard relevant in 2050.

EEDI Phase 4 is only part of the discussion; it is a technical carbon intensity standard for new ships, which may be contracted

for delivery at some point in the future, so what about ships in operation today?

The IMO could agree to use an Energy Efficiency Existing Ships Index (EEXI), or mandatory carbon intensity reduction targets for new and existing ships addressed through a strengthened Ship Energy Efficiency Management Plan and carbon intensity indicators (SEEMP & CIIs). Increasingly likely (for reasons explained later), the IMO could agree a goal-based measure with EEXI and SEEMP & CIIs being functional requirements.

As they stand, EEXI is almost a carbon copy of EEDI but applied to existing ships and it would apply to ship types already covered by EEDI. SEEMP & CIIs would strengthen the requirements to manage the in-service energy efficiency of a ship, as well as make new and existing ships

subject to mandatory carbon intensity reduction targets. However, in the absence of sufficient data to evaluate and normalise CIIs reflecting the utilisation of weight, volume and passenger capacity in different trades, it is a matter for debate whether assessment of compliance using a CII should immediately have an impact on the validity of a ship's statutory certificates. Application is slated for all ships of 400 gross tonnage and above. There is scope to negotiate this up to 5,000 gross tonnage to support use of the IMO DCS to manage administrative burdens and a focus on the ships considered most responsible for GHG emissions.

EEXI is relatively simple, familiar and the proposal is mature, but concerns have been raised about its true emissions abatement potential and the extent to which it encourages innovation. After all, its primary

## Safety

2020	2021	2022	2024
<b>SOLAS II-1: Damage Stability</b> • Required Sub-Division Index R • Watertight doors • Damage stability computers or support	<b>IMSBC Code 05-19:</b> • Materials emitting flammable or toxic gas with water • Bauxite	<b>SOLAS IV: Float-free EPIRBs:</b> Second Generation & AIS	<b>SOLAS II-1:</b> • Mooring arrangements • Lifting appliances • Anchor handling winches
<b>SOLAS II-1:</b> Damage control drills	<b>ISM Code:</b> Cyber risk management		<b>IGF Code:</b> • Lessons learned • Fire protection • Fuel containment • Fuel tank loading limits • Pressure relief on IC engines
<b>SOLAS II-2:</b> Evacuation analysis			
<b>SOLAS III:</b> Lifeboats, rescue boats, launch/release maintenance, testing & repair			
<b>SOLAS IV: GMDSS:</b> Iridium			
<b>FSS Code:</b> • Sprinklers, water quality maintenance & inspection • Firefighting arrangements for helicopter landing areas			
<b>IMDG Code 39-18:</b> • Lithium batteries • Energetic materials			

**Carbon intensity** in shipping is the ratio of carbon dioxide equivalent emissions produced to the amount of transport work done. In other words, the ratio of benefits to society (trade) to the costs to society (carbon equivalent emissions from trade).



**Transport work** can be represented either in terms of capacity tonne nautical mile (such as annual efficiency ratio (AER)); or utilisation nautical mile whereby utilisation characterised by appropriate proxies for weight, volume and passenger trades, which offers a more accurate reflection of the social benefit derived from the emissions generated.

A **Carbon Intensity Indicator (CII)** is a ship-specific performance metric that describes its attained carbon intensity. This may be compared with a required carbon intensity for the purposes of regulatory compliance or be used for comparisons between ships engaged in similar activities. CIIs are affected by factors and uncertainties beyond the control of owners and operators. These are embodied in variations in fuel consumption, but are not explicitly accounted for, making them difficult to screen out.



mid-term measures summarised in the Initial IMO Strategy. But the extent of the challenge means that discussion might need to start much earlier. There is the challenge of designing and agreeing a market-based measure(s). There is the wider narrative of decarbonisation ahead of the IMO's vision. There is time being taken to develop short-term measures. There is also the pressure on the IMO to deliver and demonstrate its commitment to the intent of the Paris Agreement and assuage concerns that it is not moving fast enough. The references to shipping in the European Green Deal are a case in point. If they result in substantive follow-up action, this increases the risk of fragmentation of the regulatory system for international shipping. This all suggests a need to achieve agreement closer to the mid-term measures timeframe of 2023 rather than 2030. It's a need not lost on some member states that are recognising the need to start important discussions ahead of 2023. The reality is that the discussions that have not yet started in earnest are the ones that will matter most.

objective is not to reduce carbon intensity, but to level the playing field for existing and new ships regarding technical efficiency.

SEEMP & CIIs would be more complex to implement. The proposed reliance on an annual efficiency ratio (determined by deadweight) for verification of compliance, rather than more nuanced CIIs for different trades, is problematic and could incentivise counter-productive compliance strategies. However, it is thought that the overall approach would better support innovation and its emissions abatement potential should be more certain; and that is the objective.

Variations on the theme of SEEMP & CIIs are expected to add to the richness of the debate. The theme is the extent to which the requirements for SEEMP are strengthened, the process for verifying compliance and the practical implications for ships that do not achieve required reductions in carbon intensity. However, judging by previous sentiment, it is difficult to see measures that do not mandate and enforce measurable reductions in carbon intensity satisfying the political and environmental imperative for action. The potential for fragmentation in the regulatory system for shipping as a result of regional initiatives is very real.

While both types of measure have their strengths and weaknesses, technically

efficient ships operated in an increasingly efficient manner are needed if the IMO is to achieve its level of ambition for 2030. In fact, this assumption must be made unless data from the IMO DCS and the 4th IMO GHG Study 2020 indicate otherwise. As such, a single goal-based measure with EEXI and SEEMP & CIIs as functional requirements could provide an important way forward. An important point for discussion is whether EEXI and SEEMP & CIIs would be equivalent, mutually exclusive alternatives, or would both need to be complied with simultaneously or in phases. Concerns over the abatement potential of EEXI cast doubt on the idea of it being an equivalent, mutually exclusive alternative to SEEMP & CIIs, strengthening the case for a measure that requires both.

Data collection is also likely to be under discussion. Firstly, in the context of establishing the stringency of short-term measures based on data from the IMO DCS and the 4th IMO GHG Study 2020. Secondly, in the context of evaluating CIIs ahead of hard enforcement of reduction targets. In both cases, the result would be more robust and effective requirements, but such discussion runs the risk of being perceived as delaying real reductions in carbon intensity.

There is more political discussion to come before the technical details start to be finalised and there is much work to be

done to achieve consensus on short-term measures. Equally, the pressure on IMO to reduce the carbon intensity of ships before 2023 should spur on developments to some form of consensus at Maritime Environment Protection Committee 75 later this year.

#### Regulation-for-change

The international political and environmental consensus is that reducing the carbon intensity and absolute emissions of GHG from international shipping is the main effort for the foreseeable future. In the context of GHG emissions, business-as-usual is not a tolerable option.

Whatever the development or growth scenario for international trade, a transition away from fossil fuels is necessary, and it comes with a responsibility to avoid upstream GHG emissions and sustainability risks arising as a result – even carbon-neutral energy sources can have social costs. That is a significant strategic and technical challenge for shipping and the energy supply chain. It is also a huge challenge for the regulatory system: enabling shipping to progressively reduce its GHG emissions, minimising the social costs of doing so, and preserving the contribution of shipping to trade and the economic growth required for sustainable development.

The critical decision for the regulatory system is whether this should be done by command and control style technical regulation, or whether the regulatory system explores the use of economic regulations to correct market failure by pricing the social costs of fossil fuels appropriately. The Initial IMO Strategy implies the latter, but the former remains a back-stop option.

Command and control style technical regulation is a familiar, well-trodden path. The progressive reductions in maximum sulphur content of fuel oil that have been required since 2012 could be replicated by the IMO for GHG emissions. For example, amendments to MARPOL Annex VI to require progressive reductions in maximum emissions factors (a value representing the rate at which a specific fuel emits GHGs) of fuels used between now and 2050. However, this approach risks introducing aspirational requirements, disrupting industry's own initiatives to decarbonise and repeating the mistakes of the timing and uncertainty surrounding the decision on the 2020 sulphur cap.

Alternative forms of regulation are attractive, but are not without difficulty: emissions taxation is politically unacceptable to many, would likely be regressive and is not the most efficient means of allocating resources. A levy

on fuel is a more flexible alternative, which the industry is understood to be sympathetic. Emissions trading schemes that should be more efficient have only achieved varying degrees of success, in part because it is difficult to accurately and robustly monetise the impact of GHG emissions on society. Emissions offsetting would not result in in-sector emissions reduction. Market-based measures are not new to the IMO and have proved divisive in the past; for example, a previous round of consideration that started in 2006 ended without agreement in 2013. While the imperative may have grown since then, this illustrates the extent of the challenge facing negotiators.

A decision on how the IMO will incentivise the transition away from a dependency on fossil fuels is slated for some point between 2023 and 2030; the window for agreement on candidate

Whichever route is chosen to incentivise a transition away from a dependency on fossil fuels, the norms for ships and shipping are expected to be challenged. Regulation-for-change will leave no part of the industry untouched. The need to understand developments in the regulatory system itself, and the risks and opportunities emerging from such changes, is more important now than at any time in recent years.

Life after 2020 will be marked by the familiarity of regulation-as-usual, and the uncertainty and challenge of regulation-for-change. LR is working hard to ensure that our customers have the latest and most comprehensive information available on both so that they can identify and respond to the opportunities and risks that life after 2020 will inevitably bring.



For further information about these or any other upcoming regulatory changes, please contact your local LR office or visit [www.lr.org/imo](http://www.lr.org/imo). Here you will find various IMO Committee and Sub-Committee meeting documents.

Visit <https://www.lr.org/en/marine-shipping/marine-subscribe/> to subscribe to receive our bulletin with updates of IMO agendas, summary reports and our forthcoming IMO legislation document.

*The information in this article was correct at time of press.*



# Measuring the carbon footprint of offshore production.

Classification societies can play a significant role in helping offshore with its decarbonisation challenges, says Mark Tipping.

**Mark Tipping**  
LR's Offshore Technology Manager



Global attention around carbon emissions is influencing how hydrocarbons are used and produced. This means major operators are looking at how carbon dioxide (CO<sub>2</sub>) releases can be reduced in offshore production, power generation and directing power to water reinjection. This has been demonstrated by major oil brands such as Equinor (formerly known as Statoil), which has issued plans to cut carbon intensity in half by 2050, and Lundin Petroleum announcing carbon neutral targets and a name change to remove the 'petroleum' reference to reflect the industry's energy transition. In line with this, earlier this year BP also set out its ambition to become a 'net zero company' by 2050 or sooner. When launching its 'Energy Transitions' report in January 2020, the International Energy Agency (IEA) emphasised that all stakeholders must play a significant role in the offshore industry's decarbonisation journey.

Societal pressure is driving many of these initiatives with hydrocarbons producers seen by some as a leading source of increasing CO<sub>2</sub> emissions. According to the IEA, 2018 saw the highest levels of CO<sub>2</sub> introduced into the atmosphere for three million years, which remained the same in 2019. Quantifying the carbon impact of hydrocarbon production itself is essential if the impact is to be meaningfully measured across the supply chain. To better understand the landscape, this should be compared with emerging technologies that also have carbon footprints. The hydrocarbons industries and the offshore sector are not solely responsible for CO<sub>2</sub> emissions – the focus of this article – or the other greenhouse gases, but it is within their power to publish how much they are producing in what stages of the project life cycle and to state the measures they can take at each of these stages to eliminate, reduce or mitigate the impact of CO<sub>2</sub> emissions.

How hydrocarbons are produced has a direct impact on the total carbon footprint of the produced fuel, which can be significantly higher from less efficient facilities or unprocessed hydrocarbons already containing a high percentage of CO<sub>2</sub> in their constituent mix. 'Energy transition' and the hydrocarbons industry have attracted criticism of "cleaning house" or "greenwashing" in the past, which points to the need for critical third-party assessment.



**How hydrocarbons are produced has a direct impact on the total carbon footprint of the produced fuel, which can be significantly higher from less efficient facilities or unprocessed hydrocarbons already containing a high percentage of CO<sub>2</sub> in their constituent mix.**

With floating production storage and offloading units (FPSOs) and floating storage regasification units (FSRUs), classification societies are engaged at every stage of the unit's life. As such, they can offer a unique perspective of the project from cradle to grave, as well as present a factual picture to the public that is independent from the hydrocarbon industry. Therefore, operators can work with class societies to help demonstrate that they understand impact and, more importantly, outline the measures being taken as the industry moves towards a net-zero carbon future.

#### Project stages: what needs to be measured?

The offshore industry has several constituent parts that make up its carbon footprint and each of these elements need to be understood by governments and the public, for the lifetime carbon footprint to be truly meaningful. This may seem an obvious statement, but it needs to be applied to the larger climate change discussion, as cherry picking can occur with focus on positive characteristics of one technology that ignores its less favourable characteristics.

The offshore industry can avoid cherry picking by taking a considered approach to its activities. IPIECA provides guidance on how to report carbon emissions. The not-for-profit organisation is run by the hydrocarbons industry, having been set up at the request of the United Nations (UN) in 1974. IPIECA incorporates the UN sustainability and carbon reduction goals into its documents, but it does not provide the detailed guidance required at a project level for carbon management. In most

cases, operators need to look closely at the unique aspects of each project. These can be broken down into generic elements:

- **Construction:** the construction phase of any project is carbon intensive from the energy used for fabrication, materials used in construction, transport, office and hotel requirements etc. While comprehensive and complex, it is possible to make meaningful estimates of the carbon footprint at this stage.
- **Operation:** the operation phase is often the longest stage of any project, which can usually be measured in decades. While reasonable estimates can be made in terms of energy required for production, the requirements associated with operation and maintenance are more challenging.
- **Decommissioning:** while rarely at the forefront of project thinking, the legacy carbon footprint for disposal can also be estimated.
- **Impact of the produced product:** how is the product used? This is simple for gas when combusted as gas, yet it is more complex for oil where the carbon might be contained within a plastic or pharmaceutical, for example, rather than a fuel.

The offshore industry can learn from other industries on emissions measurement. The automotive industry, for example, is endeavouring to measure its impact and compare competing technologies, including internal combustion engines and lithium-ion batteries. It is important that the offshore industry demonstrates, in a clear and



## OFFSHORE

constructive manner, its impact across the project life cycles and how it is managing its impact, negating it or mitigating it.

### What's available now?

Measuring our impact should be considered from the perspective of societal engagement, as well as through-life cross-industry engineering understanding. This is vital if meaningful outcomes are to be seen from the range of measures being taken to minimise the impact of production, and ultimately in the responsible use of the produced product. The next step is to consider what is available to minimise the impact and move society closer to the prospect of having a net-zero carbon future. While the following is not exhaustive and should only be taken as an indication of current initiatives, it does indicate what is being done now in mature regions for operation:

- **Carbon sequestration:** this is process of capturing and storing atmospheric carbon dioxide. It has perhaps been the most discussed technology over the past 20 years in the hydrocarbons industry, with a continuously developing and expanding knowledge base. There are several technologies in this area and their deployment is dependent on the local geology. Notable examples include the Sleipner gas field, operating since 1998 in the Norwegian North Sea, and Chevron's onshore Gorgon plant in Western Australia,

which is using sequestration technology to reduce the project operational CO<sub>2</sub> impact by 40% (according to the company's website). The challenge is the high required capital expenditure (CAPEX) and ongoing operating expenditure (OPEX) associated with achieving this. However, as carbon emissions become ever more constrained, the adoption of this technology becomes more likely.

- **Shore-based power:** tie-backs to shore-based power are being deployed for offshore projects in the North Sea. While this does not directly reduce a CO<sub>2</sub> production footprint, it does leverage power generation at scale and opens the door to purchasing power from renewable sources as they become more available and competitive. It can also reduce project CAPEX and OPEX in the form of negating the need for onboard primary power supplies.
- **Wind turbines/technologies:** wind turbines in the North Sea are becoming an attractive proposition when linked with emerging battery technologies – not necessarily for essential power, but certainly for supporting functions. Wave-generated power also has potential, but is not as well developed as wind turbine technologies.
- **Mitigation approaches:** these are being commonly adopted, such as

reforestation, and available at corporate levels and for individuals.

### What role do classification societies play?

If the industry is to measure the carbon footprint of offshore production, third-party organisations such as classification societies can help present a factual and trusted picture to governments and the public as they are independent from the hydrocarbons industry. LR has always been at the forefront of supporting measures that improve safety and the protection of the environment. The energy transition is no different, but in doing so it is important to help the offshore industry demonstrate that it understands its impact and can explain the measures it is taking as the global industrial network moves towards a net-zero carbon culture.

It is also worth noting that the various asset lifecycle stages are unlikely to be equal in impact. For example, the design stage will be relatively low compared with the construction and operation phases. The potential exists to measure each unit's carbon footprints from the impact of the design, its construction, elements of operation and final disposal through the following interactions:

- **Design:** is the design energy efficient and leveraging renewable resources? How are the field characteristics, such as CO<sub>2</sub>,

hydrogen sulphide (H<sub>2</sub>S) and mercury, managed and mitigated? Is the design efficient with respect to construction and materials use? How many stakeholders are involved in the design process? What is the carbon footprint of the offices used?

- **Construction:** this tends to be heavily energy dependent. How is the carbon footprint of the energy used managed? How does the workforce and their commute to work impact the project? How is the carbon footprint of the supply chain – the biggest impact – managed and measured, including equipment transport?
- **Operation of marine systems:** this raises various issues. What, for example, is the facility's carbon footprint simply to exist in terms of energy, along with support staff and maintenance activities required for operation?
- **Disposal:** this should not simply be about the energy required to dismantle the facility, but also about how the hazardous materials are handled and disposed.

Traditional classification scope can leave some gaps; however, larger classifications societies have sister businesses with industrial divisions capable of addressing:

- **Operation:** the impact of process systems that sit behind the facility's purpose. This will change with time as field

characteristics change and equipment is upgraded. Yet these can be measured from energy used and material resources consumed. Such monitoring could even fall within the scope of mandatory verification schemes.

- **Use of hydrocarbon products:** this is a challenge as it falls outside the ability of the operator in terms of controlling how it is used and its efficiency. However, the amount produced is accurately measured and so the carbon it contains can also be measured. This means a known target value exists on how this is mitigated by carbon sequestration, reforestation etc.

While the focus of this article has been on floating structures, it remains equally applicable to bottom-based structures such as jack-ups. This is due to most of the

technologies being comparable across the unit types.

The activity required in all these elements is to understand the process and its constituent elements, measure it and present per lifecycle stage and the whole process to the world as a whole. Society can then judge how well the industry is doing and industry can explain where it is with respect to the goal of net-zero carbon per project and the life cycle stage.

The question of mistrust between the public and the offshore industry cannot be ignored and community engagement with relevant stakeholder groups is essential at all stages. Third-party assurance providers such as classification societies can play a significant role in this process, but trust will require participation from all industry stakeholders throughout the supply chain.



## How can LR's Offshore experts support you?

We are continuously looking at how to support clients with their integrity management needs using the full range of new technologies from the sensor, robotic to the fully integrated digital solution. Whether its Classification, Verification, optimisation or iterative performance improvements, we can help you maximise opportunities and navigate risks. Please contact Mark Tipping, Manager Offshore Technology, [mark.tipping@lr.org](mailto:mark.tipping@lr.org) to discuss further.

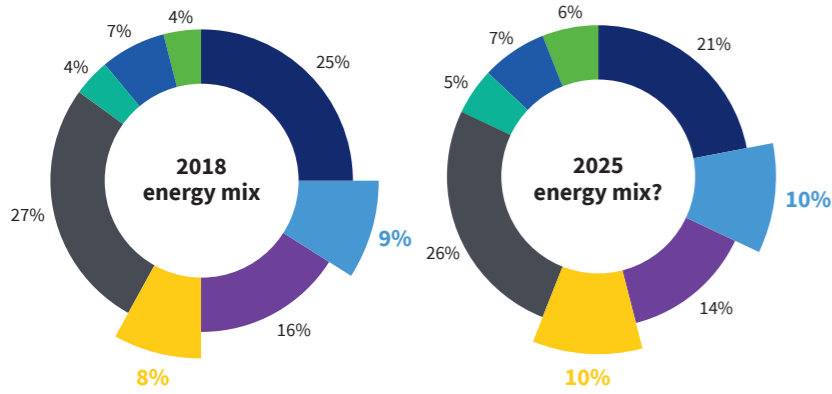


# Our offshore orbit.

Offshore oil and gas' share of hydrocarbon output is expected to grow in the next five years. Prior to the Coronavirus outbreak taking its toll on global stock markets, deepwater offshore CAPEX was expected to increase faster than any other upstream sector through to 2023, according to Rystad Energy, and CAPEX was expected to grow in 2019 after four years of decline. In May 2019, Wood Mackenzie predicted that 2020 offshore spending would amount to \$296bn. With many upstream projects planned between 2020 and 2025, opportunity is global and investment in numerous offshore vessel types is forecast, despite the current challenges.

## Offshore and energy markets – the changing mix

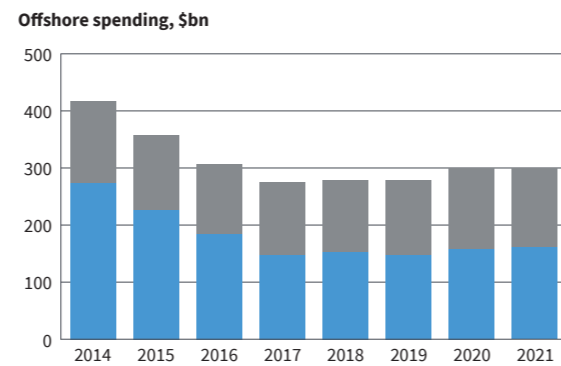
- Oil (onshore)
- Oil (offshore)
- Gas (onshore)
- Gas (offshore)
- Coal
- Nuclear
- Hydro
- Renewables



Source: BP Statistical Review, June 2019

## Offshore CAPEX expected to increase in 2020

- CAPEX
- OPEX

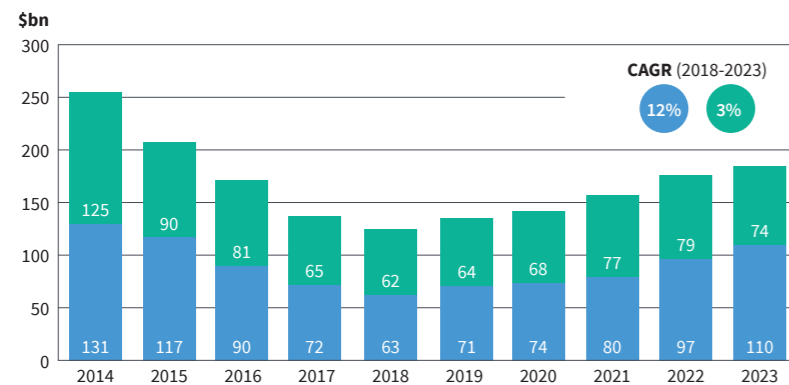


Spending is stable since 2017; Capex is expected to increase in 2020.

Source: Wood Mackenzie, May 2019

## Offshore spend to increase at 5% per annum through 2023

- Offshore Deepwater
- Offshore Shell

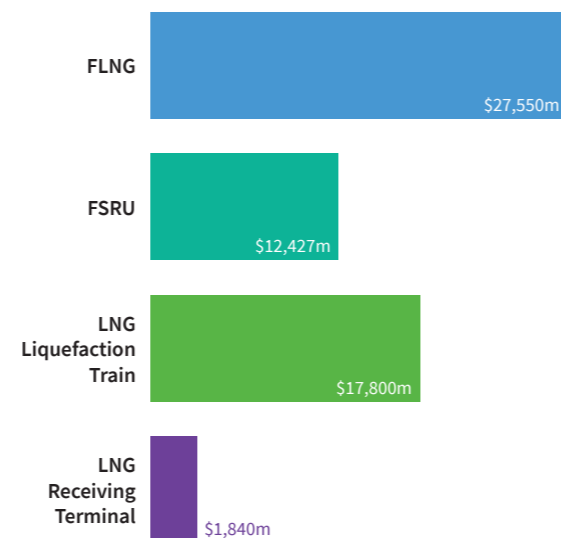


Rystad Energy expects total global upstream investment (excluding exploration drilling) both onshore and offshore to grow 4% per annum (p.a.) between 2018 and 2023.

- Offshore CAPEX to grow for the first time in four years this year.
- Total offshore CAPEX to grow 5% p.a. through 2023:
  - Offshore deepwater (12% pa).
  - Offshore shelf/conventional offshore (3% pa).

Source: Rystad Energy, Aug 2019

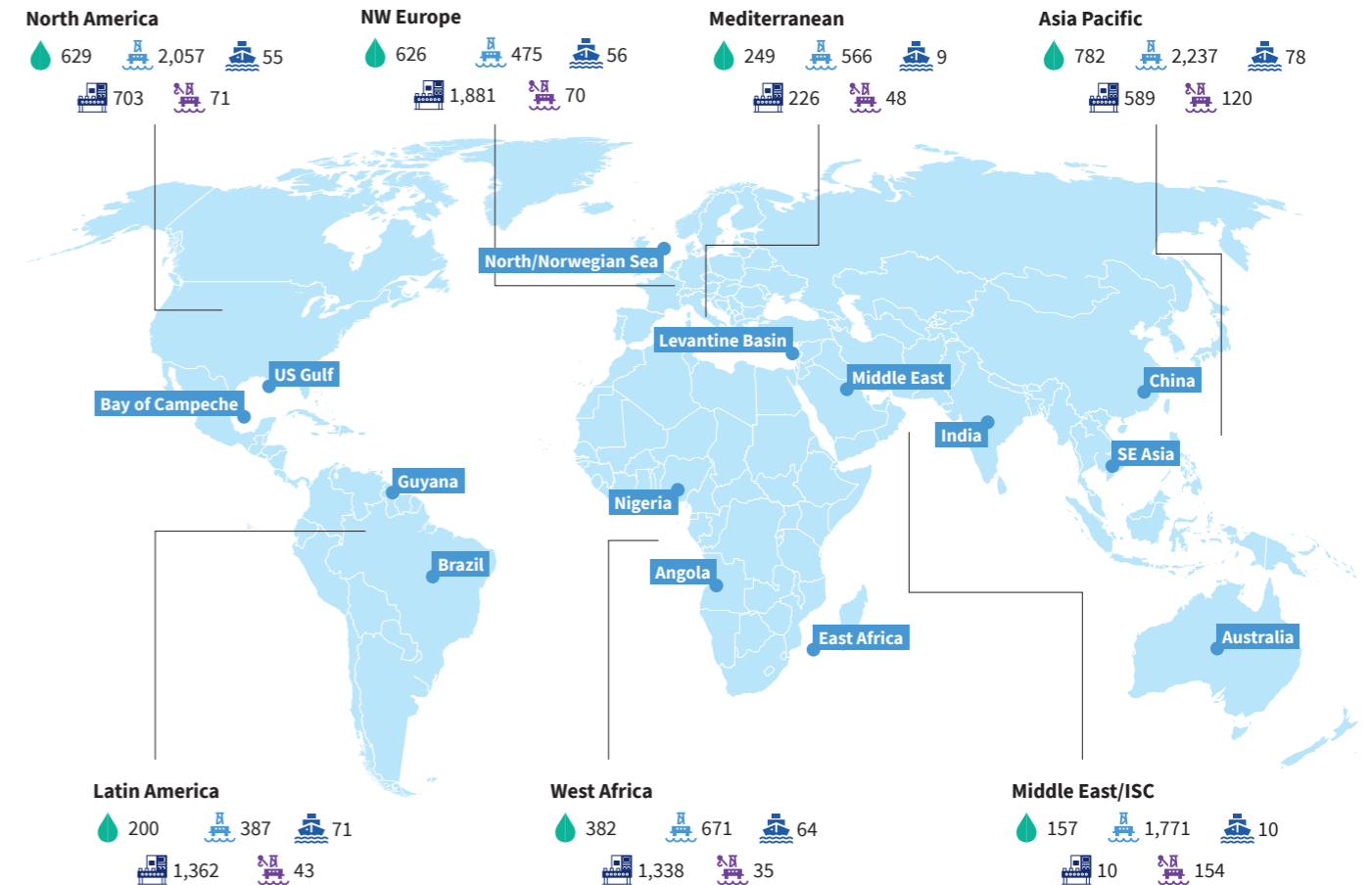
## CAPEX spend for planned offshore gas structures (exc. field dev)



Source: Energy Industries Council, Jan 2020

## Offshore regions and assets

- Producing fields
- Active fixed platforms
- Active MOPUs
- Active subsea trees
- Active rigs
- Major areas/countries



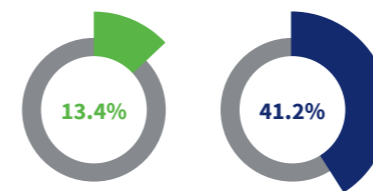
Source: Clarkson's Research, Sep 2019

## How LR stacks up

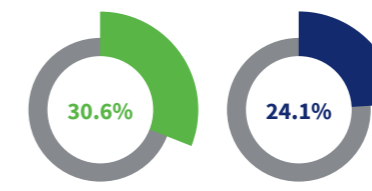
Expressed as % total GT

- Existing fleet
- Orderbook

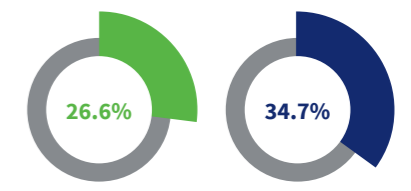
### Gas – FSRU LR Market share



### Gas – LNG carrier LR Market share



### Gas – LPG carrier LR Market share



Source: IHS Vessel Database, 31 Dec 2019

# Remote technology: the changing road ahead for risk-based inspection.

Safety, operational efficiency and compliance still a focus area for operators as risk-based inspection changes with the introduction of remote technology.

*This article was produced before the Coronavirus (Covid-19) pandemic. However, the technologies and approaches discussed are now being actively used by LR to support clients through this challenging time.*

Words: Viv Lebbon

**Risk-based inspection, often used by operators in the offshore world to improve efficiency and performance, is changing with each new piece of technology introduced to the market – unmanned cameras being a prime example. Whilst remote presence and technology can offer significant opportunities and benefits to offshore operators, it also comes with obvious limitations. The questions that many operators have are around compliance and acceptance by regulators and class societies. And if these new technologies comply with necessary Rules and help support safety cases, then will it still protect surveyors and personnel from dangerous environments?**

Mark Tipping, LR's Offshore Technology Manager, takes a closer look into risk-based inspection to answer some of these questions, looking specifically at offshore applications and regulatory regimes that have accepted these approaches.



**If a piece of equipment is being examined for maintenance, LR acknowledges this in the inspection plan and where possible (and appropriate) deploy remote inspection techniques. This will help manage the number of visits required and reduce personnel onboard during busy times.**

## What is risk-based inspection?

Risk-based inspection (RBI) is a tool used by operators to demonstrate a formal process of verifying that their assets remain safe and meet the integrity management goals of the facility, a requirement needed by many regulatory regimes. Accepted by various offshore jurisdictions around the world, RBI is an alternative to traditional periodical classification survey schemes. According to Tipping, "RBI looks at a specific component within an asset, mainly its state and location, with the purpose of detecting and monitoring degradation while applying decision-making criteria to manage risk on an acceptable level."

"It's a great benefit to operators as it gives them a better understanding of the state of their entire asset so they can plan inspection around risk and identify when assets need fixing or replacing," Tipping continued, "RBI can help operators optimise downtime and a reduction in unplanned shutdowns along

with increased efficiency by focusing on critical equipment."

This differs from the traditional approach, which requires a class society to perform surveys on a routine prescriptive basis, rather than looking at the state of the asset or critical equipment, causing unnecessary downtime which can have a financial impact.

## How is remote technology changing the RBI process?

Remote presence is defined as an inspection, survey or recorded data point without the surveyor being present on the facility. With this, some forms of remote technology can produce data and imagery that forms part of the RBI approach; for example, high fidelity images of an oil tank or data taken directly from mooring lines can help to minimise risk and prevent incidents as surveyors and crew don't have to enter the confined spaces or other hazardous environments.

"Remote presence exists today in the offshore industry, for example, the facilities that have fibre links to shore can provide real-time telemetry of the facility and its mooring lines, giving the surveyor the option to review certain parameters of the mooring lines from their desk. In other words, it's a remote activity as the surveyor is not physically present onboard the asset," stated Tipping.

The data obtained from real-time telemetry provides a higher level of assurance that the asset is working as it should. This type of activity has assisted the overall RBI approach by enabling class societies and operators to optimise the physical visits required, building on existing data and

information about the asset, which in turn saves time and money.

Unmanned cameras, another form of remote activity, has also supported the RBI approach by removing the need for a surveyor or a member of the crew to enter a dangerous area, a concern many operators and class societies share. EM&I Alliance, an integrity management and inspection services provider, developed a high-fidelity unmanned camera to provide owners with assurance that its asset is performing in a safe and efficient condition, whilst at the same time ensuring that the activity does not impact operations - in this case the surveyor is outside the area of concern, using their knowledge and experience to interpret the camera's data.

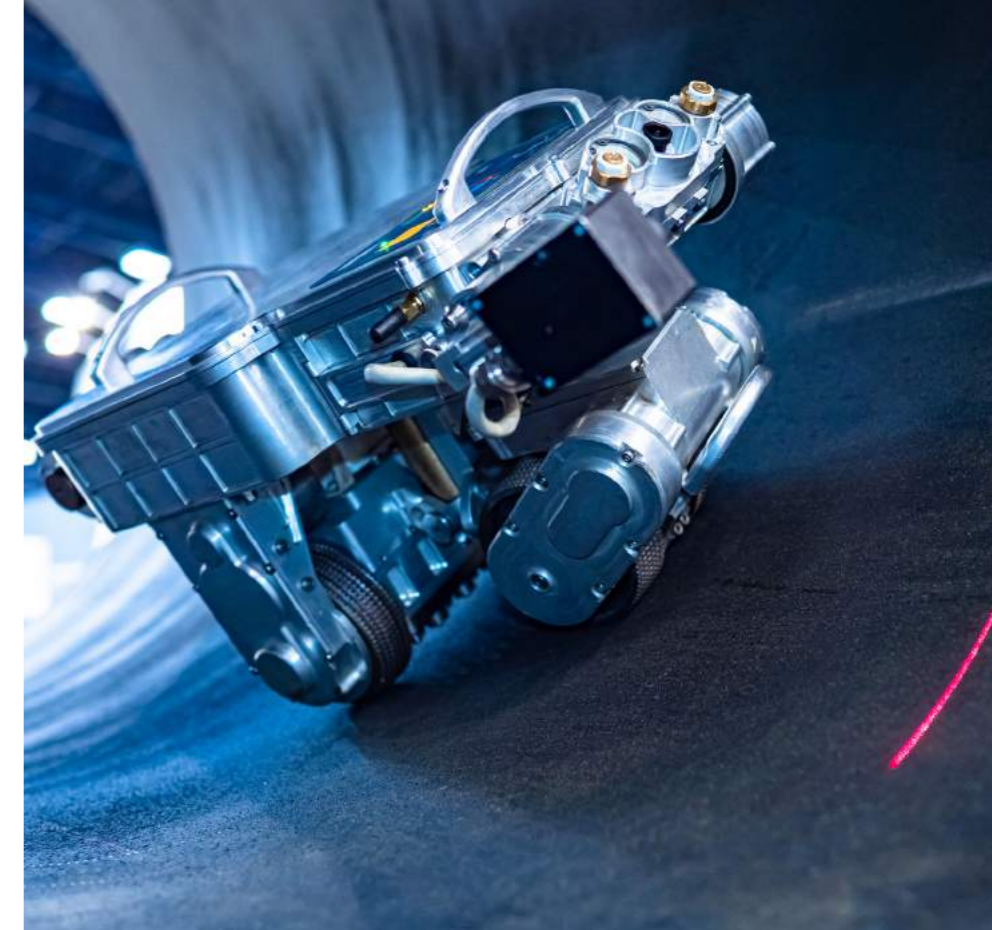
This is a true benefit to both operators and class societies as it limits the exposure of personnel from entering a potentially dangerous space and minimises time spent from stopping/resuming operations while, importantly, still utilising an LR surveyor's knowledge and experience.

EM&I Alliance cameras offer data, imagery and information about different parts of the operator's asset - typically cargo oil tanks and water ballast tanks - which in turn builds a realistic picture of the asset's overall condition, helping operators and class societies identify when surveys and inspections are needed and when the survey really does require human entry.

LR has worked closely with the inspection services provider and innovator to ensure its unmanned camera equipment and the information it produces complies with class requirements and Rules, specifically regarding quality of image and the level of detail it can pick up, such as hair line cracks. This is crucial as the imagery and data from the unmanned cameras will inform the detailed inspection plan which outlines what will (and will not) be included in the camera's results. This plan will then be used by the surveyor to determine a risk-based judgement from outside the confined space onboard the asset.

## How has LR used remote technology so far?

Remote technology means that LR can deliver the same level of service to clients without needing to be physically present on all occasions. When planning surveys under any regime, whether that's RBI or time-based, it's important to understand just how busy an asset can get during planned



maintenance periods; the increase in personnel onboard is a serious logistical and safety issue for operators to manage. While this is not the driving consideration when deciding on the suitability of a technology for an inspection item, the ability to help clients manage personnel onboard, and the associated challenges, are considered as part of the overall picture.

Therefore, "LR is careful when utilising technology and opportunities provided by the planned maintenance in order to achieve the inspection goals," said Tipping. "For instance, if a piece of equipment is being examined for maintenance, LR acknowledges this in the inspection plan and where possible (and appropriate) deploy remote inspection techniques." This will help manage the number of visits required and reduce personnel onboard during busy times.

As an example, LR can deliver certain aspects of remote surveys on a continuous basis for FPSOs mooring systems, provided that the operator has the right technology enabled to monitor the asset's performance in real-time from shore. Only then LR can accept as evidence that the asset is working as it should in accordance with the RBI approach. Tipping emphasised: "while we appreciate that there are remote technologies that can help class perform its activities in conjunction with RBI regimes, it is entirely dependent on the circumstance.

There are some scenarios where a physical survey must be performed, a general annual survey, for instance, or if a surveyor needs to inspect a specific area or component on behalf of a regulator. These surveys are often dependent on the human element whereby LR surveyors drawn upon their extensive knowledge and experience to not only deliver the service but also to conduct the manned inspections with the knowledge gained from the remote surveys to help limit impact on the facility."

## Acceptance by Class

Many operators ask whether this type of remote activity is accepted by class societies. "From a LR perspective, techniques must be as good as a surveyor performing the inspection in person and technology providers, inspection service companies and operators alike must prove that this is the case if we are to accept the data as part of the overall RBI process," Tipping explained.

To support this journey, LR developed 'Remote Inspection Technique Systems (RITS) Assessment Standard for use on LR Class Surveys of Steel Structure', which specifies testing and acceptance criteria for assessing and quantifying the capabilities of a RITS in performing inspections of steel structure on floating offshore assets and ships in service, when those inspections are being used toward the credit of Offshore Class Surveys as required by LR.



# Beyond borders.

A childhood in and around the shipyards of Asia laid the foundations for the international career of Elina Papageorgiou, LR's new Marine and Offshore President for UK and Ireland.

Words: Nicola Good

**What ingredients make up a recipe for success in maritime? For Elina Papageorgiou, recently appointed Marine and Offshore President for UK and Ireland for LR, they have been a daily diet of shipping talk and uninterrupted maritime exposure coupled with a fervent desire to work in the maritime industry.**

For Papageorgiou, who has spent her entire 16-year career at LR, most recently as Area Sales & Marketing Manager, South Europe, there was never any question of working outside of maritime. "My family has always been in the maritime industry, I've lived half my life in Asia – Korea, China, the Philippines – so I practically grew up next to one shipyard or another," she tells Horizons. "It was a central part of my upbringing as a child and my whole life since has been very connected to the marine industry."

However, Papageorgiou is quick to stress that when it came to career choices she was strictly in the driving seat. The eldest daughter of Vassilis Papageorgiou, Vice Chairman of the Tsakos Group, Elina admits she was encouraged to work the room at the numerous industry events that featured during her teenage years, and was inspired to follow her father's path, seeking his guidance along her journey.

Both of her sisters have also landed significant shipping careers – one works as Associate Director of The London P&I Club and the other is a Deputy Designated Person Ashore (DPA) for a shipowner in Athens. So it is fair to assume that the strong and convivial ties that tend to exist between the industry's leading families, as well as maritime's many attractions, must have been evident throughout Papageorgiou's childhood.

She considers herself to be an international citizen, having rarely lived in the same country for an extended period. "As a child, I was changing school and meeting

new people every two to three years. For example, when I'm in Greece, I don't feel like I'm Greek and when I'm in the UK I don't feel like I'm English. Many people who have had the same upbringing feel the same way. It is like we don't belong anywhere, but we feel like we belong everywhere."

The transient nature of her childhood has fostered an open-mindedness about change. "I like change. One should never be too comfortable and sometimes you just need to push yourself to do something different," says Papageorgiou, who appreciates that careers are built on hard work and making strategic choices when opportunities emerge.

For her, a key career decision was taking a role in Copenhagen in the Nordics Business Development team in 2010, a move that offered her a "completely different perspective" of the LR business. "This was one of those situations where I thought ok – I am going to go for it. I got offered the job and a month later I got married, then I left for Denmark a month after the wedding," she explains, admitting that "I was lucky because I had the support from my husband and my family to be able to do something like that."

Recognising that few enjoy the seamless introduction to shipping that she has had, Papageorgiou emphasises that securing future talent is a key industry challenge. "We need to communicate what the industry stands for," she tells Horizons. "It's not just a means of transportation – it's about bringing the globe closer together and breaking down boundaries between countries and economies. As the industry is being disrupted and transformed by digitalisation and the global challenge of sustainability, this is becoming more important. This is our mission and we need our future leaders to understand that."

So, what does she make of decarbonisation and digitalisation – the two main drivers in maritime right now – and their impact on

the industry in the decade ahead? "Many people are talking around these topics," she says, "with every conversation spurring further talks as the industry tries to map the challenges ahead and the likely impact on regulation. But in my view, as an industry, we still haven't been able to visualise what it all really means and will look like in the end. There won't be quick decisions – people will wait and see how the landscape evolves – although there is no question that the decade ahead will be transformational with calls for more leadership in the industry."

For Papageorgiou, the key to achieving the sustainability challenge is digitalisation. It is leading to market breakthroughs such as innovative propulsion systems and new digital design solutions where ship performance can be predicted and optimised early in the design process, enabling better, safer and greener ships.

When it comes to leadership, Papageorgiou sees a leader as "someone who can see what the next day is going to look like and take you along for the journey". As well as having occupied several leadership roles in her time at LR, she has benefited from the mentoring and support of others – most notably South Europe Marine & Offshore President Theodosios Stamatellos. His leadership approach is focused on bringing out the best in people and recognising that we all respond differently to situations, and this requires an element of flexibility.

While there are more women in senior positions in shipping than a decade ago, it's still not unusual for Papageorgiou to find herself the sole woman around the negotiating table. "[Maritime] is very much a man's world, yet we are seeing more women coming into roles across the industry," she says. "But we definitely need more as I think being a woman is very powerful in this industry. You command a different kind of respect from clients and the more female role models and opportunities we have, the more likely we are to encourage others to join our ranks."

## On teams

"It doesn't matter what team you are part of, you will still learn. Embrace the fact that those who work alongside you will come from different backgrounds and can share their experiences."

## On having a single employer

"For some it may be a long time to be in one organisation, but among the shipping community, most people work throughout their whole lives in one company. I am proud to have spent 16 years at LR and to have got to this position. 'Shipping' initially derived from the word 'relationship' and our industry is about connecting and it's the people that makes it really special."

## Life advice

"Make the most of every moment and be in that moment."

## On her new role

"I am excited for the opportunity to work with such a successful team such as the UK & Ireland. The UK plays a really important part in our M&O strategy and London is the centre of so much maritime activity. I look forward to working with the team and to continue growing LR's position in this area."

# Maximising opportunities in LNG.

In a growing LNG sector, LR's longstanding experience and expertise is more valuable than ever. Paul Bartlett speaks to LR's Global Gas Segment Manager, Panos Mitrou, about the transforming market of structural change and new opportunities.

**The IEA has called for more speed in the transition from heavily polluting fuels to natural gas. In a recent report, the IEA noted that natural gas has already helped to limit the rise in global emissions since 2010 and offers an immediate opportunity for major additional emissions reductions given the right economic and policy conditions.**

The contribution of gas to energy transitions varies widely across regions, between sectors and over time, the IEA noted, while conceding that, as a hydrocarbon, gas remains itself a source of emissions. Yet, the Agency said, it would still be possible to turn round the rising emissions trend and contribute to improvements in air quality through the wider adoption of gas.

The IEA's report came well before the Covid-19 virus outbreak in China. Even if the spread of the virus is contained effectively over the first half of this year, many analysts suggest that it is likely to have a dramatic impact on the world economy and, by implication, energy demand in 2020. However, for LNG shipowners with a long vision, the IEA report will still have been a welcome read.

Many shipowners were already on a high. The world's LNG trades have undergone a transformation as US terminals previously

earmarked for imports have turned into major export hubs for long-haul cargoes, many to the East. Meanwhile, the Chinese government has embraced LNG as a source of power and the country has demonstrated consumption levels rising consistently in double digits for more than a decade.

New sources of LNG and fresh markets in various parts of the world have led to a structural change in LNG shipping. The market has transformed from one based on fixed long-term charter contracts to a more conventional shipping model with a buoyant spot market.

This has generated new opportunities for LR with its robust track record in gas shipping generally, and LNG design and construction in particular. Panos Mitrou, LR's Piraeus-based Global Gas Segment Manager, sees a range of opportunities in new LNG trades and markets, floating LNG technology, small-scale LNG projects and LNG as a marine fuel.

The fleet itself, he points out, is expanding fast. Clarkson's Research figures reveal that the 441 LNG tankers of more than 40,000 m<sup>3</sup> at the beginning of 2017 had expanded to 550 by January this year, with a further 150 on order. The number of small units has also increased over the period, according to Clarkson's data, from 31 ships in 2017 to 43 in January.



Mitrou also sees a new type of independent LNG tanker owners – some of them not far from his own Piraeus office – with a more risk-prone approach to business. Blue-chip Greek owners have entered LNG shipping in a big way, investing billions of dollars in new vessels, only some of which are deployed on long-term contracts. The sector now has an active spot market.

The arrival of new independent owners and significant fleet expansion has been met with enthusiasm by Mitrou and the wider team at LR. It is the class of choice

for many gas shipowners, demonstrated by LR's close involvement in various eye-catching projects, including the world's largest floating gas production facility, *Shell Prelude*. It also classed the first gas-fuelled ropax vessel *Viking Grace*.

"Gas shipping is in our DNA," Mitrou tells Horizons. "We have always been and continue to be the class of preference for the greatest share of owners engaged in gas shipping and we have unparalleled expertise through our experience in floating LNG production. We also see a range of opportunities

## LR committed to continuing LNG development in China

LR is working with six Chinese partners on the development of the first 220,000 m<sup>3</sup> LNG carrier design with a GTT Mark III membrane containment system. The project comes at a key moment in China's huge appetite for LNG, much of it shipped on long hauls for which the large new design is intended.

Although demand in the early weeks of the year fell sharply as a result of Covid-19, Chinese demand for LNG in normal times has broken all records. According to the latest issue of BP's Statistical Review of World Energy, China's consumption of LNG grew by an average of more than 13% a year in the decade to 2018. The increase in consumption between 2017 and 2018 was more than the entire consumption of France.

LR's partners in the design project include the China Classification Society (CCS), COSCO Shipping LNG Investment (Shanghai) Co, COSCO Shipping Heavy Industry Co Ltd, Jiangnan Shipyard (Group) Co Ltd, the Marine Design and Research Institute of China, and the Shanghai Ship and Shipping Research Institute.

They are working together to develop a technical specification and general arrangement of the main systems. Meanwhile, LR and CCS are providing support services and ensuring full compliance with international regulations and conventions. Ultimately, once the design is finalised, the two classification societies will grant the design approval in principle, paving the way for the construction in China of the largest-ever LNG carriers, probably for deployment in the country's own import trades.

## Huge vessel requirement ahead

Today's 150-ship LNG carrier orderbook may be sufficient to meet the requirements of LNG liquefaction projects currently under construction, but it will fall way short of vessel requirements for other projects currently in the front-end engineering design (FEED) phase and/or with agreements signed, according to Clarkson's Research.

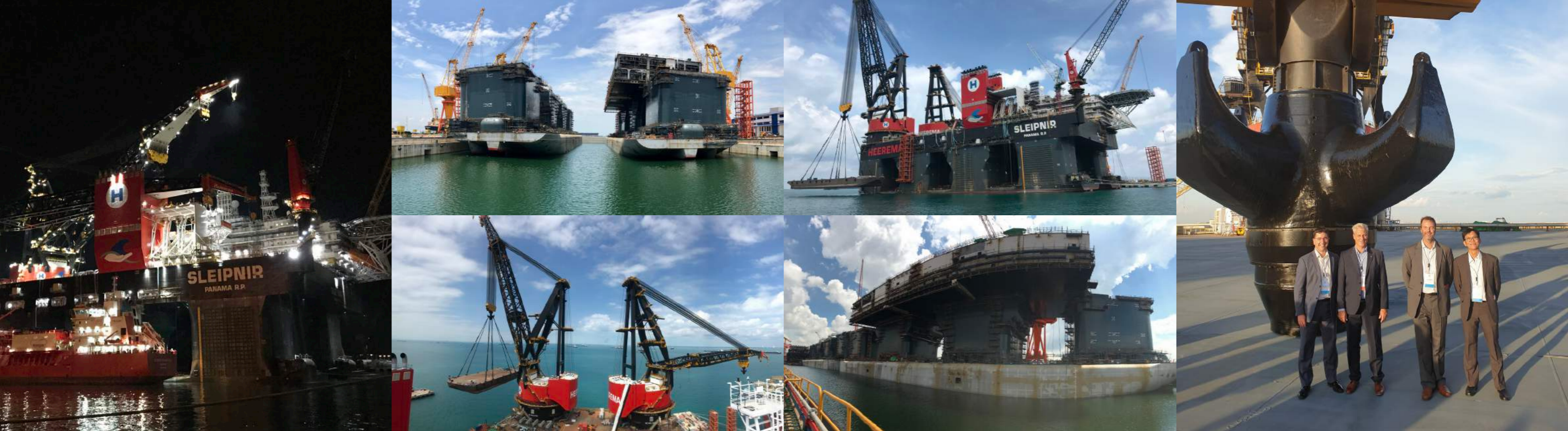
If all of these projects go ahead as planned this decade, more than 350 more LNG carriers will be required by 2030, the analysts estimate. Out of a total of 53 projects, 33 are in the US, six in Qatar, five in Canada, two in Australia, two in Russia, and one each in Cameroon, Congo, Djibouti, Israel and Mozambique. A further 61 projects, with nominal start-up dates this decade, are at the 'Proposed' stage, meaning that they may or may not get a green light. However, if they were to go ahead, Clarkson's estimates that a further 359 LNG carriers would be required, with the vast majority in the large sizes.

in the floating gas sector generally, including FSRUs and floating storage units (FSUs)."

This specific experience, Mitrou believes, also puts LR in pole position in the development of small-scale LNG technology, an increasingly important component of the LNG sector with major opportunities in both shipping and offshore. These focus on three main areas, Mitrou explains, in which LR has expertise to offer: LNG as a marine fuel; LNG as an off-grid source of power generation for industrial and residential requirements in

remote areas and island communities; and small-scale LNG carriers and bunkering vessels.

In the small-scale LNG sector, LR's close involvement in Chinese LNG development is an advantage. The country is a key player in small-scale LNG development, largely as a result of the government's drive to cut air pollution. According to reports, China plans to build a wider LNG small-scale infrastructure, including 40 LNG bunkering stations on the coast and across its river network to service short-sea and inland waterway vessels.



# Sizing up Sleipnir.

The world's largest heavy-lift crane vessel has delivered notable firsts in capability and compliance.

**For any ambitious shipowner, regulations and standards should not limit the pursuit of an innovative idea, but instead should be considered to develop compliant solutions. In a landmark LR project, we worked with Netherlands-based Heerema Marine Contractors to deliver Sleipnir, the world's largest semi-submersible heavy-lift crane vessel. Designed for the set-up and decommissioning of offshore oil and gas facilities, the unit has achieved several notable industry firsts.**

*Sleipnir*, named after the Norse god Odin's stallion, was built by Sembcorp Marine at its Singapore yard and took six years to complete from concept to delivery last June. The unit is equipped with two cranes that have a combined record-breaking lifting capacity of 20,000 metric tonnes, which is strong enough to lift the total weight of 135 blue whales. They can also reach a height of more than 215 metres, another industry first, so could deliver a drink to the rooftop infinity pool of Singapore's Marina Bay Sands hotel. *Sleipnir's* reinforced deck area of 220 metres in length and 102 metres in

width also makes it the largest crane vessel in the world.

The cranes' heavy lifting capacity can be used to install and remove jackets and topsides, as well as utilised for the installation of foundations, moorings and structures in deep water. Station-keeping is by means of dynamic positioning (DP3) or mooring system. *Sleipnir* is also self-propelled with a minimum service speed of 10 knots, with power generated by dual fuel engines that use LNG and marine gas oil (MGO).

## Fuelling innovation

At the time of the initial design, various maritime codes and standards dealing with Gas as a Fuel were evolving (the IGF code on using gases and low-flashpoint fuels had not been published yet) and it was unclear how to classify the tank hold spaces in terms of gas safety.

As *Sleipnir* would have dual fuel engines – MGO (certified as IMO Type III) and LNG and gas capacity set at one-month of fuel – a total bunker amount of 8,000m<sup>3</sup> of LNG was deemed required. During the concept design, various locations for the LNG tanks were explored. These included horizontal cylindrical tanks on open deck, similar tanks on a deck-box recess under the main deck and tanks positioned under the deck-box in the unit's air-gap.

Finally, it was decided that the safest and most effective location for the tanks would be in the insides of the inner columns of the vessel. This way, the tanks would be

perfectly protected during a collision from any side and from any dropped loads from above, as well as not occupying important internal deck-box space.

With eight leg quadrants available for these tanks, the LNG system was split into four sections, where each section would consist of two bunker tanks, lining up with the four independent engine rooms. This would also make it possible to design the LNG system as DP3 compliant, allowing the unit to operate on LNG in DP3 modus.

The positioning of tanks also presented challenges about the integrity of the steel structures as the legs may be out of the water for prolonged periods, while the design brief assumed a -25°C minimum air temperature. It was found that in certain extreme conditions, the LNG tank supporting structure could be cooled to -50°C, which could bring the structural steel within its brittle region. This was solved by using LT steel, certified for use in -50°C temperatures and able to maintain its

toughness, in certain portions of the tank hold space.

Tank choice also posed some challenges. Type C tanks were selected as the LNG bunker tanks because, design-wise, a secondary barrier would not be required. A Type C tank is also considered to be non-leaking for its design life, so the tank hold space could be considered as a safe space and no special measures for materials and ventilation would be required for dealing with a possible gas leakage.

This presented the issue of how to incorporate the hang-off arrangement of the tanks in the design assessment for the Type C tank and its design life. As there are no maritime standards currently available to deal with this, a solution was to combine the vessel motion data from the model testing with a fracture mechanics assessment of the tank support ring, so achieving a fit-for-purpose Type C tank design for the design life of *Sleipnir*.

## Key dates

### August 2013

Heerema contracts LR to assist, as the classification society and third-party independent verification body, for the concept study of a new semi-submersible crane vessel.

### January 2014

Heerema decides to proceed from the concept design towards a basic design and LR is contracted to carry out the design review of the project.

### Q2 of 2014

LR receives the contract for the classification of the two fully revolving cranes, each with a lifting capacity of 10,000 metric tonnes.

### February 2015

Singapore's Jurong Shipyard Pte. Ltd. (now known as Sembcorp Marine Rigs & Floaters) was awarded the contract for the detail design and fabrication of the unit.

### 4 July 2019

*Sleipnir* is delivered: fully commissioned, tested and operational.

### September 2019

*Sleipnir* completes a 15,300 tonnes lift installing the topsides for Noble Energy's Leviathan development in the Mediterranean. This sets a world record for a crane vessel.

# Close calls.

Organisations that focus on high potential risks, not simply the outcomes, can significantly improve their safety performance.



**James Pomeroy**  
LR's Group Health, Safety, Environment and Security Director

**When organisations celebrate accident-free periods, I'm pleased but also curious – are they also focusing on the many incidents that have the potential for serious harm? Every organisation experiences them and they happen more frequently than many realise. As Andrew Hale noted in his 2002 research paper 'Conditions of occurrence of major and minor incidents: urban myths, deviations and accident scenarios', studies of major accidents have found that high potential incidents are often preceded by precursor events.**

Organisations that focus on the potential within an incident rather than the actual outcome can get a fresh perspective on managing safety. For those operating in high-risk sectors, prioritising high potential events or incidents can significantly improve performance. Learning from the potential of incidents provides organisations with a good indicator of their inherent risk and shifts the focus from low consequence injuries to understanding

major injury risk. So, what can we learn from such an approach and what are the considerations when applying a high potential incident strategy?

### Defining an event

One of the reasons why high potential events don't tend to be commonly adopted is that, unlike lagging indicators, no standardised definition exists. The most common definition is an event that, under different circumstances, might easily have resulted in a fatality. In other words, if one factor had been different, someone would have died as a result of this incident. Some organisations, however, apply a lower threshold and include potential incidents that could have resulted in life-changing injuries. External reporting is also patchy and organisations that do disclose how they manage high potential incidents use different methodologies, so it is harder to make comparisons. This may change, however, with the inclusion of high potential incidents in the updated

GRI 403: Occupational Health and Safety 2018, the reporting criteria for corporate sustainability.

### Identifying incidents

A prerequisite for any organisation that wants to learn from its high potential incidents is to establish a method to identify them. Given that most do not result in harm, a good starting point is exploring the near miss, observations and safety reporting systems to identify the incidents that, in slightly different circumstances, could have resulted in very different outcomes. There are a number of methodologies which are used to identify the potential harm of an incident.

Some involve an informal judgement, while others use formalised methodologies, including a risk matrix, severity scales, decision trees and algorithms. Whatever methodology is used, it is good practice to agree on measurement values so that everyone involved in conducting the reviews reaches similar conclusions.

### Investigating incidents

Not all incidents are equal in outcome, and some have greater potential for learning and improvement. In a world of finite resources, it's important to prioritise incidents so that investigations are proportionate to the potential, not solely the actual outcome. The 'scale and scope' of a high potential incident should be greater and have more resources dedicated to it than a minor lost-time incident. A risk-based approach

to investigations, categorising them by potential consequences, is the most common method to ensure resources are proportionately applied.

Although employees who experience high potential incidents while at work will identify many of these events, they will also arise when assets fail. Incidents often lie dormant until identified through inspections or failures. Establishing a strong link between the inspection regimes of safety-critical assets and processes, and the incident reporting system, is essential. High-risk organisations also experience them in their operations, as will providers of safety-critical services and products. Occupational safety and health (OSH) professionals will find that establishing a common methodology for reporting all high potential events can be advantageous and will provide an invaluable metric for the organisational-wide management of risk (see the 'HiPo incident' graph below).

### Cultural enablers

The importance of organisational culture is often underplayed in high potential incident strategies. Given that many high-risk events will only be apparent to those performing the work, dedicated programmes focusing on these incidents tend to be bottom-up and rely on the participation of frontline personnel to share their experiences. This requires a system that encourages open and accurate reporting without fear of any recriminations. Training and communication will help to establish the necessary trust, providing a forum to





### Five factors contributing to a significant number of incidents

1.

Inadequate testing of the atmosphere

2.

Inadequate ventilation of the space

3.

Inadequate isolation of hazards

4.

Inadequate supervision

5.

Inadequate rescue plan

discuss concerns around reporting and explaining why detailed investigations are being undertaken into incidents where nobody was hurt.

Training will also deal with a common factor associated with these incidents – risk normalisation. This describes the process in which individuals gradually become accustomed to high-risk situations and no longer recognise the dangers. Workplace transportation provides a good example. Often individuals don't recognise the dangers of interacting near moving vehicles because their risk perception depreciates, and yet it remains the second highest cause of occupational fatalities. OSH practitioners who are new to high potential incident reporting should be aware of how the information gleaned from reporting them will be received by leadership teams – and prepare the ground.

This is important because the way managers respond to mistakes, lapses and deviations that investigations reveal will shape the culture and determine workers' future engagement. If OSH reporting has been historically focused on low consequence injuries and reducing rates of accidents, managers may be under the impression that all is well and good. They may feel they have sound control over risk. It's not unusual for managers to be surprised and even fearful when introducing high potential incident reporting, because they realise how close the organisation has come to major incidents on a regular basis. Organisational factors, such as workplace set-up, scheduling and task planning often underlie many of these incidents. Management needs to be ready to acknowledge this and respond accordingly.

These challenges are worth acting on because high potential incidents help leaders maintain 'chronic unease' and appreciate the fallibility of their current controls. Emphasising the importance of focusing on high potential incidents throughout the organisation also helps challenge the myth that serious accidents are freak events and reinforces the importance of critical safety controls.

#### Precursor analysis

When organisations improve their reporting and understanding of these incidents, they often find that most of the serious incidents involve a small number of high-risk activities. At LR, for example, four activities account for more than 70% of all its high potential incidents: driving, working over water, confined space entry and work at height. In-depth studies of these four activities will often reveal a Pareto distribution whereby three-to-four precursors account for 80% of the incidents. There are various definitions of precursors. My preference is "a high-risk situation in which controls are either absent, ineffective or not complied with, and would result in a serious or fatal injury if allowed to continue". Studies of confined space-related high potential incidents provide a good example of this, with five factors contributing to a significant number of incidents (see box above).

This level of analysis is invaluable. It can engage frontline workers so that they understand the variance between the procedure and practice, while also targeting supervision, training and monitoring activities. Precursor analysis also enables more evidential interventions to be taken

where outcomes can be measured. This is particularly important when changes in organisational factors such as scheduling and technology need to be made.

#### Corrective action

The term 'one barrier from a catastrophe' is often used in connection with high potential incidents and succinctly describes those that could have been much worse but for one factor. This single factor is often luck, such as an individual's actions or location, an item of equipment, the time of day or even the weather.

Investigations into high potential incidents often identify the fallibility of controls for high risks, many of which are reliant on controls at the bottom of the hierarchy, or single barriers that represent a single point of failure. Corrective action provides the opportunity to combat this by establishing more effective controls. The following tests provide a healthy challenge to any corrective action:

**Proportionality:** is the corrective action proportionate to the risk and does it improve control by removing, replacing or isolating the hazard? Behavioural controls, such as re-training, do little to prevent reoccurrence, while procedural controls may add complexity and potentially increase the risk of a repeat incident.

**Singularity:** does the positive change improve the overall strength of the system by resolving single points of failure and add additional layers of defence? This could involve introducing additional measures to prevent or detect variance, or recovery

### LR's LifeSavers: safety first.

*The award-winning safety-training initiative pioneering the way we tackle high-risk environments to support our customers in safeguarding their ships and assets.*

In early 2016, LR's LifeSavers training programme was introduced to enhance the safety behavioural culture in our field surveyors and achieve the highest levels of competence for high-risk activities to support our clients and partners. Building this programme not only involved defining the critical safe behaviours, but also embedding the programme into our learning processes and measuring incidents to help identify future safety trends.

The cost of lost time to the marine industry through incidents is a major issue for the sector – there is no consolidated view of the number/costs of accidents. However, the LR Foundation are undertaking a piece a research this year to gather this data.

LR's LifeSavers has now been extended to include practical field training and was recently recognised by winning the prestigious Shell Maritime 'Best Behavioural Safety Initiative' award in 2018 and 2019.

#### Why did we introduce practical training into the programme?

In 2016/17 we were experiencing incidents in high-risk activities whilst carrying out our duties to support our customers in keeping their vessels and assets safe and secure. In a total of 19 high potential incidents, some of which resulted in injury to our personnel while others had the potential to cause serious harm. These incidents were all related to common high-risk activities that our global team of surveyors regularly undertake in order to inspect and verify the safety of vessels, platforms and refineries – these activities include – boarding vessels at sea, working at height, confined space entry and driving.

It takes a combination of leadership, procedures and equipment to create and maintain a positive behavioural culture. Competency then enables a strong safety culture; when employees understand the safe methods of working and the consequences of not following procedures, they are then more likely to make safer choices and adopt better behaviours.

Traditionally, many of the high-risk activities surveyors face, such as using pilot ladders, have been learnt on the job with no formal safety training. It's not helped by the fact that some countries do not require practical training for some high-risk tasks.

#### What's changed?

LR's LifeSavers programme was extended to include practical field training with a dedicated syllabus on four critical risks – boarding vessels at sea, working at height, confined space entry and driving. We made sure all training was realistic, impactful and consistent wherever it was delivered across the world.

Over a 10-month period, we visited 24 technical training schools to review their capability and willingness to partner with us to develop a bespoke and consistent training course. Eight training centres were approved and appointed in each region of the world, so that all our field surveyors would have a consistent learning experience to help them work safely in different high-risk environments.

Since introducing the practical field programme, we have identified all those who require training, and have to date trained 2,100 field surveyors across 92 countries in 24 months, regardless of location or local legal standards.

#### What are the results so far?

This pioneering approach to safety training for high-risk activities is gaining momentum and represents a significant investment in our people's safety. We have measured success in three ways:

1. Since launching the training, we've seen a 63% in reduction of high potential incidents related to the four critical risks detailed above. To date, no individual who has taken the training has been involved in a safety incident related to these four risks.
2. Since the training was introduced, there has been a sustained reduction in audit findings, both internal and external, relating to the management of these risks.
3. We've seen a 90% change in behaviour of the attendees who said, when asked after their training, that they have changed the way they work. Some 94% said their confidence has been raised and they now feel better equipped to deal with any hazardous situations.

barriers that increase the capacity to fail safely.

**Fallibility:** when we accept that human error will occur and recognise that control measures are never 100% effective and will deteriorate, our perception on the assurance process changes. Accepting the fallibility of controls helps challenge the assumptions we make when developing corrective actions.

Many organisations establish incident review panels to peer-review investigations and review the strength and appropriateness of the corrective actions. As behaviour-based safety pioneer Dominic Cooper notes, focusing on high potential incidents requires organisations to change their focus from a reactive view of responding to incidents, towards a proactive examination of the conditions that lead to major accidents.

It also requires organisations to reassess what they view as success and focus on how effective their controls are. A mature organisational culture means employees trust the process and believe that reporting will be welcomed. Organisations that can navigate these challenges will, however, ensure that their efforts are focused on reducing their significant risks. This must be the primary obligation of every OSH practitioner.

# Supporting the Mercy Ships mission.

Ensuring a new hospital vessel for Mercy Ships is fit for purpose is just one of the ways LR uses its expertise and people to support the charity's vital work.

**For some of Africa's poorest citizens, the arrival of a Mercy Ships vessel in port holds the promise of better times ahead. The charity, which delivers free medical and dental care from a converted ro-ro ferry, can offer a lifeline to those in desperate need of healthcare.**

Like all organisations, the charity is looking to improve its ability to deliver services and has invested in the 36,600 GT *Global Mercy*. At a length of 174 metres and 28.6 metres in breadth, it will be the world's largest purpose-built civilian hospital ship. Currently under construction in China, the

ship is due to be delivered later this year before moving to Europe for outfitting with the aim of commencing service in the first half of 2021.

Since 2011, LR has supported Mercy Ships in the design and build of *Global Mercy* and will support the vessel throughout its life. The ship will have two hospital decks and be capable of carrying 500 passengers when sailing and 950 when in port. There will be a total of 641 beds in the 277 cabins.

Mercy Ships, founded in 1978 by Don and Deyon Stephens, has worked in

more than 70 countries. It has provided services valued at more than \$1.53 billion, with more than 2.71 million direct beneficiaries. The charity has performed more than 95,000 surgeries and trained over 40,800 local professionals, leaving a long-lasting impact.

At any given time during its 40-year-plus history, Mercy Ships has had between one and three ships in service. Currently, the *Africa Mercy* is the only active ship, but it represents greater capacity than all its previous hospital ships combined.

The charity shares LR's sense of purpose and values of caring, sharing expertise and doing the right thing. We are proud to support its invaluable mission. To date, LR has provided several years of classification services to Mercy Ships free of charge.

Joep Bollerman, LR's Passenger Ship Support Center Global Manager, has visited Mercy Ships' offices in Lindale, Texas, on several occasions for meetings and to provide training. "I am always impressed by the passion and dedication of all involved with Mercy Ships," he says, "and I am very proud of LR's involvement with Mercy Ships."

The charity's mission resonated strongly with LR Senior Surveyor Nima Moin, who first volunteered with Mercy in 2017. He joined 40 other engineers from around the world to provide free technical support onboard the *Africa Mercy* hospital ship while she was in dry dock for maintenance. Nima helped repair the vessel's machinery and equipment to ensure the vessel was safe to operate and looked after the installation of new hospital equipment and integration with the ship's existing systems. Surveyors from LR's Netherlands office inspected *Africa Mercy* and approved the 'floating hospital' for another year of vital service.



## Mercy Ships' record-breaking chocolate ship.

Last month in Rotterdam, Mercy Ships Holland broke the Guinness World Record for the largest chocolate bar ever made. The mammoth creation, produced by chocolatier Frits van Noppen, measured 26.8 metres long and 14.3 metres high and featured the image of the charity's new hospital ship, *Global Mercy*. It weighed in at over 13,000 kilos and covered 383.4 m<sup>2</sup>, more than double the current world record of 142.3 m<sup>2</sup>.

LR Senior Surveyor Nima Moin measured the record-breaking chocolate creation, which will raise money for the important work undertaken by Mercy Ships. The sale of parts of the giant chocolate bar has already raised more than €500,000 to help provide medical care for thousands of people in need.

Last year, to celebrate 150 years in the region, the LR Netherlands team partnered with Mercy Ships to raise money for the charity's Biomedical Capacity Building Program, which will support infrastructure and agriculture through partnerships with universities, hospitals and clinics. Approximately 60 LR employees donated between one and five days of annual leave to Mercy Ships, which raised €17,140 for the charity.

Ginger Garte, LR's Americas Environmental and Sustainability Director, was invited

onboard *Africa Mercy* last year for an opportunity to meet the crew. "I was very moved by the experience. It was amazing to witness 400 volunteers, working together with the same aim in service of others," she says.

Ginger met with Emmanuel Essah, Biomedical Projects Manager at Mercy Ships. The money that Nima and the Netherlands team raised for capacity building projects will help to ensure that Mercy Ships' technical knowledge and expertise have a practical legacy once the

charity has left the region. This includes setting up local infrastructure and training for a dental school, hospital and clinics, as well as a center for medical healing and recovery.

Emmanuel Essah warmly welcomes LR's support. "I would like to thank all the LR individuals that are supporting the work Mercy Ships is doing," he says. "We are so grateful and very excited to see how your support is helping the countries Mercy Ships visit. Thank you for supporting us in changing the world one country at a time."

# Joining the royal fleet: Prince of Wales commissioned in Portsmouth.

HMS Prince of Wales, built to LR's Naval Rules, was commissioned into the UK's Royal Navy fleet in a ceremony at HM Naval Base in Portsmouth, UK, last December and LR was represented at the event by Commercial Director, Andy McKeran (pictured).

HRH The Duchess of Cornwall, the ship's Lady Sponsor, and HRH The Prince of Wales, joined over 2,000 guests at the ceremony. Commanding Officer, Captain Darren Houston, read the commissioning warrant to the crew and attendees that were gathered in the hangar which will soon be home to F-35 jets and a variety of helicopters.



It was a huge honour to attend this prestigious ceremony and see this wonderful ship commissioned into the fleet. LR is proud to have been involved in this project since its inception, and I thank our entire naval team for their years of hard work throughout the design and build processes of the most advanced ships ever built for the UK Royal Navy.

Andy McKeran



UK MoD © Crown copyright 2019

## LR selected for UK MoD's Type 31 frigate programme.

Team 31, a consortium led by Babcock, will deliver the UK Ministry of Defence (MoD)'s Type 31 general purpose frigate programme which will provide the UK Government with a fleet of five efficient and effective ships. LR has been selected to provide classification assurance services including plan approval supply chain support and build supervision of the Type 31. The ships will be designed to LR Naval Ship Rules with a comprehensive set of notations and associated certification.

The design, 'Arrowhead 140', is a new technology-enabled global frigate class of ship with the ability to deliver a range of peacekeeping, humanitarian and warfighting capabilities. The cutting-edge design will equip seafarers with real-time data to support immediate and complex decision-making.

"The value of having Lloyd's Register, an independent organisation, present throughout the entire build programme covering nearly every aspect of the design, was very beneficial. LR were involved in most systems, for example: propulsion systems, lifting gear, electrical power supply, only stepping short for combat/mission systems. This hasn't always been the case with Naval ships so there was an educational element through the first aircraft carrier build programme [HMS Queen Elizabeth] to ensure that all parties understood what LR's roles and responsibilities were. It was a learning process for everyone purely because of the sheer scale and complexity of the vessels. We applied the lessons learnt from the HMS Queen Elizabeth project which enabled a much more efficient process for class certification of HMS Prince of Wales."

Martin Douglas, ACA Programme Director

# Portcast brings next-generation cargo predictability to the shipping industry.

Award-winning, Singapore-based Portcast uses innovative technology to improve maritime cargo predictability. Nidhi Gupta, its Director and co-founder, speaks to Horizons about the company's success.

Words: Viv Lebbon

**Last year, at Hong Kong Maritime Week, Portcast won the inaugural Captain's Table, an initiative launched by the Young Professionals in Shipping Network. This award provides a platform for young innovators and entrepreneurs to connect with the industry and showcase their ideas, resulting in a cash prize and business mentorship from LR.**

Portcast, a machine learning platform, uses real-time external data to predict cargo flows, which helps logistics companies with demand forecasting, automated pricing and capacity utilisation. Co-founder and Director Nidhi Gupta spoke to Horizons about the company's success at the Captain's Table and how the platform can transform maritime's cargo predictability.

**Please explain a little more about Portcast and what challenges it helps to solve?**

Portcast makes shipping companies profitable by predicting the cargo demand and arrival times accurately. We combine internal transactional data from shipping companies with real-time external variables and proprietary machine learning to predict the cargo volumes, impact on pricing, capacity optimisation and estimated arrival at the port of discharge. Using our technology,

shipping liners and forwarders can plan the capacity and shortfall ratios and price more dynamically. Also, manufacturers and forwarders can track their vessels and containers in real-time, at any port in the voyage. We've seen accuracies of over 90%, saved thousands of hours and uncovered revenue potential for every customer we've worked with.

**Where did the idea for Portcast come from?**

I have worked for a decade in the logistics industry as part of DHL Asia Pacific in various roles, including management consulting, business development and strategy. So I've seen the inefficiencies, or rather opportunities, that the industry has and where technology has a role to play. In discussions with my co-founder, Lingxiao Xia, whose background is data science and product development, we found a niche within the logistics and shipping industry where data science can help companies be more profitable. We spoke with more than 30 companies to validate the problem statement and how the technology could help them. That's how Portcast started.

**How did you find the team to work on the technology?**

I met my co-founder, Lingxiao Xia, at the Entrepreneur First Singapore accelerator.

His tech background complemented mine and we decided to validate our idea, business model and technology with customers. We then hired the right team of data scientists and software developers to help us build this product.

**How has your professional background helped you with Portcast's concept?**

Serving the logistics market requires a deep understanding of the domain in order to build the right product that fits customer needs. One also needs to be most effective in communicating the value proposition to customers. That's where my work experience in the industry has helped.

Other Captain's Table 2019 finalists included Quaychain, Tow-botic Systems, SeaRoutes, Irwin Rotational Lining and Marified. Each presented a solution to different industry problems, ranging from the automation of the bunkering process to a safer alternative to traditional tugs and towlines.



## 'A leader needs to show the ambition to bring change'

More from Portcast's Co-founder and Director, Nidhi Gupta

When talking about her team and previous roles, Nidhi describes a strong leader as showing clear ambition to bring change, while creating a vision that aligns people and then empowers them to help achieve that vision. At Portcast, she looks for those who are not simply focused on their role description, but also incentivised by the vision and opportunity of bringing change and being responsible for building a transformational product end-to-end. This follows Nidhi's biggest decision of her career – starting her own company after spending a decade in a corporate environment. It's a daily rollercoaster and a vast learning curve for Nidhi as an individual and a professional. Having to handle a two-year-old start-up and a nine-month-old baby means Nidhi's work-life balance is a challenge. Yet it has been helped by Portcast's flexible work environment and a strong support structure in her home life.

For shipping in general, Nidhi believes the availability of data has meant the wider industry has a much better understanding of world trade and economic patterns. Accompanied by technological innovation, this has meant digital providers are poised to bring transformational impact on how the industry works. Going forward, Nidhi sees the maritime value chain echoing how airlines operate today with online booking (no brokers), dynamic pricing, seamless tracking, international data standards, predictive (and prescriptive) control towers and insurance products to safeguard against delays.



# What's happening in our world.

The world doesn't stand still and neither do we. Catch up on the latest developments at LR from our teams around the globe.

## Industry leaders join forces on ammonia-fuelled tanker project.

**MISC Berhad, Samsung Heavy Industries (SHI), LR and MAN Energy Solutions have announced that they will work together on a joint development project (JDP) for an ammonia-fuelled tanker to support shipping's drive towards a decarbonised future.**

The creation of the alliance has been motivated by the partners' shared belief that the maritime industry needs leadership and greater collaboration if shipping is to meet the IMO's 2050 GHG emission target. It's an ambition that requires commercially viable deep-sea Zero-Emission Vessels (ZEVs) to be in operation by 2030.

Ammonia is just one of the pathways towards zero-carbon emitting vessels. The partners recognise that the shipping industry will need to explore multiple decarbonisation pathways and hope their collaboration will spur others in the maritime industry to join forces on addressing this global challenge. The partners believe that the creation of such alliances will send a clear message that shipping can progress itself to fit times and circumstances, ahead of regulatory action.



Nick Brown, LR's Marine & Offshore Director, said: "As we start the 2020s, we are proud to be among a four-party team to make deepsea ZEVs a reality within this decade. The IMO's 2050 GHG ambitions, which prescribes that international shipping must reduce its total annual greenhouse gas emissions by at least 50% of 2008 levels by 2050, require substantial and collaborative

input from all maritime stakeholders. We are confident the lead taken by this partnership will encourage others to work collectively to address the challenge. These are exciting times as we commence the industry's fourth Propulsion Revolution. During LR's history we have supported the transition from wind to coal to oil and now look forward to safely decarbonising."

## LR awards Wärtsilä digital system approval in principle.

**Wärtsilä has been awarded LR's Digital Accessibility Level 2 SAFE SECURITY Safe Security AiP for its Data Collection Unit (WDCU) and the network architecture concept for its new-build main and auxiliary machinery.**

LR's ShipRight procedure for the 'assignment of digital descriptive notes for autonomous and remote access ships' defines an Accessibility Level (AL) to a digital system. In this case, remote access for monitoring the ship's main and auxiliary machinery using external

connection is enabled and may be accessed from systems located ashore. As a result, LR awarded Wärtsilä's system with AL 2 Digital Access for Autonomous/ Remote Monitoring.

The ShipRight procedure is based on a high-level assessment focused on the risks associated with the 'digitalisation' of a ship's operations. This includes cyber risk and related areas such as the human factor, network architecture and software assurance. As part of this AiP, LR assessed that an appropriate cyber security

governance system was in place to mitigate the risk of introducing vulnerabilities to cyber-attack or other unauthorised access during the design, procurement, construction and installation of the digitally enabled systems.

At a time when information and operational technologies onboard ships are being networked together, building resilience against unauthorised access, software failures or attacks on ships' systems has been identified as a risk considered in the design and managed at that level.

## Safety Accelerator wins Global Innovation Award.

**The Lloyd's Register Safety Accelerator has been awarded the 2019 Lloyd's List Global Award for Excellence in Data and Technology Innovation. The Global Awards, which were announced in January, are a culmination of the Lloyd's List's Excellence in Shipping Awards 2019 – the industry's flagship awards programme that recognises and rewards excellence across all sectors of maritime.**



In December, the Safety Accelerator was presented with the European Lloyd's List Award for the same category, at an exclusive ceremony in London. Now, with this latest accolade, the programme has been recognised on a global scale for its excellence and impact in innovation, setting it apart from the competition worldwide.

The Safety Accelerator was shortlisted alongside fellow regional winners. A distinguished and industry-leading awards panel felt that the programme, the first of its kind globally, embodied everything that the Lloyd's List Awards were established to champion, displaying important and

impressive global impact for safety and risk in critical industries, including the maritime sector.

Alastair Marsh, LR CEO, said: "All of us at Lloyd's Register are delighted to have won the Lloyd's List Global Award for Excellence in Data and Technology Innovation for our Safety Accelerator programme, especially

following our victory in this prize category at the Lloyd's List Europe Awards in December. The Safety Accelerator spurs collaboration between digital start-ups and industry with its challenges programme, bringing new technology innovation to solve critical safety issues and highlighting the merits of working together to make the world a safer place."

## LR awards HHI approval in principle for frigate design.

**LR has awarded approval in principle to South Korean shipbuilder Hyundai Heavy Industries (HHI) for the design of its HDF-3800 frigate.**

The design allows for the frigate to be equipped with modern weapons and sensors. It will be able to undertake Anti-Air Warfare (AAW), Anti-Surface Warfare (ASuW), and Anti-Submarine Warfare (ASW) missions. Additional combat capabilities include Electronic Warfare (EW), Land Attack Warfare (LAW) and the capability of anti-drone systems and to launch and

recover unmanned aerial vehicles (UAVs).

Furthermore, the ship will adopt the new HHI Hi-Bow hull, reflecting the most modern and hydrodynamically efficient design to maintain operational and war fighting capability in extreme environmental conditions.

By awarding this AiP, LR has helped the yard assure the integrity and reliability of the design and demonstrate compliance with government regulations, industry codes and standards.



## LR FOBAS wins GREEN4SEA Clean Shipping Award.

Pictured: Maria Kyratsoudi, LR Global FOBAS Business Development Manager receiving the Clean Shipping Award from Katerina Tsolaki, Chief Scientific Officer, from ERMA FIRST S.A., the award sponsor.



## LR certifies CETENA's 'ASSIST' digital solution for use on Seven Seas Splendor.

**LR has certified the 'ASSIST' digital solution, a tool developed by CETENA that replaces hard copy Safe Return to Port (SRTp) documentation with a tablet-based solution allowing for key safety manuals to be centrally updated.**

ASSIST – a shipboard operator Smart Assistant for Safe Return – was installed on the 55,000 gt *Seven Seas Splendor*, Regent Seven Sea Cruises' newest fleet addition, which was built at Fincantieri's Ancona Shipyard.

Under SOLAS, all vessels require a SRTp Operations Manual and this digital system – the first tool to replace hard copy SRTp

documents – will substantially reduce the amount of paper documentation that a ship needs to store and avoids the wear and tear of hard copy manuals as well as human errors relating to sheet replacements and physical updates.

LR first classified the use of a SRTp onboard a passenger ship five years ago and this milestone has helped to develop a SRTp culture focused on improving onboard procedure and helping crew identify key risk factors.

The installation of ASSIST was undertaken in collaboration with the cruise ship's flag, the Republic of the Marshall-Islands (RMI) Maritime Registry, the

shipyard (FINCANTIERI) and the system manufacturer (CETENA).

Alessandro Bonvicini, Head of Design for Safety, CETENA, said: "The fully independent software system greatly reduces potential for errors during emergency situations, reduces the environmental footprint of the paper manuals, and ensures any changes made are updated to the central database immediately. It is the first time such technology has been approved by a Flag State Administration for use onboard a ship, thanks in large part to the certification by Lloyd's Register. The installation of the SRTp system was performed by Fincantieri shipyard during the ship's construction."

## Almi Tankers becomes one of first maritime firms in Greece to be awarded ISO 27001 from LR.

**Almi Tankers S.A. has been awarded ISO 27001 certification for its Information Security Management System (ISMS), demonstrating that the company has reached the high quality demanded from this internationally recognised Standard.**

The certificate was presented by Philippa Charlton, BA & IS Marketing Director at LR to Almi Tanker's CEO Captain Stylianos Dimouleas at a ceremony at the company's headquarters in Athens.

Almi Tankers also celebrates a decade of quality, environment, health and safety management excellence this year, with the ongoing, continual improvement of its services and processes. The company also holds ISO 9001, ISO 14001 and ISO 45001 certificates with the latter achieved following a recent successful migration from OHSAS 18001.



Pictured: (left to right) Captain Stylianos Dimouleas, CEO, Almi Tankers, Philippa Charlton, Marketing Director, Business Assurance & Inspection Services, LR,

Panagiotis Kamarados, South East Europe Technical Manager, Business Assurance, LR, Petros Alafasos, Client Relationship Manager, Marine & Offshore, LR.

## Drone inspection pilot flies high for Adani Ports.

**Adani Ports and Special Economic Zone Ltd (APSEZ) based in Mundra, India, has now completed a successful pilot to trial Port Crane Inspection Services from LR using an unmanned aerial system (UAS) – more commonly known as a drone.**

During the proof-of-concept exercise, the drone technology was used to inspect traditionally hard to reach areas such as the crane's forestay, backstay, underneath

the back reach, underneath of boom and A-frame-to-stays connections.

"The pilot has been a fantastic experience," commented Adani Head of Engineering & Projects, Jimmy Bhansari. "Traditionally we have used scaffolding to enable surveyors to inspect cranes and it has been difficult to access certain areas. The drones have helped us save time while removing the restrictions on where we can inspect, with less risk involved. We see this as

revolutionary in port crane maintenance operations."

Adani Ports plans to use the drone again during the next inspection to highlight changes in the condition of the crane which will help identify areas of focus for future maintenance work. The pilot follows a twelve-year working relationship during which LR has provided port crane new build quality assurance, quality control and turnkey services to various Ports of APSEZ.

## Common Structural Rules Software updated with multiple improvements.

**Common Structural Rules Software LLC, a joint venture company formed by LR and ABS, has released updates with new functionality added to both the Common Structural Rules (CSR) Prescriptive Analysis (PA) and CSR Finite Element Analysis (FEA) applications.**

CSR PA now provides the flexibility to allow users to directly import the NAPA cross sectional structural data. Using

this feature, users can seamlessly create new ship models using an existing NAPA model. PA also now includes features to model multiple small openings within transverse primary supporting members. The transverse assessment will take into consideration these openings while performing various calculations.

The FEA software is now enhanced to carry out local model analysis. This

feature will allow a fine mesh model to be built outside of the global model allowing multiple engineers to work simultaneously on the design. Both the PA and FEA software are also now compatible with the Windows 10 operating systems, as well as Windows 7.

The updated software is available for download at [www.commonstructuralrulessoftware.com](http://www.commonstructuralrulessoftware.com).



LR Class News 2019 roundup now available.

Covering classification and statutory alerts and bulletins, the roundup can be downloaded at <https://info.lr.org/classnews2019-roundup>



## Get in touch

Please visit [www.lr.org](http://www.lr.org) for more information



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