

Horizons

April 2017 • Issue 47



Building trust in digital

Find out how LR is enabling a cyber-smart marine and offshore industry



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Comment

Ensuring the safety of connected ships



Nick Brown

LR's Marine & Offshore Director

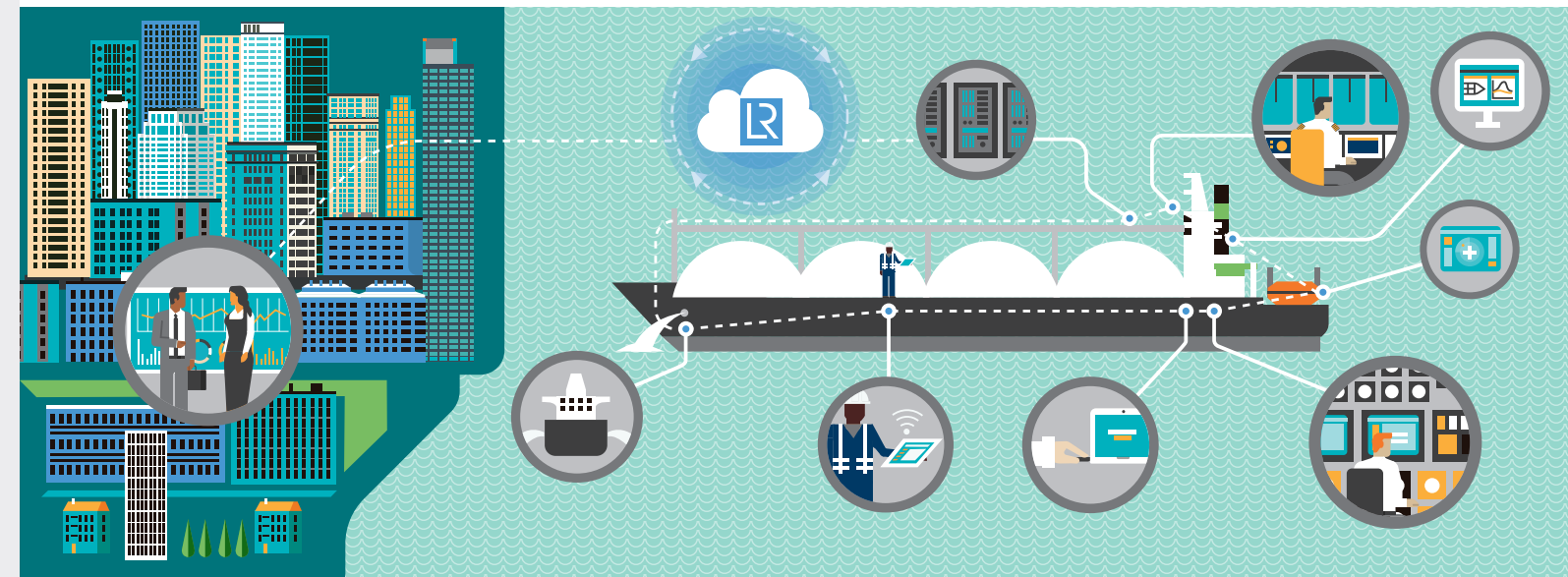
The new level of connectedness across the industry presents opportunities for improving efficiency and performance – but also safety and security challenges for equipment manufacturers, owners and operators alike.

Connectivity should not mean that a vessel is less safe. Last year, we launched two class notations and guidance to ensure that we have the guidelines (and rigorous assessments of the systems in place) to make sure that a connected ship is no less safe than an unconnected ship.

Cyber security is becoming an increasingly important element in the risk profile of critical assets that are connected. It is not just the information and communications technology (ICT) that needs to be considered, but also the operational technology (OT) of the vessel and the interdependencies of these systems.

LR has invested heavily in this area and is now launching services to address the awareness of overall operational risk and software interdependencies. These services will help the safe and secure integration of ICT and OT, taking into account all systems on board and – critically – on shore, how they are designed and installed, how they connect, and how they will be managed.

We are going beyond traditional engineering, combining LR's unparalleled knowledge of, and data on, marine components, systems, procedures and regulations to develop state-of-the-art digital tools in collaboration with strategic technical partners. By addressing the risks and building a safe and secure foundation, we are helping our clients to realise the benefits to their business available from cyber-enabled technology as well as preparing them for forthcoming regulation.



LR's new Cyber Secure services – Building trust in digital

A unique, world-class approach to providing cyber security services to the marine and offshore industry

Our Cyber Secure services are designed to help a business assess its cyber security readiness, identify possible threats and quantify their potential impact, making cyber security part of business as usual.

The new offer will deliver cyber security gap analysis and other readiness services to owners, operators and other clients based on the United States Coast Guard (USCG) strategy on cyber security and forthcoming IMO regulations, as well as the cyber security best practice already established in other industry sectors, such as the naval sector.

There is no one 'magic' solution and needs vary from business to business, so LR's approach is one that tailors the services we deliver to each individual business, developing a fully bespoke management strategy. We are also

able to provide specialist awareness and technical training to embed cyber security within the company's thinking and procedures so it seamlessly becomes a part of business as usual.

We have chosen to collaborate with QinetiQ, a leading science and engineering company operating primarily in the defence, security and aerospace markets. Through this partnership, LR can bring the benefits of QinetiQ's world-leading cyber security skills, knowledge and experience to complement our own expertise in marine and offshore risk management and deep knowledge of our clients' business needs.

Cyber Secure is the second in four streams of cyber and digital transformation services that LR is launching. The first stream, 'Cyber

Safe', encompassed the guidance and procedures for cyber-enabled ships and autonomy levels that we launched last year and now underpins innovative projects like the design of the next level of cyber-enabled ship – the 38,000 dwt i-Dolphin smart ship project, a joint industry project with China State Shipbuilding Corporation (CSSC).

LR doesn't just develop services related to the risk of cyber-based technologies but also develops services related to the benefits, and will soon launch services (currently being piloted with selected clients) to unlock data potential and facilitate data-driven insight for driving better performance and safer, sustainable operations.

Find out more at
info.lr.org/cyber

NEWS

V.Group to run new initiative with LR to drive performance improvements

V.Group has signed an agreement with LR to run an initiative on port state control performance improvement on board V.Ships and ITM-managed vessels over the next six months.

Drawing on 2016 data on port state control inspections and vetting analyses, LR developed the initiative to help ship- and shore-based teams quickly identify problems and manage the root cause. The data collated is confidential and only used by V.Group's compliance team to identify how to continuously improve their safety culture at sea.

Matt Dunlop, V.Group's Group Director of Marine Operations, said: "This is an internal initiative with the aim of continuously improving safety on board our vessels. We have a long-standing relationship with Lloyd's Register and their experience and knowledge of our management systems has been fundamental in developing a campaign that is relevant and meaningful to our seafarer colleagues."

Scott Kennedy, LR's UK&I Marine Operations Manager, added: "Safety is paramount to everything we do at Lloyd's Register and I look forward



LR's Scott Kennedy (left) with V.Group's Matt Dunlop



Subsea 7's Seven Arctic

to utilising the capability of both partners to continuously improve V.Ships' fleet safety. This initiative will only strengthen our great relationship with V.Ships."

New Subsea 7 heavy construction vessel built to LR class

Subsea 7's newest heavy construction flex-lay vessel, *Seven Arctic*, has been designed and built to LR class. Designed to meet the demands of deepwater and harsh environments, she can work at depths of 3,000 metres and features three offshore cranes, the largest of which is capable of a 1,000-tonne lift.

Built by Hyundai Heavy Industries (HHI), *Seven Arctic* measures 162.3 metres in overall length with a breadth of 32 metres. The vessel also features a 600-tonne top tension tiltable lay system for pipe laying and is fitted with six diesel generators producing just over 25,000 kw to supply eight electric propulsion thrusters.

All thrusters can be automatically controlled by the cutting-edge dynamic positioning system and the vessel is suitable for operations defined in LR's DP(AAA) Class III notation. Additional system redundancy is afforded with the physical separation of all propulsion

and control equipment throughout the vessel to prevent failure in the event of fire or flood in any one compartment. The equipment is physically separated throughout the vessel in line with these requirements.

All safety features of the vessel have been installed in accordance with the Special Purpose Ship Code 2008 and include an automated water-mist fire-fighting system, working alongside an advanced fire detection and safety control system.

The vessel is equipped with winterisation features to enable operation in cold climates and the hull has been built to comply with LR's Ice Class Notation 1D.

LR hosts world's first full-scale numerical modelling workshop

LR hosted the world's first workshop on full-scale hydrodynamic computer simulations at our Global Technology Centre in Southampton in November 2016. Ship designers from around the world came together with the aim of building confidence in the accuracy of ship-scale computational fluid dynamics (CFD) modelling within the marine sector.

This is the first time that the industry has openly compared full-scale CFD with

comprehensive measurements. Through comparisons of blind simulation results submitted by participants and the speed trials carried out by LR, the workshop demonstrated that ship speed could be predicted within approximately 4% of actual trial speeds.

The workshop is a key step on the path to making CFD the final verification of ship-scale design performance, rather than relying on scale model tests. The transition to this approach will help reduce design costs and provide a greater opportunity to develop more energy-efficient ship designs.

The subject ship of the workshop was a 16,900 dwt general cargo vessel – an ideal candidate for CFD validation, as the vessel has a simple geometrical configuration: single screw, no thrusters, no bulbous bow, and no energy saving devices.

LR contracted to class Federal German seagoing fleet

The Federal Waterways and Shipping Administration (WSV), represented by the Waterways and Shipping Agency (WSA) Bremen (a branch of the German Government), is transferring 63 ships into LR class to support the seagoing fleet of vessels owned by the German authorities.



Arkona, one of the Federal German vessels that will transfer into LR class



LR's CFD workshop

The vessels, under the departments of the Local Offices for Waterways and Shipping along the German Coast, the Federal Maritime and Hydrographic Agency, the Federal Police and Federal Customs Service, began to enter into LR class on 1 January 2017.

Thomas Aschert, LR's Marine and Offshore Area Manager for North Europe, said: "We are particularly delighted to have been granted this prestigious contract by the German Government. We believe we offer a very attractive choice for German clients who are looking to reduce risk and improve efficiency through agile and efficient support of their operations. "The decision to make Hamburg the centre for Marine and Offshore in

the North European area shows how important this market is for Lloyd's Register. Our German operations have grown in recent years, with over 300 colleagues serving our local German clients. We are still expanding to fulfil not only the current demands, but also to deliver alternative solutions leading to improvements that will benefit our clients in line with national and international requirements."

LR's Ship Emergency Response Service (SERS) boosted by Seasafe acquisition

LR has added to its portfolio of advanced data, digital and software solutions with the acquisition of Seasafe Marine Software & Computation (Seasafe).

An unexpected incident, such as a grounding, a collision or an explosion, can result in complex technical challenges, all requiring a fast and effective response.

Seasafe specialises in on-board loading and stability software to help customers manage the stability of their vessels and offshore structures, from passenger ships, heavy-lift vessels and floating production storage and offloading (FPSO) units to semi-submersibles and jack-up rigs.

NEWS

NEWS

LR's SERS, which provides emergency preparedness and response to clients worldwide to help make the right decisions and reduce risks to human life, the environment and client assets, uses Seasafe's state-of-the-art software for vessel modelling and calculations. The software enables SERS's dedicated team of naval architects and specialists to be ready to respond quickly and effectively to incidents 24 hours a day, 7 days a week.

The acquisition of Seasafe is the latest investment by LR to drive data, digital and software solutions for clients. In June 2016, LR announced its collaboration with Silicon Valley-based greenfence – the first platform technology serving the testing, inspection and certification (TIC) marketplace. LR then announced the acquisition of RTAMO Ltd, a software-enabled consultancy based in Aberdeen that provides cutting-edge data-driven solutions designed to reduce maintenance costs for asset owners.

LR and The Welding Institute (TWI) release a 2017 update to the additive manufacturing (AM) certification framework

LR and TWI have released a new version of their jointly produced framework issued last year, now called 'Guidance notes for the certification of metallic parts made by additive manufacturing'. The framework has been updated to include the experience both companies have gained from client assurance and certification, joint industry projects and their involvement in standards development for AM.

The framework is aimed at helping manufacturers and end users of equipment and components achieve quality-driven and safe adoption of AM. The updated issuance of these guidance notes reflects a more user-



UECC's LNG-fuelled *Auto Eco*

friendly approach to manufacturing certification, breaking down the approach into five key areas: design, materials, manufacturing, post-processing, and inspection and testing.

The scope of technologies and processes has also been extended to reflect industry trends, and now includes wire-arc additive manufacturing (WAAM), laser powder bed fusion and laser metal deposition processes.

Since early 2016, a number of projects have been launched to accelerate certification efforts of AM.

Keppel Offshore & Marine (based in Singapore) is one of the early leaders in metal AM for potential use for rapidly made, large-scale parts suitable for offshore and marine applications in a variety of conditions. Working alongside the Singapore Centre for 3D Printing at Nanyang Technological University (NTU Singapore), LR is supporting the qualification of Keppel's process.

In the Netherlands, LR is working with the Rotterdam Additive Manufacturing Fieldlab (RAMLAB) on a joint industry project for 'metal parts on demand' to verify that the AM technology selected can consistently ensure compliance with all applicable requirements.



Find out more at www.lr.org/additive-manufacturing

World's first LNG-fuelled car carriers delivered to LR class

Norway-based United European Car Carriers (UECC) took delivery of the first dual-fuel LNG pure car/truck carrier (PCTC), *Auto Eco*, built by Nantong COSCO KHI Ship Engineering Co. Ltd (NACKS) in September last year. The delivery marked a huge milestone in the development of the application of LNG as an alternative fuel for large commercial vessels.

The 4,000-rt unit PCTC, constructed to LR class, was the first of two sister ships being built at NACKS to comply with the requirements of the North European emission control areas (ECA), for year-round operations in the Baltic Sea. The second ship, *Auto Energy*, was delivered in November.

The ships are built to LR 1AS FS Ice Class (equivalent to IA Super Finnish/Swedish Ice Class) and the cold

countermeasures have been applied. Main propulsion for the ship is provided by a single dual-fuel slow speed two-stroke engine type 8S50ME-C8.2-GI manufactured by Kawasaki Heavy Industries, developing 11,000 kw. The engine is capable of operating on high-pressure LNG vapour or fuel oil, and is directly coupled to a controllable pitch propeller. When the engine is running on LNG, SO_x emissions and particulate matter (PM) are dramatically decreased to almost zero, compared to conventional fuel oil only.

With the industry required to showcase an appropriate response to the need for ever-cleaner designs, this delivery demonstrates that shipping can provide clean fuel designs to meet the requirements of world trade.

LR and MarineCFO combine to offer a comprehensive Subchapter M service

LR has signed an agreement to work together with MarineCFO to provide comprehensive solutions for compliance with Subchapter M. This follows LR formally announcing to the USCG its intention to assume Subchapter M third-party organisation duties.



On 20 July 2016, the USCG's Subchapter M of Title 46 of the U.S. Code of Federal Regulations became effective. This requires towing vessels greater than 26 feet or those less than 26 feet engaged in the movement of oil or hazardous material to be fully compliant by 20 August 2018.

Upwards of 5,000 previously uninspected towing vessels are expected to now enter into a USCG inspection regime that includes the development, certification, and



Signing for the LNG bunkering compatibility study

implementation of towing safety management systems by workboat operators.

LR is in unique position to assist the towing vessel industry with meeting the requirements of Subchapter M with extensive experience in safety management systems, inspection expertise and full authorisation granted by the USCG. LR is also a global market leader in the tug and inland waterway markets, classing over 21% of the world's International Association of Classification Societies (IACS) tugboat tonnage, including 30% of the IACS tugboat tonnage on order.

A trusted technology provider to the American workboat industry since the late 1990s, MarineCFO has developed Vessel 365, a cutting-edge software package that provides an efficient, comprehensive, and cost-effective solution to the documentation requirements under Subchapter M.

LR, HHI and Hyundai Mipo Dockyard (HMD) to collaborate on a ship-to-ship LNG bunkering compatibility study

LR, HHI and HMD have signed a joint development project (JDP) to produce a ship-to-ship LNG bunkering compatibility study.

This will comprehensively review the design requirements between 6,600 teu LNG bunkering ships and 14,000 teu LNG-fuelled container ships with the goal of verifying safe ship-to-ship LNG bunkering.

The study aims to help all stakeholders with an interest in LNG as fuel to envisage a clear picture of possible options for the LNG supply infrastructure.

There are no existing standards or guidelines that cover the design and procedure for safe ship-to-ship LNG bunkering. However, this method of bunkering is preferable for many port authorities for safe and effective port operation and also preferable for ship operators due to cost-effective convenience.

The main objective of the JDP is to investigate the practicability of the LNG supply model in terms of ship-to-ship between the typical size of 6,000 teu LNG bunkering ships and ultra-large container ships. These designs have been reviewed and developed based on the LNG-fuelled system and, accordingly, the study will evaluate the right direction for the LNG supply infrastructure.

LR, HHI and HMD plan to expand the study for other ship types, following the completion of this study.

NEWS

Low Carbon Pathways 2050

MRV and DCS

The first steps for further GHG regulation in both the EU and IMO debates have been the design of monitoring, reporting and verification (MRV) and data collection system (DCS) schemes. Both will produce important data and information that can assist the sector's decarbonisation.

LRQA achieved ISO 14065 accreditation in March 2017 to globally deliver services for the assessment of monitoring plans and verification of emissions reports under the MRV regulation.

	EU MRV	IMO data collection
Entry into force	July 2015	March 2018
First monitoring period	2018	2019
Application	Ships of 5,000 gt and above on commercial voyages into, out of and between EU ports	Ships of 5,000 gt and above on international voyages
Monitoring plan	Yes – standardised template	Included in Ship Energy Efficiency Management Plan (SEEMP)
Parameters	Fuel and CO ₂ Actual cargo Distance Time at sea and in port	Fuel Design dwt Distance Hours underway
Reports to	European Commission	Flag state
Verification	Third-party independent accredited verifier	Flag state
Disclosure	Public	Confidential

Above: Comparison between EU and IMO schemes

How will the shipping industry transition to a low carbon future?

There is no single answer to our global energy, efficiency and environmental needs. But what is inarguable is the urgent need to accelerate the transition to a low carbon world, and LR is committed to supporting this aim.

There are very few certainties about the future of ship design and operation and, by association, the wider system within which ships operate (ports, bunker suppliers and supply chains, trade, freight handling and logistics, etc.).

One important uncertainty is how the regulatory landscape for the control of shipping's greenhouse gas (GHG) emissions will unfold – which incentives and levers might become important drivers of investment and operational decisions in shipping.

The designers, owners and financiers of a ship designed today and launched around 2020 would probably like that

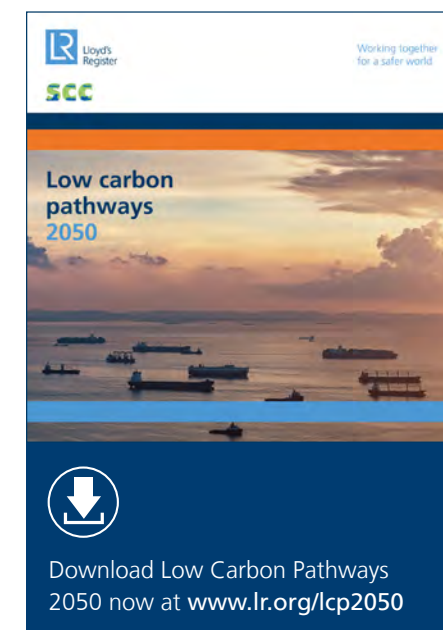
ship to retain its commercial viability for several decades. How can we best think that through?

International shipping does not currently have carbon reduction targets, but at the 70th session of the IMO's Marine Environment Protection Committee (MEPC), a roadmap was agreed that sets out a timeline and key milestones for developing a comprehensive IMO strategy for the reduction of GHG emissions from ships.

The roadmap defines a timeline for seven years, up to MEPC 80 in 2023, which includes adopting the initial IMO strategy at MEPC 72 in 2018.

In October last year, LR and Shipping in Changing Climates, a \$4-million multi-university and cross-industry research project funded by the Engineering and Physical Sciences Research Council (EPSRC), released 'Low Carbon Pathways 2050'. This study puts the

detail of the regulatory debates to one side and answers the question: given the current best available evidence, what is a reasonable estimate of how



shipping might be required to change and what does this look like?

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

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

What is suggested is a managed transition that maximises resilience and minimises the risks of technological obsolescence. The shipping industry needs a clear, high-level target and identified associated potential pathways for technology transitions.

Following the release of Low Carbon Pathways 2050, LR hosted a roundtable, bringing together senior industry leaders to discuss possible pathways and future scenarios to transition to a low carbon industry. Using the study as the starting point, discussions were centred on the challenges we face, so that, as an industry, we can address these together.

Some of the conclusions from this roundtable were that: the IMO should have a strong target; there should be great drive and ambition in the industry to ensure a quick transition; innovation is required to address the scale of the challenge; and all influencers need to be engaged through collaboration to

collate their distributed expertise so as to create a platform that facilitates the interconnectedness of all factors and players.

Other important considerations were that pioneers and leaders should be incentivised and the industry needs to be aware of the impact on seafarers (i.e. best practice, upskilling, competence, etc.).

The next milestone is the upcoming intersessional meeting at the end of June this year; expectations are high for this meeting with the hope of ensuring momentum is maintained and that the desired level of ambition is achieved.

What's the big question and how is LR delivering solutions?

Hear from our six marine and offshore area managers



Jim Smith

North Asia
Area Manager

"With over 90% of the world's gross tonnage built in North Asia, the current decline in newbuilding volumes are hitting the shipyards hard. The pressure to remain competitive is pushing the yards to try and find ways to reduce costs at the same time as new regulations and standards and increasing steel prices are exerting upward pressure.

LR is assisting the yards to control costs by helping identify potential problems in design and production at an early stage and helping take necessary action to ensure quality does not suffer. Working closely with the designers, we are also helping the yards develop new and attractive designs for future vessels efficiently, minimising time and cost.

We are able to do this because of the large investment in our people in previous years; this means our teams in North Asia have the required knowledge and capability. LR has had a leading market share for newbuilding in recent years so, although the newbuilding market is in a downturn, we have been able to retain high levels of experienced, knowledgeable staff at a period when the increasing pressure means that both shipyard and shipowner need a partner with enough capability and resources to help solve these problems."



Thomas Aschert

North Europe
Area Manager

"The main challenge facing a lot of our clients currently is the ability to keep their ships operating. Freight rates are still low and will remain so until the overcapacity is resolved. This means our clients need a confident class service provider to keep their ships away from operational interruptions, who recognises the pressure on their business and supports them in maintaining the integrity of the safety and quality of their operations. To address this, we have kept close to our clients, listening to what their needs are and ensuring that we continue to give high levels of support to maximise on hire time.

The saturation of traditional trade routes and markets (vessels, capacity, routes, lines, etc.), coupled with an increasing danger of a slowing down goods exchange and tougher competition, is another challenge. To ease our clients' burden, LR aims to reduce the impact class has on their day-to-day working by providing well-trained staff, effective tools and proactive approaches. The environmental impact of shipping and the related concerns of the public have potentially costly outcomes for our clients, but we are actively getting involved in research and finding effective and economically viable solutions to these environmental challenges."



Joanna Pohorski

UK&I
Area Manager

"In the present tough trading environment, the big question we hear from our clients is how can they comply, in the most cost-effective way, with the myriad of new regulations coming into force in the short to medium term? Not only is awareness of the regulations a problem, but also understanding the challenges and identifying the optimum solutions for compliance.

To address this concern, the UK&I Business Development team regularly run interactive client seminars in client centric locations (London, Southampton and Glasgow for example). These seminars utilise the wealth of knowledge that LR's subject matter experts possess. Recent subjects covered include ballast water management, CO₂ MRV and future fuels. Upcoming seminars will focus on cyber security, inventory of hazardous materials (IHM) and digital transformation.

In a lot of cases, we are approached after an event to explore opportunities with clients to propose bespoke consultancy offers that will assist them with these challenges. Feedback from each event not only validates the seminar's value but also encourages our clients and stakeholders to suggest other areas that they wish us to cover going forward."



Theodosios Stamatellos

South Europe
Area Manager

"Our clients in South Europe cover a wide range of activities, from shipowners and ship managers to manufacturers and shipyards, both for repairs and newbuildings and from VLCCs, LNG carriers, container ships and bulkers to short sea shipping and inland waterways, naval and cruise vessels, tugs and yachts. As such, there is not one single big question, not even on an individual sector basis. However, one common challenge that is growing exponentially among many of our business partners is around how to safely and timely employ new technologies.

Technology is moving at a much faster pace today and the industry needs to be able to adopt new innovation safely and in a timely and cost-effective manner, that is what we want to support our clients in doing. Our people become part of our clients' teams to reach conclusions that best address their challenges. With regards to new technologies, we ensure that we understand the whole picture and consider all options when assessing innovative ways to address the industry's challenges, enabling our clients to make their decisions based on the best technical insight."



Piet Mast

South Asia &
Middle East
Area Manager

"One question we hear quite a lot is: 'How do we comply with EU MRV requirements?' To address this concern, LR is running public and in-house seminars to raise awareness and provide guidance, plus delivering in-house workshops on GHG MRV. Our clients are looking for prompt, practical and cost-effective advice, and, with LR as their partner, that will be delivered.

We are also working to prepare our clients for the challenge of the 2020 sulphur emissions cap by exploring a range of compliance options with them in the most economical way.

In addition to this, shipyards across South Asia are securing commercial and naval newbuilding projects for ship types of which they have no prior experience – LR is working with all key stakeholders (yard, designer, flag) from an early stage in the project through preliminary design review, workshops and the provision of guidance on compliance with class and statutory requirements to help minimise technical and commercial risk."



Mark Darley

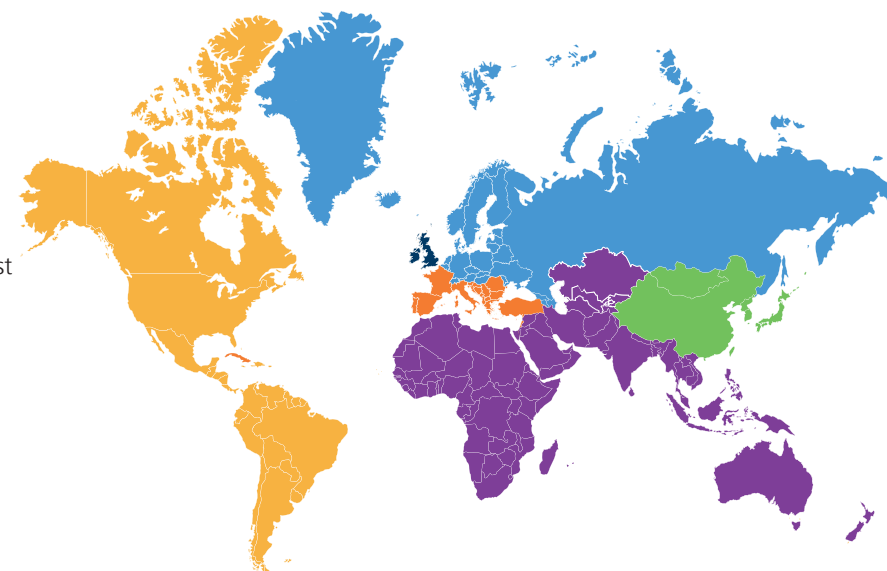
Americas
Area Manager

"The Americas area for LR spans 14 countries and encompasses all vessel segments, from cruise vessels to tugs, container ships to naval. With such a diverse mix of clients, naturally the challenges facing them differ. However, uncertainty is probably the biggest factor impacting all our clients' business operations today – the effect of the Trump administration on energy policy and trade agreements is destabilising the established understanding of trade routes and of the US' place in the international business of shipping, which has significant impact on the rest of the region.

One area of uncertainty we are able to help address is around future cyber security regulation. By the end of 2018, vessels trading in US waters could be subject to new regulations currently being developed by the USCG. LR is already working with clients to ensure they are prepared. We have launched a range of services designed in alignment with the USCG strategy on cyber security and forthcoming IMO regulations."

LR's six operating areas

- North Asia
- South Asia & Middle East
- South Europe
- North Europe
- UK&I
- Americas



Leveraging complete end-to-end experience, LR provides assurance across the gas supply chain

The gas shipping sector is an area of global growth and LR is at the forefront of this, helping our clients maximise the opportunities across the entire gas supply chain and offering specialist support and advice at every stage

PRODUCTION AND LIQUEFACTION

Supporting opportunities in remote and challenging offshore locations

Floating liquefied natural gas (FLNG) units are among the largest, most expensive assets afloat. Every FLNG unit is designed for a specific location with its own unique design and operating requirements. Our comprehensive supply chain co-ordination service is unique in the industry. Through our global network of surveyors, we verify designs, inspect equipment and monitor progress at every stage and supplier level – because, in LR's experience, the biggest potential risks in delivering an FLNG project on time, on budget and to the contracted specification issues lie within the supply chain.

TRANSPORTATION

Leading an efficient, compliant gas carrier fleet

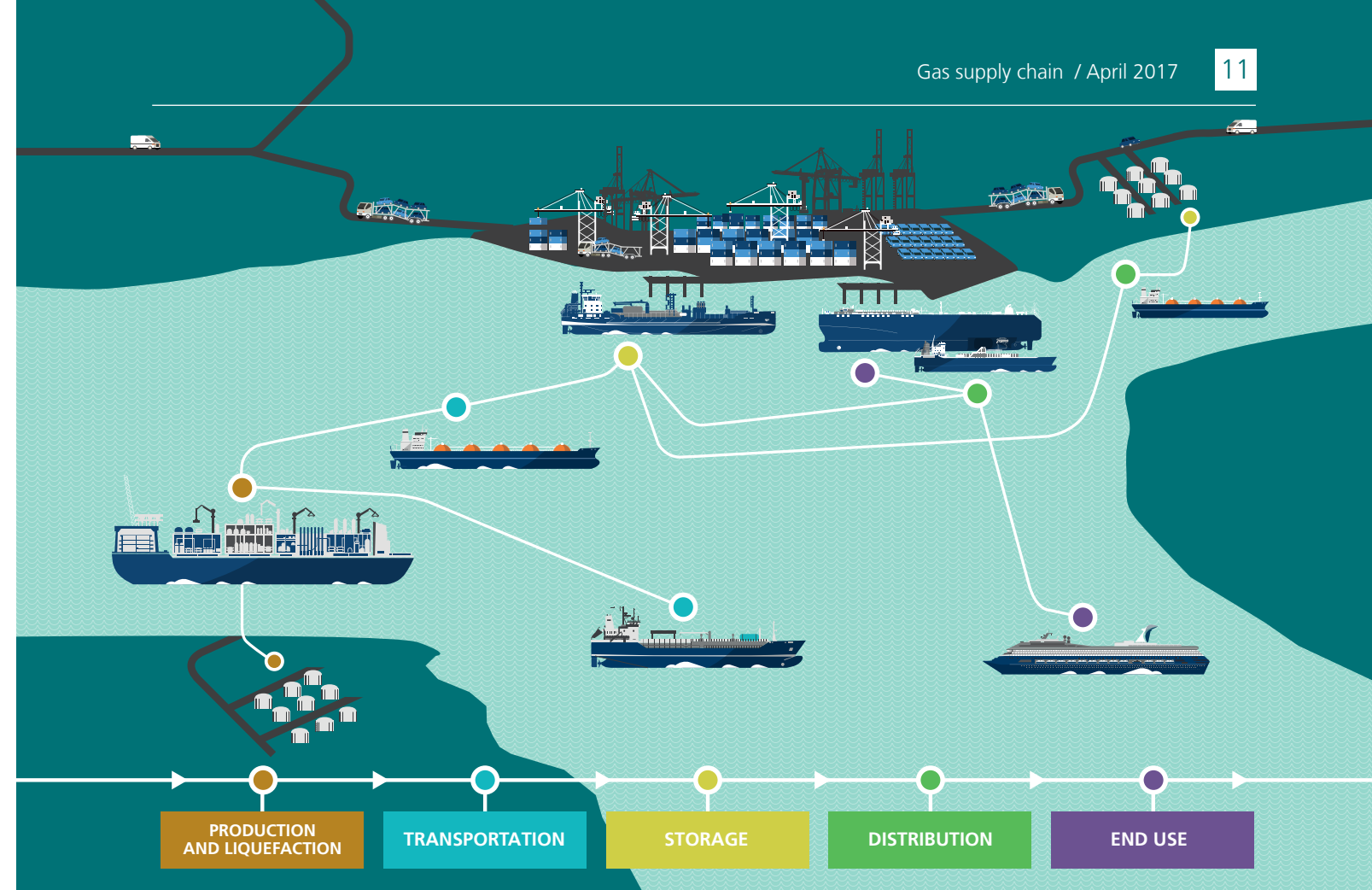
We provide a range of technical, risk management and operational advice to help our clients minimise downtime, improve fuel efficiency and comply with relevant legislation. We can also improve ships' flexibility through services such as extended maintenance schedules and condition-based tank monitoring regimes that reduce time alongside and the need for physical inspections.

STORAGE

Assurance and advice for developing critical infrastructure

A floating storage regasification unit (FSRU) is a crucial link in the gas supply chain. It has four key functions: receiving LNG; storing it; regasification; and delivery to a shore facility for distribution to the power or gas grid.

The first step in any FSRU project is to develop the design concept. We qualify initial concepts to assure clients that the design will be safe, technically sound and fit for purpose. We advise on all aspects through design and construction, can undertake a full range of inspections, surveys and certification, and provide project management and compliance and classification services. And when an FSRU enters service, we carry out detailed risk assessments and help produce overall operational strategy, including emergency planning for extreme events.



DISTRIBUTION

Guiding the local gas supply and bunkering operations

Despite its significant environmental advantages, the adoption of LNG as a fuel (particularly for deepwater shipping) has been relatively slow. However, this is driving demand for dedicated small-scale LNG bunkering ships and distribution carriers (we define this as cargo capacity under 40,000 cbm).

Our risk-based approach allows us to tailor our assessment process to each individual project. We offer a complete range of design assessment services, leading to approval in principle. Then, through our unique shipyard assessment service, we can help our clients choose the right builder for their vessel. Our experience has made us the class society of choice for the small-scale LNG sector.

END USE

Ensuring the safe adoption of gas as an energy source

LNG has proved viable and safe on short sea routes, where it's eminently suitable for ferries, small tankers and cargo vessels. However, there is increasing interest in LNG propulsion on longer fixed routes as an alternative to oil-fuelled applications. We apply our technical, regulatory and commercial experience to help all stakeholders benefit from this rapidly developing technology.

LR advises on all aspects of technology selection to help our clients meet their current and future business needs. Whether it's a new build or conversion, an LNG ship is a complex, high capex project. The biggest challenge for shipowners is deciding whether to invest in LNG technology – and if so, when and how.

LR is constantly innovating in the gas shipping sector

LR provides approval in principle and type approval for all gas carrier machinery and equipment. As technical advisors, we can help our clients qualify technology in accordance with our Rules, which are harmonised with the International Code of Safety for Ships Using Gases or Other Low-Flashpoint Fuels Code (IGF Code), ensuring automatic compliance. LR is currently leading the qualification processes in Mark V membrane technology for LNG carriers, and new-generation LPG membranes.

LR is the world's leading class society for LNG and LPG carriers, both by number of vessels and tonnage: currently, over one third of the total global fleet is LR classed.

(Source IHS-Fleet Database Q3 2016)

Small is beautiful

LR is the market leader in the small and specialised ship segment, with over 500 tugs in the current fleet and a market share of 30% in tonnage terms

Despite not always being covered by international regulations, the small and specialised ship segment should not be ignored by class societies," says LR's Richard McLoughlin. "Classification of tugs with LR provides owners and operators with peace of mind that operational risks have been mitigated."

Tugs work in a wide range of operational conditions, including significant sea states, currents and wind loading. Wave loads can result in tug motions that increase the towline dynamic component, resulting in unacceptable accelerations for the crew on board, dynamically increasing pressures on the fender system and assisted ship structure, and – combined with the towline force – directly affecting vessel stability. Add to this operating in conditions such as ice, or human factors arising from challenging and varied working conditions, and it is easy to see why regulation and control is required to limit operational risks.

Regulations covering operations within refineries, areas of restricted navigation

or congested waters frequently require tug operators to demonstrate the highest levels of compliance and redundancy. LR is well placed to assist with this through our Classification Rules.

Our involvement varies from in-depth CFD assessing mooring loads to operational aspects, such as inspections and audits on behalf of the USCG's Subchapter M. We provide services to some of the biggest tug operators in the world and specialise in delivering tailored solutions to our clients. LR is able to provide certification on behalf of flag administrations and is fully authorised to do so in most cases. These authorisations frequently extend to vessels of less than convention size, where LR provides support to operators wishing to voluntarily confirm compliance with international conventions. This results in the issue of non-convention certification, and may also include voluntary certification for International Safety Management (ISM) and International Ship and Port Facility Security (ISPS) Codes.

The use of CFD has proven to increase understanding of vessel operations, such as those carrying out escort duties. As a result of research, LR has introduced ShipRight procedures, allowing escort designs to be verified using CFD techniques and thus providing confidence to designers and operators that the vessel will produce the required performance characteristics. Evolution in hull shapes designed for performance under changing operational needs has required further examination in terms of stability aspects. LR participates in a number of IMO working groups and research projects, including the



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Small and Specialised Ships

consideration of stability issues and operational aspects, under the SafeTug programme.

Recently, environmental and sustainability concerns have driven design development. Examples of this include the development of hybrid vessels incorporating electric propulsion and battery storage solutions. The current rise in LNG as fuel and port limitations on high sulphur fuels have driven operators to consider LNG and other alternative fuels. Again, LR has provided innovative solutions for a number of tugs with hybrid propulsion systems, including Svitzer's ECOTugs that can operate solely on battery power while maintaining full manoeuvrability, an innovation that significantly reduces their carbon footprint. Another recent example of this includes the world's first purpose-built FLNG infield support vessels (ISVs).

Small and specialised ships are defined as any ship with gt greater than 99 but less than 8,000, excluding vessels intended for naval, coast guard or law enforcement operations and yachts.



RT Beagle Bay, one of the first ISVs
Image credit: KT Maritime Services Australia Pty Ltd.
Design: Robert Allan Ltd.



Group Review 2016

January 2017

Our Group Review 2016 outlines our strategy for sustainable growth and our work to support clients through a continued period of global challenges. Highlights of our year 2015/16 include our work involving the convergence of physical and cyber, sensors and automation technologies to enable their safe and secure development.



Download at info.lr.org/groupreview



Foundation Review 2016

January 2017

The Lloyd's Register Foundation's 2016 Annual Review outlines the impact it's making in becoming one of the world's leading engineering research and education charities. The review describes the Foundation's main activities over the year to drive impact and excellence in making the world a safer place for the benefit of society.



Download at info.lr.org/foundationreview



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February 2017

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The later we leave decarbonisation, the more rapid and potentially disruptive it will be for shipping. Given the best available evidence, what is a reasonable estimate of how shipping might be required to change and what does this look like?

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