

MARITIME IMPACT

ISSUE 03-15

THE MAGAZINE
FOR CUSTOMERS AND
BUSINESS PARTNERS

CUSTOMER FOCUS

YOU NEVER SAIL ALONE

SHEER STRENGTH

Customized ships are needed to move oversized and ultra-heavy loads

BUSINESS INTELLIGENCE

AIS ship position data holds great potential for decision-makers

NEW RULE SET

Keep it simple: The new DNV GL rules are easy to understand and apply



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Knut Ørbeck-Nilssen
CEO of DNV GL - Maritime

Dear Reader, dear Customer,

First of all, let me say what a pleasure it is to greet you in the pages of MARITIME IMPACT for the first time as the CEO of DNV GL - Maritime. It is an exciting time to be taking on this role, with a lot of change on the horizon in the industry. But there is one thing that does not change, and that is the importance of building relationships and supporting our customers. After all, we are in the people business! The most exciting projects for us at DNV GL are the ones we undertake with our customers - and MARITIME IMPACT is a great showcase for many of these.

I believe the maritime industry of the future will be much more data-smart. The technology is mature, and the time to embrace ICT-supported shipping is now. Ships are getting smarter and more connected all the time, as are the systems we use to optimize performance both on board and on shore. Powerful technology capable of analysing ever-bigger data sets creates new opportunities for us to capitalize on. We at DNV GL will support you, our customers, in leveraging your own data to get a better decision basis.

One of our most exciting projects of the last two years has been the development of the new, harmonized DNV GL rules, which enter into force on 1 January 2016. To create the new classification rules we engaged you and stakeholders from every part of the maritime world. You can learn more about this process and what makes the rules so special in the interview with Program Manager Class Development Holger Jefferies and the rules insert included.

The release of this latest issue of MARITIME IMPACT coincides with the Marintec China exhibition in Shanghai. When I recently visited China I was inspired by the good relations and the great cooperation with our Chinese customers. One exciting area is the emerging cruise market, potentially the world's largest soon. Read about this industry and the newly established Chinese cruise task force in this issue.

At DNV GL we will stay focused on delivering the absolutely best service we can for you, especially in these challenging times. We will make sure that no matter the project, you will be able to draw on our experience and competence to achieve success.

A handwritten signature in black ink, appearing to read 'Knut Ørbeck-Nilssen'. The signature is fluid and stylized, with a long horizontal stroke at the end.

Knut Ørbeck-Nilssen

GHANA'S BLACK GOLD

Once called "Gold Coast", Ghana is relatively new to the oil and gas business. Offshore discoveries are attracting international investments and boosting the local economy as well. A DNV GL-classed FPSO will soon be deployed there.

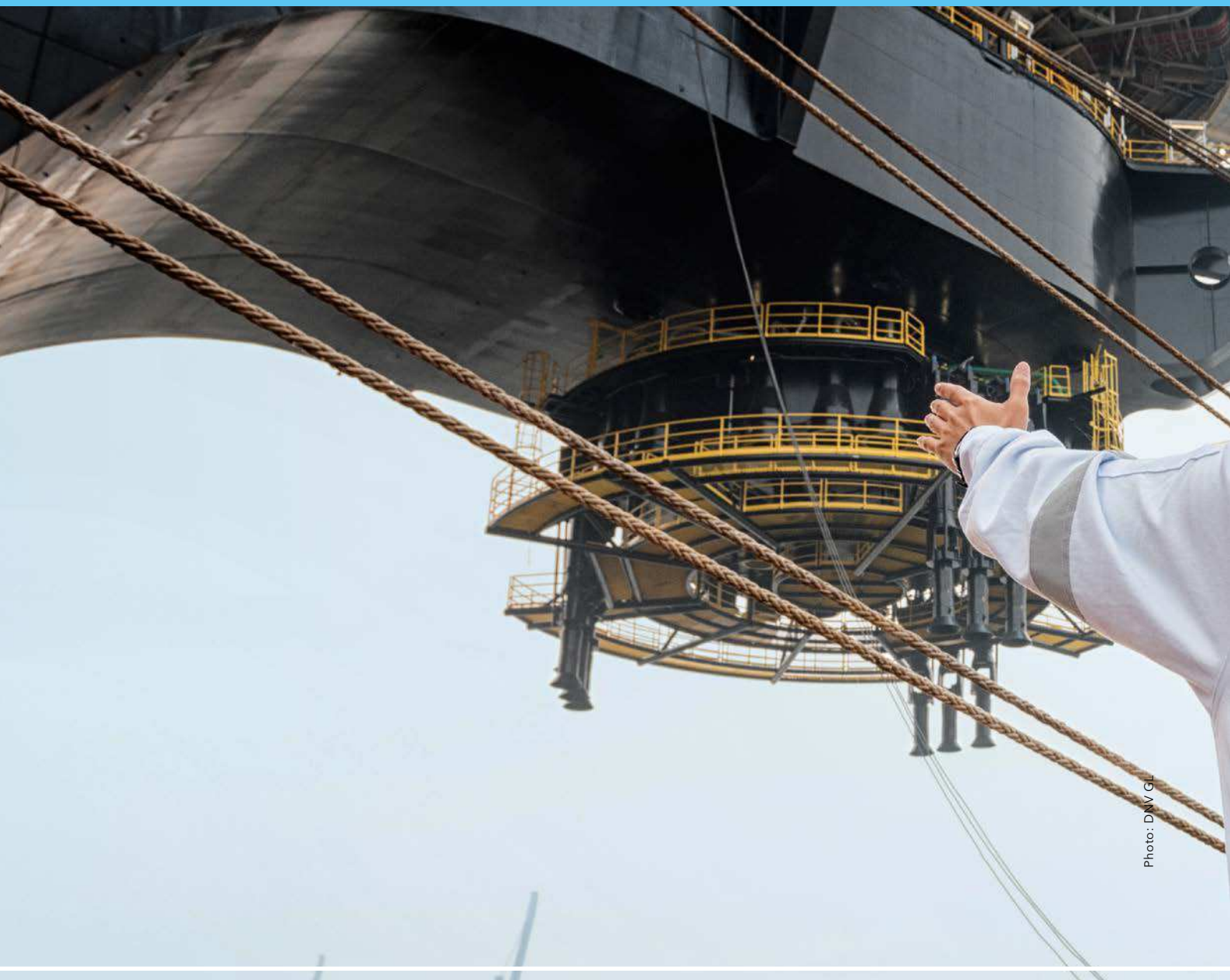


Photo: DNV GL

The Singapore-based Sembcorp Marine Tanjong Kling Yard has been contracted by MODEC Offshore Production Systems Pte Ltd. for the repair, life extension and conversion of a tanker into a floating production, storage and offloading (FPSO) unit. The ship will be deployed in the Tweneboa, Enyenra and Ntomme (TEN) oil and gas fields off the shore of Ghana. The vessel has been named *Prof. John Evans Atta Mills* in honour of Ghana's late president.

The development project is committed to maximizing local industrial involvement. Some of the on-board structure has been fabricated in Ghana. When completed, the DNV GL-classed FPSO, the second of its kind to be per-

manently moored offshore Ghana, will process and store crude oil received from various reservoirs in the deep-water Tano block. The vessel will have a production and treatment capacity of 80,000 barrels per day of crude oil, 65,000 barrels per day of produced water, and 180 million standard cubic feet per day of gas. It will provide an on-board storage capacity of 1.7 million barrels and 132,000 barrels per day of filtered, de-aerated seawater.

The conversion of the double-hull tanker began in October 2013 and is nearly completed. The ship will soon sail to Ghanaian waters where it is expected to begin operating from mid-2016. It has a design lifespan of 20 years.



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IN BRIEF



Stricter limits on sulphur emissions apply to ships passing through the Kiel Canal.

Customized application enables smart fuel operations

The DNV GL Fuel Change-Over (FCO) Calculator has already been ordered for more than 350 ships worldwide. Over 300 calculators have been delivered to ship management companies.

The introduction of stricter emission limits in Sulphur Emission Control Areas (SECAs) effective 1 January 2015 is a challenge for vessels operating within these areas. The majority of ships switch from heavy fuel oil (HFO) to marine gas oil (MGO) to make sure the sulphur content of their fuel does not exceed 0.1 per cent by mass. However, this switchover can put equipment at risk and increase operational costs unless it is performed skilfully and carefully.

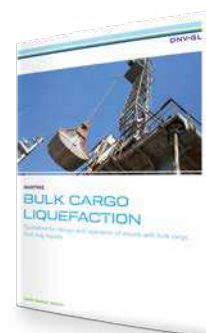
The DNV GL FCO Calculator helps identify the ideal parameters for the changeover procedures. It uses a complex numerical simulation of the fuel changeover procedure that allows for a very accurate changeover calculation and additional cost savings compared to a linear model. Input fields for all relevant influencing factors are provided. The critical value for the changeover procedure outlines the volume to be exchanged in the service system. The application minimizes the risk of mistakes by providing customization features for the individual ship. Comprehensive documentation for port authorities completes the attractive package.

New guideline for a safer bulk trade

DNV GL has published a guideline for the design and operation of vessels with bulk cargo that may liquefy.

Sloshing of cargoes such as iron ore fines, nickel ore and various mineral concentrates have likely caused the loss of six vessels of more than 40,000 dwt since 2009. 111 seafarers have lost their lives to incidents since 2010. The guideline highlights a number of measures to reduce the

risk of liquefaction, including raising the centre of gravity by ballasting the top wing tanks, adjusting the trim, re-testing moisture levels in the event of rain, and keeping a seven-day-or-less time interval between moisture testing and loading. "We wanted to offer some strategies, both in design and operation, to reduce these risks," says Morten Løvstad, Business Director Bulk Carriers at DNV GL.



Download the guideline "Bulk cargo liquefaction" www.dnvgl.com/maritime/bulk-cargo-liquefaction.html



Hong Kong's Wah Kwong implements ShipManager software by DNV GL

Wah Kwong Ship Management Limited will adopt DNV GL's ShipManager integrated fleet management software suite to further improve operational efficiency, data transparency and safety reporting.

Wah Kwong is a leading provider of maritime transport in the bulk carrier, tanker and LPG segments, operating a fleet of 26 vessels, with nine more newbuilds on the way. Wah Kwong's implementation of ShipManager supports its strategy of offering the highest standards of safety and quality of operations. In the face of increasing compliance requirements and a growing fleet, a new, integrated and professional fleet management software system is essential. The implementation of ShipManager will simplify and optimize the ship management by allowing extensive fleet-wide data collection and analysis.

"We aim to continually improve efficiency and safety and strive to be 'best in class' when it comes to operating our fleet," says Tim Huxley, CEO Wah



Hong Kong Spirit, a 166,000 GT tanker operated by Wah Kwong.



Signing ceremony in Hong Kong by senior management from Wah Kwong Ship Management, Wah Kwong Maritime Transport Holdings Limited and DNV GL.

Kwong Maritime Transport Holdings, explaining the decision to implement ShipManager. "Our choice of DNV GL's ShipManager system was in part driven by the fact that it is technically innovative, easy to learn and user-friendly," he adds.

Power without pistons: A PERFECt game changer

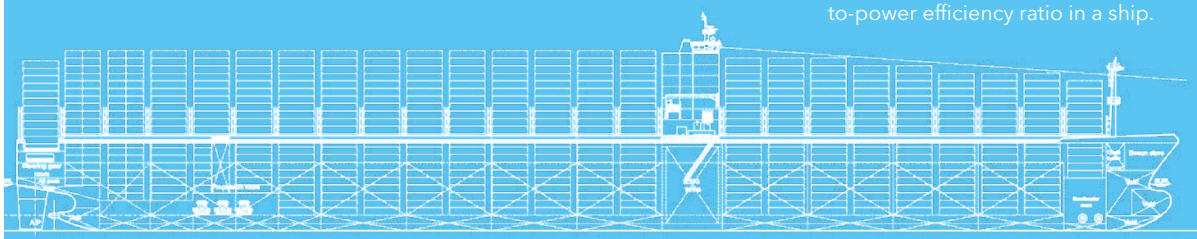
GTT, CMA CGM (and its subsidiary CMA Ships) and DNV GL released a technical and feasibility study for a new mega-boxship recently - the Piston Engine Room Free Efficient Containership PERFECt.

The concept vessel is powered by a combined LNG and steam (or "COGAS") turbine, and is electrically driven. Exploring this novel configuration resulted in the partners identifying a propulsion concept that has the potential to offer a more efficient, more flexible and greener boxship

design than current 20,000 TEU two-stroke diesel-engine-driven ultra-large container vessels.

"The shipping community has realized that LNG enables new propulsion concepts that can increase efficiency, reduce fuel consumption and therefore offer a commercially viable solution. I am confident that the utilization of LNG will increase over the next few years," says Remi Eriksen, Group President and CEO of DNV GL.

Proven on land, a COGAS power plant can achieve a 60 per cent fuel-to-power efficiency ratio in a ship.



GOING GREEN PAYS OFF

The United Arab Shipping Company (UASC) is carrying out one of the world's most ambitious expansion programmes. MARITIME IMPACT met with the company's CEO Jørn Hinge to speak about the container ship market in the Middle East, whether sustainable technologies can promote cost-effective operations and what UASC is doing to stay ahead of the game.

Barzan, one of two sister ships built to UASC's latest eco-design, has received the DNV GL Gas Ready notation.



Jørn Hinge didn't grow up dreaming about long stints at sea and moving up the ranks to become captain on board a cargo ship one day - he liked numbers. "Shipping kind of happened to me by accident. Many years ago I was working for a company in Brazil as an accountant and was approached by a colleague who needed help with talking to a client in Portuguese. I helped him out and it took off from there," he says settling into the chair in his corner office in Dubai. Today, Hinge heads the largest container shipping line in the Middle East: the United Arab Shipping Company.

A heavyweight in ultra-large container vessels, UASC owns some of the most technically advanced

ships in the business. "We benefited from the downturn in the economy in a way. When it came to commissioning the construction of our newbuilds, the shipyards were a lot more responsive to our needs. Therefore, our new vessels include many customized features to meet our requirements," he explains. The company has already named two vessels that were built to their latest design, *Barzan* and *Al Muraykh*.

These 18,800 TEU vessels belong to UASC's eco-ship generation and are the first ships to receive the new DNV GL Gas Ready notation, which verifies that a future LNG-fuelled version of the vessel complies with all the relevant safety and operational requirements. "*Barzan* and *Al Muraykh* have a CO₂ >

Photo: UASC





“We have always enjoyed working with DNV GL, and their expertise in LNG operations was one of the reasons for choosing this class.”

Jørn Hinge, CEO UASC

Reefer slots add flexibility to the fleet, enabling UASC to expand the range of products it transports.

> output per TEU that is 60 per cent lower than 13,000 TEU ships we had three to four years ago and we hope to continue reducing the emissions of our fleet as we move forward,” Hinge states.

Award-winning teamwork

Four sister ships, which are currently still on order, as well as eleven 15,000 TEU vessels have been or will be given the DNV GL Gas Ready notation. “We have always enjoyed working with DNV GL, and their expertise in LNG operations was one of the reasons for choosing this class,” Hinge says. For its commitment to sustainability in shipping, UASC was recently honoured with the “Environmental Responsibility Award” and the “Shipping Company of the Year Award” at the Seatrade Maritime Awards for Middle East, Indian Subcontinent and Africa in October. A few weeks later, UASC also received the “Green

Shipping Award” at the Maritime Standard Awards in Dubai. One of the benefits of UASC’s eco-ship generation is that these vessels have also become more fuel-efficient. “Initially, the investment is higher, but being greener helps us target more environmentally aware customers with more fuel-efficient ships, which puts us in a better position in the market,” Hinge explains. UASC faces fierce competition globally as the deployment of ships into the Middle East has increased dramatically over the past couple of years. The CEO stresses that although the amount of trade is still growing, the volume of tonnage is increasing faster than the trade. “What we as operators have to do is to create some balance in supply and demand. If there is not a sufficient amount of demand and you can’t fill your vessels, then despite the advanced technologies, energy savings and the CO₂ output per TEU will not be optimal,” he explains.

UASC ON THE BALLAST WATER MANAGEMENT CONVENTION

The next challenge in line for UASC is the implementation of the Ballast Water Management Convention (BWMC), which is expected to happen soon. Over a decade since it was adopted, the Ballast Water Management Convention is nearing ratification with 33 percentage points of the 35 per cent of global GT required now signed up. “I think it’s very unfortunate that we haven’t yet reached

the situation where we know what the final requirements for ballast water treatment systems are or if there are manufacturers around that can build and install the equipment that will be approved by the International Maritime Organization (IMO) or the US Coast Guard,” Hinge

explains. Many shipping companies are waiting for a definitive statement on what the rules are. “Of course we are already looking into treatment systems, but we can’t simply invest in our ships without knowing whether a particular system will comply with the rules set by the IMO or the US Coast Guard. It’s an uncomfortable situation to be in.”



Stowaways such as the Northern Pacific Starfish are among the many invasive species carried in ballast water that can destroy entire ecosystems.



Al Muraykh's
CO₂ output is 60
per cent lower
than that of the
previous ship
generation.

The implementation of a structural blank sailing programme with the Ocean Three alliance partners China Shipping Container Lines (CSCL) and CMA CGM has helped UASC create a balance in supply and demand, as it targets enhanced customer supply chain integrity. A blank sailing is where a group of companies will omit a particular sailing from its schedule. It is a method employed to control capacity during periods where volumes are lower. "We're making our blanking programme as transparent for our customers as possible. This will give them better support in their shipment planning and allow them to avoid ad hoc solutions - which can be costly. The programme also makes a lot of sense from an efficiency and environmental point of view," says Hinge.

At the same time, an agreement with Hamburg Süd has enabled UASC to expand its South America trade and prompted the company to diversify its trades. "Overall this new partnership is a great opportunity for us to strengthen our global network. We benefit from mutually available slots and none of us will add a surplus of tonnage to the trade," Hinge explains. "We have added 5,500 new advanced reefer units in 2015, as South America is a reefer-focused market," he adds.

To ensure that their operations run smoothly, UASC recently implemented DNV GL ShipManager Hull on 17 vessels. This advanced hull integrity management software supports shipping companies in taking a proactive approach to hull integrity inspections and increases the transparency of their documentation. Based on a tailored 3D structural model of the vessel available both on board and on shore, ShipManager Hull facilitates easy communication through a fully interactive 3D model, which

enables specific findings to be pinpointed using attached photos and drawings. Steel weight calculations for repairs based on an area marked on the model improve repair planning and the budgeting of dry-docking projects. In addition, a cross-fleet analysis allows companies to benchmark ships against their sister vessels.

Keeping up with innovation

Its ambitious global expansion strategy makes UASC the world's fastest-growing container line and it currently holds 15th place in the global boxship league rankings with a fleet of over 60 vessels and a total capacity of 470,365 TEU. Currently, the company has another ten ships on order. Once delivered, UASC's capacity will grow by 184,431 TEU. "As a global carrier, you need to keep evolving. Reliability and service excellence are at the heart of our operations and we are keen to enhance our geographical reach and explore new market opportunities. Working with DNV GL as a classification partner will keep us at the forefront of container ship innovation and help us to stay competitive, no matter what market situation we face," Hinge says. Because to stay ahead of the game, he states, you need more than a commitment to sustainability - you need the figures to prove that LNG-ready designs and other investments into sustainable technologies pay off. ■ **AJO**

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THE BLOSSOMS OF CORPORATE FRIENDSHIP

Fruitful business relationships can sometimes produce surprising results. While bulk carriers are not known for lyric sophistication and symbolism, Japanese culture certainly is.



The placement of the LNG tank as seen from the starboard side. The available space on deck is limited on a bulk carrier. This solution avoids sacrificing cargo space and ensures safety.

When DNV GL celebrated its grand 150th anniversary party in Oslo in June 2014, many CEOs of major shipbuilding and shipowning companies were among the invited guests, including Sho Minami, Chairman and CEO of Oshima Shipbuilding Co., Ltd., and Tatsuaki Hori, the company's Acting President. DNV GL and Oshima have enjoyed an excellent business relationship for many years, not only through classification but also in the form of many joint technology projects focusing on eco-friendly ship technology. To thank DNV GL for its many years of service since the two companies began collaborating in 1985, Minami presented DNV GL with a gift of 150 Japanese cherry trees, which now enchant the Høvik site with their gorgeous blossoms every spring.

Everybody who has ever read about Japanese culture knows that symbolism plays an important role in the daily life of this country. The cherry tree, also called Sunrise Tree, is not only a symbol of the Japanese nation and its people but also an expression of friendship, explains Fumio Yoshida, Senior Advisor for DNV GL - Maritime Japan. The number 150, obviously alluding to the anniversary of DNV GL, had a second meaning: Shortly before the celebration, DNV GL and Oshima had signed their 150th classification contract. This was a major achievement

Photo: DNV GL



Sho Minami, Chairman and CEO of Oshima Shipbuilding, receiving the Approval in Principle document from former DNV GL CEO Henrik O. Madsen.

that deserved celebrating as well, says Yoshida who presided over the gift-giving ceremony.

Oshima Shipbuilding, established in 1973 at the site of possibly the world's oldest shipyard in the Nagasaki Prefecture near the southern tip of Japan, specializes in building mid-sized bulk carriers of all categories, from open-type paper and pulp carriers to ore, grain, CABU and wood chip carriers. In addition, the company builds other large steel structures such as bridges, floodgates and dams; notable >



FACTS AND FIGURES OSHIMA KAMSARMAX

- Length overall: approx. 229.0 m
- Length between perpendiculars: 224.5 m
- Scantling draught: 14.44 m
- Deadweight at scantling draught: 80,000 dwt
- Service speed at design draught: 14.3 knots
- Cargo hold volume: approx. 97,000 m³
- Number of cargo holds: 7
- Type of cargo: grain, coal, ore
- Main engine: MAN B&W 6S60ME-C8.5-GI
- LNG and HFO dual-fuel system for main engine, auxiliary engines and boiler

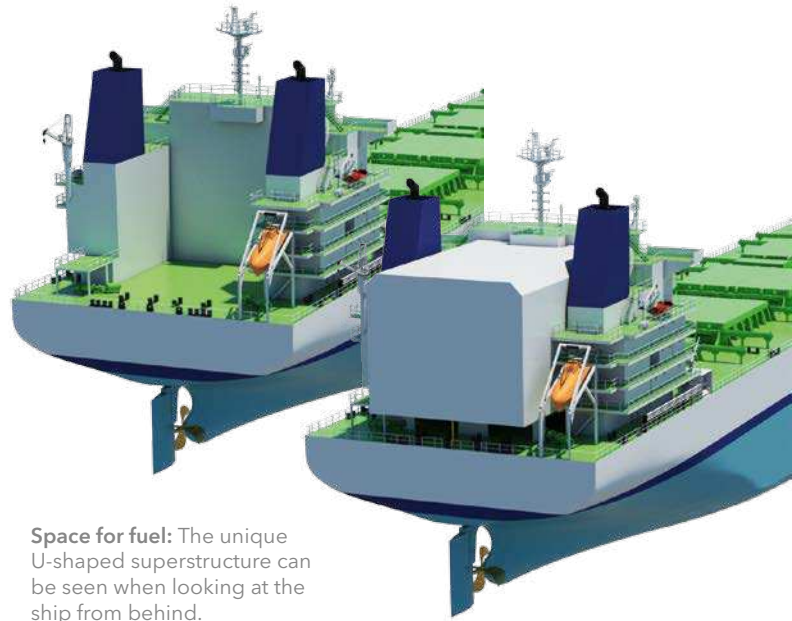
> examples include Oshima Bridge and the Fukuoka Dome. With high quality, the use of advanced, sustainable technologies and speedy execution as major differentiators in the market, Oshima is a world leader in the bulker segment, offering the largest open hatch bulk carrier with a gantry or jib crane, the largest ships capable of transiting the St Lawrence Seaway, and the largest bulk carriers for arctic conditions.

Capable of completing up to four vessels simultaneously at its dock, the company delivered 36 ships in 2013 and will complete 40 this year, the highest annual output for any single-dock operation worldwide.

Study shows feasibility of LNG

DNV GL and Oshima have been business partners for many years, says Mr Yoshida. The relationship extends far beyond classification: Oshima Shipbuilding and DNV GL have cooperated on several innovative bulk carrier concept designs in the past. In 2014 a DNV GL study investigated the global bulk carrier trade routes and their exposure to present and future environmental regulations. Based on this study, a techno-economic feasibility study for the use of LNG as a fuel on the Panamax/Kamsarmax routes was performed. An investigation of the key trade routes connecting Europe with North America served as a starting point because of the ECA water exposure and the fact that LNG prices are lower in the US.

The study showed that on a round-trip voyage with only one bunkering operation, 500 to 700 cubic metres of LNG are sufficient when using LNG within emission control areas only, and 2,000 to 2,500 cubic metres of LNG are needed when operating on LNG for the entire length of the trip.



Space for fuel: The unique U-shaped superstructure can be seen when looking at the ship from behind.

Based on these findings Oshima Shipbuilding and DNV GL initiated a joint development project to develop a commercially attractive and flexible bulk carrier design for the relevant routes. Oshima already had a Kamsarmax design which was highly optimized from a hull resistance and cargo capacity point of view and provided an excellent starting point for the design work.

Since the available space on deck is limited on a bulk carrier, major modifications had to be made to the superstructure to accommodate the LNG tanks. With the main priority of maintaining the existing vessel cargo capacity, Oshima developed a unique and innovative wrap-around superstructure design that leaves enough space for tanks capable of holding

ABOUT OSHIMA SHIPBUILDING CO., LTD.

Established in 1973, Oshima Shipbuilding Co., Ltd. is situated on the small island of Oshima off southern Kyushu. The company currently has roughly 1,000 permanent and close to 700 subcontracted employees. Its Chairman and CEO is Sho Minami, son of the company's founder.

Since 1991, Oshima has been specializing in building mid-size bulk carriers ranging in size from 40,000 to 120,000 dwt. The shipyard differentiates itself through high production efficiency and top quality. Oshima vessels are highly regarded for reliability and du-

rability. Key R&D achievements include eco-friendly technologies such as a high performance propeller, structural fins on the hull, bulbous bow improvements, air-lubricated hulls, and a low-friction hull coating. Research projects are investigating wind propulsion, selective catalytic reduction of exhaust fumes, and ballast minimization. Oshima has built over 600 ships to date.

To support the local community, Oshima shipyard established two small agricultural businesses producing tomatoes, shochu spirits and microbrewed beer, and operates a hotel of its own.



The Oshima shipyard can build four vessels simultaneously in a single dock.

Photos: DNV GL, Oshima Shipbuilding, Volodymyr Krylyuk - Fotolia

up to 3,000 cubic metres of LNG, sufficient for a full round trip. The design is flexible, safe and ready to be ordered, having received Class Approval in Principle for IMO type-C tank installation. With its dual-fuel capabilities, this vessel should be very attractive to charterers, especially for those trade routes where the price of LNG is competitive with that of HFO and substantially lower than that of MGO.

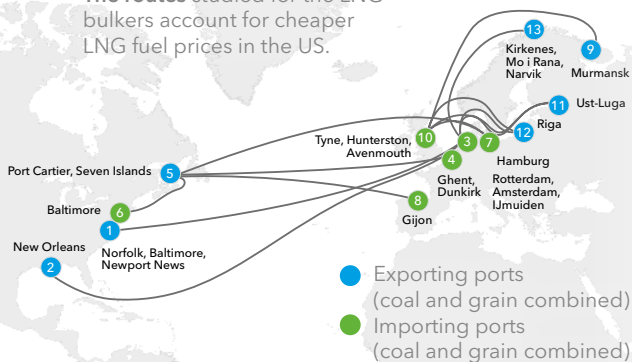
Diversification plans

The collaboration between DNV GL and Oshima Shipbuilding continues. Both companies recently presented the results of a joint project demonstrating the advantages of hatch covers made from glass-reinforced plastic (refer to info box). Meanwhile, the continued weak demand for bulk carriers in the wake of the financial crisis has prompted Oshima to look

into diversification options for its portfolio of ship types. In August of this year, the company's Chairman and CEO Sho Minami and Acting President Hori announced that Oshima will establish a second core business segment by building container feeder vessels from 2021 onwards. The product range will include 1,900 TEU Bangkokmax feeders as well as 3,000 TEU feeders. In this segment in particular, Oshima can count on the exceptional engineering expertise of DNV GL. Production will begin as soon as the company has completed its current yard expansion project and added the necessary dock space.

DNV GL has also been a door-opener for Oshima into the European markets. The new range of feeders should sell well, given the state-of-the-art technology, environmental compatibility, design quality and workmanship the Japanese shipbuilders engineer into their vessels. DNV GL is happy to contribute its proven engineering competence, advisory support and market knowledge, Senior Advisor Fumio Yoshida points out. The number of Oshima-built ships with DNV GL class is now at around 165 – and growing. And the next spring with thousands of cherry blossoms at the Høvik head office is just around the corner. ■ AC/AK

The routes studied for the LNG bulkers account for cheaper LNG fuel prices in the US.



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LIGHTWEIGHT, TOUGH, LOW-MAINTENANCE: GRP HATCH COVERS

A joint industry project with Oshima Shipbuilding on composite materials showed that composite hatch covers hold great potential for bulker owners and operators.

"We looked at different structures and components for potential weight saving, and found that hatch covers made of glass-reinforced plastic (GRP) hold the biggest potential for reducing the weight of a vessel and thereby increasing its cargo capacity," said Morten Løvstad, Business Director Bulk Carriers at DNV GL in a recent presentation on technology trends. The study

showed that a Panamax bulk carrier would be able to increase its cargo load by 320 tons, and as an added bonus downsize its crane capacity and use electric motors for handling these lighter hatch covers.

Apart from saving weight, composite hatch covers require less maintenance and are not prone to cracking and corrosion, a common problem with conventional steel hatch covers. The sealing system may also be improved. "We expect to see this system being realized in the next two years," said Løvstad.



Increased payload: GRP saves weight.

The Danish owner Nordic Bulk Carriers has been part of the joint industry project with DNV GL and Oshima, and has obtained approval from the Panama Maritime Authority for a potential retrofit on one of its Panamax vessels in operation.

SUCCESSFUL SURGERY

In an unprecedented endeavour, the ship manager Reederei NSB is widening its Panamax-class container vessels. DNV GL, the class in charge, is on board.

Too young for scrapping, too old to compete:

Roughly 500 Panamax-class container ships are currently less than ten years old, barely half their useful life. But facing overcapacities, low charter rates and fierce competition, the Panamax class is under intense pressure. Compared with state-of-the-art and much more capacious newbuildings, its prospects are dim.

This is mainly due to the way these vessels were designed. To pass the old locks of the Panama Canal, they were built with unusual dimensions - long and thin and with a large amount of ballast water to compensate the poor stability. "In addition, Panamax ships are equipped with stronger engines that achieve their highest efficiency when operating at higher speeds, rather than slow steaming, which is more common today," says Marcus Ihms, Ship Type Expert for Container Ships at DNV GL - Maritime.

So shipowners try to make their fleets more competitive by undertaking minor and major ship conversions (see below). Reederei NSB of Buxtehude, Germany, is causing quite a stir with the idea of widening three of its Panamax container vessels: *MSC Geneva* went back into service in July of this year after undergoing the procedure, her sister ship *MSC Lausanne* was delivered in late October, and *MSC Carouge* should be completed by the end of January 2016. "No one has ever cut a container ship lengthwise from the superstructure to the bow to widen it," says Tim Ponath, Chief Operative Officer of Reederei NSB. "We are very proud of our team who demonstrated the viability of our concept."

Innovative and technically sophisticated, this concept was developed jointly by NSB and the

Hamburg-based Technolog GmbH. After separating the fore and aft body from the cargo hold in dry dock, the cargo hold is cut in half lengthwise and pulled apart. The new centre sections are inserted and connected to the existing part. "The main idea behind this innovative method is cutting the hull in the least stressed areas and significantly increasing both the container intake and stability by widening it," says Lutz Müller, Senior Technical Consultant at NSB and one of the key initiators of the project.

Providing guidance

The conversion is carried out by Huarun Dadong Dockyard (HRDD), China. DNV GL, the classification society in charge of the ships, was involved from the early stages. "This is a major conversion project," emphasizes Ihms. This means that all classification and flag state rules in effect at the time of conversion have to be observed. It is important to discuss with the flag state and the class, what rules must be adhered to under all circumstances, and what parts of the ship can be handled according to existing standards rather than new requirements.

"Our Class Note for Conversion of Ships provides the necessary guidance to owners as well as engineering companies during the design phase," Ihms points out. For example, in the case of *MSC Geneva* and her two sister ships, the anchor equipment had to be adapted, as a widened ship is heavier and offers more resistance to wind. "According to our well proven method, additional chain lengths can provide more holding force. Thereby, the retrofit of the entire winch system can be avoided without jeopardizing the anchoring capability," Ihms reports. From anchor



OPTIONS FOR MINOR AND MAJOR CONVERSIONS

A changed economic environment calls for measures to make existing container tonnage originally designed for different operating conditions more competitive. A number of options are available.



Increase the draught

Increasing the draught, and thereby the deadweight, will allow the ship to take on more weight per container. Strength and stability considerations, the resulting visibility line and the location of pilot doors must be accounted for.



Heighten the deckhouse

A taller deckhouse will increase deck container capacity and improve the line of sight at the same deadweight. Appropriate lashing bridges and innovative methods to determine the cargo securing help to fully utilize the benefits.



Upgrade the lashing bridges

Installing lashing bridges or heightening existing ones improves stowage performance. This is often combined with a hatch cover upgrade to enlarge the stackweight. Structural re-approval of the substructure is necessary.



A stately lady, the widened *MSC Geneva* now boasts a 30 per cent higher TEU capacity at the same operating costs.

equipment and ship strength and stability through to statutory compliance and cargo lashing, close collaboration between all project stakeholders was crucial for the success of this world premiere.

Added benefits

A conversion adds up to four container rows to the cargo hold, increasing the container capacity by about 30 per cent. In addition, it improves engine efficiency when combined with an optimized propeller, and bolsters stability. “Stability increases exponentially when you widen a ship,” Ihms explains. As an added benefit, the required ballast water per loaded

container could be reduced by half. The IMO Energy Efficiency Design Index (EEDI) achieved will equal that of a newbuilding and meet EEDI regulations as per 2025. The life-extending surgery will pay for itself within four years – so in the end it has all been well worth the effort, Ihms assures. ■ PL

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Photos: Reederei NSB/Hasenpusch

4

Lengthen the ship

Payload and cargo intake is significantly increased by adding a new midsection. This major conversion changes the ship’s longitudinal strength in particular and requires comprehensive structural verifications.

5

Widen the ship (at right)

Often combined with lengthening, this complex conversion means cutting the ship apart lengthwise to add a new centre line section. The cargo capacity and performance is boosted substantially.

| original ship | MSC GENEVA | after conversion |
|---------------|---|------------------|
| 275.0 | Length overall in m | 283.0 |
| 32.2 | Breadth in m | 39.76 |
| 4,872 | Nom. container intake TEU | 6,296 |
| 59.4 | EETI at 19 kn/(14 t TEU homogen. x 1,000 nm) ¹⁾ | 44.9 |
| 27.1 | Fuel oil consumption per container; per day in kg/(day*TEU) | 20.1 |

1) ISO cond., LCV 40 MJ/kg; in kg/(TEU*nm)

SAILING THE EXTRA MILE

The Kuwait Oil Tanker Company has adopted a unique philosophy for building and operating one of the most advanced, fuel-efficient fleets in the world.

Embracing innovative technology helps KOTC exceed environmental standards.

As a subsidiary of the Kuwait Petroleum Corporation (KPC), the Kuwait Oil Tanker Company (KOTC) is committed to providing safe and efficient transport for Kuwait's leading export product, petroleum, in line with KPC's strategic vision. Recently KOTC completed a nine-vessel newbuilding programme. Work-

ing with various suppliers, the company installed innovative technology enabling cleaner, safer, and more fuel-efficient fleet operation.

Ali A. Shehab, Deputy CEO (Fleet Operations) at KOTC, says that unlike most shipowners, whose approach to ship operation has been driven by new

Photos: KOTC



regulations and bunkering costs, KOTC pursues a different, more forward-looking strategy that does not shy away from travelling the extra mile. "Rather than waiting for new regulations or reacting to changes in bunker prices, we actively seek new ways to improve our overall performance," he says. "As a state- ➤



"Rather than waiting for new regulations or reacting to changes in bunker prices, we actively seek new ways to improve our overall performance."

Ali A. Shehab, Deputy CEO
(Fleet Operations), KOTC



“Most owners tend to stick to the same suppliers, but we believe a more diversified approach helps us achieve better results.”

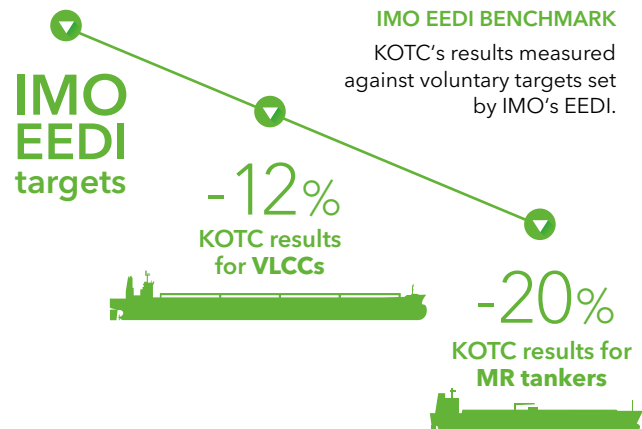
Jamil Al-Ali, Manager Fleet New Building Projects Group at KOTC

> owned entity, KOTC not only has an obligation to provide KPC with excellent and cost-effective transport services. We also represent the State of Kuwait, which has very specific policies on how we behave as a company.”

Revamping the fleet

In 2014, KOTC completed Phase III of its ambitious newbuilding programme, which included four VLCCs, four medium-range (MR) product tankers, and one long-range Aframax petroleum product and crude oil tanker. The nine vessels were built at two separate yards and involved multiple suppliers. “From engine manufacturers to bridge control, and from classification societies to suppliers of marine coatings, we worked with a wide range of industry leaders,” says Jamil Al-Ali, Manager Fleet New Building Projects Group at KOTC. “Most owners tend to stick to the same suppliers, but we believe a more diversified approach helps us achieve better results.”

Jamil Al-Ali says that this strategy not only allows KOTC to test various systems but also helps deepen



the technical knowledge across the organization. “KOTC is part of a larger, state-sponsored effort to recruit and train the next generation of Kuwaiti seafarers, and we gain more expertise by working with a range of suppliers,” he explains. “This strategy has also helped us build a strong international network – we have friends everywhere!”

KOTC takes the same approach to classification societies. “Different classification societies have different strengths and we have worked with many of the leading classes across our fleet. However, we have enjoyed a strong, long-term relationship with DNV GL for many years,” says Shehab. “Their unrivalled technical expertise, especially in fuel efficiency, noise and vibration, crew comfort and ship safety has been very useful. Their quick response to our requests is also commendable.”

Early adopter

Ralph Becker, DNV GL's Regional Business Development Manager for Middle East & India, notes that KOTC's approach to shipping has much in common with DNV GL's mission to help the industry become safer, smarter and greener. “All shipowners are looking for affordable ways to lower bunkering costs, comply with regulations and gain competitive advantage,” he says. “KOTC goes beyond that by being an early adopter, and its approach is not only effective but also serves as a model for other shipping companies.”

KOTC's newbuilds incorporate innovative technology such as latest-generation energy-saving engines which reduce SO_x, NO_x and CO₂ emissions, as well as hull forms designed to optimize water flow to the propeller and reduce hydrodynamic resistance dur-



"KOTC is an early adopter. Its approach is not only effective but also serves as a model for other shipping companies."

Ralph Becker, DNV GL's Regional Business Development Manager for Middle East & India

ing vessel transit. Furthermore, the four VLCCs and the Aframax are also equipped with volatile organic compounds (VOC) reduction systems (DE-VOC) which work by controlling and maintaining the pressure in the cargo loading drop lines above ambient pressure, minimizing the generation of VOCs, especially at the initial stages of cargo loading.

Proven results

Shehab acknowledges that being an early adopter can be a risk. But the results speak for themselves, he adds. "Measured against the voluntary targets set by the IMO's Energy Efficiency Design Index (EEDI), our initial analysis indicates our VLCCs perform around 12 per cent better than the benchmark value, and our MR tankers as much as 20 per cent better," he says. "What we learn from this newbuilding programme

will benefit the next phase of our fleet renewal." Earlier this year, KOTC announced plans to expand its fleet by eight more vessels, a mix of very large gas carriers (VLGCs), liquefied petroleum gas (LPG) and MR tankers. The newbuilds are scheduled for delivery in 2016 and 2017. "As always, we welcome new ideas to help us achieve a cleaner, more fuel-efficient fleet," Shehab says. "In fact, we are already in discussions with a number of suppliers who we believe will help us achieve our goals." ■ AW

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GROUND-BREAKING STUDY

In February 2015, KOTC signed an agreement with a leading Danish manufacturer of environmental protection systems, Pres-Vac Engineering, to measure and minimize the emissions of volatile organic compounds (VOC) from oil tankers during transit in local and international waters. This "first of its kind" study, sponsored in part by the Danish Maritime Authority, will include the installation of specialized equipment to monitor emissions on KOTC vessels.

The cooperation agreement was signed by Shaikh Talal Al Ahmed Al Sabah, CEO of KOTC, and John Lindhardt Frandsen, CEO of Pres-Vac.



SHEER STRENGTH

The equipment used to tap offshore energy resources is getting bigger and bigger. Specialized ships are needed to move these huge loads, and close collaboration between the customer, shipping company and classification society is essential.

From the energy sector to industrial machinery and to floating cargo, the technology used in many markets today is getting ever more sophisticated, and the components bigger and heavier. While wind turbine rotor blades rarely reached the 50-metre limit just a few years ago, they average nearly 75 metres today. Installation of offshore equipment is especially demanding. Around the world engineers are busy developing new concepts for relocating power generation offshore. Specific plans for mega-installations have emerged in Japan, Belgium and Germany. Offshore Yorkshire, the “Dogger Bank Creyke Beck”, the world’s biggest offshore wind power project to date, will comprise two wind farms of 200 wind turbines each. When completed the project will have a rated capacity of roughly eight billion kilowatt hours per annum, enough for about 1.8 million households.

Today’s maritime equipment, such as mobile, rail-mounted and stationary cranes and stacking equipment used in logistics at sea and inland waterway ports, continues to grow in size and power. For example, in Bronka, the deep-water port of St Petersburg, the biggest mobile in-port crane ever built is about to be commissioned. The LHM 800 series, built by Liebherr, Rostock, has a 308-tonne lifting capacity and a reach of up to 64 metres, enabling it to unload ships that are 22 container bays wide.

“Projects of these dimensions can only be carried out with specialized ships custom-built for oversized, ultra-heavy pieces of cargo,” says Jan Råde, Ship Type Expert Ship Structures and Outfitting at DNV GL. One of the leading global shipowners in this segment is SAL Heavy Lift, a company of the Japanese K Line Group. With a fleet of 16 heavy-lift cargo ships and a professional engineering department, this



Photo: Holger Martens

Hamburg-based company has earned an excellent reputation across the industry.

Tricky cargo

“Heavy-lift cranes play a key role in the offshore world today and will continue to do so. We have therefore developed a comprehensive heavy-lift crane portfolio with capacities ranging up to 2,000 tonnes,” says Alexander Gerbert, Offshore Crane Project Adminis-



The 700-tonne subsea crane RL-K 7500, developed and built by Liebherr, had to be shipped fully assembled.

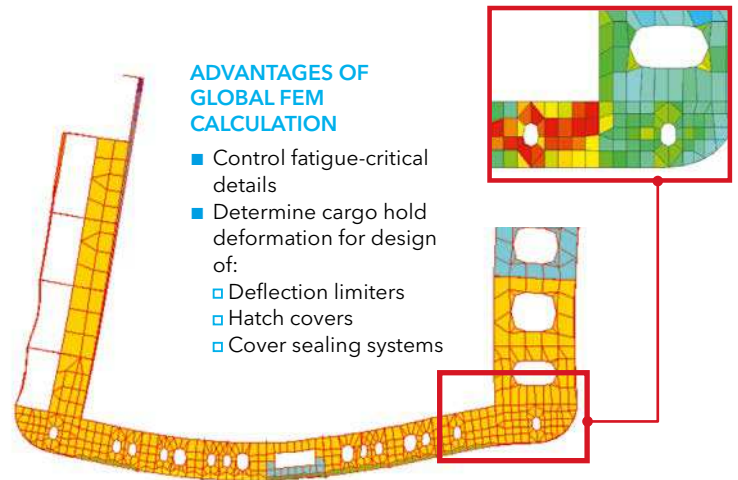
LIEBHERR

With over 41,000 employees and nine billion euros in annual sales, Liebherr is a leading global manufacturer of machinery. The company's maritime material handling business produces ship, floating, offshore, container and mobile harbour cranes, reach stackers and other specially designed material handling systems for ports. The products of the Maritime Cranes division are manufactured at four European sites: Liebherr's Nenzing GmbH, Austria; Liebherr Container Cranes Ltd., Killarney, Ireland; Liebherr Sunderland Works Ltd., UK; and Liebherr-MCCtec Rostock GmbH, Germany.

trator at Liebherr-MCCtec Rostock GmbH, a unit of Liebherr's maritime division.

Liebherr often cooperates with SAL to ship heavy-lift cargo overseas. Recently the two companies moved the RL-K 7500 crane from Rostock to South Korea. The biggest deep-water crane ever developed and built by Liebherr, the RL-K 7500, weighing in at roughly 700 tonnes, has a 50-metre main boom and can lift loads in waters up to 3,660





> metres deep. Liebherr also entrusted SAL with the transport of two knuckleboom cranes (KBC) for installation ships, as well as two mobile container cranes for a refrigeration ship to South Korea. "It is not only the sheer weight and volume of the cranes that makes this a real challenge," says shipmaster Matthias Pfeiffer of *Trina*. "In the case of the KBC cranes we also needed special rigging to protect the main hydraulic cylinders of the cranes against lateral stresses." The 160-metre vessel selected for the Liebherr project has three rotary cranes (2 × 700 tonnes SWL plus 1 × 350 tonne SWL). The Liebherr cranes, which had to be shipped fully assembled, first had to be lifted up on land to be mounted inside a stable transport rig to absorb the acceleration forces acting upon the cargo during a sea voyage.

Contrary to other shipping companies which have the cargo loading procedure directed by a port captain, SAL customarily entrusts this task to the ship's crew. The crew executes the procedure independently as planned by the company's engineering department. "This enables us to react flexibly in case of an unforeseen event," explains Captain Pfeiffer. In the Liebherr project the SAL crew found a way to place the two fully assembled cranes side by side on the same ship. "Transporting the cranes individually would not have been economically feasible for the customer, and disassembling them for shipping

would have been too expensive and time-consuming," says Pfeiffer.

One-size-fits-all is history

When the cargo is loaded onto a ship, this marks the end of a long logistical journey. Shipping damage or a delayed vessel would have severe consequences. For successful shipment it is therefore essential for the customer, the shipping company and the classification society to cooperate very closely. In the Liebherr and SAL transport project, DNV GL joined in as the third partner. DNV GL has classed nearly half of all heavy-lift vessels worldwide, more than any other classification society. "Every heavy-lift transport is a unique project," says DNV GL expert Råde. There are no standardized size categories or one-size-fits-all solutions. Every ship, be it converted or newly built, must be planned and classified individually.

Smaller, older vessels must be retrofitted, while newbuilds must anticipate tomorrow's requirements. Shipping companies facing such a decision should therefore contact their classification society at the earliest time possible. "Our services go far beyond mere classification. We support our customers from the initial idea to the planning stage through to completion and acceptance of the ship," says Råde. The DNV GL expert continues that there are three main objectives to bear in mind: "Increasing flexibility for



"It is necessary to perform a detailed analysis of the ship and the cranes for the envisioned cargo cases to ensure smooth operation and avoid damage."

Jan Råde, DNV GL's Ship Type Expert MPV, Ship Structures and Outfitting

transport projects, reducing the costs, and minimizing the risks." A number of services are combined to address these goals. "At the beginning we sit down with our customer to conduct a thorough requirements analysis: What routes will the vessel serve? What ports will it call at? What is its draught going to be? What type of cargo will it carry? Along these lines we create a realistic, detailed profile for the ship," says Rude. Thanks to its AIS database, DNV GL has an enormous information advantage enabling it to give its customers precise recommendations.

There is always potential for optimization. "To give an example, what would be the benefit of designing a vessel for a high maximum speed if it will travel in sea areas where the actual speed is much lower?" Rude asks. Keeping questions like this in mind, DNV GL presents detailed design concepts for the hull, propeller, rudder, etc. to the customer. The ship's resistance in water can be determined using CFD simulation. The result is an underwater hull optimized for the customer's operational profile, ensuring fuel efficiency. The most important criteria for minimizing risks are the ship's structural integrity and stability. As cargo gets bigger, longer cargo holds must be designed accordingly - another point the shipbuilding engineers must account for using route data, expected wave conditions, acceleration and other parameters. 3D analyses of the vessel's steel structure deliver valuable insight into its properties, including the deformation behaviour of the hull.

"A detailed analysis of the ship and its cranes with respect to the envisioned cargo cases ensures smooth operation and avoids damage during transit, loading and unloading operations," Rude points out. What is more, DNV GL will also determine whether investing in an LNG propulsion option will make economic sense. "This primarily depends on whether the ship will be deployed in ECA zones," says Rude.

Another part of the DNV GL services is an accurate calculation of all loading conditions. A set of

standardized loading conditions for this ship type will be included with the applicable DNV GL rules effective 1 January. "This will improve transparency by telling shipowners what loading conditions a multipurpose vessel should be designed for to ensure the greatest operational flexibility possible," Rude explains. Whatever the case, in addition to the classification services the customer can always choose from a comprehensive set of optional advisory services.

Seamless customer service

As many as three years may pass between the first meeting and the time the keel is laid down. But from the first day each customer is assigned a personal contact at DNV GL with full expertise regarding the specific challenges associated with the ship type. Following delivery of a ship, a specialized team assumes responsibility for taking care of it so decisions can be made rapidly. For the entire project life cycle, DNV GL will support the customer as a consulting partner. This close collaboration clearly paid off in the Liebherr and SAL transport project. "The cargo was overhanging the side of the ship. This is of great concern on certain sea routes so we had to file for a special permit," recounts shipmaster Pfeiffer. The transport went smoothly, thanks to the excellent cooperation between SAL, Liebherr and DNV GL.

Meanwhile, technology continues to progress in the energy sector. Liebherr has already begun building the next LHM 800 crane, which will be installed at the container port in Montevideo, Uruguay. DNV GL will be on board again, true to the motto "Never change a winning team". ■ SM

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Photos: DNV GL, Isic99 - CC BY-SA 3.0



SAL HEAVY LIFT

SAL, established in 1890, specializes in heavy-lift cargo transport. The company operates a fleet of 16 heavy-lift vessels with deck lengths of up to 128.5 metres and up to 3,500 m² of cargo storage space. The ships can cruise at 20 knots and have a combined crane lifting capacity of up to 2,000 tonnes. All vessels are equipped with lifting and lashing gear. SAL Heavy Lift is headquartered in Hamburg's Hafencity district and has a network of agencies and offices around the globe.

STRENGTHENING THE WEAKEST LINK

Jacking gear faces heavy environmental stresses during offshore operations, but the industry still lacks common standards governing maintenance work on these systems. DNV GL has developed a comprehensive guideline with industry stakeholders in a joint industry project (JIP) to close this gap.

Offshore engineers working on a jack-up in the North Sea watch in shock as high waves come rolling in towards them, much too close for comfort. A few minutes earlier, the unit stalled during its jacking operation, leaving it stuck in mid-air, ten metres above the water and in danger of tipping over. Though this is a fictional case, there have been similar incidents caused by the same issue: jacking gear failure.

By definition, jacking gears are among the most critical systems on self-elevating units. But, says Willem Wille, Vice President of Business Development at the Allrig Group, “maintenance work on the jacking system often doesn’t take top priority because this is considered basic equipment - when really, it is the unit’s weakest link.” Wille, an expert on jacking systems, worked closely with DNV GL in his former position as CEO of the Dutch offshore services provider Willteco.

“The lack of common standards has caused the quality of maintenance work to vary greatly in this sector. Maintenance is often carried out on an individual-component basis, making it almost impossible for operators to see the bigger picture and assess which areas may become critical in the future,” explains Michel van der Geest, Product Manager Offshore Class at DNV GL - Maritime and project

manager of the JIP. Correct maintenance and inspection of the jacking systems have also proved to be challenging due to the high turnover of people with specific knowledge on board as well as the evolving nature and intermittent use of the systems.

One of a kind

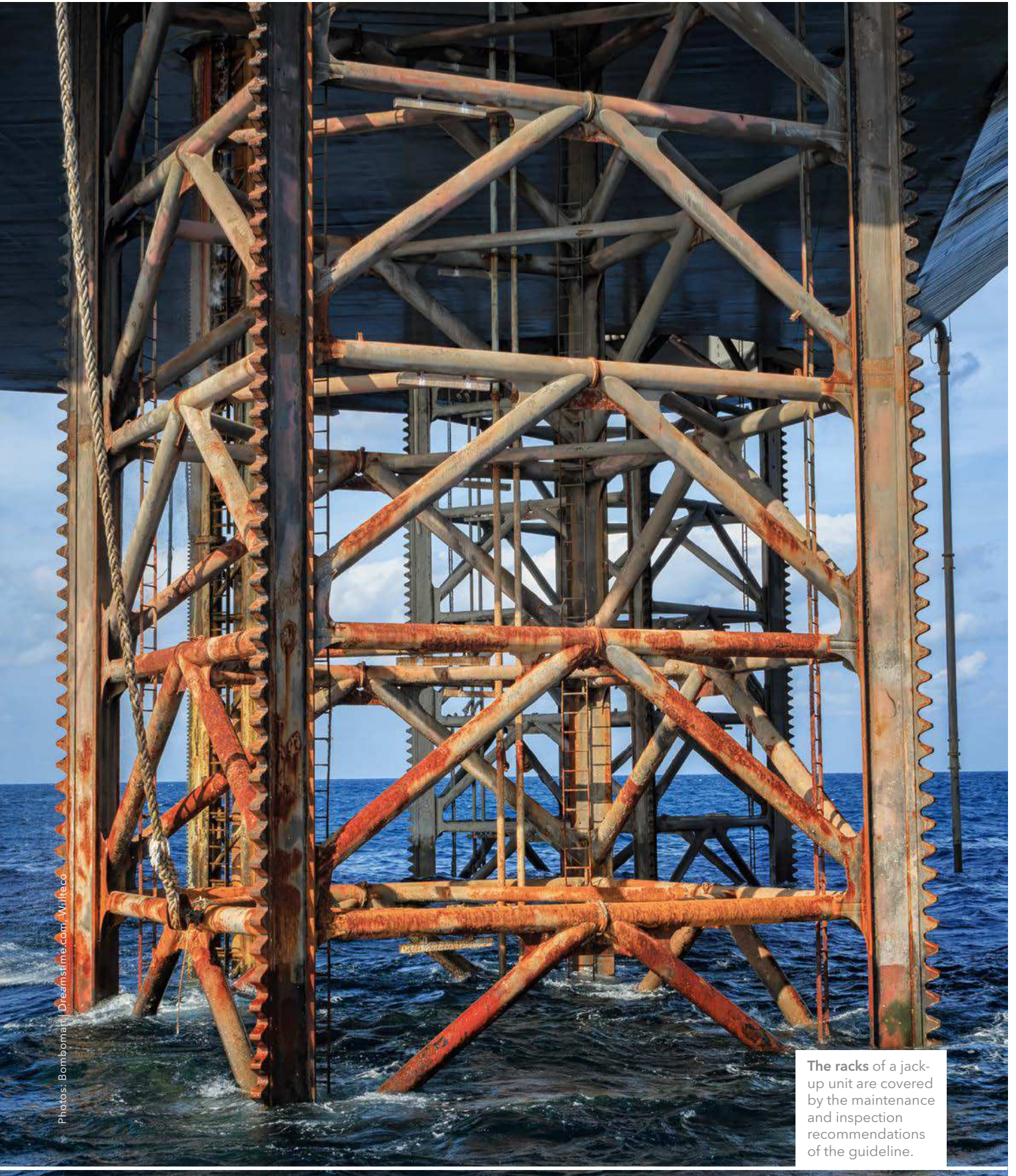
To address this issue, DNV GL teamed up with the National Drilling Company of Abu Dhabi, Willteco, and several other companies in a joint industry project to develop a comprehensive guideline for the inspection and maintenance of jacking systems. The resulting recommended practice is the first standard of its kind that addresses the common problems associated with jacking systems and was presented to some 100 industry players at a workshop in the Middle East.

The document covers the recommended practices for the inspection and maintenance of electric rack-and-pinion-type jacking systems. It also aims to increase the level of competency of crew members that carry out jacking system maintenance and inspections. In addition, it highlights critical components and areas where experience indicates lack of attention - giving guidance to original equipment manufacturers (OEM), yards and system >

“Maintenance work on the jacking system often doesn’t take top priority.”

Willem Wille, Vice President of Business Development at the Allrig Group





Photos: Bombardier, Dreamstime.com, Wilfoco

The racks of a jack-up unit are covered by the maintenance and inspection recommendations of the guideline.

The National Drilling Company's *Al Yasat* rig completed the Rig Integrity Assurance Programme (RIAP) in November 2014.



“Having an experienced, independent partner such as DNV GL on board has helped to establish our project as an industry standard.”

Abdalla Saeed Al Suwaidi, CEO of Abu Dhabi's National Drilling Company



> designers on the type of information needed to be able to assess system conditions concerning wear limitations. Recommendations to ensure the proper level of awareness and follow-ups in extraordinary operations close to design limitations are also included.

Jacking operations - what can go wrong

The list of potential issues that could affect jacking systems is long and includes undetected cracks and deformations in the legs, welding faults around the jacking house and the braking systems, or faulty control systems. Problems with the rack and pinion system itself, the lack of stress tolerances for various parts, as well as obsolete systems can also cause incidents during jacking operations. If the jacking gear fails, repositioning the platform may become impossible. Should the failure occur in the middle of a jacking operation, the platform may become unstable and prone to wave impact, putting the entire unit in danger.

“This project was extremely valuable for the industry and we were happy to share our operational procedures to increase transparency in the industry. Having an experienced, independent partner such as DNV GL on board has helped to establish it as an industry standard,” says Abdalla Saeed Al Suwaidi, CEO of Abu Dhabi's National Drilling Company (NDC).

Renovating ageing units

With 17 offshore rigs and one multi-purpose barge in operation, NDC is the biggest drilling contractor in the Middle East and was one of the first companies to sign up for the joint industry project. NDC also works closely with DNV GL experts on the so-called Rig Integrity Assurance Programme (RIAP) to ensure the structural integrity of the ageing jack-ups in its fleet. RIAP aims to extend the lifespan of older jack-up rigs by stripping them down and almost completely rebuilding them. “By next year, almost all of our older units will have completed RIAP. We have also changed the way we do major maintenance and try to have more work done in dry dock, where you have

a much better chance to catch any issues with jacking gears or other systems early on. This is more expensive, but in the long run, it pays off,” Al Suwaidi adds.

Newer jacking gears are equipped with a greater number of electronic systems, PLC drives as well as electronic safety and speed control devices. But industry representatives such as Willem Wille are still sceptical whether newer systems and their components will have the same lifespan as traditional systems. “Standards will need to be adapted to help crews operate and repair these more complex systems. Maintenance standards also need to become more varied in order to account for the growing number of jack-up units that work on offshore wind farms,” says Wille. These units carry out jacking operations five to six times a week and require a much more rigorous maintenance schedule than regular jack-ups that only change location four times a year. DNV GL runs a yearly seminar with NDC to ensure that the offshore industry continues to share operational experience, address current issues such as this one and ensure that procedures are adapted to the new generation of jacking systems being installed around the world. ■ AJO

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Moving ahead on jack-up safety. Participants of the Annual Rigowners Seminar in November 2014.

INNOVATION AND CONTINUITY

The DNV GL rules for ships will enter into force on 1 January 2016. MARITIME IMPACT sat down with Holger Jefferies, DNV GL Program Manager Class Development, who has been deeply involved in reworking the rules. He explained the background and how the new rules revolutionize ship classification.

DNV GL is the first class society to carry out a full evaluation and restructuring of its rule set. What are the greatest advantages for the customer?

Holger Jefferies: Usually rule sets are developed over time and only adjusted selectively. We have comprehensively re-evaluated the complete set to ensure that our new DNV GL rules are clearly structured, transparent, and easy to understand and apply.

What exactly makes the new rule set so easy to apply?

Jefferies: We established a systematic way to define the requirements that are necessary to classify a ship and coupled them with the class notations. The requirements in terms of documentation and certification are summarized in each chapter of the rule book which makes it easy to identify them. We defined class notations for 38 different ship types which conveniently serve as an entry point to the rules for yards and designers. All ship type requirements can now be found in one place.

The rules have been developed in close partnership with the maritime industry. Some 2,000 detailed comments from yards, manufacturers, owners, academics, flag states and other maritime stakeholders were submitted. You must have been overwhelmed and surprised to get so much input.

Jefferies: Yes, the amount of feedback we got was certainly overwhelming. We really value the input we got from the industry. It was based on stakeholders' experiences during day-to-day operations and >



Holger Jefferies is DNV GL Program Manager Class Development.

The DNV GL field surveyors have been trained extensively and are ready to apply the new rules.

Photos: DNV GL



> was instrumental in bringing the new rule set to the level it is at now. For example, feedback on procedural difficulties has helped us to ensure the feasibility and practical relevance of the rules.

How did the existing DNV and GL rules influence the result?

Jefferies: The consistency is clearly visible. Most of what we have developed builds on DNV and GL rules. The intention has not been to throw anything away but to bring the strongest segments of both DNV and GL together. The merger gave us the opportunity to create a new common basis to take us into the future.

Will the old rule sets expire?

Jefferies: Not immediately. We understand that predictability is important for our customers, and we respect that. There will be a smooth transition from either DNV or GL rules to DNV GL rules. We will be responsive to our customers' needs and for sure take into account their individual requests.

One of the keywords always mentioned in the context of the new rule set is "future-ready". What exactly does that imply?

Jefferies: The rule set gives us the flexibility we need to address present and future challenges. The environmental focus is an important factor. A good example is the class notation "Gas Ready", which has only been offered for a short time before and is now fully integrated in the rules. The rule set further sup-

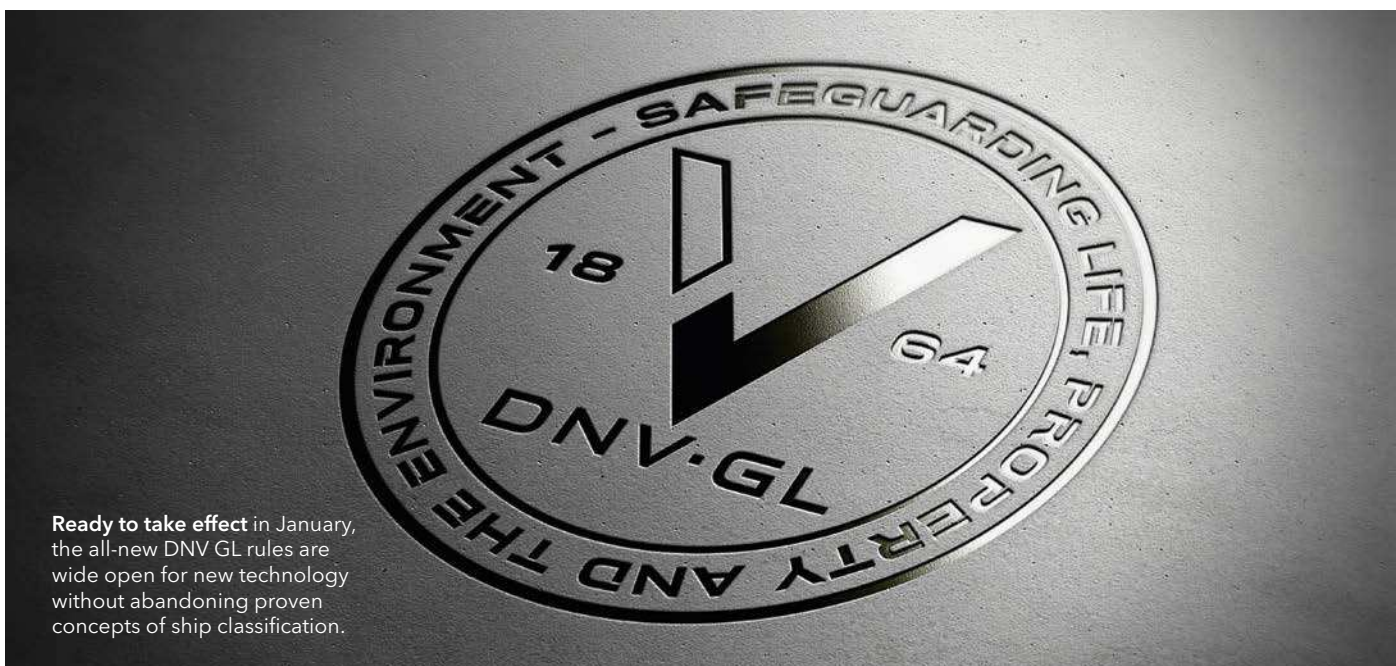
ports the application of latest technologies, such as battery installations and hybrid propulsion concepts through additional class notations.

For the hull structure rules you introduced the concept of Equivalent Design Waves (EDW). Is this part based on existing DNV or GL rules? Could you give some details?

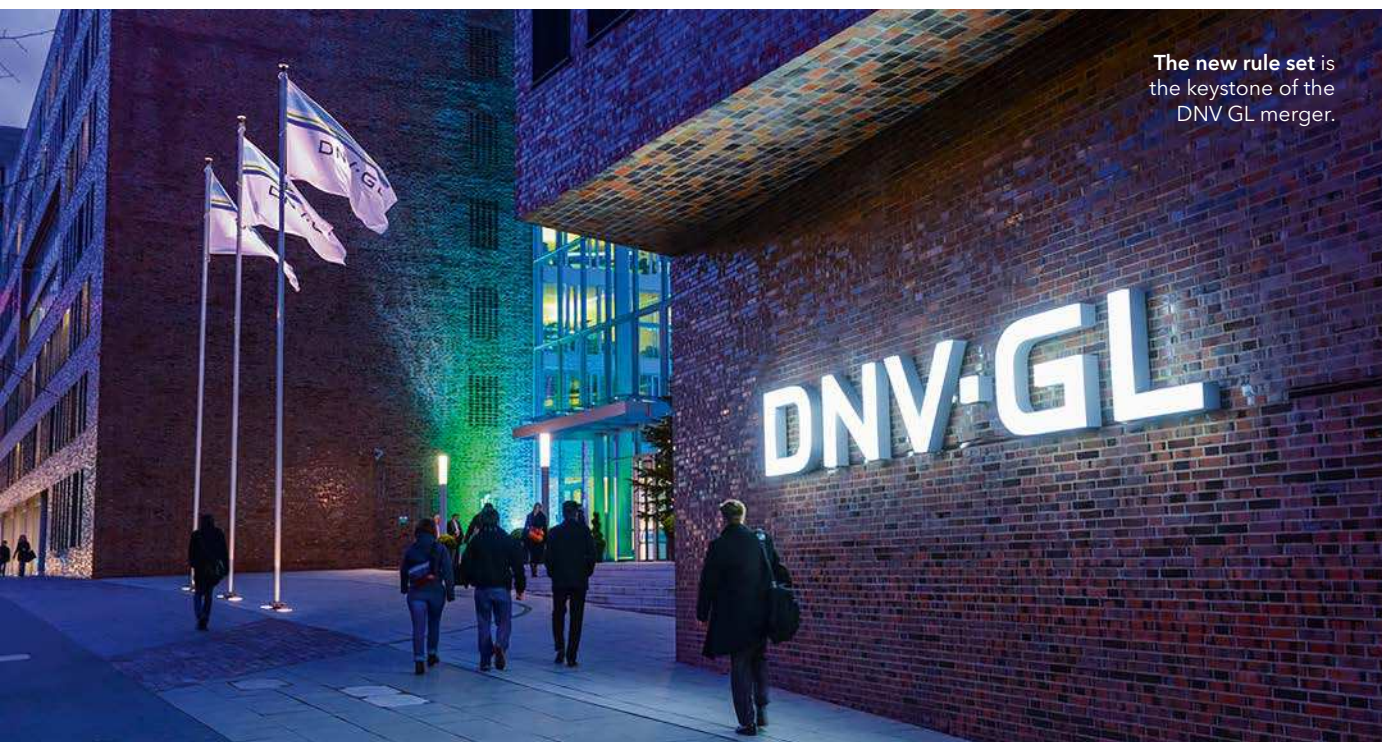
Jefferies: Our new rules for hull structures are not based directly on our existing rule sets. This part of the rules has undergone a significant update. The EDW load concept is the same as applied in the Common Structural Rules from the International Association of Classification Societies (IACS).

Traditionally, load assumptions for hull structures are largely experience-based. Using the EDW approach, environmental loads are based on actual physics and therefore show the load pattern acting on a ship more realistically. This enables a more precise description of the stresses in a vessel's structure. It will provide a better basis to optimize the structure and enable the designers to apply the steel where it is really needed. The result is a ship that is better suited to the owner's purpose, requiring less maintenance and repairs during its lifespan. And to revert to the term "future-ready", the EDW approach also allows us to develop loads for new and unusual types of vessels more easily, and incorporate them into standard design and evaluation procedures.

This sounds as if new tools and software may be necessary to support the application of the rules?



Ready to take effect in January, the all-new DNV GL rules are wide open for new technology without abandoning proven concepts of ship classification.



The new rule set is the keystone of the DNV GL merger.



Transition from existing DNV and GL rules to the DNV GL rule set will be smooth – ensuring predictability for customers.

Jefferies: We make use of what has proven to be successful in the past. Hull structure calculations continue to be supported by both the Poseidon and the Nauticus Hull software tools. During the development of the rules we also updated the tools with new functionality and features to support the new rule formulations in an efficient way.

This is done to optimize the support provided during the design process, and to ensure that all relevant aspects are easy to check. In addition, we updated the tools for machinery, systems and components, making them responsive to future developments.

The DNV GL rules will enter into force on 1 January 2016. How long will it take to roll them out globally?

Jefferies: Plan approval surveyors from around the world have been involved in every step of the rules' development, which has helped to build our competence in all of the regions. Field surveyors have completed training programmes since the beginning of the merger, in order to familiarize themselves with both DNV and GL rules. Training schemes for the new DNV GL rules have already been up and running for some time and will be completed within the first quarter of 2016.

The new rule set is said to be the biggest investment ever made by any class society. Could you give some details on that investment?

Jefferies: During the last two years, more than 200 experts in eleven project groups have been involved in developing the new rule set. This development is certainly the biggest concentrated effort undertaken by any single class society. ■ NL

DNV GL Expert

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DESIGN FOR TRADE, INNO

Departing from the beaten path and rethinking LNG carrier design was the objective of the joint industry project LNGreen. The result is an innovative concept with a remarkably improved environmental footprint and cargo capacity.

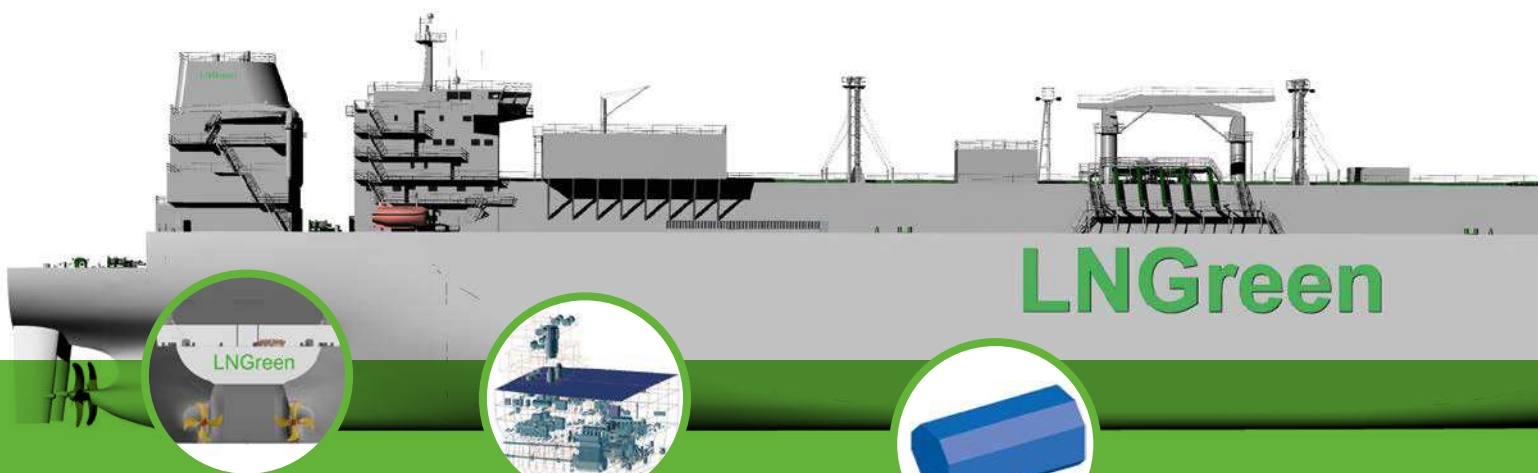
"I've seen more technological advances in the last several years than in the previous 30," says Graham Westgarth, COO at London-based GasLog. And he should know, as part of the LNGreen joint industry project with GTT, Hyundai Heavy Industries, Co. Ltd. (HHI) and DNV GL that has developed the next-generation LNG carrier. "This project shows just how important industry collaborations are in driving innovation in technology. Each of the project partners made unique contributions to the final concept and we look forward to continuing to work with them in the future," says Johan Petter Tutturen, Business Director Gas Carriers at DNV GL - Maritime.

The impetus behind the LNGreen project was to depart from traditional vessel design - optimized for a single draught and speed - and instead take the actual operational profiles and trading routes as the starting point. The result is a concept with a significantly improved environmental footprint, a higher level of energy efficiency, as well as an improved boil-off rate and cargo capacity, and a much better fit

for future trading patterns than existing vessels. Overall energy consumption was improved by 8.5 per cent.

The project is built around three main levers to optimize performance: maximizing cargo volume and minimizing boil-off, maximizing hydrodynamic performance and increasing overall machinery and system efficiency.

GTT and HHI investigated cargo containment optimization. The tank shape, necessary reinforcements and boil-off rate calculations were examined to develop alternative cargo tank designs that could yield additional cargo capacity. With a starting design point featuring a cargo capacity of 174,000 m³, cargo tank optimization by GTT and HHI allowed for a cargo capacity increase to 182,800 m³, while maintaining the same main dimensions (length overall, breadth, draught) and taking into consideration the requirements of the IGC Code and compatibility restrictions. In addition, GTT's Mark-III flex technology was used with the innovative tank layout to enhance the cargo hold and to give a low boil-off rate of 0.085 per cent vol/day.



- **Twin skeg**, with four-bladed propellers
- **Twisted rudders**, with bulbs
- **Two-stroke gas main engines**, with economizers
- **Auxiliary DF engines** with economizers
- **Power take-off (PTO)** on main engines
- **No. 4 tank**: hybrid prismatic and bi-oblique shape; No. 3 & 2 tank: similar to conventional designs

VATION FOR TOMORROW

The new tank shape created by GTT enabled HHI to design an optimized hull shape. Based on GasLog's operational data and future trading pattern forecasts, it minimizes the void space around the No. 1 cargo tank. Performance evaluation of the new hull form was carried out by comparing CFD simulations conducted by both HHI and DNV GL. "There are two main aspects to the hull optimization," says Martin Davies, Principal Consultant Ship Lifecycle Management at DNV GL. "By adjusting the shape of the No. 1 tank so that it is narrower towards the bow, we end up with a more hydrodynamic forward shoulder and this has a significant impact on the wave resistance of the design. The bulb and shape of the forebody have also been modified to improve performance in ballast

condition. The end result is an improvement of 1.5 per cent to overall hull resistance."

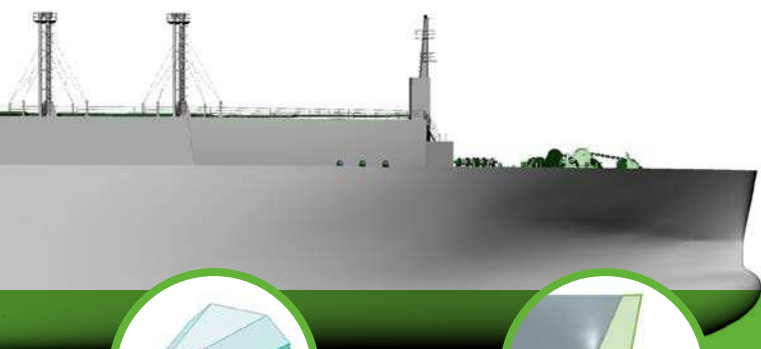
"LNG carrier machinery systems are highly complex configurations featuring a number of tightly integrated sub-systems and components," says Nikolaos Kakalis, Manager of DNV GL Research & Development in Greece. "But DNV GL COSSMOS allowed us to assess the integrated machinery system coupled with the full gas chain under GasLog's specific operational profile and targeted trades, and in turn evaluate the resulting performance and efficiency." Drawing from a library of components, DNV GL COSSMOS can simulate and optimize complex and integrated ship machinery systems, letting the project partners test different configurations and options in both the base and optimized hulls. The resulting gains of the 2S-based twin skeg propulsion configuration make up the lion's share of the overall efficiency improvements - some 7.0 per cent over the base case design.

Ultimately, LNGreen is about more than just coming up with a highly efficient design case, says Tutturén. "One of the most important aspects to working on a project like LNGreen is to create a methodology that covers all the complexity of our industry, translates it into a process for ship design and is repeatable. We want to give the industry the ability to make more robust decisions about how a vessel will meet the opportunities and challenges of the market in a consistent way, so that they know their new vessel has the best chance to compete in the market, today and in the future." ■ SIAD

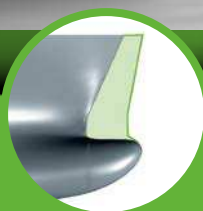
LNGREEN COMPARISON

| | BASE CASE | LNGREEN |
|---------------------------------------|-----------|---------|
| Cargo tank capacity (m ³) | 174,400 | 182,800 |
| Length overall (m) | 299.5 | 299.5 |
| Length between perpendiculars (m) | 286.3 | 293.5 |
| Breadth (moulded) (m) | 46.0 | 46.0 |
| Depth to main deck (m) | 26.5 | 26.5 |
| Depth to trunk deck (m) | 35.1 | 35.1 |
| Design draught (m) | 11.97 | 11.97 |

Photos: DNV GL



- **No. 1 tank:** trapezoidal shape in longitudinal direction. Tank length is particularly increased



- **Short bulbous bow**

DNV GL Expert

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DAWN OF THE CHINESE CRUISE MARKET



Star Pisces is owned by the Hong Kong-based company Star Cruises, which kick-started the cruise market in China in the 1990s.

China has the potential to become the world's largest cruise market. A burgeoning middle class is flocking to luxury vacation cruises. The government boosts the trend by supporting more lenient annual leave policies for employees.

Until recently, ship travel to the average Chinese citizen meant taking a steamer down the Yangtze River as a basic means of transport. But times are changing, and ship travel has taken on a luxurious sheen. In fact, there is a young, booming cruise market, fuelled by a new sense of wealth. Unlike most developed countries where wealth tends to be concentrated in the hands of retirees and older professionals, the rapid economic evolution of China has put the generation of the 25- to 45-year-olds into the privileged position of being able to afford a cruise. "This year, 52 cruise ships will operate in Asia, with more than 1,000 sailings scheduled and we are excited to see how the industry will continue to grow with more itineraries being added and more Chinese consumers starting to cruise," says Lorri Christou, Senior Vice President Strategic Marketing and Communications at Cruise Lines International Association (CLIA). "The cruise industry in Asia has had a record-breaking year so far, with more travellers cruising in the region than ever before."

Strategic equipment

The number of cruise passengers from mainland China alone grew 79 per cent annually between 2012 and 2014 to 697,000. "Chinese cruise tourists will



Destined for the Chinese cruise market: Royal Caribbean's *Ovation of the Seas* at the German Meyer Werft shipyard.

most probably surpass one million in 2015," estimates Zheng Weihang, Executive Vice President of the China Cruise and Yacht Industry Association (CCYIA). "I expect this number to reach 2.5 million by the year 2020, 4.5 million by 2025 and seven million by 2030."

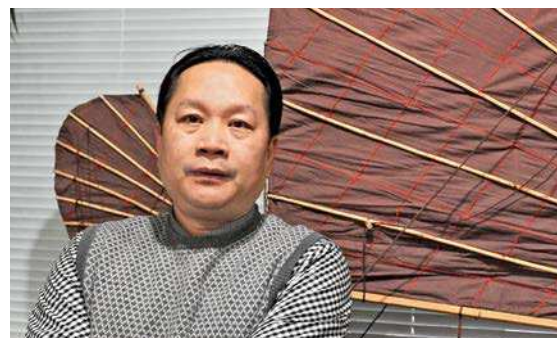
The Chinese government has defined cruise vessels as "strategic equipment" for the nation, which means that development support and subsidies are high on its list of priorities. With government help, ports are working hard to upgrade their infrastructure for new tonnage and more ships. The Wusongkou International Terminal in Shanghai now claims to be the largest of its kind in Asia. In May, Royal Caribbean said it was looking into building Chinese dry dock facilities and developing logistics centres to supply its ships sailing in the region.

Cruise lines to tap the Chinese market

Almost single-handedly, Star Cruises had started building an Asian cruise holiday market in the late 1990s. From its base in Hong Kong, the line took a step-by-step approach to unlocking the Chinese market. In 2006, Costa Cruises, owned by Carnival, deployed its first vessel to the Chinese market. International rivals like Royal Caribbean fol- >

"I expect 2.5 million Chinese cruise passengers by the year 2020, 4.5 million by 2025 and seven million by 2030."

Zheng Weihang, Executive Vice President of the China Cruise and Yacht Industry Association (CCYIA)



lowed. Typically these lines would first test the waters using older ships. That strategy has definitely changed. The heavyweights of luxury cruising are engaged in an arms race mobilizing their best gear.

Newly built ships

In June 2015, Royal Caribbean brought its newest ship to Shanghai, the 4,200-passenger *Quantum of the Seas*, to travel the region year-round. She will be followed in 2016 by her 167,800-tonne "little sister", *Ovation of the Seas* based in Tianjin. *Ovation of the Seas* will be the fifth China-based ship in the company's fleet and its first to be based in China from the outset.

Carnival Corporation revealed that its 2016 China deployment will include two vessels from Princess Cruises as well as four from Costa. Princess ships began home port cruising in China last year with the *Sapphire Princess* based in Shanghai. The next new Princess Cruises ship, the *Majestic Princess*, will be the first year-round international luxury vessel designed and built specifically for Chinese guests. The 3,600-passenger ship, which is under construction at Fincantieri yard in Italy, will also be based in Shanghai when it is launched in summer 2017. Sister brand AIDA Cruises announced in November that the German company will devote *AIDAbella* to the Chinese market in 2017.

In summer 2015, Star Cruises made the South-Chinese port of Xiamen the seasonal home-port for its *Superstar Libra*. MSC Cruises has announced its first trip to China with the newly renovated *MSC Lirica* calling in Shanghai in May 2016. Norwegian Cruise Line recently announced it would deploy a newly built ship to China's hot cruising market in 2017. The *Norwegian Bliss* is also a purpose-built ship customized for the Chinese market.

Domestic operators join in

Chinese cruise lines are trying to catch up by purchasing vessels from the multinationals. *Henna*, a 1,965-passenger cruise liner the Chinese HNA Group had bought from Carnival, went on her first voyage in 2013. State-controlled Bohai Ferry rechristened the imported *Costa Voyager* to *Chinese Taishan*. SkySea Cruises, in which Royal Caribbean and the Chinese travel company Ctrip each own a 35 per cent share, overhauled the former *Celebrity Century* for the Chinese market this year. And in a cooperation with the state-owned China

WANTED: CRUISE SHIP KNOW-HOW FOR CHINA

The growing appetite for cruise tourism among China's new affluent middle class harbours both opportunities and challenges for the ship-building industry. DNV GL expertise will be in great demand.

China is emerging as a key strategic market for the cruise industry and might become the second-largest cruise market after the US. Where do you see the challenges?

Torgeir Sterri: I am confident that China will play an essential role in the cruise industry within the foreseeable future. However, there are significant challenges involved: a very long, highly diversified value chain, demand for enormous investments, and the need for top maritime and entertainment technologies. Then there are complex development requirements, but I think those are being addressed by the industry already. Personally I see integration as the core issue. While not exclusive to the cruise business, integration is of critical importance here because of the diversity and complexity of this sector. But there is a way out of every labyrinth, and having witnessed the fast and successful growth of the Chinese offshore business over the past decade, I see no reason to doubt the same is possible in the cruise sector.

Does the Chinese government support the development? What needs to be done in terms of infrastructure?

Sterri: The Chinese government has put the development of the cruise industry high on its agenda. In



AIDA Cruises, ready to seize new opportunities in the Far East, will enter the Chinese market in 2017.

Photos: AIDA Cruises, Acred99/CC BY-SA 3.0, DNV GL



Torgeir Sterri, DNV GL Vice President, is Regional Manager Maritime Greater China & GC Country Chair. He and his team stand ready to support the emerging local cruise industry.

lishment of our Greater China Cruise Centre earlier this year where we have personnel dedicated specifically to our cruise-related business.

How will the Greater China Cruise Centre strengthen the support DNV GL gives to its customers?

Sterri: The Shanghai-based DNV GL Greater China Cruise Centre is a newly established task force serving the regional cruise-related industries. Key DNV GL staff includes the Centre Director, the Cruise Segment Director and myself, all members of the Steering Committee. During the initial stage the Cruise Centre positioned itself as the single point of contact for customers, especially cruise lines, established an annual plan and aligned its activities with the worldwide practice. The Centre coordinates all interfaces and activities with customers, runs the annual process, and ensures trouble-free delivery of services to the customer. It will also take on the roles of service centre and strategic research centre. Liaising with local stakeholders, the Cruise Centre will ensure effective communication of visions and goals to understand market demand and expectations and build our competencies accordingly. Eventually it will be our resource allocation centre, ensuring availability of adequate expertise to meet local demand. Finally, in line with the growth of the local industries, the Centre will evolve to become a fully functional unit with all necessary expertise and resources to provide a broad range of services. By the way, the Greater China Cruise Centre is not an isolated unit – it is backed by the entire DNV GL organization. We are ready to serve the local cruise industry 24/7 right now. ■ NL

“China will play an essential role in the cruise industry within the foreseeable future.”

Torgeir Sterri, Vice President, Regional Manager Maritime Greater China & GC Country Chair

February 2013, the Chinese State Council published its very first National Tourism and Leisure Programme (2013 to 2020), which integrated cruise tourism into the national tourism development scheme. After two years of preparation, the Chinese Ministry of Transportation announced its National Coastal Cruise Ports Plan in April 2015, which aims to guide and optimize the distribution of cruise ports, accounting for criteria such as local tourism resources, status of economic development, population, etc. to accelerate the development process. In last August the State Council released a guideline for investments in tourism infrastructure addressing the design, construction and operation of medium and large-sized cruise ships as well as cruise ship building and repair yards and their suppliers. More detailed promotional and supportive government measures can be expected in the near future.

How does DNV GL position itself to serve this market and support its customers?

Sterri: DNV GL has been operating in the Chinese market for decades. We have established good cooperation with the local maritime industries and are recognized as a leading class society that supports the industry towards a safer, smarter and greener future. DNV GL takes a leading position globally as a provider of classification and consultancy services to the cruise segment. We are committed to supporting the development of the Chinese cruise industry by contributing our expertise and experience in this field. One important milestone has been the estab-





"I think we will see China's true potential once the brand-new tonnage like *Quantum of the Seas* has been operating in the market for a while. If these vessels are a success, the deployment of tonnage to China will accelerate."

Helge Hermundsgård, DNV GL Area Manager & Director Global Cruise Centre

- > Merchant Group, Carnival plans to launch a new local cruise line.

Keen on building cruise ships

While no cruise ships are currently on order in China, there are plans to enter the market. The Chinese government emphasized they welcome foreign shipyards, designers and suppliers to cooperate and form joint ventures with Chinese companies. "What is needed is competence and a good network of suppliers - it will take a long time to develop these," says Helge Hermundsgård, Area Manager & Director Global Cruise Centre at DNV GL - Maritime.

China's current shipbuilding industry lacks the capabilities and expertise needed to design and supply complex cruise ship interiors and furnishings. "The real challenge for China is to partner with a European yard since none of them are really willing to do so," says Hermundsgård. Market-leading cruise ship builders have clearly stated they are not interested in helping Chinese yards become their competitors.

Only the Italian shipyard Fincantieri made a first hesitant move. A three-party Memorandum of Understanding (MoU) was signed with Carnival Corporation and China State Shipbuilding Corporation (CSSC) to explore the possibility of a joint venture in cruise ship design and shipbuilding for the Chinese market.

"I am sure that with proper funding, Chinese yards will be able to build cruise ships," says Hermundsgård. "However, there will be risks in terms of quality and time of delivery. This will require a different kind of supervision and follow-up by both owner and class to ensure quality is at the right level."

Despite the recent cruise industry boom, European and US cruise lines are still struggling to meet the needs of their Chinese customers. For example, there are frequent complaints about lines failing to properly

recognize their better-paying passengers and give them preferential treatment. Services tailored to the Chinese market should include Chinese cuisine and language services, mah-jong rooms, appropriately designed dining rooms and larger duty-free shops. Import duties on luxury goods in China are as high as 40 per cent, so duty-free shopping is a major draw.

Catering to Chinese preferences

Travelling abroad is still regulated in China. Large travel agencies typically charter a block of cabins or even an entire ship for resale to passengers. Since holidays are limited, a standard cruise is shorter than the average itineraries sold in America and Europe. The Chinese government has instructed companies to "improve the implementation of the regulation on employees' annual leave" and to allow them to take extended weekends off to boost the tourism business.

"I think we will see China's true potential once the brand-new tonnage like *Quantum of the Seas* has been operating in the market for a while. If these vessels are a success, the deployment of tonnage to China will accelerate," says Helge Hermundsgård. "At any rate, international operators must develop the cruise experience that will suit the Chinese taste. Then there is the chance that China will become a sourcing market for international cruises, which may be equally important to the future evolution of the cruise industry in China." ■ NL/CZ

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A NEW SERVICE MODEL

When it comes to customer service, shipowners want prompt response and ready solutions to operational and technical issues.

Singapore is a thriving maritime hub with hundreds of shipowners and managers operating approximately 800 DNV GL-classed vessels. It is a challenge to meet these customers' needs and expectations. Steen Lund, Regional Manager for Maritime South East Asia & Pacific, puts it in a nutshell: "If we want to be their preferred partner, we need to be available at any time."

In response to rising demand, DNV GL Singapore decided to streamline its customer support: In April this year the Singapore Service Centre (SSC) was opened to provide a single point of contact to every customer for all operational issues.

The personal touch

Pawan Sahni, Head of the SSC, explains: "At the DNV GL SSC, every customer has a personal contact, with key account managers in charge of individual customer relationships. The SSC provides operational solutions, while the DATE (Direct Access to Technical Services) continues to be our helpdesk for technical issues."

One of the key driving forces behind SSC is Sean Hutchings, Area Manager Singapore, Indonesia and Philippines. "The SSC is manned by experienced fleet-in-service surveyors who understand the challenges faced by superintendents and fleet managers," he points out. "Each surveyor is assigned to the SSC for a period of two months on a rotational basis. This is a great way to help our surveyors become more customer-centric."

Well-informed experts

Customer response has been very positive. Vinay K. Gupta, Vice President Fleet Management, Rickmers Shipmanagement (Singapore) Pte. Ltd., says that



Singapore Service Centre. The place where DNV GL customers get answers quickly.



Focus on the customers. Steen Lund, Regional Manager for DNV GL Maritime South East Asia, and Pawan Sahni, Head of the SSC.

"With the SSC it is very easy to get answers: A single e-mail or phone call is enough..."

Vinay K. Gupta, Rickmers Shipmanagement (Singapore)

"with the SSC it is very easy to get answers: A single e-mail or phone call is enough to get an immediate response. The attention to detail is great, including case histories." Sandy Kumaran, Senior Manager Fleet Services, confirms: "The innovative creation of a dedicated DNV GL Service Centre in Singapore has significantly improved response times and service levels. The SSC reassures customers that queries will be attended to by experts who are well familiar with their day-to-day challenges."

For the time being, the focus of the SSC remains on Singapore. "We want to build up the service centre to meet our local customers' needs," says Steen Lund. "We will ask for feedback at the end of the year and look at how we can improve further and adapt our services to meet market requirements. We might even consider rolling the SSC out to the rest of South East Asia at a later time." ■ AY

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CLEANING UP SHIP RECYCLING

When a ship is sent to die, 95 per cent of its components live on. But the safety and sustainability record of ship recycling yards could be improved. MARITIME IMPACT explains how EU regulations aim to achieve this.

Every year up to 1,500 ships are recycled to rejuvenate the world fleet and reclaim valuable materials such as steel, aluminium and copper. The majority of these vessels are recycled in India, Pakistan, Bangladesh, China and Turkey. Conditions at shipbreaking yards vary. Personal protection equipment such as helmets, shoes, gloves and masks is not always available. Hazardous materials, from heavy metals to fuel oil, may leak into the sea and soil, polluting the area and creating serious health hazards.

Radical changes

Past efforts to regulate the handling and disposal of hazardous materials (Basel Convention 1989) and to improve safety and environmental standards in ship recycling (Hong Kong Convention 2009) have failed to produce any tangible results. "Progress has been very slow. But the implementation of the European Ship Recycling Regulation will bring about some

radical changes over the next few years. It applies to roughly 60,000 ships, about two-thirds of the global fleet," says Gerhard Aulbert, Global Head of Practice Ship Recycling at DNV GL.

The European Ship Recycling Regulation, in force since 30 December 2013, addresses the environmental and health issues associated with ship recycling while avoiding unnecessary economic burdens. Applicable to all EU-flagged vessels as well as non-EU-flagged ships calling at or anchoring in ports within the European Union, it accelerates implementation of the requirements of the Hong Kong Convention and sets out responsibilities for shipowners and recycling facilities both within the EU and in other countries.

One of the cornerstones of the regulation is the so-called inventory of hazardous materials (IHM). Every EU-flagged newbuild has to carry an inventory of all hazardous materials contained in its structure and

A perspective for the future of shipbreaking: This Chinese yard builds, repairs and recycles vessels.



equipment plus a statement of compliance, at the earliest by 31 December 2015 and at the latest by 31 December 2018. If the ship is to be recycled the IHM should be on board from the date when the European list of ship recycling facilities is published, which is expected to happen by the end of 2016.

Before a ship is recycled, its owner must provide the recycling yard with ship-specific information and prepare a recycling plan. But Thomas Nigl, who investigated IHM standards in his master's thesis at DNV GL, cautions: "While IHMs are an important step towards establishing safer and more environmentally friendly ship recycling methods, much needs to be improved in terms of procedures. Methodology discrepancies in the development of IHMs for newly built versus existing ships have led to considerable differences in the quantities of 'HazMats' identified on board."

Too much is left to the discretion of the individual HazMat expert, he points out. "The industry needs definitions and documentation for the development of IHMs and the materials themselves. Standards and an effective control mechanism for material declaration in the supply chain would also be desirable to ensure that IHMs are effective."

Getting approval for shipbreaking

A new benchmarking system established by the EU regulation restricts recycling to facilities approved by the European Union. "Methods such as beaching will most likely be banned, and recycling facilities will have to obtain EU approval to compete for European-flagged vessels," explains Gerhard Aulbert. Waste disposal management, facility infrastructure, safety procedures and training are key criteria for approval.

To reduce pollution from leakage, recycling facilities need to dismantle vessels on paved surfaces and install drainage systems. This could prove to be a challenge in places such as Alang, India, where more than half of the world's decommissioned ships are scrapped. High tides and a naturally sloping beach make it easy to haul ships onto the shore and carry out pre-cleaning and block breaking in shallow water. "These kinds of practices cannot continue. I expect the number of recycling yards to decrease because beaching will not prevail in the long run," explains Aulbert. Some ship recyclers have already upgraded their facilities to achieve compliance with the EU regulation and gain competitive advantage. "But many facilities still violate the Basel Convention standards for disposal of hazardous materials and have a long way to go."

Several owners are taking steps towards improved sustainability. "Hapag-Lloyd is one of the

companies that are developing IHMs for their newbuilds. But to date, only ten per cent of ships recycled have an IHM on board," Aulbert points out.

Based on studies DNV GL conducted on smaller ship recycling facilities in Turkey, more sustainable practices are expected to increase the costs of ship recycling by about 17 euros per light displacement ton (LDT). DNV GL expects the IHM development to open up the avenue for shortening the value chain of ship recycling, as the inventory also includes a ship's valuable parts - resulting in additional revenue for shipowners. For example, the EU regulation allows shipowners to have a vessel recycled by one facility, but sell their steel globally "giving owners more independence from recycling facilities regarding the profit from the ship," says Aulbert. "Using the list of EU-vetted facilities, shipowners will also have a better basis for deciding which recycling yard to use and can ensure that their vessels are scrapped in a sustainable way." ■ AJO

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"The implementation of the European Ship Recycling Regulation will bring about some radical changes over the next few years."

Gerhard Aulbert, Global Head of Practice Ship Recycling

SEA OF DATA

Vessel, voyage and cargo data is gathered by ship operators and other stakeholders every single day. While each data set is captured for a specific purpose, combining all these data sources opens up a world of information synergies allowing insight far beyond the original purpose – without increasing the collection effort, simply by systematically reusing what is already there. Our diagram highlights some of these data types and technologies and what they can do.

Risk-based inspection



Integrating available public and voyage-specific ship data including logged data about the cargo on board provides insight into the structural loads acting on the ship's hull. By combining this data with structured hull **survey and inspection results**, surveyors and inspection officers can be directed to those areas of the vessel where the risk due to fatigue or other damage is highest.



directed to those areas of the vessel where the risk due to fatigue or other damage is highest.



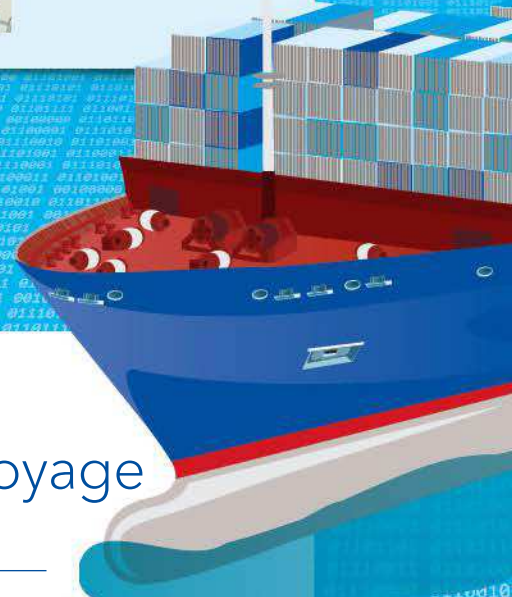
Weather information

Data from meteorological services and crew observations can be aggregated to calculate prospective wave loads acting on a specific vessel and derive route and speed recommendations to **avoid costly delays** and improve fuel efficiency.



Onboard voyage information

To **save fuel in operation**, vessel tracking information may be combined with data captured on board. **Software solutions** such as DNV GL Navigator Insight allow the voyage information needed for operational purposes to be logged digitally.



Loading data



Data about actual cargo masses and tank filling together with wave data and course information can be applied to a simulation model of the ship. This is input to compute lifetime consumption of the vessel.



AIS data

The Automatic Identification System (AIS) was made mandatory to avoid ship collisions and improve safety by allowing ships to “see” each other. But **ship location** data is also useful to owners, governments and others. Today satellites with worldwide coverage receive and distribute AIS signals.



Web technology

Based on AIS, ship movements around the world can be tracked from mobile phones at no cost. In the future, the Internet of Things and people networks can potentially be merged by **specialized smartphone apps** to get a quick overview of crucial operational data anywhere at any time.



Public ship databases

Engine data from public ship databases combined with ship position and velocity information allows operators to **estimate and compare** power consumption of most vessels worldwide. Uneven speed profiles indicate where fuel can be saved.



Photos: B. Whelan/istock.com, Warden Wolf Images/Vice and Virtue - iStock.com, iStock.com, Shutterstock.com, Jeff Dye/istock.com

A guest contribution by Martin Stopford

WAKING UP TO SMART SHIPPING

The sea transport industry is reaching a critical point where the conventional business model for shipping companies is no longer adequate. The wind is changing, and those willing to adapt will certainly have a better chance of prevailing.

The shipping market is in a state of uncertainty. The world economy is sluggish, with a recession just as likely as an upswing. Overcapacity continues to be a problem; while slow steaming gives shipowners some flexibility, it cannot hide the fact that there are too many ships, the demand for transport remains flat, environmental restrictions are getting tighter and competition is fierce.

As the shipping industry gradually adopts efficiency-enhancing technologies, another frontier is moving into focus: ICT. The industry has been slow to recognize its economic potential, perhaps because its true significance is not ship efficiency but rather an entirely new way of looking at business management. This is important because the traditional business model of this industry is about to become an anachronism. Changing old habits and viewing new concepts with scepticism is human nature, and the concept of smart shipping is no exception. But it should not be dismissed lightly. Four propositions may highlight that smart shipping can and should be viewed as a better way to manage sea transport:

1 Changing the maritime business model is possible

In fact, three major changes occurred over the past 500 years: the shift from coastal to global shipping in the 15th century, heralding in the great age of discovery; the age of imperial trade in the 19th century which saw the arrival of the steamship; and the birth of global free trade in the 1950s and the adoption of containerization, bulk shipping and chartering of big vessels.

2 Conventional marine technology is running out of solutions

From 1865 to 1975, ships made massive technical advances: first the move to diesel engines; then liners and tramps were replaced by much bigger and more specialized ships. More recent technical innovations enabled improvements of fuel and operating efficien-

cy. Today we have pushed technology to the maximum. Increasing ship sizes, for example, no longer yields significant improvements in terms of fuel efficiency; you may call this phenomenon "diseconomies of scale": with their enormous dimensions modern ships cause problems in waterways and ports. It would appear wiser to invest in better systems rather than bigger ships.

3 Smart shipping offers a new business model

Most of today's shipping companies are small and have a big balance sheet, volatile income, tight costs and rather few technical resources. With environmental pressure increasing, there are not many ways left to improve performance other than slow steaming. After 65 years, the current business model has outlived itself. Smart shipping, when implemented skilfully, offers some key benefits: Smart shipping allows shipping companies to use their assets more efficiently by automating ship operations and navigation and reducing the need for highly skilled staff on board. It allows ship operators to manage ship and shore personnel as one single, productive team. It integrates fleet systems, similar to a modern automobile factory, improving asset performance. It enables the use of big data to extract meaningful information that can be used to improve processes, reduce accidents, and inform management about the business. Ship operators can prepare regulatory reports digitally instead of manually. And smart shipping provides shipping companies with the means to develop global through-transport systems similar to those used by leading international Internet-based retailers and logistics providers.

To accomplish all this, a set of technical means and skills are needed (see box on the right). Ships need to be equipped with telematic sensors capable of transmitting readings automatically. Digital transmission makes equipment data available very cheaply: The technology has been around for years. Unfortunately what is missing is international standard protocols.

Photo: HMC/Zapf



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the shipping company's management office. To reap the full benefit of operational data from ships, shipping companies need highly skilled data processing experts with some on-board experience.

4 Other transport industries are ahead

The principles of smart shipping as outlined here are already being practised in other industries. For example, one of the leading global package delivery companies has 48,000 trucks with telemetric systems and 200 parameters on each system, allowing the company to monitor every single vehicle around the clock. A major aircraft manufacturer is delivering its next-generation planes with management systems allowing remote monitoring of all on-board functions. Any deviation from normal behaviour will trigger a reporting routine and alert the engineers at the factory.

Big data is not a hoax

There is still much scepticism around big data. An example may demonstrate what it can do: In a study involving twelve delivery vehicles with 124 deliveries, analytical techniques applied to the telemetric data enabled savings in operating costs of 30 per cent by eliminating one of the vehicles, cutting the total driving time from 36 to 21 hours, and reducing the overall distance travelled from 1,300 to 740 miles. This outcome speaks for itself.

The history of the ocean transport industry contains enough examples of clever businessmen who read the signs of the times and changed their business model when they recognized the need to do so. As performance expectations increase, shipping companies must overcome their reservations, change their way of doing business and embrace smart shipping. When change is imminent, it is up to the individual shipowner to decide whether he is "part of the club" or not. ■

Satellite communication is an extremely useful technology. New satellite infrastructure will soon cover the whole world except a small part of the Arctic and Antarctic. These satellites are very sophisticated and reliable. They allow shipowners to manage a fleet as one entity like a factory, which fundamentally changes the way a shipping business can be run.

Cloud-based storage for sensor data eliminates the need of a company server room. Modern smartphone-style apps offer great opportunities to perform certain simple tasks, provided the industry manages to establish a common, disciplined framework.

Appropriate information systems are needed to aggregate the data into meaningful performance information for management decision support. Automation of data capture and basic navigation, maintenance, operational and other tasks through feedback loops should be implemented wherever it is cost-effective. To build the required network infrastructure interlinking on-board telemetrics with the company server via satellite, each ship needs a network services device (NSD). Here again, harmonized systems using identical formats are imperative to make the system work. Once it does, it will serve to detect anomalous conditions, diagnose them, isolate the causes and resolve them without needing a systems engineer on board. The feedback loops will enable fully transparent systems which are monitored remotely by the equipment manufacturers and

THE SMART SHIPPING "TOOLBOX"

- | | | | |
|---|---|--|---|
| <p>1. Telematics: Sensors generate digital information about equipment and ship - cheaper and better than ever.</p> <p>2. Satellite communication: New global systems (99.9% reliable) communicate with</p> | <p>ships allowing fleet data to be collected, processed and beamed ashore. This will work for telephony as well.</p> <p>3. Data storage: The cloud provides storage for data generated by sensors.</p> | <p>Analysing big data improves performance.</p> <p>4. Smartphone-style apps: To do specific jobs without big computer systems and management information.</p> <p>5. Information systems:</p> | <p>Management knows exactly what is going on, including performance levels.</p> <p>6. Automation: Feedback loops allow automation of many tasks (navigation, maintenance, operations, etc.).</p> |
|---|---|--|---|



RAISING THE AIS DATA TREASURE

IT experts call it data mining: the art of extracting highly specific and meaningful information from large stores of business data. AIS ship position data harbours enormous potential for decision-makers across the industry.

Around the world, more than 400,000 ships are equipped with Automatic Identification Systems (AIS), which transmit ship identification, position, speed, draught and dimensional data to shore via satellite at regular intervals. These AIS transponders allow accurate tracking of ship movements around the world. Far beyond the original idea of improving navigational safety and security at sea, this information can be used for a multitude of purposes.

Powerful computers and business intelligence software open up a vast array of new uses for AIS information. In many industries, data mining technol-

ogy, which searches a company's stored business data for key information to support strategic decisions, has become an indispensable means of understanding the behaviour of customers, supply chains and competitors. Today's big data processing capabilities make this technology even more attractive. In fact, AIS data mining has the potential to become a fundamental game changer for the shipping industry.

High visibility

Equipped with AIS data, an electronic map and a set of GPS coordinates to identify ports, quays, emission

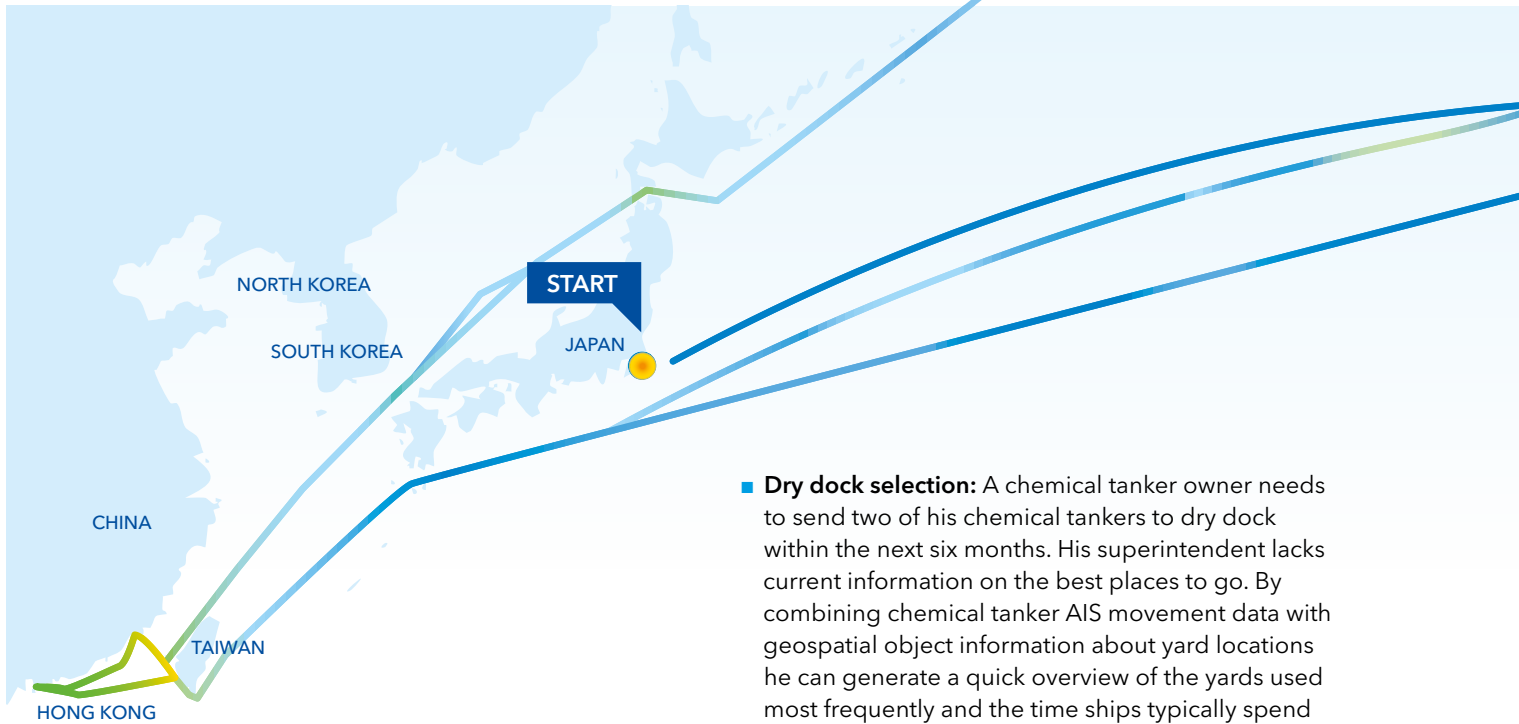


Ship position data transmitted at regular intervals can be used to enhance operating efficiency.

control areas, etc., ship operators can track vessel routes and speeds over ground in near real-time or estimate arrival times at the respective next port of call. Cargo owners looking for available ships or status information on chartered vessels can obtain snapshot overviews of ships in port or in certain regions, and visualize cargo flows.

But that is by no means all. Combined with other data sources, such as technical vessel information, consumption models, weather and sea state data, geographical information and sailing schedules, AIS data can deliver tremendous value to shipping companies and other stakeholders, supporting maritime business at an operational, tactical and strategic level.

Typical applications for integrated AIS analytics and post-processing include tracking how partners and competitors run their networks and manage their port operations, or how many direct connections and transshipments are being offered. AIS data can >



> provide insight into port and terminal congestion problems, berth availability, slow steaming practices, speed profiles, and their effects on fuel costs.

One of the key benefits of this technology is the availability of ship and voyage information to any interested party. Ship operators can use this data as reference for benchmarking their own fleet's schedule integrity, operational costs, time spent in ports and at anchorage, bunkering footprints and average speed. A few example scenarios may highlight the potential economic benefits of AIS data analytics.

- **Dry dock selection:** A chemical tanker owner needs to send two of his chemical tankers to dry dock within the next six months. His superintendent lacks current information on the best places to go. By combining chemical tanker AIS movement data with geospatial object information about yard locations he can generate a quick overview of the yards used most frequently and the time ships typically spend in dry dock.
- **Delay management:** While common, delays in container shipping can be costly as berths become unavailable, speeding up burns more fuel, cargo from skipped ports needs to be repositioned, etc. Managing delays efficiently is crucial, and being able to retrace where services ran out of schedule and what remedial actions were taken (increasing speed, skipping ports, cutting and running, etc.) will enable ship operators to optimize their strategies for keeping ships on schedule and their costs under control.
- **Port selection:** A tanker operator encounters problems at certain ports and pinpoints long vessel



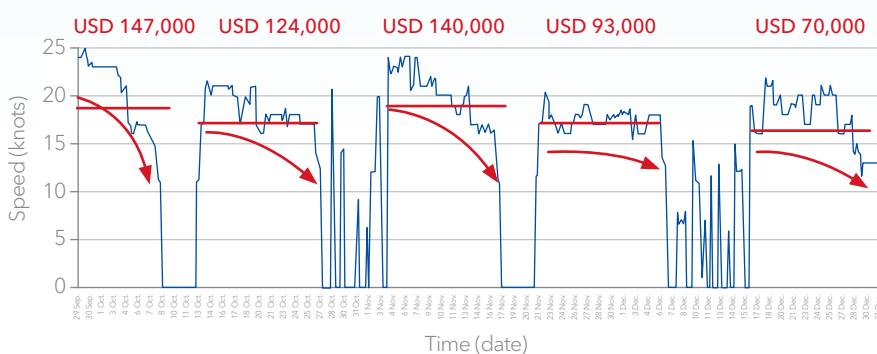
Learning from past mistakes. Excessive waiting and cargo handling times can be identified through AIS analytics (example: Hamburg).

CLIENT EXAMPLE: SPEED DEVELOPMENT OF A 8,500 TEU CONTAINER SHIP

To sail at the given ship's most fuel-efficient speed and reap the savings benefits, the operator must correlate port, ship and voyage-specific data.

Speed legend

- 20-25 knots
- 15-20 knots
- 10-15 knots
- 5-10 knots
- 0-5 knots
- 0 knots



THEORETICAL SAVINGS POTENTIAL THROUGH CONSTANT SPEED: USD 500,000

turnaround times as the core problem. By using AIS data to calculate average turnaround times for similarly sized crude oil and product tankers at other ports in the same region, the company can identify ways to save time, reduce charter hire and avoid supply chain bottlenecks.

- **Berth selection:** A container carrier contemplating a schedule change needs to determine berthing availability at various ports within a region. Acquiring this information the traditional way can be time-consuming. However, an analysis of AIS data can reveal which terminals are underutilized on specific week days, and at what times ships have arrived at and departed from specific terminals in recent weeks or months. The container carrier can thus see quite clearly what would be the best times to call at a certain port.
- **Voyage management:** AIS data can be used by shipping companies to analyse their own and their competitors' performance in terms of voyage management. For example, the granularity of speed information provided by AIS data is much better than that of noon reports. A variety of key indicators can be derived from a detailed AIS data analysis, such as speed variability. A vessel sailing too fast at the beginning of a voyage only to slow down to arrive in port at the proper time is indicative of poor voyage planning. An excessive average sea passage speed may be caused by poor

pro forma scheduling. Long port stays are often the result of poor port productivity or inadequate coordination with the terminal operator. Similarly, anchorage times due to premature arrival can be avoided by planning voyages more carefully. Other important parameters that can be extracted from AIS data include a ship's nautical miles sailed per day, and the operating profile standard deviation (head-haul/back-haul).

In a comparative test, irregular speed patterns resulted in an annual fuel bill difference of approximately two million US Dollars for an 8,500 TEU container ship.

A treasure worth unlocking

There are many more potential applications for AIS-based business intelligence. The above examples demonstrate the power of this new technology which enables a new level of transparency in the shipping market. Early adopters can expect to reap huge benefits from it. ■ KD

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JOINING THE DIGITAL WORLD

New satellite infrastructure, sensor technology, big data - the range of possible applications for ships capable of being online around the clock is unlimited. But a few issues have to be resolved first.

The maritime industry is embarking on a veritable connectivity revolution. Increasing numbers of ships are equipped with satellite-based broadband Internet connections; network capacities are rising, and data speeds are getting better while the cost per transferred bit is falling.

"A lot has happened since 1899 when East Goodwin Lightship in the Straits of Dover sent the first distress signal using radio technology, which had been invented by Marconi a few years earlier," says Steinar Låg. He is the lead author of the DNV GL position paper on ship connectivity published recently. "Over the last two decades we have seen more and more vessels being equipped with satcom technology capable of transferring data at high bandwidths using VSAT (very small aperture terminal) systems. We expect

the vast majority of classed vessels to be broadband capable by 2020." Whilst the original purpose of maritime communications was safety, typically driven by regulatory requirements, shipowners today deploy broadband communication technology on a voluntary basis to support data-driven applications which improve ship operation while giving convenience and entertainment options to crews and passengers who don't want to leave their digital lifestyle behind when they go to sea.

Exponential growth

In recent years, market-driven demands have converged to create a boom in advanced maritime communication technology. COM-SYS studies have shown that the number of maritime VSAT instal-





Satellite technologies enable shipowners to optimize ship operation. Smarter vessels improve cost-efficiency and provide better performance information from on-board systems.

lations in service increased from 6,001 in 2008 to 21,922 in 2014, an annual growth rate of 24 per cent. Forecasts for the coming years predict continued growth, expecting the number of maritime VSAT terminals to exceed 40,000 by 2018. This business opportunity is attracting Internet suppliers to the market, resulting in increased competition which in turn drives greater bandwidths, higher speeds, and lower prices. New satellite systems are being launched and several more are under development. Inmarsat, for example, has just launched their new GlobalXpress service using the new I-5 satellites. It delivers data rates of up to 5 Mbps/50 Mbps.

"I can only say: Welcome to a world of new opportunities. We see endless possibilities and endless benefits," Låg says.

While convenience and entertainment for crews and passengers are important enough, there is a long list of additional benefits for shipowners that come with advanced satellite technology. Improved ship connectivity is expected to enable and accelerate the adoption of new maritime applications such as condition monitoring, remote diagnostics and maintenance, autonomy and remote control, traffic control and e-navigation, risk-based classification and surveys, energy efficiency optimization, safety and environmental monitoring.

Smarter vessels equipped with advanced ICT and sensor systems will improve cost-efficiency and reduce downtime. Shipowners will gain better insight into the performance of on-board systems and how they are operated by the crew. What is more, they can analyse the operational data collected remotely to compare vessels and deploy best practices across their fleets.

"Remote diagnostics and maintenance can save shipowners time and money while improving safety. Sensors capable of warning about potential failures

can be installed on many components of a ship. The sensor readings can be collected and stored on board and transmitted to an onshore data centre for further analysis and long-term storage. This technology allows owners to perform preventative maintenance before a fault occurs, thereby saving money, reducing downtime and increasing safety," explains Låg. "Shipowners want technologies that optimize ship operation, and this new technology will be a game changer for the industry."



Steinar Låg is lead author of the DNV GL position paper on ship connectivity published recently.

With opportunity comes challenge

However, there are a few clouds on the horizon. One example is the reliability of communication links. Then there is the threat of cyberattacks, a hot topic even at the highest levels of global politics. A particular, if hypothetical risk would be hacker attacks on autonomous vessels. Data quality is another aspect; and the current lack of standards needs to be addressed as well.

"At the moment, the biggest challenge is the urgent need for requirements and standards around ship connectivity to keep up with the

rapidly advancing technology in this area," says Låg. "The focus should be on ensuring adequate availability and reliability, and on defining service architectures and interfaces allowing quality verifications; this would stimulate a competitive vendor market."

DNV GL will continue to contribute to the development of standards and requirements in this field while supporting its clients in navigating the challenges so they will soon be able to reap the benefits of a connected maritime industry. ■ DD/EH

DNV GL Expert

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13.01.16

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19.01.16

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19.01.16

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19. - 20.01.16

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20.01.16

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Mumbai, IN

21.01.16

Revised ISO Standards 9001:2015 and 14001:2015 for Shipping Companies
Dubai, AE

24. - 25.01.16

Designated Person Ashore (DPA) Training Course
Dubai, AE

26. - 27.01.16

Internal Auditor ISM- ISPS-MLC for Shipping Companies
Istanbul, TR

26. - 27.01.16

Planning and Managing a Dry-Docking for Superintendents
Singapore, SG

27.01.16

Introduction to Crewing
Barendrecht, NL

28.01.16

Hull Inspection Course
Singapore, SG

28.01.16

STCW 2010 Implementation Workshop
Barendrecht, NL

02.02.16

Introduction to the Offshore Industry and Dynamic Positioning
Barendrecht, NL

10. - 11.02.16

Hull Structure and Inspection Advanced Course - Tankers, Bulk Carriers and Container Vessels
Barendrecht, NL

14. - 18.02.16

Superintendent Workshop - Managing Day-to-Day Operations
Dubai, AE

16. - 17.02.16

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Manila, PH

17. - 18.02.16

Offshore Vessel Management and Self-Assessment (OVMSA) Workshop
Rotterdam, NL

18. - 19.02.16

Internal Auditor ISO 50001 for Shipping Companies
Chennai, IN

18. - 19.02.16

Risk Management, Incident Investigation and Change Management
Singapore, SG

22. - 24.02.16

Internal Auditor IMS, ISO 9001, 14001 and 18001 for Shipping Companies
Manila, PH

24. - 25.02.16

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Istanbul, TR

24. - 26.02.16

Harmonized CSR
Busan, KR

25. - 26.02.16

Accident Investigation in Shipping - Analysis and Root Cause
Manila, PH

29.02. - 02.03.16

Train the Trainer for Shipping Companies
Delhi, IN

03. - 05.03.16

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Mumbai, IN

07. - 08.03.16

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Busan, KR

08. - 09.03.16

Internal Auditor ISM/ ISO 9001 for Shipping Companies
Istanbul, TR

08.03.16

Introduction to Crewing
Singapore, SG

10. - 11.03.16

Welding in Structure & Piping
Busan, KR

14. - 15.03.16

Accident Investigation in Shipping - Analysis and Root Cause
Singapore, SG

14. - 16.03.16

HAZOP Leader Course
Barendrecht, NL

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07. - 08.12.15
Flexible Marine Power and Propulsion Solutions
Oslo, NO

08. - 10.12.15
Ballast Water Management Technology
London, GB

09. - 10.12.15
Offshore Wind Vessels Conference
London, GB

16. - 17.02.16
RoRo Shipping Conference
Gothenburg, SW

24. - 25.02.16
FPSO Europe Congress 2016
London, GB

24. - 25.02.16
SMM Istanbul
Istanbul, TR

14. - 17.03.16
Seatrade Cruise Global 2016
Fort Lauderdale, US

15. - 18.03.16
Green Ship Technology
Copenhagen, DK

16. - 18.03.16
Asia Pacific Maritime 2016
Singapore, SG

21. - 23.03.16
CMA Shipping 2016
Stamford, US

24. - 25.03.16
Offshore Vessel Connect North America
Houston, US



Based in Miami for 27 years, Seatrade Cruise Global is being held from 14 to 17 March 2016 in Fort Lauderdale.

11. - 13.04.16
Cell Line Development & Engineering
Vienna, AU

13. - 15.04.16
Sea Japan 2016
Tokyo, JP

13. - 15.04.16
Ferry Shipping Conference 2016
Stockholm - Helsinki and return, on board *Silja Symphony*

02. - 05.05.16
OTC 2016
Houston, US

06.05.16
Seatrade Awards 2016
London, UK

10. - 12.05.16
Canada LNG Export Conference and Exhibition 2016
Vancouver, CA

12. - 14.05.16
Seatrade Cruise Asia 2016
Busan, KR

01. - 06.06.16
CLIA Cruise360 - A Panoramic View of Cruising
Vancouver, CA

06. - 10.06.16
Posidonia 2016
Athens, GR

15. - 16.06.16
Pacific LNG Summit 2016
Tokyo, JP

16. - 19.08.16
Nor-Fishing 2016
Trondheim, NO

29.08. - 01.09.16
ONS 2016
Stavanger, NO

06. - 09.09.16
SMM 2016
Hamburg, DE

21. - 23.09.16
Seatrade Cruise Med 2016
Santa Cruz de Tenerife, ES

25. - 28.10.16
Shiptec China 2016
Dalian, CN

01. - 03.11.16
Seatrade Middle East Maritime 2016
Dubai, AE

30.11. - 02.12.16
The International Workboat Show 2016
New Orleans, US

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