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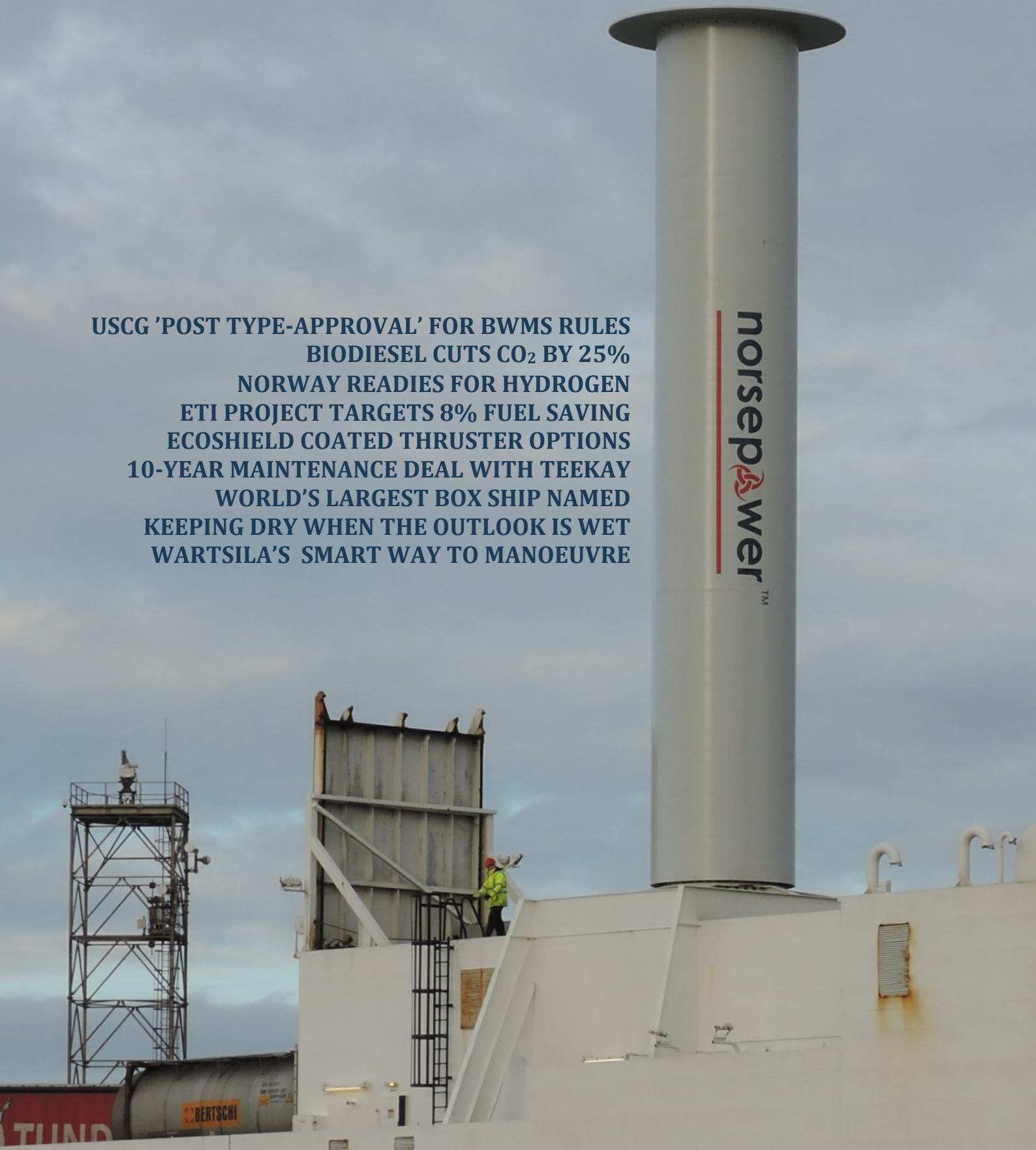
MARINE ENGINEERS MESSENGER



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Telegraph

The cruise industry is gearing up to meet growing Chinese demand for cruise capacity, with GE Marine Solutions president and CEO Tim Schweikert anticipating 4.5 million Chinese passenger by 2020, more than 20% of current global cruise passengers.

China's economic evolution and a rising middle classes are the driving factors behind the forecast, together with relaxed visa rules, which means that China can now accommodate more foreign visitors from cruise vessels. According to Schweikert cruise shipbuilding is developing in parallel, signalled by the move made by Carnival Corporation, which recently agreed to design and build two cruise ships with the China State Shipbuilding Corporation (CSSC) and Fincantieri. These will be the first ships ever to be built in China for the Chinese market.

Enhanced manoeuvrability is expected to play a particularly important role for cruiseships operating in China and GE's Marine Solutions is currently partnering with shipbuilders to design the next generation of marine propulsion pods, targeting improved fuel efficiency and manoeuvrability. This is expected to be beneficial for the Chinese market since the government is creating emission control areas at major shipping ports, introducing a sulphur cap, ahead of the global IMO 2020 regulations.

"One way to embrace the change is through adopting cleaner engines, such as GE's Tier 4 diesel engine, which meets IMO Tier III and US EPA Tier 4 requirements without the complications of urea after-treatment. Separately, GE's marine gas turbines can be equipped with GE's dry low emissions combustion system to reduce NOx. The emission volume is well below what IMO Tier III and US EPA Tier 4 standards require and with no exhaust treatment and no methane slip," says Schweikert.

He believes alternative clean fuels, such as LNG, will become a more predominant marine fuel in future. "The move is typified by Carnival Corporation, which has three LNG-powered cruiseships on order. In addition, GE's fuel-flexible COGES system is capable of burning diverse fuels including LPG, natural gas, marine gas oil and other bio-synthetic paraffinic kerosene blends."

Booming demand will also see the cruise industry embrace digitalisation to further raise efficiency, especially to mitigate against unplanned downtime. "Analytic tools can predict an equipment's potential failure before it becomes an operational disruption, reducing downtime and more crucially, avoiding disruptions during the voyage. This predictivity can also enable a shift from calendar- to condition-based maintenance, further reducing maintenance cost," he says.

Digital technology can also help improve fuel efficiency by analyzing weather conditions and current to optimise propulsion rate and speed. It can help operators make smart decisions to change to use cleaner fuels on the course of the route, depending on the speed needed, further curbing emissions and cost of fuel.

"By using the right technology—green and digital—operators are sailing in the right direction to capitalise on the opportunities in 2017 as well as those further on the horizon," says Schweikert.

USCG PROVIDES ADDITIONAL 'POST TYPE-APPROVAL' FOR BWMS RULES

The US Coast Guard (USCG) has issued a Marine Safety Information Bulletin (MSIB 03-17) providing additional guidance to its ballast water management (BWM) extension programme.

Notably, the USCG emphasises the need for shipowners to provide sound evidence of whether or not a USCG type-approved BWM system is "available" for the vessel in question before granting an extension. This means that shipowners will have to study the available type-approvals, understand the technical constraints associated with each system, and justify why these systems are not appropriate for a particular vessel.

However, while the USCG recognises that "one size does not fit all and that it will take a variety of type-approved systems to meet the needs of the global fleet, it also makes it clear that extensions will not be granted indefinitely.

The Coast Guard Maritime Information Exchange is the official website listing USCG type-approved equipment. However, as of March 2017, copies of certificates for type-approved BWM systems, including appendices, can also be found via the USCG's ballast water portal.

The US has not acceded to the IMO BWM Convention but has instead adopted its own ballast water management requirements which are set out in Title 33 Code of Federal Regulations (CFR) Part 151 Sections 151.1510 and 151.2025. The regulations, which entered into force in June 2012, apply to all non-recreational vessels, both US and foreign, that are equipped with ballast tanks and intend to discharge ballast water into US waters. A vessel's compliance date is determined by its first scheduled dry-docking after 1 January 2014 or 1 January 2016, depending on the vessel's ballast water capacity. Upon a vessel's compliance date, it must use one of the accepted BWM methods listed in the regulations. For most vessels, this means that a USCG authorised ballast water treatment system must be installed and used.

Regulation 33 CFR 151.2036 allows the USCG to grant an extension of a vessel's compliance date to a shipowner who has documented that, despite all efforts, compliance with one of the accepted BWM methods is not possible. Prior to December 2016, when no USCG type-approved BWM system was available, it was relatively simple for a shipowner to document that this was not possible. As three BWM systems have now been type approved, this changes the way the USCG approach these extension requests and the following guiding principles provided in MSIB 03-17 should be noted:

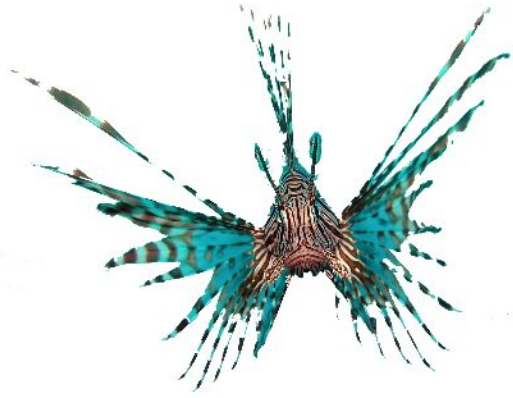
A request for an extension should be submitted 12-16 months before the vessel's compliance date. Requests submitted too late risk being rejected due to time constraints during the review process. Requests submitted too early may have to be revised due to changes in the market or availability of USCG type-approved systems.

The request should contain a strategy for compliance, outlining the steps to be taken to bring the particular vessel in compliance with the regulations before the end of the extension. This may require the inclusion of a timeline and installation plan for a USCG type-approved BWM system. Requests that do not provide a justification as to why compliance with one of the accepted BWM methods is not possible by the vessel's current compliance date will be rejected.

If an extension is granted, it will no longer be linked to the vessel's dry-docking schedule, but will contain an "expiry date" based on the compliance strategy and installation plan provided in the request. Further extensions to those granted after 6 March 2017 should not be anticipated.

The USCG emphasises the need for shipowners to provide sound evidence of whether or not a USCG type-approved BWM system is "available" for the vessel

A vessel with an Alternate Management System (AMS) installed do not qualify for an extension because the vessel is in compliance with the regulations. The AMS can be used for a period of five years after the vessel's compliance date. New installations of AMSs are still considered by USCG as an acceptable method of complying with the regulations – but only if it has been determined that a USCG type-approved system is not appropriate for the particular vessel.



Most vessels trading on US ports will need to install a USCG type-approved BWM system eventually and Members and clients are advised to start the preparatory work as soon as possible. The USCG recommends shipowners to proactively engage a vessel's Flag State, Classification Society, as well as the USCG, when developing the compliance strategy for a vessel as this may prevent delays or lapse in eligibility to trade in US waters. It may also be necessary for shipowners to work closely with the BWM system manufacturers to ensure that the systems in development meet the needs of their vessels.

BALLAST WATER

SOUTH KOREAN YARD CONTRACTS EVOQUA SEACURE FOR TANKER NEWBUILDS

Evoqua Water Technologies has secured an order from a South Korean shipyard for the supply and installation of SeaCURE ballast water management systems (BWMS) to two 115,000dwt crude oil tankers under construction for a Singapore-based ship owner.

Each vessel will feature a 3000m³/h capacity SeaCURE BWMS, which Evoqua will deliver for installation this summer during the vessels' early construction phase. The vessels are scheduled for delivery in 2018.

Speaking of the significance of the contract, Matt Granitto, Evoqua's Business Manager, Ballast Water Treatment, said: "We are delighted to have been awarded this contract. The order is indicative of the confidence the tanker segment has in our SeaCURE system as a ballast water management solution that does exactly what it has been designed to do. We now have tanker references on newbuilds and existing tonnage.

"With so many different ballast water treatment technologies and systems available, ship owners do need to be confident that the system selected is not only compliant, but capable of meeting ship-specific operational and budgetary requirements. The electrochlorination process at the heart of Evoqua's SeaCURE system is proven technology, capable of handling the high flow rates and variable water quality we encounter during operations."

JaeWook Bae, Team Manager of the BWMS Business at Krosys, Evoqua's Korea-based partner that secured the order, added: "The driver for awarding Evoqua the project was the side-stream technology inherent to the SeaCURE system. The side stream which will feed the system will be from the sea chest in the engine room when the ship is in marine water, and from the aft peak tank when in brackish or fresh water. This process perfectly fits the operational profile of this ship type, while offering shipbuilders a compliant solution that is more cost-effective and easier to install than comparable systems."

According to Lars Nupnau, Evoqua's Global Business Development Director, Ballast Water, an influencing factor was the SeaCURE systems ability to treat the vessels' aft peak tank without the need for an additional electrochlorination unit.

"Rather than taking a full flow or in-line approach to ballast water treatment, the small-feed stream process is particularly advantageous to the tanker segment as just one system can treat all ballast water tanks," Nupnau explained.

"Typically, a full flow or in-line system would require a second, separate ballast water treatment to manage the aft peak tank, but because the electrochlorination part of our system is installed in the engine room – a designated safe area – we can use the same electrochlorination unit. For the ship owner, this means lower capital expenditure and a less complex, time-consuming installation."

SeaCURE BWMS utilises a patented process that injects biocide into ballast seawater before it reaches the large surface filter intakes to reduce the growth marine organisms that become harmful to filters.

Available as a compact skid or as modular components, the system is suitable as a newbuild or retrofit installation since biocide generation takes place in small side streams from the main ballast water thus reducing system footprint and optimizing available space.

The Evoqua SeaCURE system can also be configured to provide marine growth protection for critical onboard seawater cooling systems.

NORWEGIAN CRUISE LINE CONSULTS FORESHIP ON BALLAST WATER COMPLIANCE

Foreship has secured a major design consultancy contract covering the first post-Ballast Water Convention treatment systems to be specified by Norwegian Cruise Line.

The contract calls for independent naval architecture and marine engineering consultancy services to ensure installations on five NCL ships are fully IMO-compliant.

After an initial project involving the surveying, installation feasibility study, design drawings and documentation for class approvals on *Norwegian Dawn (*pictured*)*, Foreship was invited to provide the same service for the Norwegian cruise ships *Pearl, Sky*, *Jade* and *Spirit*.

"Environmental responsibility is a core value for NCL, and we welcomed the clarity brought by entry into force of the BWM Convention," said Giovanni Canu, VP Technical Operations, Norwegian Cruise Line. "Work to install compliant BWM systems on Norwegian Dawn began within a month of ratification. Foreship quickly showed their value in ensuring the project proceeded smoothly to class requirements, leading us to extend to five ships. We need to manage BMTS installations effectively fleet-wide; there will be high demand once shipping moves decisively on compliance."

Foreship's full scope includes mechanical and electrical design work to DNV-GL requirements, taking in diagrams for BWTS foundation support structures, piping routing, machinery arrangements, cabling diagrams and systems integration. Foreship is also contributing on-site installation support, where required, with the bulk of work to take place while ships are in service.

"We are an independent consultancy and recommend shipboard systems in the configurations which are most beneficial for each ship," said Kim Palén, Operations Manager, Foreship. "In the case of NCL, Alfa Laval's PureBallast 3.1 BWMS had already been selected, with switchboards and automation cabinets also common across the ships, so we have taken a unified approach.

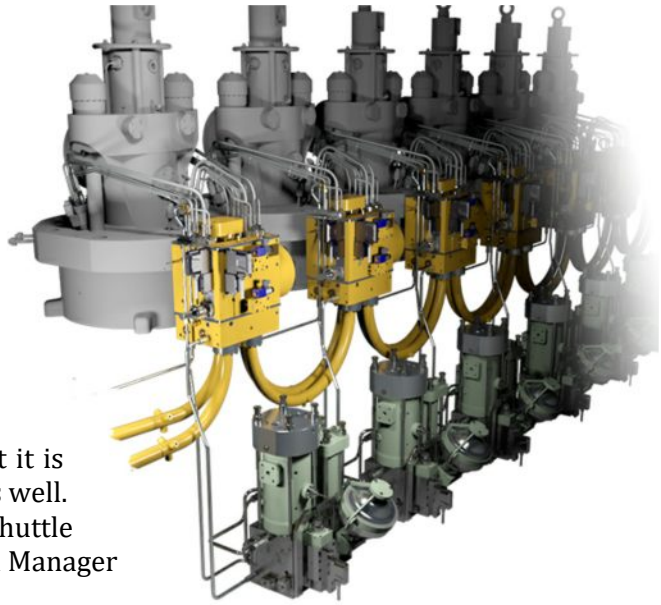
"Nevertheless, our technical background reports have shown that flexibility is required to take account of variations between different vessels: even sister ships can become more like cousins after different service and refurbishment histories."

Ballast water pump sizes have varied on different ships, for example, while cabling and piping routing and penetration locations have not been uniform. Palén added that decisions on where to locate parts of the system – above or below deck, for example – depended on space availability.

"We are involved in this project from start to finish, from the drawing stage to providing all of the mechanical and electrical suppliers involved with technical assistance as requested." He added that Foreship was managing the NCL project via its Miami office, close to the owner's technical team. The decision reflected a wider strategic move by Foreship to develop full project management services as a separate offer to clients.

PRIME MOVERS

FIRST ME-GIE TWO-STROKE DELIVERED



The world's first ME-GIE ethane combusting two-stroke engine has been delivered from MAN Diesel & Turbo licensee Mitsui Engineering & Shipbuilding Co., Ltd. (MES) in Japan. The Mitsui-MAN B&W 7G50ME-C9.5-GIE is the first engine in a series of three.

Further research has led to new possibilities for this engine leading to exciting new prospects for multi-fuel combustion including the combustion of waste gas.

"The ME-GIE engine was originally designed for the combustion of ethane gas, however, research has revealed that it is possible to operate the engine on volatile organic compounds as well. Accordingly, it is also a potential solution for the propulsion of shuttle tankers and VLCCs," said René Sejer Laursen, Sales & Promotion Manager at MAN Diesel & Turbo.

The benefits of the diesel-type combustion are now fully exploited in the ability of the two-stroke engine to run on almost any gas quality without efficiency reductions, and in the complete combustion maintained by a relatively high gas injection pressure.

The engine will be able to run on a mixture of LPG, among which are included VOCs, and methane or ethane with unchanged gas mode efficiency. The mixture may contain as much as 50 % LPG and the findings so far indicate that even larger amounts of LPG may be added to the gas.

MAN Diesel & Turbo sees significant opportunities in the development of this engine since the engine may also run on almost any form of waste gas. The waste gas could be the light hydrocarbons or volatile organic compounds (VOCs) emitted from crude oil during storage and when loading/unloading of crude oil. This opens for new applications of the engine in for example shuttle tankers, for power generation in remote power plants or in off-shore applications, such as floating production storage and offloading vessels (FPSOs), where waste gas is abundant and poses a potential environmental hazard.

FUEL SUPPLY

METHANOL BOOSTER SUCCESS

Following the success of its FCM One Low-Flashpoint (LF) booster system on methanol-fuelled tankers with ME-LGI engines, Alfa Laval is now supporting MAN Diesel & Turbo as the engine series is further developed to work with LPG.

In late 2013, Alfa Laval was selected by MAN Diesel & Turbo to deliver Low-Flashpoint Supply Systems (LFSS) for the world's first methanol-fuelled tankers. Since 2012, the two companies had been collaborating broadly on fuel conditioning for MAN Diesel & Turbo's new two-stroke diesel engines with Liquefied Gas Injection (LGI) technology. But when the engine maker contracted to equip nine vessels with methanol-burning ME-LGI engines, methanol came quickly into focus.

"MAN Diesel & Turbo has worked closely with Alfa Laval in development projects like Exhaust Gas Recirculation, where Alfa Laval PureNOx technology cleans the circulation water," said Søren H. Jensen, Vice President and Head of R&D, Two-Stroke Business at MAN Diesel & Turbo. "That, together with deep expertise in fuel conditioning, made Alfa Laval the natural choice to deliver the Low-Flashpoint Supply Systems for methanol."

The finished booster technology, the Alfa Laval FCM One Low-Flashpoint (LF), was installed on tankers built at Minaminippon in Japan and Hyundai Mipo Dockyard in Korea. The vessels' three owners, MOL, Westfal-Larsen and Marinvest, have since logged over 4500 running hours with the FCM One LF in the past three years.

"The effectiveness and market-readiness of our ME-LGI engine technology has been clearly demonstrated by the fleet," said Kjeld Aabo, Customer Director at MAN Diesel & Turbo. "Alfa Laval's low-flashpoint booster technology has played a significant role in that success, and we look forward to further cooperation as the application develops."

In fact, new booster developments are already underway. MAN Diesel & Turbo is currently modifying the ME-LGI engine series to use LPG as an alternative fuel, and once again Alfa Laval is preparing the booster system. After more than one year of development, the first Alfa Laval FCM One LPG will be delivered to the MAN Diesel & Turbo's Copenhagen test site in the coming weeks.

"Tests of the engine and booster are expected to be completed by the end of 2017," said Roberto Comelli, Business Manager, Fuel Conditioning Systems at Alfa Laval. "In the meantime, Alfa Laval is preparing to support MAN Diesel & Turbo when the first LPG-related orders come in. We are proud to be associated with LGI engine technology and to help bring more customers access to this low-emission alternative."

ALTERNATIVE ENERGY

MAERSK TANKERS TO INSTALL FLETTNER ROTORS

The Energy Technologies Institute (ETI) in partnership with Norsepower, Maersk Tankers and Shell Shipping & Maritime have agreed to install and trial Flettner rotor sails onboard a Maersk Tankers-owned LR2.

"Wind power has a role to play in supporting the shipping industry to reduce its fuel consumption."

The project will be the first installation of wind-powered energy technology on a product tanker, and will provide insights into fuel savings and operational experience. The rotor sails will be fitted during the first half of 2018, before undergoing testing and data analysis at sea until the end of 2019.

Maersk Tankers will supply a 109,647dwt Long Range 2 (LR2) product tanker vessel which will be retrofitted with two 30m tall by 5m diameter Norsepower Rotor Sails. Combined, these are expected to reduce average fuel consumption on typical global shipping routes by 7-10%.

The project is majority funded by the UK's ETI with contributions from Maersk Tankers and Norsepower. Shell will act as project coordinator, and provide operational and terminal / port consultancy to the project team, while Maersk Tankers will provide technical and operational insight.

Flettner rotors have the potential to reduce ship fuel consumption substantially, especially on tankers and dry bulk carriers. It is one of the few fuel saving technologies that could offer double digit percentage improvements. To date, there has been insufficient full scale demonstration on a suitable ocean going marine vessel to prove the technology benefits and operational impact. Demonstrating the technology in this project will make it more attractive to shipping companies and investors, and could play a significant role in reducing the fuel costs and improving the environmental impact of shipping in the future.

"We are optimistic that support for this trial from these industry leading organisations will open up the market for our technology to a larger number of long-range product tanker vessels – paving the way for ship fuel efficiencies, and ultimately reducing emissions, including greenhouse gases," said Norsepower CEO Tuomas Riski. "As an abundant and free renewable energy, wind power has a role to play in supporting the shipping industry to reduce its fuel consumption and meet impending carbon reduction targets."

Tommy Thomassen, Maersk Tankers CTO, added: "Together with our partners, we have the opportunity to deploy an innovative technology that can improve fuel efficiency on our LR2 product tanker vessels and help to reduce their environmental impact. We look forward to contributing to the project, and sharing our decades of experience and knowledge within safety and tanker operations."

The Norsepower Rotor Sail Solution is a modernised version of the Flettner rotor – a spinning cylinder that uses the Magnus effect to harness wind power to propel a ship. Each Rotor Sail is made using the latest intelligent lightweight composite sandwich materials, and offers a simple yet robust hi-tech solution. When wind conditions are favourable, the main engines can be throttled back, providing a net fuel cost and emission savings, while not impacting scheduling. Independent experts will analyse the data gathered from the project before publishing technical and operational insights, and performance studies.

BIODIESEL CUTS CO_2 BY 25%

Following a successful pilot installation, GoodFuels Marine has also won Port of Amsterdam's tender for its fleet of five patrol vessels. The vessels will now run on fuel containing 30% high-quality biodiesel to reduce CO_2 emissions by 25%, compared to fossil diesel.

Marleen van de Kerkhof, Port of Amsterdam Harbour Master, said: "Clean shipping is a key spearhead of our sustainability strategy. Part of this strategy entails making our own patrol vessels more sustainable. Using marine biofuels enables us to reduce our own CO_2 by 25%, which is a good step in the right direction."

"Port of Amsterdam and Port of Rotterdam have actively supported the development of marine biofuels from the beginning," said Dirk Kronemeijer, CEO of GoodFuels Marine. "This is why we are especially pleased that, after a successful pilot, Port of Amsterdam will be able to reduce the CO_2 emissions of its own patrol vessels by 25%. We are committed to further investing in the Port in the field of the storage, production and distribution of sustainable marine biofuels in order to accelerate the development towards clean and low-carbon shipping."

Tjerk Wagenaar, Director of Natuur & Milieu, said: "Port of Amsterdam is taking a great step forward in making its operations more sustainable through this measure. The transition to sustainable advanced biofuels is an excellent example of how shipping can reduce its CO_2 emissions."

GoodFuels' renewable 'drop-in' biofuel is a sustainable and high-quality alternative to fossil diesel. The blend used by Port of Amsterdam contains 30% advanced second-generation biofuels and complies to the EN590 norm. This means it can be used directly in all diesel engines without any modifications to the engine and the factory warranty remains valid. The sustainable biodiesel is produced from certified waste flows that cannot be used in other industries or for other purposes. This promotes the circular economy.

NORWAY READIES FOR HYDROGEN

The Norwegian Maritime Authority (NMA) has announced its intention to work closely with the industry in the development of the technology to augment the use of hydrogen as a marine fuel.

"It is our opinion that the use of hydrogen as marine fuel is fully achievable provided that the process is properly organised," said Senior Surveyor Kolbjørn Berge. He leads a newly established project group at the NMA that focuses on new technology, and the NMA is well prepared for taking on new challenges.

"The important thing is that the overall safety level is as high as for conventional oil-powered machinery, and there will be requirements for risk analysis and explosion analysis to ensure safe use," he said. He

encourages anyone with innovative ideas to contact the NMA at an early stage of the process to make themselves familiar with the applicable rules.

Several interesting projects are underway. The Norwegian Public Roads Administration, for instance, is in the process of challenging companies, shipyards and technology environments to construct a hydrogen-powered ferry. They are currently hosting a dialogue conference for relevant companies and suppliers. The project will enable zero emission technology for routes not suitable for electric operation only. “We are very positive about cooperating with the industry to realise the hydrogen project,” said Director General of Shopping and Navigation, Olav Akselsen.

BUNKERING

IBIA WELCOMES MPA’S EFFORTS TO ENSURE INTEGRITY OF MFM SYSTEMS

The International Bunker Industry Association (IBIA) has welcomed the efforts of the Maritime and Port Authority of Singapore (MPA) to ensure the integrity of the mass flow meter (MFM) systems that are mandatory for supply of marine fuel oil (MFO) in the port.

The MPA has temporarily suspended the harbour craft licences of five bunker tankers operated by Panoil Petroleum Pte Ltd. while investigating irregularities found on their piping fixtures.

An MPA spokesman told IBIA that the authority conducts regular spot checks on bunker tankers. “MPA will continue with our checks on bunker tankers to ensure compliance to the requirements set out in the Technical Reference for Bunker Mass Flow Metering (TR48).”

Since the start of the year, only bunker barges with MPA approved MFM systems are allowed to supply MFO to ships taking bunkers in the port. The MPA has emphasised that the technology will enhance efficiency compared to bunker deliveries using manual methods for measuring delivered quantity.

Equally important, however, is that requiring barges to use tamper-proof, MPA-approved MFM systems should enhance transparency of the bunkering process, providing accurate and reliable measurements of delivered quantity.

Bunker sales in Singapore totalled 4.46 million metric tonnes in January 2017, the highest ever for any month, according to MPA data. Sales for the first two months of 2017 are up 8% year-on-year, which may indicate that buyers find the MFM mandate reassuring.

IBIA believes that Singapore’s mandatory MFM requirement will help create a level playing field in the port, as it should reduce the risk of quantity-related malpractices.

But for the regulation to be effective, it must also be effectively enforced, and that includes monitoring and taking action against any attempt to circumvent it. It is reassuring that the MPA is keeping a close eye on barges to ensure the integrity of MFM systems isn’t undermined.

MPA says it will not hesitate to take action against any bunkering malpractices in the port of Singapore, and any licensee found to have contravened any terms and conditions of the licence will have their licence either suspended or cancelled.

Although the Singapore requirement means the MFM volume reading is binding, bunker surveyors still have a role to play. They can help ship operators ensure all the relevant checks are performed when receiving bunkers via MFM approved barges, and help document any potential irregularities that may compromise the integrity of the MFM system. IBIA has developed a Standard Operating Procedure (SOP) to help bunker surveyors identify their responsibilities when overseeing bunker deliveries involving MFMs in Singapore, and IBIA’s Singapore branch provides relevant training courses for surveyors.

The SOP is an example of IBIA’s ongoing efforts to work with all parts of the bunker supply chain to encourage best practices and raise industry standards.

WASTE HEAT

ETI WASTE HEAT RECOVERY PROJECT TARGETS 8% FUEL SAVING

The Energy Technologies Institute has launched a new project to develop and demonstrate a waste heat recovery system for ships that could deliver fuel efficiency savings of at least 8%.

The £3.6m project will be led by Avid Technology which will work alongside RED Marine Limited, Royston Power and Enogia, to deliver a cost-effective waste heat recovery system for use across all types of ships. The 26-month project should see the waste heat recovery system installed on an offshore support vessel by end of 2018 ahead of a further six months of testing.

Unlike the power and heat sectors and other forms of transport there does not seem to be a credible alternative to fossil fuels to power vessels, so in the medium to long term, the best potential to achieve substantial CO_2 reductions is by reducing fuel consumption.

Fuel efficiency in shipping can be improved by reducing the electrical load provided by the ship's generators, through recovering heat energy from the exhaust stream, in addition, substantially reducing the temperature of the exhaust gas by converting the heat to electricity.

The technology being developed in the ETI's project should be capable of being deployed on a range of vessels, including chemical tankers, general cargo vessels, container feeders, offshore support vessels and roll-on roll-off passenger ships.

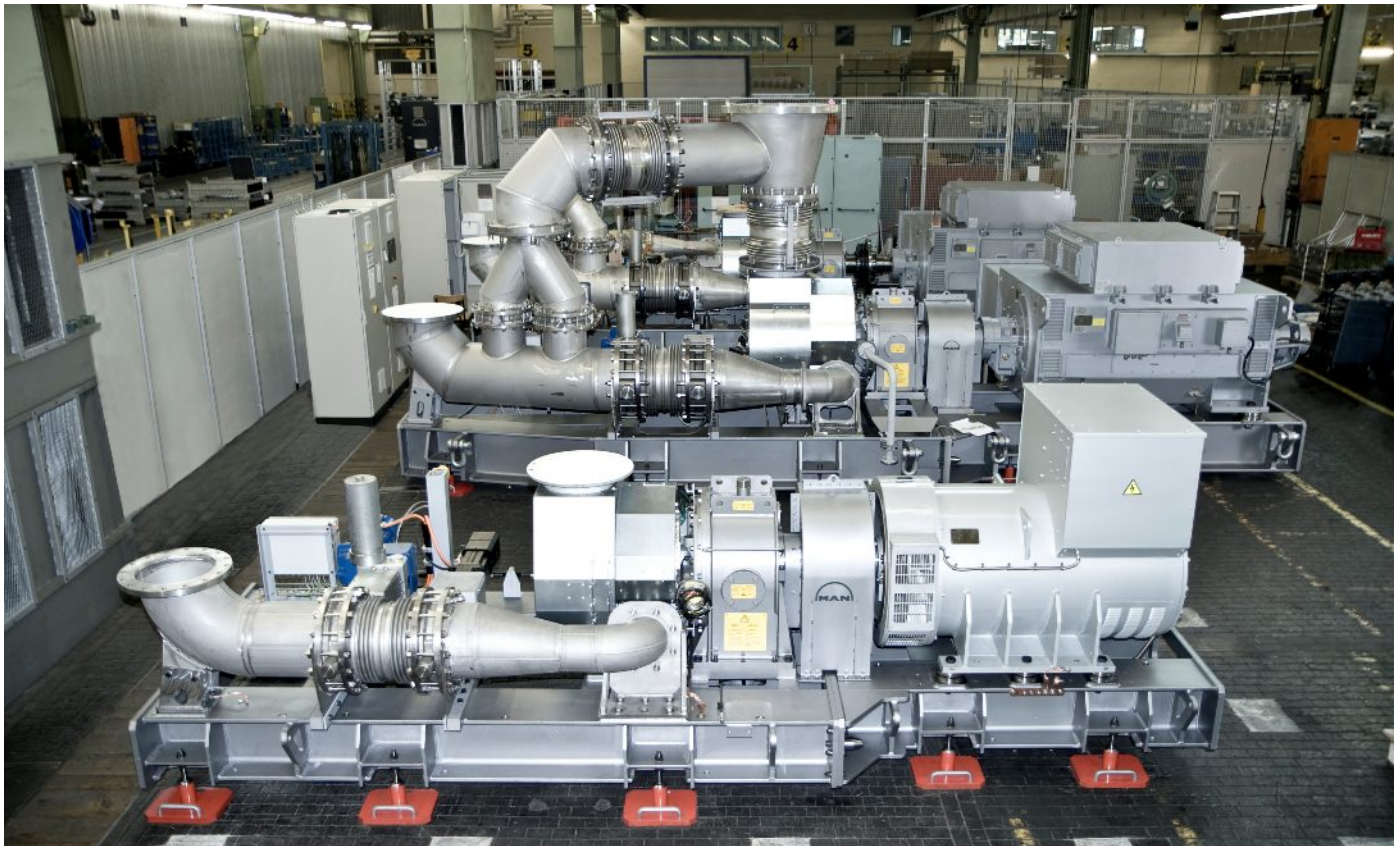
The ETI has recently published an insight report which analyses the UK shipping fleet, the potential opportunities for ship owners and operators and identifies the most promising technologies that could reduce fuel consumption economically.

"We have established that a 30% reduction in fleet fuel consumption can be achieved by using a combination of innovative technologies, including waste heat recovery systems, with an approximate payback period of just two years. It is important that we now develop and demonstrate this technology to provide confidence to shipping owners and operators that it can deliver tangible efficiencies and savings under real world conditions, the ETI said.

Ryan Maughan, founder and managing director of AVID Technology, which specialises in the design and manufacture of electrically powered systems for low emission vehicles, said: "Unlike other forms of transport, the marine industry has yet to establish a credible alternative to fossil fuels so the immediate priority is to achieve substantial carbon dioxide reductions by reducing fuel consumption.

"The technology solution we are targeting with our partners is based on improving fuel efficiency by recovering heat energy from the exhaust stream therefore reducing the electrical load provided by the ship's generators and by lowering the temperature of the exhaust gas by converting heat to electricity."

The project is one of several demonstrations currently being commissioned by the ETI that will seek to reduce emissions and increase the efficiency of shipping fleet.



ZF MARINE CUSTOMERS BENEFIT WITH ECOSHIELD COATED THRUSTER OPTION

ZF Marine Krimpen is applying Subsea Industries' Ecoshield hard coating to the nozzles and underwater components of its azimuth thruster units supplied to vessels operating in inland waterways.

The Netherlands-based company, a division of Germany's ZF Group, is using Ecoshield on thrusters supplied to a number of US-based customers to reduce operational wear and tear in brown waters such as the Mississippi River.

Frank van der Vegt, Area Sales Manager, Commercial Craft Thruster Systems, ZF Marine, explained: "We were looking to improve the protection of the thruster's underwater components against damages due to the debris, sand and silt common in shallow draught inland waterways, particularly the Mississippi, as well as to prevent damage due to cavitation and corrosion."

The solution was found in Antwerp, in 2015, when ZF approached Subsea Industries to investigate whether its hard-coating could protect its thrusters from the effects of abrasive waters.

After a series of patch tests proved successful ZF Marine began applying the hard-coating to all underwater areas of the thruster. Since then, Ecoshield has been applied to the ZF 1000hp azimuth thrusters installed on 12 tow/pushboats operating in US waters.

"We offer the Ecoshield-coated thruster as an option, but it is a very good solution for increasing the life of thruster installations aboard tugs and pushboats operating in shallow waters," said van der Vegt. "We can see a really big improvement. They are less prone to damage, reducing maintenance and operational costs. We see these benefits not only with the towboat application, but also other applications such as harbour tugs and passenger vessels."

Manuel Hof, Production Executive and NACE Inspector at Subsea Industries, said: "We are pleased that ZF Marine's decision to apply our award-winning Ecoshield hard coating to its thrusters is paying dividends for its customers. The Ecoshield-coated thruster option adds considerable strength to its position as the leading supplier of propulsion systems to the U.S. pusher boat market."

Subsea Industries has more than 400 ship references for Ecoshield on rudders but is seeing a marked increase in application to thruster tunnels and gearboxes due to the operational savings it brings them.

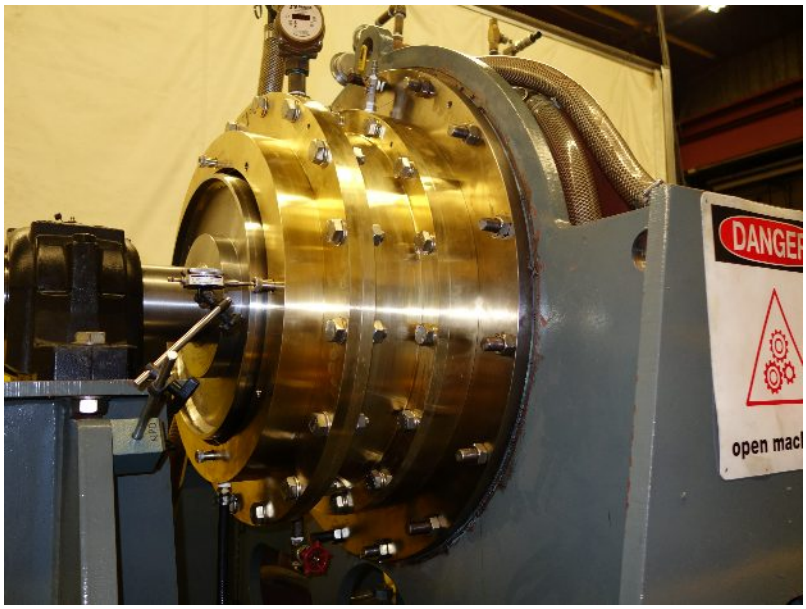
"We are also seeing an increase in interest from original equipment manufacturers," said Hof. "Ecoshield safeguards propulsion systems and steering gear against cavitation and corrosion damage throughout the vessel's service life, which can increase significantly the operational life of rudders and thrusters. We have Ecoshield-coated rudders and thrusters that have not needed recoating after more than five year's operating in some of the harshest marine environments."

SEALS

THORDON'S SEATHIGOR FOR MARITIME ENVIRONMENTAL AWARD

SeaThigor, the forward propeller shaft seal Thordon Bearings introduced to the market last year, has been nominated in the technology category of the Green4Sea awards, which will take place in Athens this April.

Commenting on the nomination, Thordon Bearing's President and CEO, Terry McGowan, said: "We are delighted to have been nominated for this important award so soon after the SeaThigor's introduction. After several years of development and testing, we have produced what I believe is the safest, most reliable propeller shaft seal on the market."



Officially unveiled at Hamburg's SMM exhibition, last September, the SeaThigor forward seal has been cited as "raising the bar in dynamic and static seal design". It incorporates an ingenious secondary seal module to provide Safe-Return-To-Port capability in the event of a face failure of the primary seal.

A pneumatically activated inflatable element prevents water ingress along the shaft, allowing for the repair of the main seal whilst at sea, or for the shaft to turn at a lower speed so the vessel can safely return to port for primary seal repair or replacement.

Craig Carter, Director of Marketing and Customer Service, Thordon Bearings, added: "As with all our seals and bearings, SeaThigor combines high performance with cost and environmental efficiency. We are witnessing increasing interest in seawater lubricated propeller shaft bearing systems and the SeaThigor is an important part of this. SeaThigor is now an integral part of our COMPAC bearing system."

Green4Sea Award winners are selected by way of an open, on-line voting process which allows all members of the global maritime community to choose those they feel deserve to receive the accolade. The winner will be the one who receives the most votes.

The shipping industry can cast its vote online at http://www.green4sea.com/2017-green4sea-awards until 24th of March 2017.

DIGITALISATION

ABB UPGRADES ITS REMOTE DIAGNOSTICS TOOL

ABB is deepening its analytical and predictive approach to vessel maintenance with the latest upgrade of its Remote Diagnostic Service (RDS). ABB is one of the leading advocates of the digitalisation of shipping and has already launched Integrated Operation Centers in Asia, Europe and the USA where data produced by ships is received and monitored.

The upgraded software functionalities will give more power and transparency to the shore side operations of ship owners whilst ABB has stepped up its proactive monitoring of the data and predictive analytics. The enhancement of ABB's digital services comes after an internal study found existing remote monitoring of machinery reduced maintenance costs by 50%.

ABB is aiding the development of the shore side operations of shipping companies by giving the opportunity to replicate ABB's Integrated Operations Centers in their own Operational Centers. The latest version of RDS software allows shipping companies to deploy their own analytics, or those from a third party where applicable, with greater ease. ABB has further developed its dedicated hardware for the monitoring of large and small rotating machinery with tight integration to the RDS software. The graphical user interface has also been improved to increase user experience and to give identical views of the detailed data both onboard and onshore.

To further leverage the data received from vessels, the ABB Digital Service team has been strengthened with more data scientists and architects to promote the search for insight into the health of the monitored assets. The ABB software used as part of the Remote Diagnostic Services combines the capabilities of a dedicated onboard software with a full analytic engine onshore. Due to this modularity and capability, the software can now run the same analytics onboard as onshore.

For shipping companies with limited bandwidth availability or a high number of data points, ABB is deploying leading edge analytics to seamlessly customize the solution and optimize the data transfer.

An internal study found that by taking a proactive approach to the monitoring of equipment through the use of RDS and its software, customers were able to save up to 50% on maintenance costs. There has also been up to a 70% reduction in visits by ABB engineers to vessels bringing a significant decrease in the cost for customers.

"Through our Integrated Operations Solutions and Centres we aim to be connected to 3,000 vessels by 2020," said Kenneth Nakken, Vice President Digital Services, at ABB's Marine & Ports business. "We develop all our digital solutions with the customer in mind and we believe our new Predict service will strengthen the shore side operations of all involved."

ABB is also launching a new mobile application that will allow the user to monitor the health status of connected marine machinery, starting with Azipod propulsion.

ROLLS-ROYCE TO DEVELOP PARTNERSHIPS FOR REMOTE SHIPS

Rolls-Royce has announced the latest stage in its research and development plans to make remote and autonomous shipping a reality and reap the benefits of increasing digitalisation in the marine industry.

The company is looking to develop partnerships and opportunities with other organisations around the world to, create the capability, competencies and jobs to supply the technology and components required.

Today, the latest part of that programme has been confirmed with the announcement, in Finland, of a significant research grant by Tekes - the Finnish Funding Agency for Innovation. The funding will enable Rolls-Royce to invest further in a research and development centre in Turku, Finland. The company plans to carry out further development projects there focused on the future development of land-based control centres, and the use of artificial intelligence in future remote and autonomous shipping operations.

Mikael Mäkinen, Rolls-Royce, President – Marine said: "Digitalisation will transform the shipping industry in the years ahead, and the time is now right to set out how we are going to make this happen. Over the coming years, we need to invest globally to develop the required capabilities and to establish a range of market-ready products and systems to take advantage of what is a significant global market opportunity.

"By combining our world leading capability and knowledge, with a clear plan of where we need to go next, we can work with our customers, governments and our global academic research network to develop and bring to market the advanced technology, products and supporting services needed both 'on-vessel' and 'on-shore' to make our vision of future remote and autonomous ships a reality."

In Norway, the company is currently investing in a range of R&D projects, which will include a new Marine Fleet Management Centre in Aalesund, to allow remote monitoring, data analysis, optimisation of ships and their onboard equipment. The centre will allow Rolls-Royce to extend its 'Power by the Hour' concept, already proven in its Aerospace business, to serve the marine sector. 'Power by the Hour' is a new service to be delivered from the Marine division of Rolls-Royce which makes use of 'big data' to monitor, plan and perform maintenance and repairs on onboard ship equipment.

Asbjørn Skaro, Rolls-Royce, Director, Digital & Systems – Marine, added: "We are pleased to see the establishment of a centre for Remote Control & Autonomous Ships in Finland, and welcome the continued support from Tekes. We are looking at further funding and capability opportunities in countries including Finland, Norway, UK and Singapore to develop our ship intelligence technology and build customer partnerships worldwide.

"By drawing on our existing capabilities in our Marine business, together with the global expertise we have across the Rolls-Royce Group and our relationships with partners, we believe we can secure up to £200m of investment to revolutionise shipping."

SERVICE

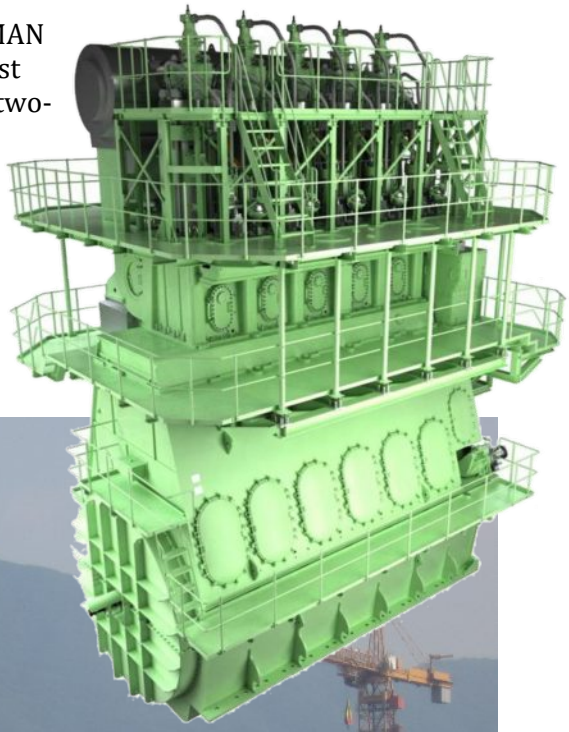
MAN PRIMESERV SIGNS 10-YEAR MAINTENANCE DEAL WITH TEEKAY

MAN PrimeServ, the after-sales division of MAN Diesel & Turbo, has signed a maintenance contract with Teekay Shipping.

The new EMC (Engine Management Concept) contract is for the maintenance of *Oak Spirit, Creole Spirit* and *Torben Spirit,* sisters from Teekay's 173,400m^3 LNG carrier series. The agreement covers the provision of spare-parts, maintenance management and the servicing of each vessel's 2 × 5G70ME-GI (-Gas Injection) dual-fuel main engines.

Jeffrey Ang, Head of CoC – Engines & Marine Systems, Asia Pacific – MAN Diesel & Turbo, said: "This agreement is significant in that it is the first market agreement that PrimeServ has clinched involving our dual-fuel, two-stroke ME-GI engines. Furthermore, with Teekay nominating us as their preferred service provider, this contract will undoubtedly add momentum to our efforts to expand the EMC's reach within the gas-engine segment."

According to the terms of the contract, MAN Diesel & Turbo, Copenhagen will deliver maintenance management and spare parts, while MAN Diesel & Turbo, Shanghai will take care of the service provision for the engines.



VOLVOX TERRANOVA MODIFICATIONS COMPLETE

Bakker Sliedrecht has completed the electrical restoration of trailing suction hopper dredger *Volvox Terranova*

While working on a project in Indonesia, Volvox Terranova was heavily damaged by an old sea mine. Van Oord decided to repair and modernise its vessel at the same time, contracting Bakker Sliedrecht to modify the suction tube configuration and restore the electrical installations.

To increase production, the configuration of the suction tube was changed. The two submersible motors in the suction tube were replaced by one motor that is more powerful. Also, two transformers were placed to work with the new submersible motor. In addition, a new electrical drive system was installed that powers both the jet pump as the dredging pump.

As the blast wave of the sea mine was very powerful, damage was caused throughout the ship. Therefore, Bakker Sliedrecht inspected the entire electrical system from power generation to power distribution. All damaged components were repaired to restore this system. A whole new main switchboard was assembled in the workshop of Bakker Sliedrecht and installed on board the ship. The cable ducts and cabling were also renewed.

The PLC Scada system was renewed to offer the dredging operators a clear visualization that allows them to monitor the dredging process efficiently. The existing BIMAC vessel management system was also upgraded with new software. Furthermore, I/O points were updated by removing old points and adding new ones.

All works were completed on time with reinstatement of the dredger completed in December, well ahead of her first assignment.

Frank Verwaard, Project Manager at Van Oord, said: “Van Oord decided to take the lead in the project from start to finish instead of engaging a third party, for example a shipyard or newbuilding yard, to renovate the Volvox Terranova.”

MANOEUVRING

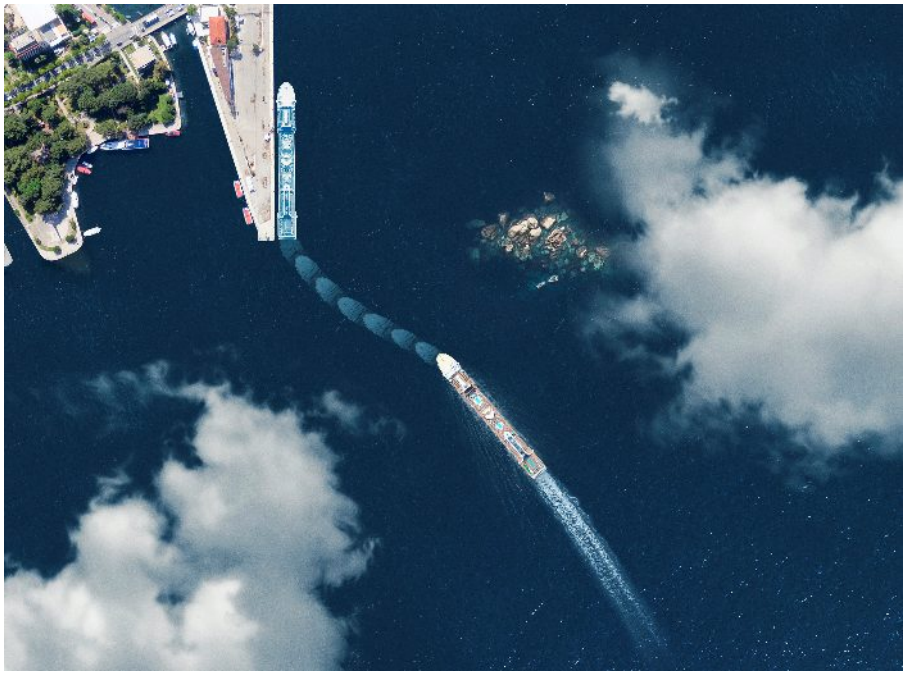
WARTSILA PREDICTS A SMART WAY TO MANOEUVRE

Wärtsilä launches SmartPredict last week at the Seatrade Cruise Global exhibition in Fort Lauderdale, Florida.

Developed by the company’s Dynamic Positioning unit, SmartPredict is designed to provide safer and more efficient vessel operations by reducing the risks associated with manoeuvring.

The system displays the vessel’s predicted future position and heading, and uses proven dynamic positioning (DP) analysis algorithms to evaluate forces affecting the vessel, thereby providing advanced motion prediction. SmartPredict also features a configurable prediction time display.

Most conventional prediction systems can utilise only basic input parameters, and thus offer limited usability. Wärtsilä's SmartPredict software module, however, utilises all the parameters used for automated control by the DP and adjusts them for the motion characteristics of the specific vessel. Such inputs include the vessel's current position and heading, as well as its velocity and rate of turn and all associated accelerations. Also taken into consideration are the manual commands from the coordinated control joystick, and environmental input from the onboard wind sensor(s). These factors are all continuously evaluated to provide a constant updating of the vessel's path.



"Allowing the operator to see into the future enables smarter and safer ship handling decisions to be made, thus lowering the risk of accidents occurring. We see SmartPredict as being an important step towards more automated procedures, such as docking, and eventually fully autonomous vessel manoeuvring," said Maik Stoevhase, Director, ANC & Integrated Systems, Electrical & Automation, Wärtsilä Marine Solutions.

The Wärtsilä user interfaces provide a simple, intuitive display, allowing the operator to toggle on or off the 'ghost ship' indicators for the predicted positions. This display also allows the user to configure the time steps for the predictions. Fully compatible with the Electronic Chart Display & Information System (ECDIS) overlay function, SmartPredict provides clear indications of potential dangers during ship manoeuvring, thus immediately increasing the safety and efficiency of operations.

MOORING

MOORMASTER OPERATIONAL AT NEW HELSINKI TERMINAL

A MoorMaster automated mooring system is now operational at the Port of Helsinki's West Terminal 2 passenger ferry terminal.

The MoorMaster MM400E15 machines at the LJF berth will moor the 212m *Tallink Megastar* and the *Tallink Star* passenger ferries three times a day each. Mooring of these vessels takes a matter of seconds compared to conventional mooring that would take substantially longer. The introduction of the technology also removes hazardous mooring lines from the mooring process.

The development of West Terminal 2 included the construction of a new berths and a terminal building, passenger bridges and access roads; and is the largest single investment project undertaken by the Port in the past 10 years.

MoorMaster is a vacuum-based automated mooring technology that eliminates the need for conventional mooring lines. Remote-controlled vacuum pads recessed in, or mounted on the quayside or pontoons, moor and release vessels in seconds. MoorMaster units have completed an estimated 260,000 mooring operations at ferry, bulk and container handling, and lock applications worldwide. Click on the images and films below to see the system in action.

SHIP DESIGN

ABS GRANTS AIP FOR LNG DUAL-FUEL BULKER DESIGN

Classification society ABS has granted Approval in Principle (AIP) for the Seatransporter-DF, a dual-fuel design concept developed by Nassau-based Algoship Designers. The design has the capability to accommodate multiple engine types as well as Type-C or membrane containment systems for LNG fuel.

"Technically innovative designs that advance the use of LNG as fuel will play an increasingly important role in the marine sector, and ABS is working alongside industry to enable this critical technological advancement," said ABS Executive VP for Global Marine Dr. Kirsi Tikka. "As industry considers future fuel strategies, design concepts that promote the use of LNG as fuel will play an increasingly important role in that mix."

As the marine industry continues to adjust to comply with more stringent air emission requirements, the use of LNG as a fuel will be adopted in more subsectors in the marine industry. Developed to help meet the current and upcoming international air emission standards, the Seatransporter-DF design can be used in Emission Control Areas (ECAs).

Algoship worked with CleanShips LLC of Stamford, CT, to develop a version of the bulk carrier design that would meet specific operational requirements without compromising cargo carrying capacity. The 38,000dwt version is equipped with a 2,400m^3 LNG fuel containment system that could allow for approximately 100 days' endurance. Algoship is applying the same design philosophy to Panamax, Ultramax and Kamsarmax sized carriers and has determined that the dual fuel technology is also applicable to other vessel types.

"ABS contributed to this effort as a trusted advisor, engaging early in the process to apply its rigorous engineering and safety standards and verify the feasibility of the design," said Algoship Designers Ltd President Antony Prince. "By working with ABS through its AIP process, we've been able to demonstrate that the Seatransporter was developed with a focus on safety and reliability and will be able to satisfy flag and port state requirements."

NEWBUILDS & DELIVERIES

WORLD'S LARGEST BOX SHIP NAMED

Samsung Heavy Industries has christened the world's largest containership *MOL Triumph*.

The first of four 20,150 TEU leviathans for Japan's MOL was named at SHI's Geoje shipyard in South Korea.

With length of 400m, a 58.8m beam and 32.8m draught, the eco-friendly *MOL Triumph* features an SHI-designed energy-saving propeller and rudder.

MOL Triumph will be delivered later this month after finishing preparations for her maiden voyage.

VAN OORD ORDERS FIRST LNG-POWERED CRANE VESSEL

Van Oord has ordered the construction of a new crane vessel. This vessel, which will be named *Werkendam*, will be Van Oord's first LNG-powered vessel. It will generally be deployed to Netherlands-based projects executed by subsidiary Paans Van Oord.

Werkendam is being built by Neptune in Hardinxveld-Giessendam, the Netherlands. It will take about twelve months to build and will be able to run on LNG, with gas oil as backup. With a 38m^3 fuel tank on the aft deck, *Werkendam* will be able to store enough LNG onboard to sail and operate for fourteen days without bunkering.

According to Van Oord, the vessel will use less fuel and emit less CO_2 without compromising operational production. The vessel will be equipped with various sensors and energy storage systems to monitor fuel consumption of almost all the equipment and systems onboard, which will make it possible to store and reuse overcapacity, for example when operating the crane.

The data produced by these monitoring systems will provide crew members with an insight into energy consumption, enabling them to respond appropriately.

DAMEN ASD 2913 TUGS FOR NEW PANAMA CANAL LOCKS

Meyer's Group has ordered two powerful Damen ASD 2913 Tugs to operate in the newly expanded Panama Canal.

At an official signing ceremony at the Panama Maritime XIII World Conference, Michel Mittelmeyer, Chief Executive Officer said the Meyer's Group was awarded a contract last year to offer towage support in the new Panama Canal locks. These new tugs fulfil the requirements of the Panama Canal Authority as more powerful vessels, of at least 80t bollard pull, are needed given the ever-increasing size of vessels.

These two additions will give the company an 11-strong fleet, and six of these are Damen vessels.

Commenting on why the Panamanian company decided to place a fresh order with the Dutch shipyard group, Mittelmeyer said: "We have known Damen Shipyards Group for many years now, and respect the quality of its vessel construction and this is coupled with very good service support."

In 2012, the Meyer's Group bought two Damen ASD 2810 Tugs and an ASD 3212. But before this, the company had also chartered many Damen vessels.

The latest two additions - *Arcangel San Rafael* and *Arcangel San Gabriel* - will join the fleet in May and August and operate in Puerto Limon, Costa Rica.

SPLIETHOFF ORDERS SIX NEW-GENERATION MPVS

Amsterdam-based shipping company Spliethoff has placed an order for six 165m multipurpose vessels with China's Zhejiang Ouhua Shipbuilding.

The new R-Class, Polar Code-compliant vessels will be optimised for fuel efficiency and equipped with scrubbers to reduce their environmental footprint as much as possible.

With a hold length of over 100m and heavy lift capability, the vessels are will can operate in the specialised breakbulk market with heavy and outsized cargoes.

The first vessel of the series, *Raamgracht*, is scheduled for a January 2019 delivery, followed, in regular intervals of two months, by five sisters*: Realengracht, Reguliersgracht, Rijpgracht, Ringgracht* and *Rozengracht*.

NCL PRESENTS THE LEONARDO-CLASS

Norwegian Cruise Line has presented the first images of its new Project Leonardo-Class ships. Four of the vessels have been ordered from Fincantieri for delivery in 2022.

"We are looking forward to this exciting new generation of ships. The new, breathtaking design will offer our guests a flexible on-board experience with an incredible array of offerings and further integrates inside and outside spaces, so they feel more connected with the sea", said Christian Böll, Managing Director Europe, Middle East and Africa Norwegian Cruise Line.

The four 140,000gt ships will build upon the highly successful Breakaway-Plus Class ships. A priority of the prototype design is energy efficiency, with the aim of optimising fuel consumption and reducing the impact on the environment.

FEATURE ARTICLE

KEEPING DRY WHEN THE OUTLOOK IS WET

Dave Bleyenberg explains how Hydrex Underwater Technologies' next generation Mobdock and cofferdam designs are changing the way in which thrusters are removed and repaired.

The introduction of advanced underwater repair techniques and equipment now means that entire thruster units can be removed, overhauled or propeller blades and seals replaced or repaired while the vessel remains afloat, minimising the impact on operational schedules and budgets.

One company that established itself as the leading provider of in-water hull and machinery repairs is Hydrex Underwater Technologies, which last year unveiled its next generation flexible Mobdock system to meet the demands of shipowners looking to reduce time spent drydock.

"Our lightweight Mobdocks can be transported to any location around the world, to facilitate thruster repairs during a vessel's port stay," said Dave Bleyenberg, Hydrex Production Executive.

"The size of the thruster unit doesn't matter or the type of ship, since the Mobdock design can be tailored to meet the requirements of each specific project. Although bow thrusters can be removed quickly and 'in the wet', reinstallation does need to be done in a dry environment because the blades need to be replaced without water ingress."

Bleyenberg said that in the past thruster overhauls were planned to coincide with a scheduled drydocking, resulting in extended off-hire time and drydock fees as the vessel would invariably wait for the overhauled thruster to return for reinstallation.

"We can reduce these costs by simply removing the unit while the ship is afloat and have it overhauled by the Original Equipment Manufacturer (OEM) so it is ready when the vessel enters drydock. This really speeds up the repair process. We can also reverse the procedure so that if a thruster is removed in drydock, we can reinstall it under water in dry conditions at a later date. In this way, the ship can already leave drydock while the unit is still with the manufacturer."

Recently, Hydrex diver/technicians removed the bow thruster of a large offshore supply vessel and reinstalled the unit after it was overhauled. By carrying out both parts of the operation underwater while the vessel was at anchorage in Dampier, Australia, the ship could stay on project as there was no need to enter drydock.

"After the bow thruster was removed it was overhauled locally by the OEM. The Hydrex team remained on stand-by so that it could start the dry reinstallation when the bow thruster arrived back on location," recalls Bleyenberg.

Hydrex has carried out several operations in Australia, all of which were done with a limited window of opportunity available.

"Flexibility is a key element of every job," said Bleyenberg, highlighting a project in Coatzacoalcos, Mexico, that underscores the point.

"Last year we performed underwater thruster repairs on two vessels for the same owner simultaneously. Repairs were carried out on both azimuth thrusters of an FPSO while the thruster seals of a heavy load carrier were replaced, helping to expedite the repair and keep costs to a minimum."

"The stern thruster tunnel of the heavy load carrier was sealed off with Mobdocks. Water was then emptied from the thruster tunnel, creating a dry workspace around the unit to carry out a full inspection. Four blade and three shaft seals needed replacing."

A special cofferdam, meanwhile, was designed to repair the oil distribution box on the FPSO's thruster unit. This enabled the team to carry out the repair without removing the thruster. The vessel's other azimuth thruster had more serious problems and a complete removal was required but as the thruster was not designed to be removed underwater, Hydrex created a bespoke procedure to remove the unit.

Further examples of thruster operations carried out by Hydrex are the open top cofferdam repair of the bow thruster of a 162m pipe layer berthed alongside in Mobile, Alabama and the flexible Mobdock repair of the thrusters of a pair of 360m containership sisters in Rotterdam.

The underwater repair solutions Hydrex has developed since its first prefabricated cofferdam, in 1979, have changed the way in which shipowners carry out repairs to machinery and hulls below the water line.

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