

# MARITIME IMPACT

ISSUE 02-17

THE MAGAZINE  
FOR CUSTOMERS AND  
BUSINESS PARTNERS

MODERNIZING CLASS

# SMARTER OPERATIONS



### DIGITAL TRANSFORMATION

The rollout of e-certificates is just the beginning of the digital journey

### REMOTE INSPECTIONS

How drone surveys can lead to less downtime and reduce costs

### VIRTUAL TRIAL

A new CFD application lets yards and owners choose the most efficient design option



DNV-GL



## MARITIME

# EXPERTISE IS KNOWING WHICH DETAILS MAKE ALL THE DIFFERENCE

When you're designing and building a new ship or offshore structure, DNV GL provides much more than just regulatory compliance. With strong, long-term relations not only with owners and operators, but also with shipyards, suppliers and designers in all major shipbuilding

regions, we help to realize the optimal vessel for your operations.

Can you afford anything else?

[Learn more at \[dnvgl.com/maritime\]\(https://dnvgl.com/maritime\)](https://dnvgl.com/maritime)



**Knut Ørbeck-Nilssen**  
CEO of DNV GL - Maritime

Today's shipping industry is facing a challenging operational environment characterized by fierce competition, economic uncertainties and more demanding regulations. At the same time, technology is developing rapidly - some of which can help companies improve their operations, both in terms of efficiency and safety. As a leading classification society, we can certainly support the sector in adapting to this "new normal". Keeping abreast of technological innovation and finding practical applications for use in the maritime community is our first priority.

Digitalization brings efficiency potential to our industry. In this issue of MARITIME IMPACT, you will find many examples where DNV GL is assisting its customers to benefit from advanced technologies: drones improve surveys of cargo tanks and hard-to-reach spaces; e-certification enables quick certificate authentication around the world; machine learning improves responsiveness and quality; and much more.

Environmental regulations continue to have a fundamental impact on shipping. DNV GL helps its customers navigate this complexity and identify opportunities to comply at minimum costs. Read in this issue about the best options to fulfil the NO<sub>x</sub> regulation in ECAs. Learn about DNV GL's new Virtual Trial desktop app and evaluation service that allow every yard and owner to use CFD simulation to optimize hull performance. And see how ship managers have identified the most cost-effective combination of energy efficiency enhancements for their fleet with the assistance of our advisory services.

Let us together explore the best options to make shipping safer, smarter and greener. Class - as a tried-and-trusted mechanism for more than 200 years - has a key role to play by bringing proven assurance processes to new and unfamiliar technologies.

At trade fairs such as Marintec China in Shanghai, we can witness the speed of change and innovation. China is not only a major maritime player, but also becoming a technology power-house - and DNV GL is celebrating its 130-year tradition in the country since the start in 1888. Join us on this exciting journey.

A stylized, handwritten signature in black ink, appearing to read 'Knut Ørbeck-Nilssen'. The signature is fluid and extends across the width of the text area.

**Knut Ørbeck-Nilssen**

# BREATHING EASIER

In a world struggling to contain air pollution from human activities, reliable exhaust gas measurements are crucial. With state-of-the-art lab equipment DNV GL tests exhaust gas systems around the world for adherence to current standards.



On 18 September 2017 DNV GL celebrated the reopening of its Envilab exhaust gas emission measurement laboratory in Hamburg, following a two-year, comprehensive technical upgrade. The ISO 17025-accredited, state-of-the-art laboratory was first commissioned more than 20 years ago and has been delivering independent, reliable exhaust gas emission measurement services for marine engines and exhaust after-treatment systems

to engine and system manufacturers, shipowners and shipyards ever since.

The lab equipment is mobile and can be taken to any facility worldwide quickly to perform customer-specific measurements based on the latest emission standards, including the new IMO NO<sub>x</sub> Tier III limits. The picture shows the Caterpillar Marine test bed in Rostock, Germany.



Photo: DNV GL

# CONTENTS



16



20

## Smarter Operations

- 10 REMOTE INSPECTIONS**  
The drone squad
- 16 E-CERTIFICATES**  
The path to digital classification
- 20 EXPEDITION CRUISE SHIPS**  
Ready to face the extremes
- 28 CFD SIMULATION**  
Ship trials in the virtual world
- 40 ENERGY MANAGEMENT**  
How to reach your efficiency goals
- 56 IMO TIER III COMPLIANCE**  
The fight against noxious emissions

## 24 ARCTIC SHIPPING

Why the industry should share more data with marine insurers to assess and manage risk

## 32 ADDITIVE MANUFACTURING

3D printing has the potential to transform the maritime industry - a journey into the future

## 36 HISTORY

Licence to float - a special survey on board the legendary four-mast bark *Peking*

## 42 CLUSTER STUDY

How global trade drives the development of major port cities

36



46



- 46 DNV GL IN CHINA**  
The classification society's history in China dates back to the 19th century - and business is picking up speed
- 50 POLAR CODE**  
Eimskip and Royal Arctic Line have ambitious plans for the Far North

- 52 SILENT CLASS NOTATION**  
Stricter demands for noise and vibration aim to increase comfort and safety on board
- 60 THE CLOSER LOOK**  
CMA Commodore John D. Noonan shares 35 years of shipping experience

## Standards

- |   |   |                          |
|---|---|--------------------------|
| <b>03 Editorial</b><br>Knut Ørbeck-Nilssen,<br>CEO of DNV GL - Maritime | <b>08 News</b> ECO Insight 2.0 • Shore power • Position paper on standardization • Veracity pilot | <b>27 Training</b>       |
| <b>04 Broader view</b><br>Breathing easier                              | <b>30 Facts &amp; figures</b><br>Blockchains in the shipping world                                | <b>55 Events</b>         |
|   |   | <b>62 Communications</b> |
|   |   | <b>63 Imprint</b>        |

## IN BRIEF



Sensor data can help the maritime sector to gain more insights.

### Standardization drives digital transformation

DNV GL has released a new position paper setting out the importance of standardization for digital applications in the maritime industry. The paper examines how standardization can enable effective collection, storage, exchange, analysis and use of data while contributing to improved data quality and sensor reliability.

"Standards advance efficiency, safety and environmental performance," says Pierre Sames, Group

Technology and Research Director, DNV GL. "With the rise of the Internet of Things in shipping, a standardization strategy could drive a more digital maritime industry for the benefit of many stakeholders."

The report discusses the need for standardization in six key areas: ship data models, sensor naming and referencing, maritime taxonomies and code books, sensor metadata, shipboard data recorder, as well as sensor quality and reliability.

### Shore Power notation for offshore vessel

The offshore vessel *KL Sandefjord*, owned by "K" Line Offshore, is the first offshore vessel with the DNV GL Shore Power class notation, which confirms the design and installation of a shore power interface on board.

When in port, the vessel can shut down its engines and run its on-board systems using shore electricity ("cold ironing"). This reduces fuel consumption and also eliminates the associated emissions. It will have a marked improvement on the air quality in the port and surrounding environment.



*KL Sandefjord* is equipped to utilize shore power in port; her sister vessel will bear the same notation, says owner "K" Line Offshore.

Photos: DNV GL, "K" Line Offshore



## ECO Insight 2.0 is boosting fleet performance

DNV GL has released the all-new ECO Insight 2.0 fleet performance management solution. Completely reworked with a new more intuitive design and interface, the release also includes the rollout of a new mobile app where customers can track vessel performance information in real-time from their mobile phones.

"Based on the feedback from almost 100 customers, we focused on improving usability and providing more operational support in ECO Insight 2.0," says Torsten Büssow, Global Head of Fleet Performance Management at DNV GL - Maritime. "Users can now set up the display of their fleet performance information in a way that suits their needs."

At the centre of the new release is a new homepage with an interactive map, live vessel positions and tracks, as well as several weather overlays. Customers can access more performance KPIs, track vessels, and receive daily alerts.



## Wilhelmsen to share data on new platform



Sharing key ship data is getting easier: the DNV GL industry platform Veracity can grant access to selected stakeholders.

Norwegian shipowner and ship operator Wilhelmsen is exploring specific ways of sharing data using DNV GL's new open industry platform Veracity. In one of the first pilot projects on Veracity, Wilhelmsen is testing a system to share ship compliance and condition data with port state authorities to reduce paper work and physical inspections when entering ports.

"As ships and their systems become more sophisticated, we have more equipment with sensors on board that generate and share data," says Inge André Sandvik, Chief Digital Officer at the Wilhelmsen group. "By gathering and structuring this data, we will open up a huge range of possibilities, for example predicting maintenance needs, optimizing vessel performance and safety, and streamlining port entry procedures. The Veracity platform of DNV GL allows us to invite partners, suppliers and other stakeholders to access this data and collaborate on the platform."

In a pilot project in cooperation with a major port state authority (PSA) Wilhelmsen and DNV GL are testing the Veracity platform. Wilhelmsen has created a secure data container on Veracity where they can collect compliance, condition and other relevant data from their vessels. They can then grant the PSA access to this data on the platform, which reduces paperwork and speeds up port entry. "The project is still in an early phase, but it shows how an open and secure data platform could reduce friction between stakeholders and create greater efficiencies," says Sandvik.



Cezary Galinski, Senior Principal Surveyor, is Head of the DNV GL drone squad based in Gdynia, Poland.

# THE DRONE SQUAD

With four drone types in its arsenal, DNV GL has adapted its survey technology to various ship structures. Recently DNV GL reached a new milestone with its first offshore drone survey.

12 October 2017 is a gusty day in Gdynia, Poland, and outside the DNV GL station Leszek Alba is waiting for the wind to change. Alba is one of DNV GL's 16 drone surveyors. Today, he is testing the Custom drone's stability in different wind conditions and the stability of the video transmission - an important factor during the inspection of remote structural components in tanks and cargo holds.

18 months after DNV GL carried out its first production drone survey in June 2016, it has become the leading provider in this field. "When we started out, we wanted to find a safer, more efficient and cheaper way of fulfilling the requirements of close-up surveys. During these inspections, a surveyor has to be able to touch a surface to check the condition of the material," explains Cezary Galinski, Senior Principal Surveyor and Head of the DNV GL drone squad. This global team is headquartered in Gdynia but also works out of Dubai, Shanghai, Singapore and Houston. "So instead of taking the surveyor to the component, we bring the component to the surveyor, >



Photos: DNV GL



Wind conditions and the flying distances make offshore drone surveys a particular challenge for drone surveyors.





DRONE TYPE INFO

## FLYABILITY ELIOS

The Flyability Elios drone is enclosed by a round cage, making it particularly robust and collision-resistant. It is used in tight, confined spaces.

> on 4k, high-definition video,” he adds. So far the team has conducted more than 25 drone production surveys around the world. Typical ships include tankers, bulkers and, more recently, semi-submersibles and jack-ups. “These are the vessel types that require close-up surveys,” explains Galinski.

DNV GL has four drone types in its arsenal: The Custom drone, the DJI Phantom, the Mavic drone and the Flyability Elios drone – each with different capabilities and areas of application. What they all have in common is that they were modified in Leszek Alba’s workshop. This cellar room, filled with carefully

catalogued shelves, spare cables, batteries, soldering irons and a variety of drones in different stages of construction, is where DNV GL customizes off-the-shelf drones to make them fit for inspection purposes.

### Making a DNV GL drone

“Commercially available drones are built for users who fly them outside in open spaces and shoot footage of objects below. So, one of the first things we do is change the drone’s software settings for adjusting the camera angle. This enables us to film objects that are in front of or above the drone,” says Galinski.

Adding protective gear is the next step. “We have to fly the drones close to ship structures, therefore we developed a special cage for the DJI Phantom drone. And we equipped the Custom drone with a protective wire to shield its propellers, the camera and the lighting systems we attach to it to enable it to operate in dark spaces,” says Alba. Galinski’s team has also fitted the Custom drone with a zoom camera. This means that instead of having to fly within distances as short as one metre from the structure, the drone can take high-definition images from further away.

**DNV GL’s first offshore drone survey**

This is particularly important when surveyors fly the drone on the open ocean, and has proved to be incremental to the success of DNV GL’s first offshore drone survey, which was carried out on the semisubmersible vessel *Safe Scandinavia* in July 2017 (scan QR code on page 11 to watch the video). This tender support vessel (TSV) owned and operated by Prosafe supports Statoil’s drilling operations off the coast of Norway. “It was a great opportunity for us to demonstrate our drone’s ability to check the condition of remote external components in challenging offshore conditions. The inspection only required the semi-submersible to deballast. We flew the drone approxi-

“A surveyor has to be able to touch a surface to check the condition of the material. So instead of taking the surveyor to the component, we bring the component to the surveyor, on 4k, high-definition video.”

**Cezary Galinski**, Senior Principal Surveyor and Head of the DNV GL Drone Squad

mately 25 metres below the main deck to check the condition of the fairleads and their connections to the columns that hold up the TSV. With wind speeds of about 15 knots, this went very well and the survey showed that the fairleads and their connections were in a good condition,” says Galinski.

It was a first for the owner Prosafe as well. “Innovation is one of our core values. We are very pleased to have chosen to try the drone survey, as it helped us optimize our survey requirements and allowed us to save significant amounts of time and money. >

Photos: DNV GL





**DRONE TYPE INFO**

## DJI PHANTOM

The DJI Phantom drone can operate for about 20 minutes and is lighter than the Custom drone. It is used for external surveys but can also be flown inside spaces such as tanks. When fitted with its protective shield it is more resistant to damage.

> Normally this kind of operation would cause a disruption of several days to our client. The drone survey took only a few hours and was just as effective," says Ian Young, Chief Operating Officer at Prosafe.

**The challenges**

To get to this point, Galinski's team has gone through years of experiments, modifications and practice runs. And even after optimizing the technology, flying drones on maritime structures comes with its own set of challenges. "When inspecting the cargo hold of a large oil tanker, for example, you have to fly the drone about 30 metres away in the dark. In addition, the pilots are surrounded by thousands of tonnes of steel, which means that the drone's GPS and magnetic compass, which usually help it identify its position, don't work - nor does its positioning support. This makes its behaviour somewhat unpredictable," says Galinski. "If you fly a drone in your garden with the position-keeping function enabled, you can push it away and it will automatically return to where it was before. On a ship, any sudden input may cause the drone to become unstable and require the pilot to correct its position manually," he adds.

During an offshore survey the pilots have to manoeuvre the drone along structures at distances of up to 180 metres. "In this kind of environment



DNV GL drone surveyor Leszek Alba tests the Custom drone outside the Gdynia office.



DRONE TYPE INFO

**MAVIC**

The Mavic drone is the DJI Phantom's smaller cousin. Its tripod mode slows down its operational speed considerably, making it ideal for slow manoeuvring and close-up surveys, where it gets as close as one metre to the structure.





DRONE TYPE INFO

## CUSTOM

The Custom drone, a five-kilogramme heavyweight, is the largest of the DNV GL survey drones. With a 20-minute operating time it is ideal for external surveys.

the wind is the greatest risk factor. We chose the DJI Phantom drone for the *Safe Scandinavia* survey, because it can be fitted with a cage. Protecting the drone was important, since we were operating it close to obstacles such as anchor chains and wires. What is great about the DJI Phantom drone is its compact size. It fits into a backpack, making it convenient to take offshore by helicopter," explains Alba. The successful survey demonstrated that the Custom drone was up to the challenge: it not only survived the inspection but also delivered valuable results.

### The future of drone surveys

Looking ahead Galinski expects drones to revolutionize the inspection regime. "I am confident we will see the introduction of autonomous drones. This would open up many new possibilities. For example, they could be dropped into inerted compartments where humans cannot enter," he explains. The surveyor could stay outside while the drone would follow a predefined flight path to check the condition of the compartment. "This would enable us to carry out inspections without lengthy preparations, while keeping the surveyors safe," adds Galinski. In future, it might even be possible for an autonomous drone equipped with artificial intelligence to carry out a survey independently, monitored by the surveyor from the shore office using a virtual-reality headset.

For the time being, the autonomous functionality still requires further development. "Outside drones can follow a predefined flight path using a GPS signal. But for confined steel compartments we need to find an alternative approach," says Galinski. In a joint research project DNV GL and the University of Trondheim, Norway, are developing an autonomous drone. With several options under consideration, Galinski expects to see the first autonomous surveys of inerted compartments in the near future. "Two of our drone pilots have completed the BVLOS (Beyond Visual Line of Sight) certification, allowing them to operate drones beyond the line of sight. So while drone inspections remain a niche for now, more advanced models with AI capabilities could soon transform ship surveys. We want to be ready for this." ■ AJO

### DNV GL Expert

Cezary Galinski, Senior Principal Surveyor

Phone: +48 58 511 5218

E-Mail: [cezary.galinski@dnvgl.com](mailto:cezary.galinski@dnvgl.com)



# THE PATH TO DIGITAL CLASSIFICATION

DNV GL is holding a steady course in the digital transformation of its classification services. The only unexpected surprise so far: the speed of the journey.

"We started looking into machine learning as a tool for modernizing classification in 2016," says Morten Østby, Senior Principal Consultant at DNV GL. "When we realized how important this could be, we implemented it in April 2017. Now it is in production."

Such a fast-track realization is fairly typical of the digital transformation sweeping DNV GL's classification business. "We want to move the customers over to a digital interface," says Østby, "where clients and vessels can stay up to date, get warnings, and take advantage of digital storage capabilities - and that's just the beginning."

Østby's ally in the push to modernize class, Principal Engineer Arun Sethumadhavan, emphasizes the main focus of the digital initiative: "We are striving for ease of access and comprehension for customers. Today that means mobile access and expanded functionality."

The jumping-off point for the journey through DNV GL's modern class universe is a personalized online portal that provides customized and secure access to all digital services and support resources. As of November they are embedded in DNV GL's new Veracity platform.



### Simply efficient

"Smart survey booking is a major move in streamlining a previously tedious and often inefficient manual task," says Østby. The smart survey booking solution automatically finds the best window for a ship's annual survey, allowing for as many requirements and requests as possible to be covered in one survey to avoid multiple inspections.

"Based on this time window and a list of possible ports entered by the operator, the system also looks for the closest geographical location, accounting for the scope and duration of the survey, port capabilities and surveyor availability, and issues a recommendation. This minimizes both the time involved in booking the survey and the inconvenience for the vessel while keeping the costs down by helping reduce surveyor travel times," Østby says.

An automated version of the application is expected to be available before 2019. "The software will enable us to track ship itineraries and notify them in advance so they can order earlier, which leaves them with a larger time window for planning and owner preparation," Østby points out. A link to all DNV GL-approved service suppliers in the respective port will soon be added, along with a host of additional features designed to improve efficiency and keep the survey costs down.

### Learning application

Many improvements are made possible by introducing machine learning, or ML, into the survey booking process. "ML is used to calculate the time required for each survey," says Østby. "When the scope and other parameters are set, the system outputs a time estimate based on historical data."

DNV GL has also incorporated ML into its DATE (Direct Access to Technical Experts) service where a customer's problem description transmitted by e-mail can make it challenging to assign the case to the correct category and expert or section for fast processing. "A discrepancy between the description and interpretation may cause the inquiry to be routed to the wrong expert," says Sethumadhavan. "Now DATE uses ML to vet cases based on historical data and quickly directs them to the proper expert. This cuts down on manual vetting and reduces time wasted on re-routing and finding another expert. We are already seeing that ML-assisted vetting is more than 80 per cent accurate, and it gets better every day."

Each ML-vetted routing receives a confidence rating before being enacted. Any inquiry that has not received a very high confidence rating is returned for manual vetting. "ML is chosen for category assignment only when the confidence level is

### REMOTE INSPECTION: EYES ANYWHERE

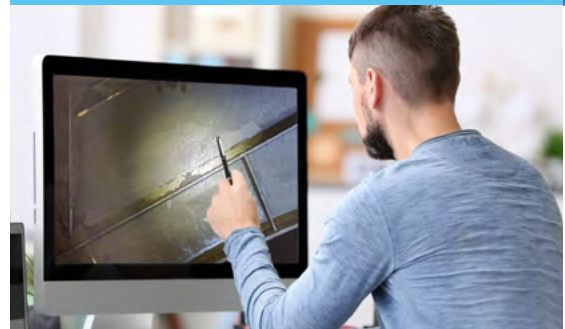
Ship inspection often poses a conundrum: The object may be a fairly straightforward structure or piece of equipment on board, but human eyes are still required to verify its state. Traditionally that means the human doing the looking has to be on board.

But that is not necessarily true anymore. Remote technology is enabling eyes to see the object of inspection from virtually anywhere in the world. Equipped with something as simple as a smartphone app, personnel on board can connect to the surveyor on land, and the survey is underway.

"The expert steers the input and evaluates the quality of the data," says DNV GL's Senior Principal Consultant Morten Østby. In other words, the "cameraman" on board takes instructions from the surveyor on land who acts as the "director". One key prerequisite: the surveyor must have actual on-board experience. "You have to have been there to be able to know what you are seeing," Østby confirms.

"But the customer must be willing to cooperate," he adds. "Proof of repair or remediation must be provided." For the time being the technology will be used on occasional surveys, not for certification, and possibly for selected follow-up items when the surveyor has left the ship.

Remote inspection could also be used for certification of materials and components. "The first steps have been taken. Many more will follow," Østby assures.



From his land-based computer the surveyor can instruct the personnel on board during a video survey.

very high," explains Sethumadhavan. "But by using continuous learning logic, the ML system is constantly refining its selection criteria and improving its hit rates quickly."

But there are other human factors that complicate the advisory process. "While we all use English only, there are different language patterns and rules in different parts of the world," Østby says. "We have had to teach the machines to accept compound words and different spellings. We can even teach them to vet incorrect language." >



### > E-certificates wanted by many owners

DNV GL has been running pilots on electronic certificates for several years, achieving IMO compliance and winning the endorsement of many flag states. After rolling out e-certificates in mid-October 2017, the first ship with full electronic certification was the LNG carrier *Macoma* (see next page).

"This took some preparation, but it shows just how fast the technology can be taken into use once it has proved viable," says Østby. "Just six weeks after the rollout, 25,000 electronic certificates were issued for more than 3,000 vessels in operation, including many class entries and newbuilds, and the number is growing rapidly every day."

Customers benefit significantly, says Østby, by being able to share certificates globally immediately upon issue. "Ports, vetting organizations, flag states, charterers, buyers, insurers - everyone wants to see the certificates," he says. "Before, owners and captains had to keep track of the original while sending multiple copies to land. Manual updates were an overwhelming task, and the system was by no means secure. Now the signed original is secure but easily accessible in the Cloud."

Using an e-mail subscription function, each modification of an e-certificate triggers a warning to all involved parties, with the verified document attached. Documents are accessible through the DNV GL interface but access can also be granted via any secure public website using a unique tracking number, UTN (see box on next page).

"All transactions are in keeping with IMO guidelines," says Østby. While some flag states have been hesitant to accept the change, the overall response has been positive. "So far more than 80 per cent of statutory certificates have been approved for issue."

"We want to move the customers over to a digital interface where clients and vessels can stay up to date, get warnings, and take advantage of digital storage capabilities - and that's just the beginning."

Morten Østby, Senior Principal Consultant at DNV GL

Reflecting updates instantly, electronic certificates are accessible around the world.

Embracing the new digital reality can also be a personal challenge, he notes, and DNV GL is willing to help those unfamiliar or uncomfortable with digital transactions to familiarize themselves with new methods and learn to trust the system.

On the other hand, many owners want e-certification for all their ships as soon as possible. "Owners see the benefit. Endorsements are verified and completed automatically, complex processes such as the frequent certificate updates are automated, and there is no human handling of documents," Østby sums up. "That reduces the quality assurance work to verify certificates."

He notes that the system can also be used offline: "A surveyor can complete the job without online access and issue the certificate when connectivity is available again, either when the ship is within range or when they return to land."

DNV GL is proud to be leading the fast march toward modernizing classification, bringing efficiency, accuracy, and security to certification and survey booking processes that had remained virtually unchanged for decades, if not centuries. ■ KG

Find out more:

#### DNV GL Experts

Arun Sethumadhavan, Principal Engineer,  
Hull, Materials and Machinery  
Phone: +47 480 00 735  
E-Mail: arun.sethumadhavan@dnvgl.com

Morten Østby, Senior Principal Consultant,  
Technical Support  
Phone: +47 482 99 993  
E-Mail: morten.oestby@dnvgl.com

## ELECTRONIC CERTIFICATION

# FROM ROLLOUT TO REVOLUTION IN JUST FOUR DAYS

On 16 October 2017, DNV GL rolled out its IMO-compliant, fully electronic class and statutory certificates across its entire classed fleet – a historic first in the ship classification industry.

Just four days after DNV GL launched the solution, the LNG carrier *Macoma*, built at Daewoo Shipbuilding & Marine Engineering (DSME) in Okpo, South Korea, was delivered to Teekay Shipping with a full set of digitally signed electronic class and statutory certificates.

Hans-Olav Siebke, DNV GL Work Process Manager Newbuilding, said: "For the newbuilding regime, it was our goal to achieve a 100 per cent digital delivery following the rollout of electronic certificates. It was very encouraging and rewarding to see our customer's vessel delivered with a complete set of electronic certificates just four days after their release, realizing the full potential of the system."

Reflecting the owner's perspective, Philippe Wesel, Newbuilding Site Manager, Teekay, said: "We welcome the vessel to our fleet along with DNV GL's brand-new electronic certificate regime. We look forward to utilizing the IMO-compliant electronic regime and the additional DNV GL functionalities to the greatest possible extent to reduce the administrative burden on the ship and shore staff."



**The LNG carrier**  
*Macoma* was the first ship delivered with full digital certifications.

At another site in East Asia, Yo Hirokawa, Key Account Manager at the DNV GL Japan branch, was assisting in a class entry at the time of the rollout. With one exception, all certificates for the ship had been issued on paper. The owner had requested full electronic certification if possible.

Implementation lead Arun Sethumadhavan from DNV GL recalls the situation: "I remember very well writing the e-mail response to the owner's request of a complete set of e-certificates. We consider the new regime to be a big step forward, so I was extremely pleased to oblige the owner's wish to receive a complete

set of electronic certificates for a class entry vessel within four days of the rollout."

Having received the confirmation, Hirokawa and his colleagues proceeded to reissue all the certificates in electronic, digitally signed format immediately.

On 19 October 2017, Arun Sethumadhavan was able to inform his project team that the first class entry with a full set of electronic certificates had occurred. His summary: "This historic event proves three things: the system works efficiently; it is as fast as we had hoped, if not faster; and our customers want it."

## ACHIEVING A PAPERLESS CLASS

DNV GL is the first classification society to achieve full-scale production capability of IMO-compliant electronic certificates. This enables issuance of electronic certificates for the entire DNV GL fleet at the first periodical survey following rollout, subject to flag acceptance.

Shipowners and managers, flag states, port state authorities, vetting agencies and many other stakeholders can benefit from a paperless class and statutory regime allowing certificates to be managed, shared, stored and verified for authenticity anywhere at any time.

### Main features:

- Reduced administrative burden saves owners and other stakeholders time and money
- Paper handling is eliminated (printing, scanning, archiving)
- Certificates can be shared with stakeholders using access codes
- Updated certificates are available on the My DNV GL service Fleet Status
- No risk of losing a certificate

Certificates are published on the My DNV GL service Fleet Status on veracity.com immediately upon completion of a survey or issuance

by a DNV GL office. They can also be received by e-mail using the subscription feature on the platform, or delivered in electronic format to the vessel. Documents are protected against tampering and carry a digital signature and a unique tracking number (UTN) for validity and authenticity verification using an online authentication service available via [trust.dnvgl.com](http://trust.dnvgl.com) by entering the UTN and the ship's DNV GL ID.

Operators can share the secure certificate folder with selected stakeholders using a temporary access code generated on the My DNV GL service Fleet Status.

# READY TO FACE THE EXTREMES

Whether Arctic, Antarctic or Amazon, today's expedition cruise ships take their passengers to the most remote natural wonders. Hapag-Lloyd Cruises is one of the sector's major players. Head of New Builds Henning Brauer speaks about challenges to overcome when constructing these vessels, and the plans for the future.

On a grey Friday afternoon, Dr Henning Brauer is sitting in his office in Hamburg's iconic Berliner Bogen office complex. The rain is relentlessly hammering the windows. The Arctic and its natural wonders is far away. Yet it is here, on the desk of the Head of New Builds, that the plans for the next-generation ships of Hapag-Lloyd Cruises are slowly taking

shape - in drawings, software applications and in Brauer's head.

The shipbuilding engineer joined the company eight years ago, initially working with the *Europa 2* project team. Today he heads a team of five, overseeing the complex design process for Hapag-Lloyd Cruises' two future expedition cruise ships

**Both newbuilds** will be launched in 2019 and will travel to the most exotic destinations.



**Expert**  
Dr Henning Brauer  
is Head of New  
Builds at Hapag-  
Lloyd Cruises.



*HANSEATIC nature* and *HANSEATIC inspiration*. "This contract is a real challenge," says Brauer, his eyes shining with excitement. "These vessels not only have to be comfortable, economical and efficient; they must satisfy the most stringent environmental requirements as well," the 39-year-old shipbuilder points out. Their destinations will be the highly regulated Arctic, Antarctic and Amazon regions. "It is the desire to experience nature that makes customers book with us," says Brauer. Expedition cruises have never been more popular among passengers: "All the numbers tell us that these vessels will be very well occupied. We are already receiving some enquiries for these newbuilds," reports Karl J. Pojer, President and CEO of Hapag-Lloyd Cruises.

#### Expedition pioneers

But future passengers must still be patient and wait until the two vessels will finally launch. The expedi-

tion ships are under construction at Vard shipyard. Earlier this year the keels were laid down and steel cutting began; *HANSEATIC nature* is scheduled to be christened and take her maiden voyage in April 2019. *HANSEATIC inspiration* is to follow her six months later.

What is unusual about this project: Vard have been experts in building offshore and fishing vessels but the Hapag-Lloyd Cruises contract is the yard's first engagement in the cruise ship segment. This situation is not unlike the order placed by Hurtigruten with Kleven Verft: The Scandinavian cruise ship owner is having as many as four new expedition ships built at the yard which has so far been focused on supply and other specialized vessels.

"A small ship is no less complex than a big one. However, an expedition vessel is clearly more demanding than a conventional cruise ship," Brauer points out. "Vard have been able to convince us >

Photos: Hapag-Lloyd Cruises



In June 2017 the keel laying of HANSEATIC nature took place at Vard shipyard.



> of their high quality standards." The Norwegian yard had plenty of experience building smaller vessels as well as ice-class ships, he adds.

#### Close cooperation

Apart from making the best of the limited space available on board, implementing the new Polar Code is probably the most challenging aspect in designing the vessels. "The tightened regulations ensure a higher level of safety - while at the same time making the ship roughly 200 tonnes heavier, costing plenty of precious space and raising the costs. All these are factors we have to compensate for by enhancing efficiency in other places," Brauer explains. Hapag-Lloyd Cruises and Vard are handling this together. "We are honoured to have been chosen by Hapag-Lloyd Cruises for this project," says Roy Reite, President and CEO of Vard. "A leading player like Hapag-Lloyd Cruises placing their trust in Vard's capabilities to develop these unique, high-end vessels shows the recognition we have quickly earned in this segment of the specialty shipbuilding market."

DNV GL is providing specific assistance to the owner and the yard: "For example, our Maritime Advisory services help owners quickly determine the Polar Code's requirements relevant to their vessels, assess how close they are to compliance, and develop an action plan," says Steven Sawhill, Discipline Leader, Cold Climate Advisory Services at DNV GL - Maritime.

Since increased fuel consumption will play a key role for the new ships, which will be built to a higher ice class, DNV GL has optimized the interplay between the hull form, the initial general arrangement and the stability requirements. This will lead to a reduced fuel bill of up to ten per cent.

"These vessels not only have to be comfortable, economical and efficient; they must satisfy the most stringent environmental requirements as well."

Dr Henning Brauer, Head of New Builds at Hapag-Lloyd Cruises

The experts of DNV GL, Vard and Hapag-Lloyd Cruises had investigated more than 100,000 different hull shapes during the development stage. "We were very pleased to have been able to exceed Hapag-Lloyd Cruises' expectations and offer an optimization solution that demonstrates that efficiency and sustainability go hand in hand," says Knut Ørbeck-Nilssen, CEO DNV GL - Maritime.

#### Sensitive sea regions

The glass walls of Brauer's first-floor office are covered with engineering drawings: cross sections, detail representations, deck floor plans. "The challenge in shipbuilding is in the details," says Brauer, looking at the drawings. "From wiring and colours through to every individual piece of steel, everything must be perfectly matched." Which makes the designer's work incredibly complex. Not to forget the tight environmental regulations. "We will be navigating in sensitive sea regions. No wonder the demands are extreme," the ship expert adds. To meet the new regulatory requirements, the ships must be built 15 to 20 per cent larger per passenger than 30 years ago, Brauer estimates. Not only



Hapag-Lloyd Cruises' President and CEO Karl J. Pojer (l.) and Tudorel Topa, Senior Vice President of Vard, celebrated *HANSEATIC inspiration's* steel cutting in October 2017.

are they more complex to design and build; their operational systems are much more sophisticated as well: a selective catalytic reduction system filters out 95 per cent of noxious emissions; a Promas rudder with a custom-designed propeller cuts fuel consumption; and state-of-the-art "E-Zodiacs" feature electric propulsion. And when it comes to waste disposal and wastewater-treatment, the owner naturally favours sustainable technologies as well.

"In building these ships we make sure we are always on the safe side by going beyond what the regulations require," Brauer says. After all, the longest trip without shore excursions is 32 days. "If anything goes wrong, we will be on our own. There will be nothing but ice for thousands of miles."

The regions beyond the 60th parallel are definitely considered to require the highest navigational skills. But with highly qualified crews, advanced technology and smart ship design, Hapag-Lloyd Cruises can count itself among the top players. "We have been

active in this segment since the early 1990s and are in fact one of its pioneers. Our extensive experience is a clear competitive advantage," says Brauer.

Reason enough for the industry to watch the development carefully. With its advanced newbuilds *HANSEATIC nature* and *HANSEATIC inspiration*, Hapag-Lloyd Cruises is once again raising the bar, combining its expertise from two segments: expedition and luxury cruises. ■ NIS/SJ

#### DNV GL Experts

Dr.-Ing. Karsten Hochkirch  
Head of Department Fluid Engineering  
Phone: +49 331 9799179 0  
E-Mail: karsten.hochkirch@dnvgl.com

Steven Sawhill  
Discipline Leader, Cold Climate Advisory Services  
Phone: +47 476 87 694  
E-Mail: steven.sawhill@dnvgl.com

#### THE NEW POLAR CODE

The Polar Code went into effect on 1 January 2017, imposing new rules on ships navigating Arctic and Antarctic waters. The code defines how these vessels must be designed, crewed and prepared.

For example, improved damage stability and fuel tank protection are required of ships with polar ice class. "The Polar Code's provisions help ensure shipowners and operators understand

the capabilities and limitations of their vessels for operating in polar environments. This reduces the likelihood of mistakes and poor judgement, thus increasing safety and improving protection of the polar environment. The code also gives owners and operators a structure for conducting relevant operational risk assessments," says Steven Sawhill, Discipline Leader, Cold Climate Advisory Services at

DNV GL - Maritime. The stricter regulation was passed by the IMO to ensure both the safety of life at sea and to protect the sensitive environment in the Arctic and Antarctic, while the commercial shipping activity in these regions is increasing. DNV GL contributed to the code: "The Polar Code adopted some of the functional goals we developed and implemented in our winterization notation," says Sawhill.

# MARINE INSURANCE AND ARCTIC RISK

Shipowners may welcome more ice-free transit in Arctic waters, but according to a recent DNV GL study sponsored by the Gordon and Betty Moore Foundation, the industry should share more data with marine insurers to assess and manage risk.

The retreat of Arctic ice has opened new possibilities for tourism, resource exploration, development and marine transport. For example, over the past decade alone, cruise ship activity in Svalbard, an archipelago between mainland Norway and the North Pole, has doubled. At the same time, oil shipments from the Russian Arctic jumped from insignificance to ten million tonnes per year.

"Wherever there is industrial activity, there is risk, and nowhere more so than in the Arctic," reminds Steven Sawhill, Discipline Leader, Cold Climate Advisory Services at DNV GL - Maritime. "Imagine if an accident - be it a cruise ship or an oil tanker - occurred in polar waters," he says. "Marine insurers certainly acknowledge the risks, but perhaps have not fully appreciated the difficulty and costs of arranging rescue, salvage and environmental clean-up operations in these waters."

Sawhill, who has spent most of his career studying shipping in the High North, notes that in some areas, the harsh environment increases the likelihood

of accidents and, given the pristine state of many of the region's marine ecosystems, the environmental consequences of an accident could be catastrophic. "Increased shipping activity, combined with harsh weather, pervasive ice, limited hydrographical and bathymetric charting, and the scarcity of land-based emergency response infrastructure, all contribute to higher risk," he says. "Assessing these risks properly is critical to ensuring safety and preserving the environment."

## A comprehensive study

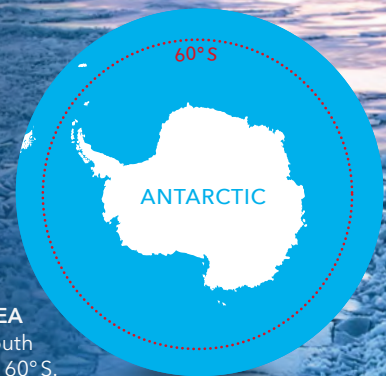
In 2015 DNV GL was approached by the America-based Gordon and Betty Moore Foundation with the request to prepare a study identifying mechanisms that the marine insurance and reinsurance sectors (I&RS) currently use to reduce risks to Arctic marine ecosystems and coastal communities from vessel traffic. Over the next year, DNV GL organized the study around a literature review, online questionnaires, workshops with non-governmental organiza-

## POLAR WATERS

The Polar Code applies to SOLAS- and MARPOL-certified ships operating on domestic or international voyages in polar waters. Polar waters are defined as the following areas:



**ARCTIC AREA** - the waters north of latitude 60°N, with deviations to include waters around the southern exposure of Greenland, but excluding some national waters.



**ANTARCTIC AREA** - all waters south of latitude 60°S.



tions with interests in Arctic environmental protection, and in-depth interviews with a small, targeted set of marine insurance professionals.

“We soon discovered that there was very little published material on the subject, and when we began to analyse our surveys, we saw that while marine insurers understand Arctic shipping is risky, many did not feel they had sufficient information to adequately assess these risks,” says Sawhill. “Many look to regulators, class, owners and even, to a lesser degree, flag states, to assess risk. Furthermore, their exposure to Arctic risk is minimal, leading to some ambivalence among marine insurers. As one interviewee said, ‘We do not want to spook our members by being too reactionary, but neither do we want to give them a false sense of security.’”

### Knowledge gap

This lack of knowledge also makes it difficult for marine insurers to calculate Arctic risks and set payouts. As one insurer put it: “The amount of trade in the Arctic and the number of incidents is too low for us to get a handle on the loss severity side of the equation. We have too little experience on the cost of dealing with an incident in these waters.”

Sawhill notes that this lack of experience may lead some insurers to overlook ways in which the terms of their coverage might be amended to

In the absence of practical experience and data, insurers find it difficult to assess risks to shipping in Arctic regions.

### GORDON AND BETTY MOORE FOUNDATION

The Gordon and Betty Moore Foundation was established to create positive outcomes for future generations. In pursuit of that vision, the Foundation collaborates with specialists in a broad range of disciplines to foster path-breaking scientific discovery, environmental conservation, patient care improvements and preservation of the special character of the San Francisco Bay Area.

encourage safer operations in Arctic waters. For example, the survey showed that insurers don’t consider routing as a factor in underwriting. “We do not instruct, ask or advise our insured on minimizing routing impacts,” explained one insurer. “We do not have any measures or instructions on avoiding essential marine habitat or designated areas. This is very operationally related and is not a mandatory requirement.” At the same time, others acknowledged that if good information on such areas and best practice is readily available, it could be incorporated in the underwriting and loss prevention process.

Sawhill is careful to point out that marine insurers understand that operation in polar waters represents a new risk picture and have shown a willingness to learn more, but that many don’t know where to turn. “It is in everyone’s interest that marine insurers get involved and work more closely with owners, class and relevant organizations to share knowledge,” says Sawhill. “Fortunately, marine insurers see themselves as part of the solution and are willing to take >

Photo: vice\_and\_virtue - iStockphoto.com





Pristine waters and coastal areas in the Arctic and Antarctic are environmentally highly sensitive.

> measures to improve safety – and remain competitive.”

Indeed, the marine insurance sector has not been idle. In 2012, marine insurer Lloyd’s of London commissioned a comprehensive study (“Arctic Opening: Opportunity and Risk in the High North”) that detailed the challenges of operating in the Arctic. Other reports followed, and their findings helped shape the IMO’s International Code for Ships Operating in Polar Waters (the Polar Code), which went into force on 1 January 2017. Critically, the Polar Code includes POLARIS, an operational risk assessment tool to help operators evaluate whether a ship of a given ice class can safely operate in a given ice condition.

### A collaborative approach

In May 2017, the Arctic Council (made up of eight countries with interests in the Arctic) launched the “Arctic Shipping Best Practice Information Forum”. Michael Kingston, a UK-based maritime lawyer who is assisting the Arctic Council’s Shipping Expert Group in the development of the forum and represented the International Union of Marine Insurance (IUMI) at the IMO, says this work will be critical going forward.

“The aim of the forum is to raise awareness of all those involved and might be potentially affected by Arctic marine operations, and to facilitate the exchange of information between the forum members,” he explains. “By bringing together all stakeholders, including marine insurers, to share information and best practices, we can take a big step toward to minimize Arctic risk.” Kingston adds that the forum members will soon have access to a web-based knowledge-sharing portal, which will be launched in February 2018.

Kingston also worked with Sawhill to analyse the Gordon and Betty Moore Foundation DNV GL report

(see page 25). He notes that while its findings are useful in identifying specific knowledge and perception gaps, the report also serves as a call to action. “While directed at marine insurers, I encourage all stakeholders to review this report,” he says. “Everyone understands the opportunities of Arctic shipping and drilling, but not well enough the risks. As the report notes, the risk management resources are there – but they aren’t much good unless people use them.”

### Shared responsibility

For Sawhill, minimizing risk in the Arctic cannot be achieved with the passage of some regulation, industry guideline or class notation – all industry stakeholders must play an active role. And considering the level of risk in polar waters, the alternative is almost unthinkable.

“There is a tendency in our industry to wait for a disaster before making changes, then expressing dissatisfaction after the legislation comes into force,” says Sawhill. “Regulations rushed into force under these conditions do not address underlying causes but public outrage, often generated by shocking images: victims in a lifeboat, a soiled beach, an oil-covered seabird. Our goal is to encourage the industry to take a more proactive, collaborative and transparent approach to managing polar risk. After all, if the industry plans to operate in these waters, we have an obligation to show the world we can do it safely with minimal impact on the environment.” ■ AW

### DNV GL Expert

Steven Sawhill

Discipline Leader, Cold Climate Advisory Service

Phone: +47 476 87 694

E-Mail: [steven.sawhill@dnvgl.com](mailto:steven.sawhill@dnvgl.com)

### DNV GL: ARCTIC SHIPPING RISK ASSESSMENT AND WINTERIZATION

DNV GL supports shipowners in complying with the Polar Code and obtaining a Polar Ship Certificate. The services include both statutory certification on behalf of the flag administration, and advisory services to help owners prepare for certification. DNV GL also offers a suite of specialized notations, including ice strengthening, icebreaker notation, and winterization, to meet cold-climate operating needs. Other advisory services include GAP analysis, technology qualification for a new (or unproven) technology in cold-climate operation, and safety culture management related to human performance and behaviour under Arctic conditions.

Photos: Vasilvich/vice\_and\_virtue – iStockphoto.com



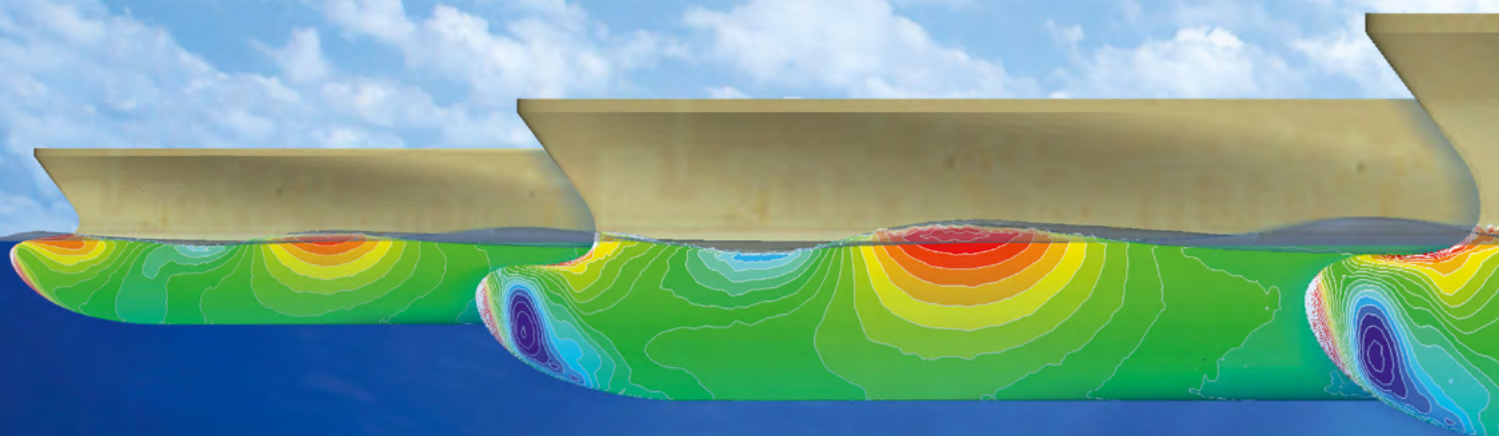
# TRAINING AT DNV GL



For the complete range of training courses offered by the Maritime Academy please visit: [dnvgl.com/maritime-academy](http://dnvgl.com/maritime-academy)

- 10. - 14.12.17**  
**Superintendent Workshop - Managing Day-to-Day Operations**  
Dubai, UAE
- 11. - 12.12.17**  
**Designated Person Ashore (DPA) Training Course**  
Madrid, SP
- 11. - 12.12.17**  
**Internal Auditor ISM-ISPS-MLC for Shipping Companies**  
Singapore, SG
- 11. - 12.12.17**  
**Maritime Risk Management and Incident Investigation**  
Dubai, UAE
- 11. - 12.12.17**  
**Vetting Inspections**  
Pasay City, PH
- 11. - 13.12.17**  
**Company/Ship Security Officer (CSO/SSO) Training Course**  
Mumbai, IN
- 11. - 13.12.17**  
**HAZOP Leader Course**  
Antwerp, BE
- 11. - 14.12.17**  
**Approved HazMat Expert**  
Barendrecht, NL  
Gdynia, PL
- 11. - 15.12.17**  
**Superintendent Workshop - Managing Day-to-Day Operations**  
Singapore, SG
- 12. - 13.12.17**  
**Designated Person Ashore (DPA) Training Course**  
Piraeus, GR
- 12. - 13.12.17**  
**Energy-Efficient Operation of Ships - Masterclass**  
Piraeus, GR
- 12. - 14.12.17**  
**Company/Ship Security Officer (CSO/SSO) Training Course**  
Genoa, IT
- 12. - 14.12.17**  
**Internal Auditor of an Integrated Management System acc. to ISO 9001, ISO 14001 and OHSAS 18001 for Shipping Companies**  
Istanbul, TR
- 13. - 14.12.17**  
**Practical Marine Risk Assessment**  
Dubai, UAE
- 13. - 15.12.17**  
**Train the Trainer for Shipping Companies**  
Mumbai, IN
- 14.12.17**  
**STCW for Crewing Managers**  
Rotterdam, NL
- 14. - 15.12.17**  
**ISM Internal Auditor - Survey Simulator Practice**  
Madrid, ES
- 15.12.17**  
**Emergency Preparedness and Crisis Management**  
Singapore, SG
- 16.12.17**  
**Complying with the MLC 2006**  
Mumbai, IN
- 18.12.17**  
**Introduction to the Maritime Industry**  
Singapore, SG
- 18.12.17**  
**Introduction to the System of Maritime Regulations**  
Groningen, NL
- 18. - 19.12.17**  
**Designated Person Ashore (DPA) Training Course**  
Rotterdam, NL
- 18. - 19.12.17**  
**Internal Auditor ISM-ISPS-MLC for Shipping Companies**  
Pasay City, PH
- 20. - 21.12.17**  
**Maritime Risk Management and Incident Investigation**  
Singapore, SG
- 22.12.17**  
**Revised ISO Standards 9001:2015 and 14001:2015 for Shipping Companies**  
Goa, IN
- 28. - 30.12.17**  
**Internal Auditor ISM-ISPS-MLC for Shipping Companies**  
Colombo, LK
- 08.01.2018**  
**Understanding STCW incl. Latest Amendments**  
Singapore, SG
- 09. - 10.01.18**  
**Designated Person Ashore (DPA) Training Course**  
Singapore, SG
- 10.01.18**  
**Understanding ISPS**  
Mumbai, IN
- 16.01.18**  
**Cybersecurity in the Maritime Industry - General Awareness Training**  
Singapore, SG
- 12.02.18**  
**Behaviour-Based Safety**  
Singapore, SG

Photo: Rido - Fotolia



# SHIP TRIALS IN THE VIRTUAL WORLD

DNV GL's new Virtual Trial application allows yards and owners to predict the efficiency of different hull design options accurately, quickly and economically.

The hydrodynamic performance of a ship hull is an important factor influencing the vessel's fuel efficiency and life-cycle costs. A thorough understanding of the characteristics that determine performance streamlines the conceptual design stage of a newbuilding project and can result in a competitive advantage during the bidding and purchasing processes as well as in charter party negotiations for vessels in service.

Today we have several different options for assessing hydrodynamic performance. Empirical benchmarking by searching databases for vessels with similar key parameters can be a quick and inexpensive way to evaluate a design. But the results will only reflect general trends, rather than allow accurate predictions, and are of limited use for unusual and innovative designs.

Model tests deliver much more detailed results. But with a typical lead time of about ten weeks, they can delay the initial design and tender phase of a project significantly, along with being rather costly. Furthermore, while the results from one particular facility may be consistent across designs, comparing data from different facilities can be challenging.

## Automated delivery of key performance data

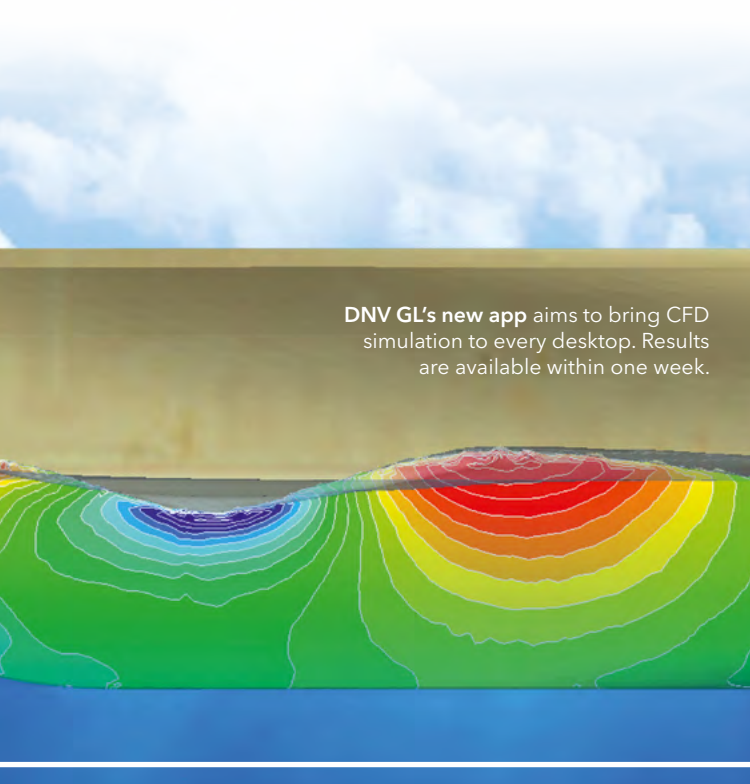
To support customers in choosing the most efficient design option for their newbuild or retrofit, DNV GL has developed a cost-effective tool which predicts a design's hydrodynamic performance quickly and accurately. The new Virtual Trial application, integrated into DNV GL's customer portal, uses computational fluid dynamics (CFD) simulations to analyse, com-

pare and benchmark the fuel efficiency of hull design variants at full scale.

As CFD simulation technology has matured it has become a viable alternative to traditional model basin tests while reducing lead time and costs. However, the computer resources and expert know-how required to design and carry out such tests are still not commonly available. Furthermore, the varying assumptions and simulation parameters used by yards and design offices make reliable comparisons and benchmarking nearly impossible.

"What we have done with our Virtual Trial application is let our customers run CFD simulations without having to invest in CFD expertise," says Senior Project Engineer Carsten Hahn, DNV GL - Maritime. Virtual Trial streamlines and automates the CFD simulation process. Users can upload individual vessel hull forms, run simulations with preset parameters and then compare the results against those from similar vessels. Whether for a newbuilding or a retrofitting project, Virtual Trial reduces the barriers to full-scale CFD simulation testing and comparative benchmarking.

"Virtual trials can be launched in complete anonymity, from anywhere, at any time, by simply uploading the hull geometry file and defining the operating profile," Hahn explains. Then, without the need for any CFD-specific input, users can conduct fully automated full-scale RANSE (Reynolds-averaged Navier-Stokes equations) VoF (volume of fluid) CFD simulations on the resistance and propulsion of their vessels. The results are available within one week in a Web-based report representing the CFD data and



DNV GL's new app aims to bring CFD simulation to every desktop. Results are available within one week.

hull lines in 3D, providing the user with enhanced insight into the flow details.

**Potential industry standard**

"We see many potential uses of the Virtual Trial application," says Uwe Hollenbach, Principal Engineer Fluid Engineering at DNV GL - Maritime. "Design offices and shipyards can analyse and benchmark different hull options during the conceptual design phase, then track how design changes will affect the vessel's hydrodynamic performance to ensure that contractual requirements are still achievable."

Competing designs can be uploaded to Virtual Trial by the designers themselves to ensure that the hull lines stay confidential. The shipowner can then be granted access to the results. "This allows shipowners to compare competing design proposals from different yards or design offices during the bidding process to obtain an impartial assessment of the designs at a fraction of the cost and lead time of model tests," says Hollenbach. The standardized CFD

set-up also lets shipyards and designers see where they could improve their designs by comparing them against anonymized state-of-the-art designs from the Virtual Trial database.

"For vessels in service this application could even serve as a performance certificate, showing potential charterers or buyers how a vessel might perform within their operating profile," Hollenbach suggests. Even with advanced performance monitoring solutions it can be difficult to predict the performance or the fuel consumption for different operating profiles. But with the Virtual Trial app, the owner could simulate the intended operating parameters and provide a tailored performance assessment to the potential charterer within a week.

The standardized Virtual Trial report format might even become an industry-wide reference tool for comparison and benchmarking, especially when projects are submitted by different parties. This will make performance predictions more transparent and reliable. Virtual Trial lets customers take control of their data, benefit from widely accepted benchmarking capabilities, and enhance their competitiveness. ■ AJO/SIAD

**DNV GL Experts**

Uwe Hollenbach, Principal Engineer Fluid Engineering  
 Phone: +49 40 36149-8771  
 E-Mail: uwe.hollenbach@dnvgl.com

Carsten Hahn, Senior Project Engineer, Fluid Engineering  
 Phone: +49 331 979917912  
 E-Mail: carsten.hahn@dnvgl.com

Photos: Andrey\_Kuzmin - Shutterstock, DNV GL



Selecting the best hull design based on hydrodynamic performance has never been easier: DNV GL's cost-effective Virtual Trial tool allows users to assess and compare hull forms online using the My DNV GL customer portal – confidentiality assured.

# BLOCKCHAINS IN THE SHIPPING WORLD

The ability to reduce trade documentation, processing costs, delays, data manipulation, fraud and human error through uncompromisable "smart contracts" makes blockchain technology attractive to the shipping world.

## Warehouses

**Warehouse management** is a typical environment where blockchain technology can play out its strengths. Every single product or shipment, every inventory item and document can be **tracked reliably step by step**. Sources of damage, shrinkage and other losses can be identified. **Paperwork, delays and human error are reduced dramatically**, and transparency is improved. **IoT integration** offers further benefits.



## Shipments

Key concerns in supply chain management are simplification, the reduction of paperwork and the avoidance of fraud. In a blockchain process, the **shipper retains full control** and each party involved can only see data relevant to its role. It could **minimize the costs of transactions** involving many parties, and the enormous amounts of associated paperwork. **Ideally, each stakeholder (shipowner, government, regulators, agencies) will provide a node (computer)** of its own where the blockchain is replicated. A field trial by Maersk and IBM in February 2017 was successful.



Blockchain is a digital distributed ledger technology: business transactions of any kind are recorded in sets or "blocks" of data that build upon each other logically, similar to the entries in a ledger. Every transaction is time-stamped and encrypted. Multiple instances of this electronic ledger reside on many networked computers or "nodes" that are constantly synchronized and verified automatically using hash technology, comparable to the checksum method. Any attempt to manipulate existing records would be futile since discrepancies between the many instances of the same ledger will be detected immediately.

Blockchain technology allows transactions to be tracked and traced infinitely, can be used in

any business transaction and holds great promise for industry sectors involving multiparty or high-value transactions such as logistics, supply chain management, finance, food and insurance. A well-known implementation of the blockchain principle is the cryptocurrency Bitcoin, which has never been compromised since its introduction in 2009. ■ AK

### DNV GL Expert

Patrick Rossi, Senior Cyber Security Product Manager & ISDS Approval Engineer

Phone: +49 40 36149-8727

E-Mail: patrick.rossi@dnvgl.com

## Customs

Customs authorities must ensure the security and integrity of import and export transactions. Blockchain technology can potentially dramatically **reduce the time and effort of tracking and monitoring shipments**. Customs declarations submitted in a blockchain are **instantly visible to all parties** involved in the import. Importers will have verifiable information on the shipment, the product origin, and the associated financial transactions.

**Typical fraud patterns can be eliminated.** Interaction between government agencies, trade agreement product qualifications, carnet and bonded movement tracking are facilitated.



## Insurance

Transport insurance is an extremely complex and labour-intensive process. As a decentralized ledger, a **blockchain is manipulation-proof and easily accessible**. It enables rapid data exchanges between stakeholders including accelerated agreement on terms and conditions, **simplifying key business processes** such as shipment tracking, invoice verification and auditing. It has the potential to **reduce time, cost and risks throughout the insurance value chain**. A trial by Maersk, Microsoft and several insurance partners has been successful.

## Payments

Banking transactions in the international logistics industry can benefit from blockchains in multiple ways by **accelerating payment processing, tracking of balances, credits and debits**. Every person involved and their actions are traceable, which helps **mitigate risks, prevent manipulation** and money laundering and ensure compliance. In digitalized banking, **blockchains simplify verification**, ensure secure invoicing and payments, and build trust.



## Secure

Every transactional step in a business process is **recorded as a line item in the dedicated blockchain**. Every contributor to the process adds its own line item(s). Visibility of the data is limited to authorized parties. Once the entire process has been completed, **every step is traceable and cannot be falsified**. With identical, synchronized copies residing on many computers, **a blockchain is ensured against loss and destruction**.



## Transparent

"Who did what and when" can easily be determined at any time. **No step can be skipped or be performed without being logged**. Ongoing business processes can be monitored in real time. Blockchain technology uses open-source software that is **easy to customize**, is interoperable with existing and legacy systems, and has great potential for **integration of IoT technology**.



## Decentralized

A blockchain is a distributed database fed with data through **decentralized peer-to-peer transactions** without involving intermediaries or a central authority. Record-keeping is accomplished by consensus between multiple parties as the database is replicated on many computers. The resulting **seamless audit trail** builds trust and accountability among all stakeholders.

Photos: Elenathewise/mih/Sashkin/sveta/ist888456/weerasak - stockadobe.com, Podsolnukh - shutterstock.com



The ability to produce metal parts in a 3D printing process anywhere holds great promise for the maritime sector.

## A NEW DIMENSION IN MANUFACTURING

3D printing, or additive manufacturing, has the potential to transform the maritime industry - radically disrupting existing business models and redefining the entire supply chain. DNV GL is ready to help the industry navigate the way ahead, seize the potential, and mitigate risk, on a journey into the future.

"Imagine you're the captain of a vessel off the coast of Australia," says Marit Norheim, Vice President, Material Specialist, Hull, Materials & Machinery at DNV GL - Maritime. "A system component has broken and must be replaced to continue sailing. Communication with the shipowner reveals that the

piece is not kept in stock as a spare part and has to be manufactured by the European supplier before being shipped to you. Your vessel is looking at a downtime of weeks, perhaps even months."

Norheim's colleague Ramesh Babu Govindaraj, Principal Material Specialist, takes up the story: "But



what if that component can be printed in your nearest port? The manufacturer sends the relevant CAM file to their local office, a partner organization, or possibly the port itself where it is promptly made using a 3D printer. The part is then attached to a drone which transports it to your vessel, simply dropping it onto the deck for the crew to install. The downtime, not to mention the costs of manufacturing and logistics, is minimal."

"And," he adds with an enthusiasm clearly inspired by the unique possibilities of this technology, "what if your vessel even had its own printer? One it could utilize to print spare parts on demand?"

There's a slight pause in conversation for this scenario to sink in. "Don't you think," Norheim states, somewhat rhetorically, "this can be truly transformational for the maritime industry?"

### Layers of potential

It sounds like something from the realm of science fiction. But this is a near-future scenario, not an



The aerospace industry has already demonstrated the feasibility of additive manufacturing (AM).



"The implications for stakeholders throughout the industry are enormous. If products and components can be printed as needed locally or even on board a ship, this is truly a disruptive innovation for the supply chain."

**Marit Norheim**, Vice President, Material Specialist, Hull, Materials & Machinery at DNV GL

industry pipedream, as Norheim and Govindaraj, who have been studying the potential of additive manufacturing (AM) at DNV GL's Høvik headquarters, are quick to stress.

AM is a type of 3D printing. Over the past few years additive manufacturing has hit the headlines revealing how machines applying layer upon layer of polymers can create objects of almost any shape and geometry guided by design files - even in the comfort of your own home.

What is more, a fascinating new development is now sending shockwaves of excitement through numerous industrial arenas, including the maritime industry: it is now possible to print in metals.

"Suddenly everyone is paying attention," Norheim reveals. "The implications for stakeholders throughout the industry are enormous. If products and components can be printed as needed locally or even on board a ship, this is truly a disruptive innovation for the supply chain, translating into

shorter lead times, lower costs, and a reduction of effort in labour, logistics and spare parts stock keeping." AM can be used for maintenance and repair as well, simply by adding layers of material to worn components to avoid having to replace them. "This," Norheim stresses, "could be a complete game changer."

### Global movement

Govindaraj remarks that the technology already had that effect for certain analogous industries such as aviation, where an Airbus A350 boasts more than 1,000 3D-printed parts. The maritime sector is following suit and, he says with conviction, the desire to embrace AM is abundantly clear.

"There are now 3D printers in many ports and industry hubs around the world," he notes, "and this is just the start. Parts ranging in size from screw pins and bearing shells to box heat exchangers and even propellers have been printed successfully. As the technology, and our understanding of it, >

> matures, the spectrum of printable components will increase. That is exciting, but it does come with challenges as well."

**The need for legal protection**

The challenges for the manufacturers and for multiple other players within the supply chain are obvious. If manufacturing shifts away from their factories to local sites and even ships or oil and gas platforms around the world, their current business model will feel the pressure. As for shipowners, while the potential to save costs and time is promising, the risks associated with AM parts and their quality assurance - which includes answering the question whether a given part is "fake" or not - surely increase.

Simply put: if it becomes this easy to print fakes, or reprint parts once you have obtained an original file, isn't that the potential death knell for manufacturers already reeling from the loss of production? Every stakeholder, Norheim notes, is entitled to a legally protected environment to do business. "Manufacturers have to protect their intellectual property, and shipowners must safeguard the integrity of parts

to ensure safe operation," she points out. "Part of the solution lies in the software that is used." Employing a technology like blockchain (see page 30) would allow those printing the parts to use a specific design only once - the same way consumers can digitally rent a film and play it once without actually owning it. This means the manufacturer still has a product to sell and the customer knows they are getting "the real deal". "And then, of course, there's the role of class," Norheim emphasizes.

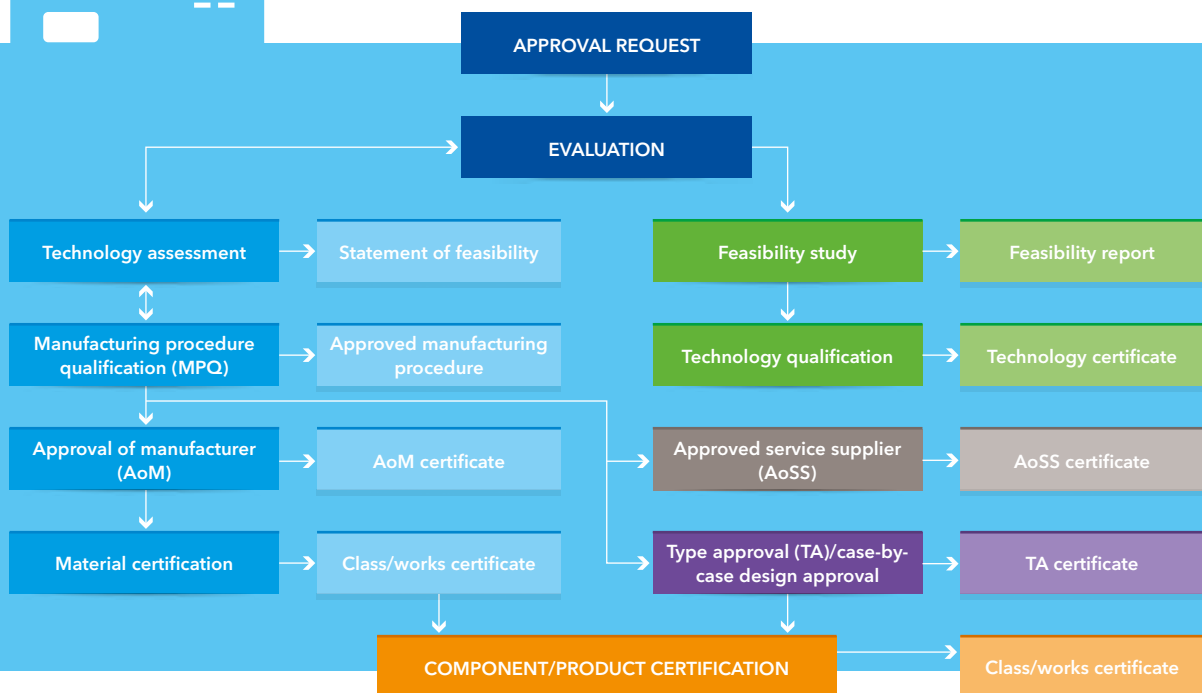
**Building understanding**

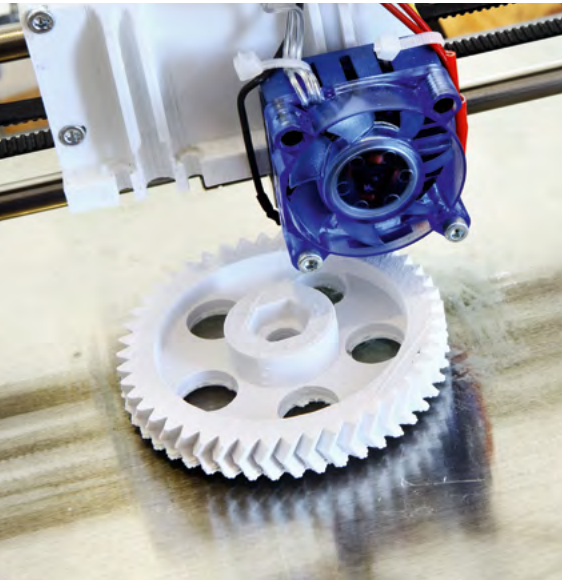
DNV GL has been looking into the potential of 3D printing for the maritime and oil and gas sectors since 2010. This has seen the organization releasing research and innovation papers, undertaking pilot studies and, more recently, an involvement in various JDPs, the latest of which involves a specialist team working alongside PJ Diesel Engineering, Kompressorenbau Bannewitz, Maersk Drilling, Thürmer Tools, and FORCE Technology to assess the repair and reconditioning of turbochargers with laser cladding 3D printing technology.



**CERTIFICATION PATHWAY FOR ADDITIVE MANUFACTURING**

As an innovative technology, especially for metal parts, additive manufacturing (AM) has yet to find its way into the mainstream of ship and offshore parts procurement. To help shipowners and operators know when they can trust AM parts, DNV GL has developed a detailed approval and certification procedure for AM processes as well as a new classification guideline for the approval of 3D-printed products.





Ensuring that AM parts are genuine and reliable is key to winning the trust of the industry.

“There are now 3D printers in many ports and industry hubs around the world and this is just the start. Parts ranging in size from screw pins and bearing shells to box heat exchangers and even propellers have been printed successfully.”

**Ramesh Babu Govindaraj,**  
Principal Material Specialist  
at DNV GL

However, Norheim, Govindaraj and Sastry Yagnanna Kandukuri from DNV GL Oil & Gas have focused on a more over-arching remit - initially researching, then developing DNV GL's first classification guideline for the approval of 3D-printed products. This guideline, which has been released recently, is a landmark achievement for DNV GL and their customers.

#### Building confidence

“DNV GL has a long history as an independent and trusted partner for the maritime and oil and gas sectors,” Norheim states. “So it is important that we take a lead role in supporting our global customers and helping them realize the potential of emerging key technologies.”

Govindaraj explains how it will be delivered, going step-by-step through the class guideline DNVGL-CG-0197. “Basically we have to start at the very beginning,” he explains, “with a complete review of any requested 3D prototype model that is to be printed. We look at the design, functionality, materials - every parameter that will have an impact upon the final product. This is followed by a technology assessment, manufacturing procedure qualification, data transfer, then the actual printing and post processing. We are physically present for the printing of the prototype, and have a full understanding of the printer capability to ensure that it can be emulated anywhere around the world.”

He continues: “This is still a critical manufacturing process, regardless of the fact that it is not being undertaken in a traditional manufacturing environment,

so we ourselves and our customers need to have complete confidence in it. The final step is a comprehensive evaluation and testing process, as we would undertake with any product. If we are satisfied with the results, we will issue the certificate. This may be a revolutionary concept, but our customers need the same level of assurance in these products as they would in any others. That is exactly what we aim to provide with our new guidelines.”

#### Here to help

Norheim concludes that 3D printing is “here to stay” and should be welcomed, noting: “It is an opportunity that should be embraced, rather than a challenge the industry should try and resist. The new classification guideline is here to help, assisting all stakeholders in the implementation of AM.”

Govindaraj agrees, adding: “We are ready to certify, and ready to support. This really is a new dimension, and we look forward to helping our customers discover its potential.” ■ AJ

#### DNV GL Expert

Ramesh Babu Govindaraj, Principal Material Specialist,  
Hull, Materials & Machinery  
Phone: 47 902 25 084  
E-Mail: ramesh.babu@dnvgl.com



**Piggyback ride** across the Atlantic Ocean: Late last summer the DNV GL-classed heavy-lift vessel *Combi Dock III* carried the 106-year-old four-mast bark *Peking* from New York City to Brunsbüttel, Germany. The transfer took twelve days.



Photos: By Nightflyer (Own work) [CC BY-SA 4.0 (<https://creativecommons.org/licenses/by-sa/4.0/>), via Wikimedia Commons, DNV GL

G

## HOMECOMING QUEEN

After 106 years, 34 Cape Horn roundings and plenty of rust, the fate of the four-mast bark *Peking* lies in the hands of DNV GL surveyor Markus Pelz. Will she float - or will she not? A slightly unusual mission on board the historic sailing ship.

31 July 2017 was a very special day even for a seasoned surveyor like Markus Pelz. It was not a container ship, bulk carrier or tanker that was waiting for his visit at the pier in Brunsbüttel port that morning. It was a sailing ship - a 106 year-old windjammer, the historic four-mast bark *Peking*. She was one of the legendary Flying P-Liners of the German shipowning company Laeisz. Only four of them have survived, namely *Pommern*, *Passat*, *Padua* (renamed *Kruzenshtern*) and *Peking*. The Flying P-Liners were once the workhorses of globalization and the pinnacle of the technical evolution of sailing ships before they were replaced by steamships. >



Using a hammer, DNV GL surveyor Markus Pelz checks the interior wall of the old cargo ship.

> They were mainly deployed as saltpetre carriers between South America and Europe.

After being taken out of service, *Peking* had been used as a museum ship near the Brooklyn Bridge, New York, for 41 years before being bought back. She will adorn the port of Hamburg as a new landmark in a few years. But first the majestic windjammer will undergo comprehensive restoration at Peters Werft shipyard in a 20-million-euro project, which will be overseen by the Hamburg Maritime Foundation. Then she will embark on her very last voyage to Hamburg to join the future German Port Museum as its largest and most prominent asset, permanently anchored in the same city where she was built by Blohm + Voss shipyard and launched in 1911.

#### Safe return

Before all this can happen, the ageing, rather rusty vessel must undergo a thorough inspection by the critical eyes of DNV GL surveyor Markus Pelz. In a twelve-day journey she crossed the Atlantic Ocean one last time, this time on board the DNV GL-classed heavy-lift carrier *Combi Dock III*. Such gracious help will not be available to her on her way to the repair yard in Wewelsfleth – she will have to rely on her

own buoyancy because the gate of the flood barrier on the river Stör is too narrow for a heavy lifter like *Combi Dock III*.

The question was: Would the old lady, 115 metres in length, having mastered 34 Cape Horn roundings, make it to the yard? Did the dried hull of the “ship inside a ship” survive the long trip from America to Europe intact? Questions only Markus Pelz could answer. He must perform a thorough review of the ship’s ability to float and be moved. If the inspection is positive, he will give his approval for the vessel to

#### Legendary windjammer

*Peking* was a member of the Flying P-Liner fleet of shipowner F. Laeisz, Hamburg. The 66 vessels, whose names all began with the letter P, were famous for their speed and safety. They courageously rounded the notorious Cape Horn when other ships were seeking shelter to wait for better weather. *Peking* was built by Blohm + Voss, Hamburg, and was launched in 1911.

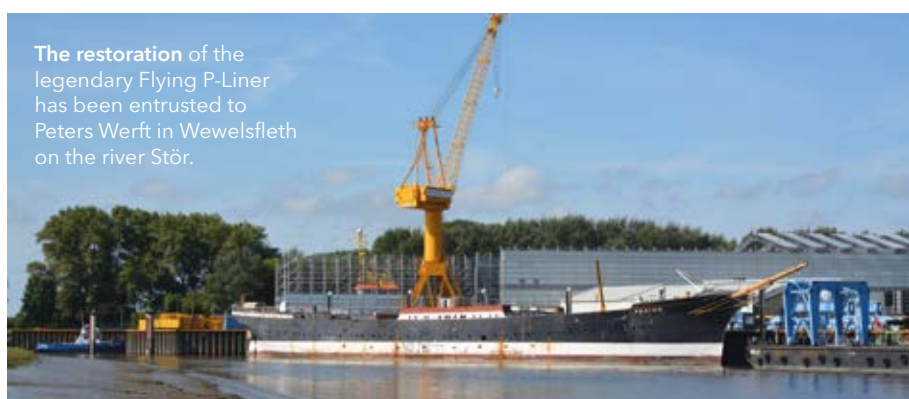




Having passed the survey in Brunsbüttel, *Peking* is allowed to go afloat.



**Good mood** on board: Lars Biemüller, Project Manager at Peters Werft, Joachim Kaiser, board member at Hamburg Maritime Foundation, and DNV GL surveyor Markus Pelz (f. l.).



The restoration of the legendary Flying P-Liner has been entrusted to Peters Werft in Wewelsfleth on the river Stör.

be floated inside the cargo bay of *Combi Dock III* and released into the waters of the Elbe and Stör rivers.

Markus Pelz cannot conceal a certain anxiety this morning. Hundreds of visitors have come to the Elbe port to catch a glimpse or two of the historic windjammer. The yard, the tugboat operator, the owner, the foundation, and dozens of politicians and journalists are waiting for the big moment. Cameras have been set up, and a press conference has been scheduled. Pelz is deep down in the musty-smelling belly of the big sailing ship, his little hammer knocking against the steel hull again and again. "Toc, toc, toc." Rust flakes off, but the steel doesn't buckle. Metre by metre the surveyor works his way through the huge cargo hold where heavy bags of guano used to be stowed 100 years ago. *Peking* also exported goods for emigrants, including the occasional Steinway grand piano. Even pigs and chickens were carried on board in special cages. After all the crew, which spent up to nine months at sea during a round trip without seeing a port, needed food.

#### Licence to float

But Pelz is oblivious to all that now. All he cares about is the thickness of the steel plates. "Considering the

age of the ship, she is in reasonable shape," he says approvingly before continuing his toc-toc-toc. A few metres and minutes later, however, there is more rust than usual spraying away under his hammer. Pelz frowns. Is he about to find a hole that will thwart all plans, now that the inspection is almost over?

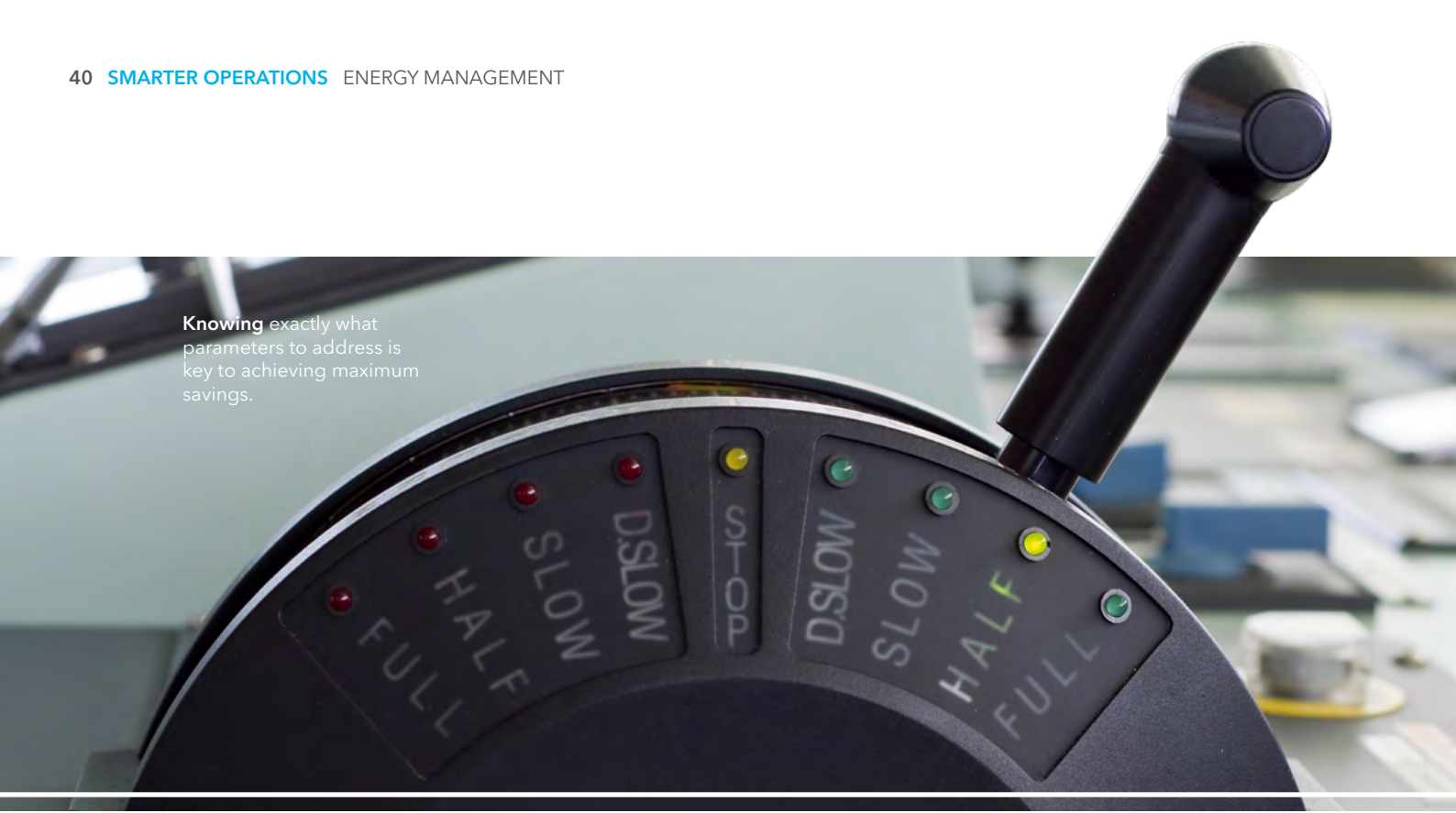
But it turns out that the employees of the Hamburg Maritime Foundation had already taken a good look at *Peking* after her handover in New York City and taken appropriate action. "We welded a steel plate against the other side," explains Joachim Kaiser, a member of the board of directors, who had accompanied the ship on her voyage across the Atlantic Ocean. Pelz is happy. And *Peking* has his permission to be floated. "Inspecting a ship that represents so much history is a very special experience. I don't think I'll ever forget this assignment," he says, a sailing enthusiast himself, and his excitement is palpable. ■ NIS

#### DNV GL Expert

Markus Pelz, Senior Surveyor, Station Hamburg

Phone: +49 40 36149-2950

E-Mail: markus.pelz@dnvgl.com



Knowing exactly what parameters to address is key to achieving maximum savings.

# HOW TO REACH YOUR EFFICIENCY GOALS

In a competitive market, and with fuel prices likely to rise again before long, shipping companies cannot afford to leave any stone unturned to maximize energy efficiency. While on paper, every vessel larger than 400 GT has to have a Ship Energy Efficiency Management Plan (SEEMP), few realize their full savings potential.

There are so many factors influencing the performance of a vessel that many shipping companies find it challenging to determine where to start. Not every possible optimization measure makes sense in every instance. It takes knowledge and experience to identify the most promising parameters to address.

Acknowledging that too many owners, managers and operators struggle with selecting the right set of technical and operational optimization measures to realize their full saving potential, DNV GL has enhanced its proven Energy Management approach and supporting toolkit. "With our Energy Management 3.0 advisory service, we help the customer design and implement a comprehensive strategy that will take their current energy management to the next level - and save fuel," explains Merten Stein, Head of Shipping Advisory Germany at DNV GL - Maritime. "Especially owners, managers and operators of medium-to-large sized fleets can improve their energy management significantly."

The proven advisory approach follows a basic three-step process:

1. Analyse the ship specifics, operating profile and existing energy management system to identify the most promising and feasible improvements.
2. Design an energy management concept and strategy, define specific measures and targets, determine the organizational implications, develop a monitoring and reporting concept as well as a

## COST-SAVING POTENTIAL BY SHIP TYPE

Typical savings achievable for specific ship types

Energy efficiency measure cluster	Typical saving potential (%)		
	Container	Bulker	Tanker
Ship operation*	7-11.5%	7-13.5%	5.5-12%
Ship condition*	2-5%	5-10%	5-10%
Machinery*	1.5-5%	1.5-5%	2.5-6.5%
Fuel management*	1-2%	1-2%	1-2%
Consumer & cargo*	0.3-2%	0.2-1.5%	2.2-6.5%

\*savings cannot be accumulated due to overlaps



change management concept and pinpoint quick wins.

3. Coordinate and monitor the implementation, provide supporting tools and define relevant procedures. This also includes supporting staff behavioural changes and firmly embedding energy management in the corporate culture.

Finally, validating the implementation status of the energy management system regularly, monitoring the effects on the ship's operating costs, and identifying potential additional measures in a continuous improvement process will ensure real impact.

DNV GL has helped numerous owners, managers and charterers achieve significant savings along this path. Merten Stein points out: "Often many smaller measures add up to substantial savings. Taking a holistic approach by combining these measures to deliver the greatest possible benefit is key."

### Implementing best-in-class energy management

Euronav, a global leader in the crude oil tanker market, had identified fuel efficiency management as a key instrument for strengthening their market position and financial performance. DNV GL reviewed the existing fuel saving regime, then prepared a comprehensive list of technical and operational fuel saving measures. A tailored set of key measures was allocated to each tanker, with a focus on low-cost operational improvements, especially staff awareness, buy-in and cooperation. Furthermore, the company's organizational setup, job descriptions, operational procedures, energy management policy and processes, and SEEMPs were updated, and the cornerstones of a performance management system were established based on tanker industry best-practices.

Stamatis Bourboulis, General Manager of Euronav Ship Management Hellas, confirms: "DNV GL's advisory team helped us advance in terms of energy management: they combined management techniques and technical insights and provided both the structure and the expertise we needed to pave the way for fuel savings."

### Performance management support and e-learning

For "K" Line, which operates a fleet of more than 500 vessels, DNV GL prepared recommendations regarding strategy, organizational setup, roles and responsibilities, reporting and monitoring, continuous

improvement and specific optimization measures. To enhance transparency and enable management to take ship-specific fuel-saving action, improvements to existing performance management dashboards were suggested. In addition, DNV GL adapted its Maritime Academy's proven e-learning solution to "K" Line's specific needs. The programme successfully raised crew awareness, educating and motivating the seafarers to focus on saving fuel.

"We received comprehensive support from

DNV GL to strengthen our energy management function - from reviewing the status quo and defining new solutions to rolling out fuel-saving measures across our fleet. In addition, DNV GL's e-learning tool, adapted to our requirements, helped us reach more than 2,000 seafarers globally while saving fuel," says Joichi Sasaki, the Associate Director in charge of Energy Management & Advanced Technology.

### Fuel-saving potential

Practical experience has shown that significant fuel savings can be achieved across all ship types,

depending on ship type and the sophistication of the customer's systems. For a bulk carrier, for example, a 7 to 13.5 per cent saving potential is possible in ship operation alone. Proven measures in this field include voyage execution and charter planning, and in particular, speed and route optimization as well as fuel efficiency incentives in the charter party.

Another five to ten per cent can often be gained by optimizing the ship's condition: Advanced condition monitoring, defining the best hull and propeller cleaning intervals, and choosing the right coating can improve hull performance substantially. Monitoring engine performance and operations, including the auxiliary engines, typically results in another 1.5 to 5 per cent in savings (see table).

With more than 1,600 prepared SEEMPs, 500 ship energy management audits and 80 energy projects carried out for customers around the world, DNV GL has the practical experience required to deliver custom-tailored support to shipping companies across all segments. ■ AK

"DNV GL's advisory team helped us advance in terms of energy management: they combined management techniques and technical insights and provided both the structure and the expertise we needed to pave the way for fuel savings."

Stamatis Bourboulis, General Manager, Euronav Ship Management Hellas

### DNV GL Expert

Merten Stein, Head of Department, Shipping Advisory Germany  
Phone: +49 40 36149-4052  
E-Mail: merten.stein@dnvgl.com

# GLOBAL MARITIME MEGACITIES

The steady growth of the global trade volume drives the development of major port cities. A joint study of DNV GL and Menon Economics ranks the world's leading maritime capitals, revealing strengths, challenges and future potential.



**1**  
**SINGAPORE**  
 Top shipping centre, best port and logistics, attractive and competitive

## THE WORLD'S TOP-FIVE MARITIME CAPITALS

Each of the leading maritime capitals owes its rank to a unique combination of strengths. The subjective and objective assessments do not always coincide.

Rank	Shipping centres	Finance and law	Maritime technology	Ports and logistics	Attractiveness and competitiveness	Overall ranking
1	Singapore	London	Oslo	Singapore	Singapore	<b>Singapore</b>
2	Hamburg	Oslo	Singapore	Shanghai	Oslo	<b>Hamburg</b>
3	Athens	New York	Tokyo	Rotterdam	Copenhagen	<b>Oslo</b>
4	London	Singapore	Shanghai	Hong Kong	Hamburg	<b>Shanghai</b>
5	Hong Kong	Shanghai	Busan	Hamburg	Dubai	<b>London</b>

Source: Menon Economics - The leading maritime capitals of the world 2017

Major port cities around the world try to attract businesses and industries far beyond shipping and logistics to compete in the league of maritime capitals that dominate the industry. To better understand the implications of this dynamic development and compare the world's leading maritime centres based on objective scientific criteria, consultancy Menon Economics and DNV GL jointly prepared the study "The Leading Maritime Capitals of the World 2017", an assessment of the 15 most important port cities.

The third issue of the biannual report includes rankings of major capitals in four maritime sectors – shipping, finance and law, technology, and ports and logistics – based on nearly 50 indicators. "For each assessment category we used both objective measures and subjective input from more than 250 industry experts," explains co-author M. Shahrin Osman, Head of Digital Solutions & Advisory Middle East, DNV GL Maritime (refer to interview on page 44). All statistical results were combined into an overall ranking, which lists Singapore, Hamburg, Oslo, Shanghai and London as the top-five maritime capitals of the world (see table on the left).

### The champions

The city state of Singapore takes first place in two of the four basic assessment categories ("Shipping centres" and "Ports and logistics") as well as the overall "Attractiveness and competitiveness" category, and second place in a third category ("Maritime technology"). Hamburg takes second place in the overall ranking because of its comparative strengths in many fields, and Oslo places third.

Of the 15 cities shortlisted for the study, six are located in the Asia-Pacific region, six in Europe, two in the United States, and one in the Middle East. China is the only nation represented by three cities. The city state of Dubai takes tenth place overall moving three places up the rank from the 2015 study.

Singapore, situated in a privileged geographic location close to key markets, is an important shipping and commercial management marketplace and transshipment port. It is known for its skilled workforce, low tax rates, low corruption index, advanced infrastructure, pro-business government policies, and general ease of doing business. Singapore's maritime industry is highly diversified, and the city's leaders drive maritime education, research and development and a world-leading advanced maritime service industry. Hamburg, Oslo, London

and Rotterdam are in a tight race for leadership in the European maritime economy, each featuring different strengths: while Oslo is especially well positioned in maritime finance and technology, Hamburg, Europe's third-largest port, is more important as a shipping centre. London takes first place in maritime finance and law, and Rotterdam excels in port and logistics services.

### Focus on maritime business excellence

As the demand for raw materials and goods in Asian emerging markets rises, most experts expect both Shanghai and Dubai to move up on the list of leading maritime capitals. Shipping companies are increasingly mobile and less committed to specific locations so the top maritime hubs compete for their headquarters. To succeed they must attract capital and wealth, skills and capabilities, excel in education and science, and position themselves as leading

centres for relevant technologies.

DNV GL's Maritime Advisory offers a broad portfolio of maritime business excellence consultancy services to help customers better understand the complexities of maritime markets and make educated decisions. "More than 300

consultants and engineers located in major maritime hubs stand ready to prepare general or custom studies on maritime clusters, market entry, business concept feasibility and business intelligence topics, organization capability building in enterprise risk management, energy efficiency and safety, and digital transformation in shipping organizations," says Osman.

To provide customers with the best advice possible, Maritime Advisory collaborates with specialized external partners offering deep expertise in specific niche areas, such as Menon Economics. With its comprehensive and holistic knowledge and expertise in the maritime sector and its thorough understanding of global and regional policy, DNV GL has been in a unique position to conduct the study on the leading maritime capitals of the world. ■ AK



### DNV GL Expert

M. Shahrin Osman

Head of Digital Solutions & Advisory Middle East

Phone: +971 4302 6347

E-Mail: m.shahrin@dnvgl.com

# DECISIVE FUNDAMENTALS

The focal points of world trade are shifting, as the study by DNV GL and Menon Economics indicates. An interview with co-author Mohd Shahrin Osman, Head of Digital Solutions & Advisory Middle East at DNV GL - Maritime.



**3**  
**OSLO**  
 Leading in maritime technology, excellent in finance and law

**4**  
**SHANGHAI**  
 Excellent port and logistics, emerging marine technology centre




**5**  
**LONDON**  
 World capital of maritime finance and law, key shipping hub



Photos: ©boulle1301/Francesco Bucchi/norbel/Morten Almeland - stock.adobe.com, DNV GL, Kokkai Ng - iStockphoto/Getty Images

**Mr Osman, what are the factors that make a port city grow beyond its importance as a regional distribution centre and become a true maritime capital?**

**Mohd Shahrin Osman:** There are certain fundamental prerequisites that must be fulfilled. You need a very busy port city - for example, Singapore or Shanghai. But why would a city like Oslo - traditionally not a leading port city - be at the top of the list of maritime capitals? The reason is the city's strength as a global shipping centre as well as its strong focus on technology and advanced maritime services. So at least some of these essential building blocks need to be there.

The other question is, what would cause a city's role to change so it performs well as a maritime capital? One of the key factors is a clear, proactive government policy focused on upgrading the local capabilities, whether in port operations, shipyards or the entire shipping sector. A large population alone does not automatically make a city a maritime hub. Other factors must be present, as well. Policy initiatives and measures must enhance the natural strengths of the city to raise it up to world level.

**Do you see a strong correlation between national or regional wealth and the ranking of a city?**

**Osman:** In general there is such a correlation, but national wealth alone doesn't do it either. Look at the USA. None of the US port cities are among the top-ten maritime capitals - New York City placed 11th - although the USA have probably the highest concentration of wealth in the world. I guess it is a question of what the particular city wants to focus on. Rotterdam and Hamburg may not place so much emphasis on financial services, the stock exchange and general wealth but rather on the maritime industry, where they are firmly established as leaders. New York City has one of the highest numbers of listed maritime companies but relies on a very diversified portfolio of services beyond maritime, contrary to Hamburg or Rotterdam, which have a strong maritime legacy and long-standing culture related to shipping and port activities.

**Do you think places like Hamburg and Rotterdam are in jeopardy as maritime capitals?**

**Mohd Shahrin Osman**, co-author of the study "The Leading Maritime Capitals of the World 2017".



**Osman:** I believe they can be expected to remain among the top-ten in the coming decades because the level of activity continues to be very strong. They further invest in maritime and port infrastructure, such as marine services and shipyards. The maritime schools in Hamburg for example produce many graduates, so there continues to be a high concentration of activities throughout the maritime sector. I cannot imagine such a place to lose its importance overnight. The key question is whether it will retain its position among the top-three.

#### How fierce is the competition among the leading maritime capitals?

**Osman:** There is a combination of competition and cooperation. On the one hand, the cities complement each other, selling to different geographies and markets, while on the other hand, they're competing. When you look at the aspect of global company headquarters, Singapore has been very successful in attracting companies by being very supportive of business and taking proactive measures.

#### Dubai is not located on a major shipping lane. Could that be a problem?

**Osman:** Dubai is a strong trading centre with a strong tourism industry. While not directly located on a major shipping lane, Dubai is in a good strategic position in east-west trade and offers an extensive aviation infrastructure that handles one of the largest number of passengers of any airport. It also connects the wider Middle Eastern region from India to the emerging markets in Africa and even South America.

#### Where do you see India going in the medium term as it builds momentum in international trade?

**Osman:** India has excellent geographical conditions and competence, and it provides

the largest number of seafarers of any nation. Hence it has managed to grow its ship management activities in recent years. What is still missing is a stable political climate, a mature infrastructure and advanced technology. But a lot is happening in the country's logistics infrastructure, a prerequisite for the manufacturing supply chain; this is what India is going to focus on for the next decade.

#### Do you agree with Martin Stopford that at some point in the future there may just be two or three major maritime capitals eclipsing all the others?

**Osman:** This is difficult to predict because many cities are making a big effort to improve their competitiveness. When a shipping company sees that there is continuous improvement in the quality of services, they will find it difficult to move away because there are also soft factors, such as culture, legacy and many others to consider. If they are happy where they are, and their governments do what they can to keep them there, moving elsewhere will not make much sense. With that in mind, it is hard to imagine that there will be just two or three centres within the next decade.

#### Do you believe that cities which are important distribution centres for their own hinterland can be expected to remain rather stable as major maritime centres?

**Osman:** There are two factors to consider: for example, Rotterdam is an important trade hub that serves its hinterland. It has the multimodal infrastructure to maintain its role. The same applies to Shanghai, which is growing because it feeds a huge domestic market. At the same time it is a very important export base. But then, if you compare Hong Kong with Singapore, neither plays a major role in supplying its hinterland. The reason Singapore stays ahead is because it continues to adapt to changing market conditions, including the competitive landscape, for example by allowing joint operations for its port. Singapore invests in ancillary activities, such as establishing itself as a petrochemical hub, and it continues to attract a lot of shipping banks. It is also investing in its future as a top LNG trading hub. So to compensate for the absence of a hinterland as a basis for trade, Singapore continues to invest ambitiously in its infrastructure, maritime technology and connectivity to underpin its position as a maritime capital. ■ AK



#### TOP-15 MARITIME CITIES

Overall ranking of the 15 shortlisted global maritime capitals

1.  Singapore
2.  Hamburg
3.  Oslo
4.  Shanghai
5.  London
6.  Rotterdam
7.  Hong Kong
8.  Tokyo
9.  Copenhagen
10.  Dubai
11.  New York
12.  Athens
13.  Busan
14.  Houston
15.  Guangzhou

# DNV GL IN CHINA: FIRST IN CLASS

The roots of DNV GL in Norway and Germany are well known in shipping circles. But only few know about the history in China dating back to the 19th century.

DNV GL has been active in China for nearly 130 years. As one of the first international classification societies to establish a Chinese presence, the company hired its first ship surveyor in Xiamen in 1888. But real growth for DNV GL in China came in the

wake of the sweeping social and economic reforms implemented in the late 1970s and early 1980s.

Today DNV GL has more than 900 employees in 20 cities across Greater China, serving five of its business areas including maritime, oil and gas, energy, business

Shanghai is the world's busiest container port.



assurance, and software. The range of services covers ship and offshore classification, oil and gas, energy storage and distribution, renewable energy, verification, certification and technical and advisory services.

Following a six-year freeze in diplomatic relations between Norway and China, bilateral political relations were back on track in the spring of 2017, marked by a visit of Norway's prime minister Erna Solberg to the new DNV GL China headquarters in Shanghai in April 2017.

### Change of guards

Remi Eriksen, President and CEO of DNV GL, confirms the importance of normalized relations: "China is one of our key markets, and the most important one in Asia. The normalization puts DNV GL and Norwegian companies back on equal terms with international competitors in China."

With relations back to normal, DNV GL is picking up speed in maritime markets. Recognized as the leading international classification society in China, DNV GL - Maritime works from nine posts along the coastal areas where most of the Chinese maritime activity takes place.

Outgoing Greater China Regional Manager Torgeir Sterri says: "Over the years DNV GL has been

deeply involved in the rapid development of the Chinese shipbuilding industry. Many of the largest and most advanced ship and offshore newbuilding projects have been classed by DNV GL. Additionally, we certify around 5,000 Chinese companies against international standards and provide advanced software solutions to a wide range of sectors."

Sterri will return to Europe in January 2018 after nearly five years at the helm in China. His successor, Norbert Kray, comes to China from his current post as Area Manager Japan, and will join the Executive Leadership Team for DNV GL - Maritime. Kray has extensive knowledge of the Chinese market, gained during his years as Global Head of Surveying in the former Germanischer Lloyd prior to the merger with DNV (see focus story next page).

"When comparing Japan and China," Kray says, "the most obvious difference is size, both of the market and the geography." The Greater China region encompasses not only mainland China but also Taiwan, Hong Kong and Macau. "It is such a big area that it will be hard to visit everyone as often as I'd like to."

Another challenge is a Chinese shipbuilding industry transitioning into new and more sophisticated ship types. "As they move into passenger and LNG shipbuilding, we need to identify new projects >



"Many of the largest and most advanced ship and offshore newbuilding projects have been classed by DNV GL."

Torgeir Sterri, Outgoing Greater China Regional Manager, DNV GL - Maritime





**Norbert Kray,**  
DNV GL's incoming  
Greater China  
Regional Manager.

## A NEW JOB FULL OF OPPORTUNITIES

"Doing business in China is vastly different from anywhere else in the world," says Norbert Kray, incoming Greater China Regional Manager for DNV GL - Maritime. "But I like challenges, so I am really enthusiastic about this new post."

In January 2018, Kray will make the move to Shanghai from his present post as Area Manager Japan, leaving behind a legacy of solid growth. During his many years as Chief Surveyor with Germanischer Lloyd in China prior to the merger with DNV he gained valuable knowledge of the Chinese market. "As Global Head of Surveying during the shipbuilding boom I visited

Asia, and especially China, quite frequently. I spent a lot of time talking to yards and owners there, so I know the region quite well," says the 51-year-old German.

That experience will serve him well as head of one of the largest regions in the DNV GL portfolio. Greater China covers not only the mainland but also Taiwan, Hong Kong and Macau. "As in much of Asia, the key is cultivating relationships. Visiting clients is as important as it is in Europe, but for different reasons. You have to be on the road more in order to get first-hand information about upcoming business activities."

> quickly and be ready to support them with DNV GL's experience and insight in these segments."

### Pioneering projects

Kray won't have to wait long to sink his teeth into new challenges. DNV GL is ramping up to handle several groundbreaking newbuilding projects due for delivery between 2017 and 2020, among them the world's first high-speed LNG-powered ro-pax ferries being built at Guangzhou Shipyard International Company (GSI) for Rederi AB Gotland of Sweden. Upon delivery the first of the two 1,650-passenger ferries will be the first Swedish-flagged passenger vessel powered by LNG. Both ships are being built to DNV GL class, including comfort ratings for climate, noise and vibration (see page 52). The ships will have 1,750 lane metres for

cars, camper vans, trailers and buses, and will operate between the Swedish mainland and the island of Gotland in the Baltic Sea.

DNV GL has recently signed a classification agreement with AVIC Weihai Shipyard for 4+2+2 ro-pax ferries for Swedish owner Stena Line. This is the biggest single ro-pax newbuilding order in history. Designed by Deltamarin, the vessels will be constructed to the new DNV GL class rules and represent the first ships of this type to be classed under the new 1A regime. Bearing the DNV GL GAS READY class notation, the vessels will be among the most efficient ferries in the world. They are scheduled for delivery in 2019 and 2020. The UK Maritime and Coastguard Agency (MCA) has requested DNV GL to carry out most of the statutory work on their behalf for these vessels.



Stena Line has ordered a series of LNG-powered ro-pax ferries from AVIC Weihai Shipyard. The DNV GL-classed ships will be among the world's most efficient ferries.



Kray says his primary goal in his new role is to maintain DNV GL's strong track record of delivering quality services. "But we also have to be prepared to meet new customer demands. Classification societies are transforming into modern service providers, and customers are demanding more from us," he observes. "Of course we want to provide these services, but we also have to maintain our neutral role. If we blur the lines between our customers' business and our own, we lose trust. It is essential that we retain our integrity in the entire industry."

Asked to name the biggest challenge in one of the world's biggest markets, Norbert Kray points to the pace of change. As China moves into new ship types, it will encounter new challenges, and DNV GL will have to be there to help avoid pitfalls and capitalize on opportunities.

Norbert Kray is well equipped to advise, having worked his way up from his first job as a shipbuilding engineer: "I started as a shipbuilder and studied naval architecture. Later I worked as a designer on container ships, bulk carriers and cruise ships, so I can offer my personal experience to new clients. I believe practical experience is essential when you work in classification."

Kray has known outgoing Greater China chief Torgeir Sterri since the DNV GL merger. As the handover approaches, they are stepping up the dialogue. "It is especially important in today's market to ensure a smooth handover. Remember the industry is still in crisis mode. Any disturbance is magnified when everyone is on alert."

One key piece of wisdom Sterri has already imparted to his successor: "He made sure I understand that this is a huge job, and that I should be patient



Norway's prime minister Erna Solberg and Remi Eriksen, President and CEO of DNV GL, visited DNV GL's new headquarters in Shanghai.

with myself. He told me that in a job like this you can't do everything at once." But Norbert Kray isn't one to shy away from a challenge. "I know there will be some big changes. But for me, taking a post like this is like a dream come true." ■ KG

DNV GL is continuously investing in its local expertise in China, appointing experts for all types of vessels and mobile offshore units to serve as key points of contact for technology-specific customer enquiries. Another move is the appointment of a Senior Regional R&D Manager whose primary task is to interface with yards, designers and owners on joint industry projects.

#### Fast and efficient customer service

Knowledge-sharing is also part of the local market strategy. The DNV GL Maritime Training Academy, established in 2006, offers training in eight areas of corporate expertise. The academy has locations in Shanghai, Dalian, Nanjing, Nantong, Guangzhou, Hong Kong, Taipei and Kaohsiung, providing a broad range of educational programmes to DNV GL customers. More than 70 courses are offered, from general to advanced, including design, ship management, offshore and software.

Of course the Chinese market will also benefit from DNV GL's strong push to provide even better service to all clients with quicker response and improved efficiency. On a regional level, DNV GL China has established a special unit to centralize FiS (Fleet in Service) planning for surveys to improve efficiency. Globally the classification society has also started using intelligent software agents to help customers find the best time and place to book a survey. The introduction of the Simple Survey Booking tool in October 2017 simplifies survey booking, fitting in-

specions into the customers' schedule while saving time and costs.

At the same time, DNV GL has rolled out electronic certificates across its entire classed fleet. They eliminate paper handling, are easy to share and reduce administrative burden on all stakeholders (see page 16). The DATE service has also been received extremely well in the market. It enables customers to tap into DNV GL's broad expertise and global reach by giving them direct access to technical experts on a 24/7 basis. These and more than 30 other services can be accessed through DNV GL's online customer portal with a single sign-on.

With all this going on, what is Norbert Kray most eagerly looking forward to once he assumes his new post in January? "Working with new technologies is always exciting, but the maritime business is a people business at heart. I can't wait to get reacquainted with old friends and start working with the great DNV GL team. Perhaps most of all I look forward to cultivating relationships with the owners and the yards, supporting them and finding new opportunities to grow our business." ■ KG/CZ

#### DNV GL Expert

Ping Kwong Vincent Li, Regional Business Development Manager, Region Greater China Maritime  
Phone: +86 21 3279 9000  
E-Mail: vincent.li@dnvgl.com

# POLE POSITION

Eimskip and Royal Arctic Line are leading the way to expand trade channels between Iceland, Greenland, North America, Scandinavia and the rest of Europe. The potential is huge, but conditions are challenging. DNV GL is on hand to ensure their new container vessels are fully Polar Code-compliant.

Eimskip and Royal Arctic Line have ambitious plans for the Far North. Eimskip, an Icelandic transportation specialist with a fleet of 22 vessels, and Royal Arctic Line, which has the sole concession for sea cargo transport to and from Greenland, have signed an agreement for three new container ships to boost trade between their nations and key markets to new and prosperous levels.

Diminishing regional ice coverage, married to expanding island infrastructure, has created a platform for opportunity. However, the Arctic's unique conditions require special consideration, with a need for all new ships operating in the area to comply with the IMO's recently adopted Polar Code. DNV GL China is ensuring this is the case, working closely with the Guangzhou Wenchong Shipyard to certify these regionally vital new ships.

## Transforming trade

Eimskip and Royal Arctic Line, which is owned by the Government of Greenland, initially signed the capacity-sharing contract in 2016. The move is being seen as, in the words of Verner Hammeken, CEO of Royal Arctic Line, "an important step for connecting Greenland to global markets."

Gylfi Sigfússon, President and CEO of Eimskip, illustrates how the vessels will help fast-track developing regional economies: "The port developments in Nuuk (Greenland), Reykjavík and Tórshavn (Faroe Islands) will enable larger vessels to serve in our market area. We assume that the cooperation will increase business activities in the Arctic region, especially between Iceland and Greenland. Activities have, until now, been limited due to lack of frequency and direct services."

Injecting the added capacity will not only transform the trade routes, but, according to Hammeken, will produce huge knock-on effects for businesses in Greenland. He states: "It creates opportunities for our export customers, allowing goods to be further refined in Greenland before transporting them directly to destinations all over the world in a more efficient way. Customers can also select transportation directly from new market areas instead of having to go only through Denmark. With this, we are looking

at a future with more options, and higher efficiency, making it easy to do business with Greenland."

## Rigorous requirements

Doing business may be easy, but the conditions the ships encounter certainly won't be. To ensure the requisite levels of safety and environmental protection, the IMO has responded to increased levels of Arctic and Antarctic shipping activity with the Polar Code. From 1 January 2017 all new vessels operating above 60 degrees north (extending down to a demarcated area at 58 degrees north) and below 60 degrees south must comply with the code. Vessels constructed before this date must be compliant by the first intermediate or renewal survey after 1 January 2018.

This means stringent requirements relating to vessel design, construction and equipment, with further operational needs for, amongst other things, crew training, and search and rescue capability. In the very harshest of environments, every element of every vessel must be fit for purpose. This is where class plays a vital role.

## Expert partners

DNV GL supports shipowners in their ambitions to achieve compliant operations in polar regions - providing advisory services to help prepare for compliance and statutory certification on behalf of flag administrations.

In February 2016, DNV GL made history by certifying the first ever Polar Code-compliant vessel, working with the Danish Maritime Authority to certify

The ice-classed vessel *Magne Viking* operates in harsh environment offshore regions.



Connecting Greenland to the global markets: The new container ships will be delivered in 2019.



#### FACTS AND FIGURES

##### Main particulars:

- Length: 179.40 metres
- Length between perpendiculars: 176.20 metres
- Width: 30.95 metres
- Depth: 17.40 metres
- Draught: 9.00 metres
- Scantling draught: 10.30 metres
- Class notation: DNV GL +1A Container Ship BWM(T), DG, BIS, TMON, LCS, ICE(1A), E0, NAUT(AW)

##### Main equipment:

- One main engine:
  - MAN 7G60-C9.5 with EGR bypass IMO Tier III
  - MCR: 18,760 kW at 97 rpm
  - SMCR: 17,000 kW at 97 rpm
  - NCR: 13,400 kW at 89 rpm including PTO power
- Three auxiliary engines:
  - MAN 9L21/31 with SCR IMO Tier III
  - 1,980 kW × 900 rpm × AC450V × 60 Hz × 3 Ph

- One auxiliary engine:
  - MAN 6L21/31 with SCR IMO Tier III
  - 1,320 kW × 900 rpm × AC450V × 60 Hz × 3 Ph
- Scrubber system dealing with exhaust gas from one main engine and four auxiliary engines meets SO<sub>x</sub> Tier III
- Initial delivery plan: 1st vessel in April 2019, 2nd vessel in May 2019, 3rd vessel in June 2019

the AHTS *Magne Viking*, owned by Viking Supply Ships. This established expertise is now in demand worldwide, much to the advantage of owners such as Eimskip and Royal Arctic Line. DNV GL China is working alongside them and China Shipbuilding Trading Company and Guangzhou Wenchong Shipyard to oversee the construction of the three 180-metre long, 31-metre-wide vessels, all of which boast capacities of 2,150 TEU. The Ice Class ships, two of which will be owned by Eimskip and one by Royal Arctic Line, are expected to be delivered in April, May and June 2019.

Deltamarin was responsible for the design of the vessels, which it notes are “designed to achieve the best possible key performance indicators, such as container carriage variety, homogenous loading capacity, optimal manoeuvrability and harsh-weather seakeeping performance.”

“We are very proud of this new contract, which further confirms our expertise in cargo ships,” comments Markku Miinala, Director, Sales and Marketing at Deltamarin. “The design is based on Deltamarin’s

extensive development work for a new generation of energy-efficient and operationally optimized 1,000–3,000 TEU container vessels intended for feeder service.”

#### Supporting advantage

Once operational, Eimskip and Royal Arctic Line’s new assets can call on the support and service of DNV GL’s regional network of bases, including its dedicated teams situated in Tórshavn, Reykjavík and Nuuk.

The vessels have the potential to chart a new route forward for regional trade. With DNV GL’s assistance, Eimskip and Royal Arctic Line will be assured that the way ahead is safe, secure and 100 per cent compliant. ■ AJ

#### DNV GL Expert

Andrass Joensen, Station Manager North Atlantic, Iceland, Faroe Islands and Greenland  
 Phone: +35 48982215  
 E-Mail: andrass.joensen@dnvgl.com

# THE RIGHT VIBES

Stricter demands for noise and vibration aim to increase comfort and safety on board. DNV GL supports the Chinese shipyard GSI in achieving compliance.

For seafarers working on recently delivered vessels, life on board is about to get much quieter. A resolution passed by the IMO's Maritime Safety Committee (MSC) incorporates the previous recommendation for noise on ocean-going ships into SOLAS (Safety of Life at Sea), thereby making it a mandatory requirement. MSC resolution 337 (91) aims to enhance crew well-being and safety by ensuring undisturbed resting times and therefore reducing the risk of accidents caused by fatigue. It applies to nearly all sea-going newbuilds (above 1,600 GT) with a building contract signed on or after 1 July 2014.

In addition, the certification body ISO replaced their guideline for measuring, reporting and evaluating vibration with regard to habitability on passenger and merchant ships with a new standard in 2016 (ISO 20283-5). While not mandatory, this standard implies a significant drop of the currently applied levels of acceptable vibration. "To give an example: the acceptable vibration level on a cargo ship's navigation bridge has been lowered from 8 mm/s to 5 mm/s, and in the crew accommodation areas from 6 mm/s to 3.5 mm/s," explains Michael Holtmann, Team Leader Vibration & Shock, Department of Structural Engineering, DNV GL - Maritime. "It may take some time for the new ISO standard to be implemented in shipbuilding specifications, but judiciaries and maritime authorities can already apply it in case of disputes or crew complaints about the vibration levels on board a ship," he adds.

## Sound pressure reduced by 56 per cent

Meanwhile, the impact of the IMO noise standard is already being felt across the shipbuilding industry. "Many of the ships that were first affected by the rule have recently entered into operation or are in the final stages of construction," says Stefan Semrau,

Senior Engineer Maritime Advisory at DNV GL - Maritime. The mandatory directive requires the noise levels on vessels with a GT mark of 10,000 or above to be reduced by five decibel (dB) in crew accommodation areas, compared to the previous recommendation IMO A.468 (XII). This includes cabins, hospitals, messes, offices and recreational rooms.

"While five dB may not sound like a lot, this figure poses a significant challenge to shipyards, because the decibel scale is not linear. To put it into perspective: cutting the noise level by nine dB means the environment would be half as loud to the human ear. A reduction of five dB is equivalent to curbing

the sound pressure by about 56 per cent," explains Semrau. He is one of DNV GL's noise and vibration (N&V) experts in Hamburg. DNV GL has established dedicated N&V service centres in Hamburg, Høvik, Shanghai and Miami. In 2017, the company worked on 144 N&V projects around the world, 26 in China alone.

Using a fully numerical analysis (FEM), a statistical energy analysis (SEA) or a semi-empirical analysis during the early design

stage, DNV GL experts work with shipyards to predict the level of noise and its propagation through the ship structure. "The main noise sources on board are the propeller, the main engine as well as the auxiliary engines and the exhaust gas systems," explains Semrau. "We also troubleshoot vessels in operation that have noise issues affecting the crew," he adds.

During the analysis, DNV GL examines the sources of vibration and noise, the sound transmission pathways and the insulation of the affected areas. "A fully numeric solution leads to extreme project costs. Therefore, classification societies rely on their experience along with databases of comparable vessel designs to create a statistical baseline for new analyses. DNV GL's database is vast and contains projects from



Hao Chen, Chief Design Officer of GSI shipyard

"The reliability of DNV GL's analyses is the reason why the company has been our main partner in N&V control since the 1990s."

around the world. This puts us in an excellent position to offer accurate noise predictions,” Semrau explains.

One of the most difficult areas to analyse is the propeller, as the design is tailored to a vessel's specific requirements. “We invented the Tip Vortex Method to overcome this problem. It creates a digital model of the propeller to simulate its flow parameters. We can then compare these parameters to similar models in our database to get an accurate noise prediction,” Semrau adds.

#### A strong partnership in China

“The reliability of DNV GL's analyses is the reason why the company has been our main partner in N&V control since the 1990s. In the past five years, we have worked together on more than 15 N&V projects,”

says Hao Chen, Chief Design Officer at Guangzhou Shipyard International Company (GSI). “Investing in reliable N&V analyses early on saves significant costs that can occur at a later stage, for example if the noise levels exceed the specifications during sea trials. We believe that DNV GL has the most knowledge and experience in this field, and our cooperation makes us confident that our newbuilds excel in N&V control,” he adds.

“GSI's holistic approach to tackling N&V issues and the cooperative attitude of both its technical staff and the management have made this a great partnership for us as well. We look forward to continuing to support GSI in the future,” says Xiaofeng Jason Liu, Head of TCC Maritime Advisory China at DNV GL. >

The LNG-powered ro-pax ferry *Thjelvar* will comply with stricter N&V requirements.



**Ceremony in Shanghai:** Falk Rothe (m.), Head of the Technical Centre China, DNV GL, presenting the first SILENT certificate in China to Dr Haili Wang (l.), Project Leader of Xiamen University's research vessel *Jiageng*, and Ruimou Cai (r.), Deputy Chief Designer and Project Manager at GSI, for the ship.



> One of most recent N&V projects GSI and DNV GL have worked on is the LNG-powered ro-pax ferry *Thjelvar*. Ordered by Swedish owner Rederi AB Gotland, this DNV GL-classed vessel will be able to carry 1,650 passengers and will undergo sea trials at the end of 2017. "Making sure the vessel's design complied with the new N&V requirement was not a big challenge for us, as GSI also builds passenger and research vessels, which have to comply with even stricter noise requirements," explains Chen.

In October, DNV GL awarded the SILENT certificate to GSI and Xiamen University for the recently delivered oceanographic research vessel *Jiageng*. It is the first time this certificate has been awarded to a Chinese-built vessel. "This has been a very demanding project due to the ambitious requirements. However, through excellent collaboration between the owner, yard, designer and DNV GL, we were able to achieve compliance with the rules during the first sea trial," said DNV GL Senior Principal Engineer Kai Abrahamsen.

#### ABOUT DNV GL'S SILENT CLASS

The DNV GL SILENT class notation is the first set of rules for underwater noise emission from vessels. Its intention is to provide owners of acoustically sensitive vessels with concise and realistic criteria regarding underwater noise emissions, while allowing environmentally conscious owners to demonstrate a small environmental "footprint" as well. By ensuring that a ship's hydro-acoustic capability is optimized, the notation helps the vessel achieve the best possible operational and environmental performance.

Ships such as offshore survey, seismic, fishing and research vessels must minimize their underwater noise emissions to perform their tasks effectively. Other vessels such as cruise ships and ferries may need to demonstrate effective noise emission control as well, particularly when operating in environmentally sensitive areas.

Photo: DNV GL

The DNV GL SILENT class notation (see box below) is voluntary and covers underwater noise emissions. However, for owners operating regular cargo ships, N&V control on board is at the top of the agenda.

#### How to push down the volume

Small container vessels just above the 10,000 GT mark are one of the vessel types that has been most affected by the new mandatory IMO standard, because they are designed with high engine power and the accommodation areas are close to the main noise sources. Without modifications to the design, many would not fulfil the mandatory requirement.

However, there are several things a yard can do to dampen the noise: "Floating floors are one of the main measures we recommend. This means you add a layer of mineral wool onto the vessel's steel structure and then top it off with another level of steel or cement," says Semrau. Floating floors effectively reduce higher frequency noise, which can come from sources such as exhaust gas systems. Lower frequency noise portions can be reduced by installing so-called damping tiles. This method involves glueing on a second layer of steel.

The main challenge with this is time. "It is important to consider the impact of N&V from an early design stage and to look at every structure's potential effect on N&V. For example at GSI, even the design of the hull line, which usually focuses on efficiency, considers the impact on the vessel's N&V performance," says Chen. Semrau agrees: "Taking a holistic approach to N&V control and factoring in potential measures as early as possible is the best strategy for achieving compliance and minimizing additional costs." ■ AJO

#### DNV GL Expert

Stefan Semrau, Senior Engineer Structures, Maritime Advisory  
Phone: +49 40 36149-3979  
E-Mail: stefan.semrau@dnvgl.com

# EVENTS & EXHIBITIONS



Please also visit: [dnvgl.com/events](http://dnvgl.com/events) for a constantly updated list of events, conferences and exhibitions.

12. - 14.12.17  
**Ballast Water Management Technology**  
London, GB

23. - 24.01.18  
**Mega Cargo Show 2018**  
Mumbai, IN

24. - 26.01.18  
**Vietship 2018**  
Hanoi, VN

30. - 31.01.18  
**LNG Bunkering Summit 2018**  
Amsterdam, NL

30. - 31.01.18  
**Maritime Reconnaissance and Surveillance Technology**  
Rome, IT

30. - 31.01.18  
**Passenger Ship Safety Miami**  
Miami, US

07. - 08.02.18  
**18th Ballast Water Management Conference**  
Singapore, SG

21. - 22.02.18  
**12th Arctic Shipping Summit ACI**  
Montreal, CA

05. - 08.03.18  
**Seatrade Cruise Global**  
Fort Lauderdale, US

12. - 14.03.18  
**CMA Shipping**  
Stamford, US



The NaviGate expo will offer an interesting and interdisciplinary look into the maritime sector's industry and logistics in Turku, Finland, on 16th and 17th May, 2018.

14. - 15.03.18  
**Container Terminal Automation Conference**  
London, GB

14. - 16.03.18  
**Asia Pacific Maritime**  
Singapore, SG

20. - 22.03.18  
**Intermodal Asia**  
Shanghai, CN

20. - 23.03.18  
**GST & Shipping2030 Europe**  
Copenhagen, DK

10. - 11.04.18  
**Hamburg Offshore Wind 2018**  
Hamburg, DE

10. - 12.04.18  
**European Offshore Energy 2018**  
Birmingham, GB

10. - 12.04.18  
**WorkBoat Maintenance & Repair Conference**  
New Orleans, US

11. - 12.04.18  
**AVL Large Engines TechDays**  
Graz, AT

11. - 13.04.18  
**Sea Japan 2018**  
Tokyo, JP

18. - 19.04.18  
**Wind & Maritime 2018**  
Rostock, DE

18. - 20.04.18  
**Shippax Ferry Conference 2018**  
Oslo, NO

30.04. - 03.05.18  
**OTC 2018**  
Houston, US

15. - 17.05.18  
**Europort Romania**  
Constanta, RO

16. - 17.05.18  
**NaviGate 2018**  
Turku, FL

22. - 24.05.18  
**7th Edition of Navalia, International Shipbuilding Exhibition 2018**  
Vigo, ES

23. - 25.05.18  
**Welding Incheon Korea 2018**  
Incheon, KR

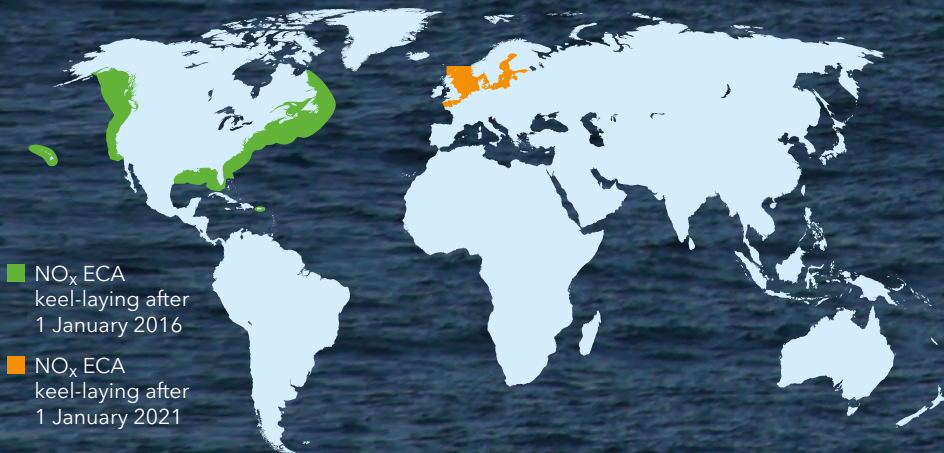
# THE FIGHT AGAINST NOXIOUS EMISSIONS

The IMO's Tier III limits for nitrous oxide (NO<sub>x</sub>) emissions from new ships operating in emission control areas (ECAs) are one of the latest regulatory challenges for many shipowners. DNV GL answers some key questions regarding available technologies, ship design and retrofitting.

Environmental regulations have increased almost exponentially in recent years. The latest addition, the IMO Tier III limits for nitrogen oxides (NO<sub>x</sub>) emissions inside ECAs, confronts owners with an entirely new set of challenges in terms of both technology and compliance. DNV GL has developed a comprehensive set of advisory services to supplement its voluntary class notations, equipment certification and exhaust gas measurement programme, helping owners and engine manufacturers understand the implications and handle the intricacies of the planning and certification processes. Furthermore, the DNV GL brochure "DNV GL NO<sub>x</sub> Tier III Update" offers an excellent introduction to the subject. "While the so-called sulphur cap applies retroactively to all ships globally, the new NO<sub>x</sub> limits are only relevant for new ships operating inside ECAs," clarifies co-author Stine Mundal, Head of Section, Environmental Certification at DNV GL - Maritime. "However, many

owners and shipyards underestimate the complexity not only of the technology required for implementation, but of the certification process as well. In particular, the documentation requirements for Tier III certification are well defined by IMO as well as the certification process which requires only one responsible applicant, whether it is the owner, shipyard, engine or aftertreatment manufacturer."

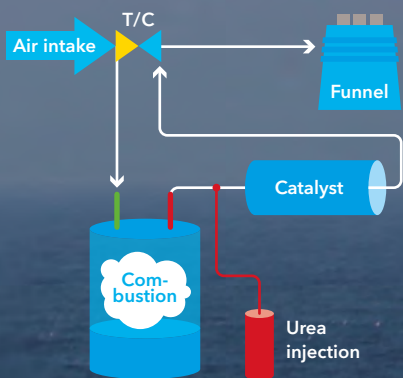
The IMO Tier III limits for NO<sub>x</sub> emissions entered into force as part of MARPOL Annex VI on 1 January 2016. They require the NO<sub>x</sub> emissions from a new ship to be reduced by 80 per cent compared to an equivalent Tier I-compliant engine. The Tier III limits apply to ships keel-laid after 1 January 2016 when operating in North American and US Caribbean Sea ECA, and to ships keel-laid after 1 January 2021 when operating in the North and Baltic Seas. China, while imposing only SO<sub>x</sub> limits in its ECAs for the time being, is contemplating adding NO<sub>x</sub> eventually (refer to interview).



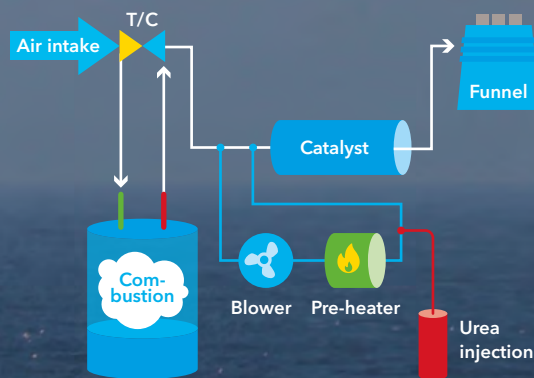
**The IMO Tier III** NO<sub>x</sub> emission limits apply to new ships inside North American and US Caribbean Sea ECA. European newbuilds will follow suit from 2021.



## HIGH-PRESSURE SCR SYSTEM



## LOW-PRESSURE SCR SYSTEM



**SCR takes heat:** a high-pressure SCR unit is preferably placed upstream of the turbocharger turbine. Low-pressure systems can use a pre-heater to heat up the exhaust gas and are placed downstream of all engine components.

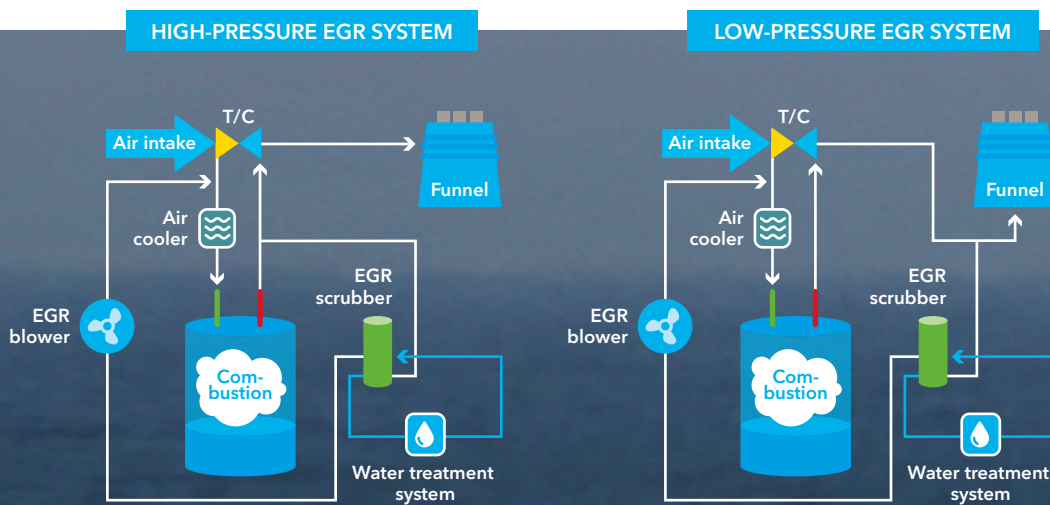
The new NO<sub>x</sub> limits cannot be met without specific treatment of exhaust gases. There are basically three approaches to achieving Tier III compliance: exhaust gas treatment using selective catalytic reduction (SCR) technology; exhaust gas recirculation (EGR); or alternative fuels, most notably liquefied natural gas (LNG). The best choice for a given vessel depends on the planned trading pattern, engine size and travelling speed, among other factors. "Owners should get informed as early as possible when planning a new ship, especially with regard to the main engine, because the emission control strategy they choose has far-reaching implications for the design of the machinery and the entire vessel," Stine Mundal points out.

#### Selective catalytic reduction

SCR is an exhaust gas after-treatment technology commonly used in diesel vehicles and industrial applications. By injecting ammonia or urea into the exhaust gas stream in the presence of a catalyst, the nitrous oxides are reduced selectively, forming water and molecular nitrogen. The SCR concept has an NO<sub>x</sub> abatement capability in excess of 80 per cent and does not compromise engine performance or influence engine design. Two configurations are available to make sure the exhaust gas temperature necessary for proper SCR function is maintained. "Transitional engine loads, for example during engine start-up, are not covered by the regulation, and emergency operation is exempted from the NO<sub>x</sub> emission control regulation," says Mundal.

The initial investment for an SCR system is relatively high, and ad-

>



Exhaust gas recirculation systems likewise come in two configurations differing in the location from where the exhaust gas is diverted. Depending on the fuel, a small scrubber and a wash-water treatment system can also be required.

> Additional space is needed on board. To maintain the engine and exhaust system in good condition it is necessary to monitor and control fuel quality, engine load, exhaust gas temperature as well as the urea injection rate and temperature. The required urea-water solution, which must be bunkered, and periodical replacements of the catalyst elements increase the ship operating costs. On the other hand, Mundal emphasizes, "SCR technology is highly effective at removing  $\text{NO}_x$  at most engine loads and is proven in industrial applications as well as over 300 ship installations. It is currently the most mature after-treatment technology, and DNV GL has years of experience with SCR systems."

#### Exhaust gas recirculation

As a second viable method of reducing  $\text{NO}_x$  emission, exhaust gas recirculation (EGR) redirects a portion of the engine's exhaust gas back to the charge air where it replaces some of the oxygen. This lowers the combustion temperature, thereby reducing the formation of  $\text{NO}_x$ . Depending on the fuel, an EGR system can be equipped with a small scrubber which cleans the recirculated gas to avoid corrosion and sooting of the combustion chamber. A wash-water treatment system and a sludge tank are required as well, and in most cases caustic soda must be carried on board for scrubber operation.

The technology is supported by major engine manufacturers. However, operational experience with this technology is limited, initial investment costs are relatively high, and fuel consumption can be expected to increase by approximately four per cent. The IMO is currently developing guidelines for

the discharge of bleed-off water from EGR  $\text{NO}_x$  emission reduction systems.

#### Alternative approaches

DNV GL considers LNG as one of the most viable and promising options to meet emission limits. LNG avoids  $\text{SO}_x$  emissions entirely and reduces  $\text{NO}_x$  emissions by 80 to 90 per cent. Tier III certification is nevertheless required, and certain technical considerations are necessary to ensure  $\text{NO}_x$  compliance. LNG as a ship fuel is making headway rapidly and enjoys a positive reputation among the general public. Initial investment costs remain high, however, and LNG fuel tanks take up significant amounts of space on board.



As an alternative fuel, liquefied natural gas (LNG) is an attractive option for both  $\text{SO}_x$  and  $\text{NO}_x$  compliance.

“The documentation requirements for Tier III certification are well defined by IMO as well as the certification process which requires only one responsible applicant.”

**Stine Mundal**, Head of Section, Environmental Certification DNV GL - Maritime



EGR	VS.	SCR
Reduced efficiency	← Combustion of main engine →	No impact
Possible	← Impact on engine durability →	No impact
Compact	← Space required →	Medium
Need to comply	← Overboard discharge compliance →	Not required
Yes	← Sludge production →	No
Limited	← Experience in maritime industry →	Yes
Yes	← Can be combined with SO <sub>x</sub> scrubber →	Special cases
Possible	← Can run on HFO →	Not recommended
Low	← OPEX →	High

**Comparative overview** of the advantages and disadvantages of EGR versus SCR exhaust gas treatment systems.

### CHINA DECLARES DESIGNATED ECAS TO TACKLE ITS AIR POLLUTION CHALLENGES IN MAJOR PORT CITIES

#### What emission regulations are currently in effect in Chinese coastal regions?

**Stine Mundal:** On 1 January 2017 a 0.5 per cent sulphur limit in ship fuel went into effect in eleven major Chinese ports. These are located in the Pearl River delta, the Yangtze River delta and the Gulf of Bohai, each of which represents an emission control area (ECA) of its own. On 1 September, all the additional ports in the Zhejiang Province of the Yangtze River delta also implemented this limit. Within these areas ships must switch to a low-sulphur fuel within one hour of arriving at their berth, and continue using this fuel until one hour before departure.

Alternative emission reduction methods such as scrubbers or shore power are permissible as well. On 1 January 2018 the 0.5 per cent sulphur limit will enter into force in all other ports inside these three ECAs as well. One year later ships will be required to make the switch to low-sulphur fuel before entering the respective ECA.

#### What is unclear about this regulation?

**Mundal:** The Chinese government will reassess the situation in late 2019. Depending on the outcome, the emission restrictions might be tightened. It is conceivable that the ECAs will be enlarged, a stricter fuel sulphur limit of 0.1 per cent imposed, or that nitrous oxides (NO<sub>x</sub>) will be included based on NO<sub>x</sub> Tier III. In the latter case the Chinese ECAs would conform to MARPOL Annex VI.

#### How is the domestic supply industry evolving with respect to ECAs?

**Mundal:** The market is definitely responding. We are already working with a handful of Chinese scrubber manufacturers. Just earlier this year we issued an approval in principle to the first exhaust gas scrubber design by Shanghai Bluesoul Environmental Technology, confirming compliance with our design rules. Other suppliers are getting ready to enter the market and may - with appropriate financial backing - even appear in the global market in the medium term.

Other alternative fuels such as methanol or ethylene are not widely used as yet. Intake air humidification, which adds water to the combustion process to lower the combustion temperature and reduce NO<sub>x</sub> formation, may achieve Tier III-compliant NO<sub>x</sub> reduction rates but has not reached technical maturity as yet.

#### Complexities to be taken seriously

Retrofitting ships with Tier III NO<sub>x</sub> technology is extremely challenging says Mundal, so “any new vessel that might one day change its operational pattern or be resold should be considered to be designed with Tier III NO<sub>x</sub> abatement in mind.” Furthermore, she adds, SO<sub>x</sub> and NO<sub>x</sub> compliance should be viewed as related items: “To ensure compliance with both the SO<sub>x</sub> and the NO<sub>x</sub> emission limits in the most efficient, practical and economical manner, a complete, all-encompassing compliance strategy is absolutely critical.” The DNV GL advisory services can be invaluable in guiding the planning, selection and implementation process, the certification expert says. “And there are additional advantages to consider as well: Tier III NO<sub>x</sub> compliance comes with added benefits. A compliant vessel will potentially have a significantly better resale value and is entitled to substantial harbour fee discounts in many major ports.” ■ AK

#### DNV GL Expert

Stine Mundal, Head of Section, Environmental Certification  
DNV GL - Maritime  
Phone: +49 40 36149-7138  
E-Mail: stine.mundal@dnvgl.com

# PARTNERING WITH PIONEERS



The oil and chemical tanker *Chembulk New York* is part of a fleet of 29 vessels.

John D. Noonan, CEO Emeritus of Chembulk Tankers, is being recognized as CMA's Commodore for his lifelong achievement and outstanding contribution to the maritime industry. In this interview with MARITIME IMPACT, he talks about how he has navigated his way from the decks of a ship to the corner office, the corporate values at Chembulk, and about collaboration with class.

When Chembulk Tankers' outgoing CEO John D. "Jack" Noonan was named the Connecticut Maritime Association (CMA) Commodore for 2017, the person most surprised was none other than Jack Noonan himself. Although a long-standing and active member of the CMA, Noonan "was shocked" by his selection as Commodore, recalling that his initial reaction was: "I'm not in the same league as the prior CMA Commodores." Clearly, the CMA Board of Directors, which is responsible for selecting the Commodore Award recipient, disagreed.

A graduate of the US Merchant Marine Academy at Kings Point, Noonan spent his entire career working through the ranks of the maritime industry. After having sailed for six years as a deck officer with the US-flagged Texaco tanker fleet, he spent more than 35 years in the chemical tanker sector; all of which were with Connecticut-based companies. Having served as CEO of Chembulk Tankers since 2010, Noonan announced his retirement recently. As CEO Emeritus

he is currently ushering in his successor and long-time colleague Dave Ellis to ensure a seamless transition. Noonan remains committed to the industry and will continue to lend his experience and support to its institutions and invest in its future.

"The characteristics that make Noonan an obvious choice for the award are the same that are vital to the continued success of the industry - commitment, collaboration, dedication and vision," notes Paal Johansen, DNV GL's current Regional Manager for the Americas and designated Global Cruise Director with effect of 1 January 2018. "These are goals Noonan shares with the leadership of DNV GL. Long associated with the classification society and a member of the North American Committee, Noonan has focused his career on some of the same values that guide our organization: leveraging history and experience to influence the future, recognizing the value of new regulations that improve the industry, embracing innovation, and capitalizing on the ability to gather data for better decision-making."

### Investing in the future

Noonan has always considered it vital to understand that investing in the future means investing in the maritime industry. Noonan has spent his career as an industry advocate, encouraging young people to follow maritime careers and helping to finance them through the companies he has been part of. Noonan has given generously to his alma mater and was instrumental in the creation of the Dan Dahlgard Memorial Scholarship, which was awarded for the first time in 2017 to a student at the Massachusetts Maritime Academy.

### The value of partnership

Noonan appreciates the value of partnerships and aligning with like-minded organizations – this is why he views collaboration as another tool for advancing industry. Partnerships go beyond cooperating with educational institutions; they require reaching out to other industry leaders with similar values and goals. This commonality is one of the drivers for Chembulk's partnership with DNV GL.

"DNV GL has been an excellent partner," Noonan says, pointing to the company's vision and willingness to work alongside companies with similar aims. That commitment is what will make a difference for the safety and longevity of the maritime industry.

"Part of being dedicated to the industry is having the discipline to adopt new ideas," he says. Research and development efforts fostering innovation will change the face of the industry in surprising ways. To reach common goals it is important to collaborate, Noonan says, and that means being willing to listen and to embrace change even when it is difficult.

Noonan's career has spanned decades that saw the tanker industry evolve from frantic telephone calls to coordinated shipments to responding rapidly to changing information on a monitor. The enormous amount of data available today, while challenging, has undeniably transformed the way the maritime industry works, and its potential to effect continued change is considerable.

"Accepting change is a byproduct of the willingness to invite independent thinking and differing opinions," Noonan says. "Once a decision is reached, there must be a commitment to seeing things through. I try to foster buy-in, and I insist upon taking ownership."

### Ushering in change

Buy-in is one of the challenges that arise when regulations change, but achieving it early in the process is critical. "Throughout my almost 40-year career, I've seen a lot of new regulations implemented," Noonan says, "and the anticipation always created a higher level of anxiety than the implementation." Furthermore, "with every new regulation there's always the law of unintended consequences," he adds. Understanding these consequences and preparing to address them dramatically influences compliance. A trusted partner like DNV GL who provides support through that transition period is invaluable.

Success in the maritime industry is partly a product of grit and determination, says Noonan, summarizing a lifetime of experience, but it also requires the ability to look forward and to see change as it unfolds. Forming strong alliances with organizations that are looking in the same direction is key.

Now the time has come for the CEO Emeritus to steer into calmer waters: "I had decided it was time to end my run at Chembulk. My wife Kathy will retire from teaching this year, so we have been talking of this decision for some time. Although I am retiring from Chembulk, I am not 'retiring' in the true sense of the word. I do intend to remain involved in the maritime business and will take some time to evaluate my options and opportunities," he stresses. ■ RC

### DNV GL Expert

Nick Roper, Vice President Business Development, Region Americas

Phone: +1 281 396 1171

E-Mail: nick.roper@dnvgl.com

### CHEMBULK TANKERS - AN EVENTFUL HISTORY

The company was originally founded in 1980 as part of the MT Maritime Management (MTMM) Group. As a Singapore-based operator of time-chartered vessels and owner of second-hand tonnage, Chembulk initially focused on the South East Asian vegetable and commodity chemicals trade. Acquired from MTMM by AMA Capital and Varde

Partners in January 2007, Chembulk became an independent chemical tanker company. In the same year it was sold to Indonesia's Berlian Laju Tanker (BLT). In 2015 Chembulk Tankers split from BLT to emerge from its parent's restructuring as an independent chemical tanker owner controlled by two private equity powerhouses.

John D. "Jack" Noonan joined Chembulk Tankers in 2007 and served as CEO until November 2017.



# THE POWER OF INFORMATION

The maritime world is constantly in motion. New approaches to ship design, operation and management are being developed, tested, implemented and superseded. At DNV GL, too, we are always working to provide you with services and information that can help your business adapt to changing markets, regulations and advancements.



## VERACITY PLATFORM

DNV GL's digital services are now available on Veracity, our open industry platform. Anybody can sign in to access a wealth of maritime applications and analytic services that can help customers make better use of data and successfully advance their business.

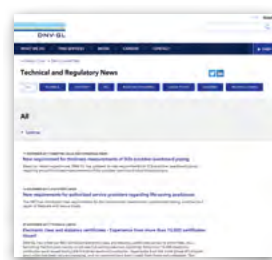
[veracity.com](http://veracity.com)



## STUDIES AND PAPERS

Our research studies and white papers demonstrate insights of the maritime industry with long-term impact. They provide you with a broader view of our services and current maritime topics.

[dnvgl.com/mp](http://dnvgl.com/mp)



## TECHNICAL AND REGULATORY NEWS

Whether it is about incident causality information, new requirements released by the IMO/ILO or other authorities and bodies, guidance and advice on specific issues or Port State Control results: DNV GL keeps customers and business partners up to date.

[dnvgl.com/tecreg](http://dnvgl.com/tecreg)



## UPDATE - A NEW SIDE OF YOUR SHIP TYPE

Sharing our knowledge and experience to benefit our customers and the industry - our Updates offer an in-depth focused look at the issues, news and technologies of a specific ship type.

[dnvgl.com/mm](http://dnvgl.com/mm)



## THE APP

The DNV GL - Maritime app is packed with features and information, including NEWS & EVENTS, CONTACTS, VESSELS, MARKET INSIGHTS and TRAINING COURSES. There have never been so many ways to interact with us

and stay informed about the latest developments at DNV GL.

To download the app for your Android or iOS device, scan the QR code or visit Apple's App Store or Google Play and search for "DNV GL - Maritime".



---

## DNV GL

DNV GL is a global quality assurance and risk management company. Driven by our purpose of safeguarding life, property and the environment, we enable our customers to advance the safety and sustainability of their business. We provide classification, technical assurance, software and independent expert advisory services to the maritime, oil & gas, power and renewables industries. We also provide certification, supply chain and data management services to customers across a wide range of industries.

Combining technical, digital and operational expertise, risk methodology and in-depth industry knowledge, we empower our customers' decisions and actions with trust and confidence. We continuously invest in research and collaborative innovation to provide customers and society with operational and technological foresight. With origins stretching back to 1864 and operations in more than 100 countries, our experts are dedicated to helping customers make the world safer, smarter and greener.

The trademarks DNV GL and the Horizon Graphic are the property of DNV GL AS. All rights reserved. ©DNV GL 12/2017

## IMPRINT

**MARITIME IMPACT**, issue 02/2017; **Publisher:** DNV GL - Maritime, Communications, Hamburg; **Editorial directors:** Andreas Bodmann, Nikos Späth; **Managing editor:** Nikos Späth (NIS); **Authors:** Simon Adams (SIAD), Kevin Gallagher (KG), Rachel Carmichael (RC), Alexandra Jane Oliver (AJO), Alan Johnstone (AJ), Sabrina Junge (SJ), Andreas Kühner (AK), Alexander Wardwell (AW), Cathy Zhang (CZ); **Design and production:** printprojekt, Hamburg; **Translations:** Andreas Kühner; **Layout and prepress:** Lohrengel Mediendesign, Hamburg; **Print:** Media Cologne, Cologne; **Cover photo:** ©MAGNIFIER - stock.adobe.com; **Disclaimer:** All information is correct to the best of our knowledge. Contributions by external authors do not necessarily reflect the views of the editors and DNV GL. **Subscription:** If you would like to subscribe or unsubscribe this publication, please write us an email: [maritime.impact@dnvgl.com](mailto:maritime.impact@dnvgl.com)

