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Busy in troubled waters

The countdown is on: Maritime players around the world are looking expectantly to Hamburg, where the 27th SMM (shipbuilding, machinery and marine technology), the leading international maritime trade fair, will open its doors from September 6th to 9th. Every two years SMM is a key barometer of the mood in the industry. This year’s edition comes as the market situation is more demanding than ever. Shipyards worldwide are registering historically few orders and shipping companies continue to face low and often insufficient freight and charter rates on top of tightening environmental regulations. Developments over the next few months will likely pose immense challenges for nearly all maritime sectors, so anticipation of this year’s SMM is high for those interested in learning how the industry is reacting to these difficult times.

The level of interest is cause for some optimism. SMM 2016, like its predecessors, has been booked solid for months and will be bigger than the one before. More than 2,100 exhibitors from 67 countries have signed up for the fair, according to the organiser. SMM’s unbroken attraction impressively demonstrates that maritime companies worldwide are well aware of the importance of networking, knowledge transfer and aggressive marketing to gain ± or simply hold ± ground against strong competition.

Starting on page 48 we take a closer look at this outstanding event. Our SMM preview presents exhibitors of innovative products for the maritime industry, and two trends stand out. Besides their growing use of “green” technologies, many companies are also going digital. The Internet of Things, “big data,” digital twins and cyber security are becoming increasingly prevalent in the maritime industry. It’s no surprise, then, that the latest developments in digitalisation and green ship technologies are focal points of the fair ± and of this issue of Ship&Offshore.

The potential of real-time connectivity, voyage performance monitoring and online maintenance management as game changers for more cost-effective ship operation is discussed in the article on page 10.

Our Shipbuilding & Equipment section continues with several articles under the heading of Green Ship Technology ± from turbocharger retrofits (page 20) and controllable pitch propellers using a water-based hydraulic system instead of oil (page 32) to stricter rules for sewage treatment plants (page 36), an electronic system that lowers lube oil consumption (page 38) and a tractor tug that meets Tier IV emissions standards (page 39).

Opening our Ship Operation section is also a piece on green shipping. It explains how the acquisition and integration of meaningful performance data on board can help to substantially reduce a ship’s ecological footprint along with fuel costs. See page 136.

Another international trade fair in Hamburg this autumn will draw the shipbuilding and offshore industries’ attention to the port city: Following its successful debut in 2014, WindEnergy Hamburg, a new global forum for the wind industry, will be held for the second time ± shortly after SMM.

More than 1,200 exhibitors from over 30 countries will be presenting their latest products and services for the on- and offshore markets. A brief overview can be found on page 100.

Further articles in our Offshore & Marine Technology section are devoted to the growing offshore wind energy market. One of them, on page 102, discusses the challenges of existing position-reference systems for offshore service vessels operating in wind farms and the potential of a new type of sensor to optimise local positioning for this special application.

The article on page 108 points out how a new spar-type floating substructure made of concrete could facilitate the trend of offshore wind farms being built in ever-deeper waters while providing a cost-effective and robust alternative to steel.

We also put a spotlight on Iran for the very first time in this issue. Following the lifting of trade sanctions in January 2016, market observers see it as one of the most exciting maritime and offshore growth prospects in the years ahead. Turn to page 96.
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Float-out of Genting Dream

Meyer Werft shipyard has floated out the 151,300gt cruise ship Genting Dream from its covered building dock in Papenburg. Over the last few weeks the shipyard has conducted extensive tests, interior work and machinery trials on the vessel, built for Dream Cruises. The first-ever Asia-based premium cruise line brand, Dream Cruises was recently launched by cruise and resort operator Genting Hong Kong, part of Malaysia’s Genting Group. Following the float-out and further tests in the harbour, the Genting Dream will be berthed alongside the yard’s outfitting pier, according to Meyer Werft. The ship’s conveyance down the Ems River to the North Sea is scheduled for mid-September.

The first turbine at the Sandbank offshore wind farm was recently erected

Sandbank | The Sweden-based energy company Vattenfall and Stadtwerke München (SWM) say they have now erected the first wind turbine at the Sandbank offshore wind farm in the North Sea. Sandbank is being built 90km west of the island of Sylt and will include a total of 72 Siemens wind turbines of the SWT-4.0-130 type. Erection of the towers on the foundations and installation of the nacelles and rotor blades will be carried out by the installation vessel MPI Adventure. Sandbank is expected to go into full operation at the beginning of 2017. The wind farm will generate, in continuous operation, an annual amount of electricity corresponding to the consumption of 400,000 German households.

Damen’s decommissioning vessel will specialise in topside decommissioning, offshore platform removal, and subsea cleaning and removal

Vessel for decommissioning market

New series | Damen Shipyards Group has announced its latest concept design: the Damen Decommissioning Series. The vessel will specialise in three core areas of the oil and gas decommissioning sector: topside decommissioning, offshore platform removal, and subsea cleaning and removal. The design is based on in-house research carried out by one of Damen’s undergraduate interns. The vessel has a monohull design and split stern, a characteristic that will come into play during platform removal operations. According to preliminary estimates, the vessel will be able to decommission fixed platforms weighing up to 1,600 tonnes, i.e., over half of the fixed platforms located in the North Sea. To give maximum flexibility to clients, the concept design includes modular add-ons in the event the vessel would be active solely in the decommissioning market. The add-ons to the existing design include the installation of a crane or a helideck. Functionality can be further boosted with the addition of accommodation modules to increase personnel capacity.

Another option will be the addition of a temporary platform to create a solid stern. The subsequent increase in deck capacity could be used for transporting and installing monopiles and foundations for the offshore wind industry, Damen says.

New CEO at L’Orange

RRPS | Stuttgart-based L’Orange GmbH has announced that Erik Manning will be taking over as CEO of the Rolls-Royce Power Systems (RRPS) subsidiary effective September 1st 2016. He succeeds Dr Ralph-Michael Schmidt, who will be retiring. Schmidt was employed at L’Orange for over eleven years. With Erik Manning, yet another industry expert will be taking over the helm, L’Orange says. He has many years of experience in the mechanical engineering sector and has worked in various positions at Germany’s RRPS for more than 25 years. Most recently, he served as vice president of purchasing and programme manager of group-wide projects for the company.
BMT Nigel Gee secures LNG ferries contract

Rederij Doeksen | BMT Nigel Gee (BMT), an independent British naval architecture and marine engineering design consultancy, has announced a new project to design two 70m aluminium-hull catamaran RoPax ferries for the Dutch shipping company Rederij Doeksen. BMT will be responsible for concept through to production design.

Both vessels, which will be built by the Triyard Holdings subsidiary Strategic Marine in Vung Tau, Vietnam, will serve the Friesland Islands connecting Harlingen, Terschelling and Vlieland in the Netherlands, and enter service in April 2018. The vessels are single-fuel LNG, with both main engines and generators running off the LNG supply. They will have significantly lower emissions than conventional steel and diesel-powered vessels, with at least a 30% reduction in CO₂ and 100% reduction in NOX and SOX, according to BMT.

At 70m long with a 17m beam, the vessels will also have a very low operating draught of 2.5m to facilitate operating in the Waddensea.

Keel-laying of first 25m pilot vessel for Houston

Abeking & Rasmussen | The German shipyard Abeking & Rasmussen has laid the keel of the first of two SWATH@A&R pilot vessels to be used in the US port of Houston in Texas. Each vessel is 25.6m long and 13m wide. They will achieve a speed of 19.5 knots. The SWATH (small-waterplane area twin hull) vessels can accommodate up to twelve pilots and a crew of four. Both new-buildings will be completed by the end of 2017.

The four main engines include two dual-fuel (CNG + diesel) generator sets that provide 2 MW each at 1,000 rpm and two diesel generator sets that provide 2 MW each at 750 rpm. The ferry will generally sail using its dual-fuel engines every hour between 6am and 10pm. Texelstroom will use only one dual-fuel generating set during most of the approximately 20-minute crossing. A 700m² solar photovoltaic panel field on the ferry's roof generates energy that is stored in electric batteries.

Image of the new RoPax ferry

Hybrid RoPax ferry is delivered

Texelstroom | One of the world’s first hybrid RoPax ferries, Texelstroom, has been delivered to Koninklijke NV Texels Eigen Stoomboot Onderneming (Royal TESO) in the Netherlands. Built by the Spanish shipyard La Naval, the 135.40m-long, symmetrical ferry is powered by medium-speed dual-fuel engines from Belgium’s Anglo Belgian Corporation (ABC). Texelstroom will ferry up to 1,750 passengers and 350 vehicles between the Dutch port of Den Helder and the Dutch Wadden Sea island of Texel.

IN BRIEF

Order | Singapore yard Keppel Offshore & Marine says its subsidiary Keppel Singmarine has won contracts from Jan De Nul Group of Belgium to build three trailing suction hopper dredgers (TSHDs). The order is worth about USD 73.5 million in total. The first two dredgers are expected to be completed in the second half of 2018.

Opening | ABB is opening a new Integrated Operations Center in Singapore, the third facility of its type, which will allow the company’s expert engineers to work round the clock worldwide. Typically, ABB noted, at the end of the working day, the Singapore centre will hand over to colleagues in Norway and Finland, and this process will continue across the globe when a new Integrated Operations Center is opened in the US later this year.

Return | The classification society ClassNK has resumed operations in Iran with the reopening of its Tehran office and agreements with the Iranian Classification Society (ICS) and Ports and Maritime Organisation (PMO), Ministry of Roads & Urban Development of Iran.

Expansion | Holland Shipyards Group has acquired Teus Viet Dredging, a member of the Teus Viet Group. With this expansion, Holland Shipyards Group further increases its scope of products and services in the dredging sector.

New branch office | Lukoil Marine Lubricants has opened a branch office in Hong Kong.

Cooperation agreement | Hug Engineering AG of Switzerland, and Nießing Anlagenbau GmbH in Borken-Marbeck, Germany, have concluded an agreement on co-development and marketing of integrated soundproofing and exhaust gas purification systems.

Acquisition | Unique Group, a leading integrated subsea and offshore solution provider, through its subsidiary Unique Maritime Group (SEA) PTE Ltd, has completed the acquisition of Oceanvision PTE Ltd and Oceanvision Equipment Services PTE Ltd. Oceanvision will now be part of the Unique Group of Companies.

At the ceremony: representatives of the yard, owner and classification company

Texelstroom is one of the world’s first hybrid RoPax ferries | Photo: LaNaval
Contract for polar cruise vessels

Hurtigruten | Rolls-Royce has signed a contract worth about GBP 25 million with the Norwegian shipbuilder Kleven for delivery of ship design and equipment to two new polar cruise vessels, with an option for two more. The ships were ordered from Kleven by the Norwegian expedition cruise operator Hurtigruten. In addition to the ship design with a wave-piercing bow, Rolls-Royce says it will supply an integrated package of technology and equipment. Among the deliveries will be the Rolls-Royce Unified Bridge, which represents a complete redesign of the ship bridge environment. Consoles, levers and software interfaces will have a common look and feel, resulting in a more comfortable, clutter-free and ultimately safer and more efficient working environment for the captain and his team on the bridge, according to the British company. Hurtigruten, which means “fast route” in Norwegian, has been transporting goods, local passengers and tourists along the Norwegian coast since 1893, with 34 port calls between the cities of Bergen and Kirkenes daily, all year round.

Order for multi-purpose self-elevating platform vessel

Gusto MSC | The Japanese shipyard Japan Marine United has an order to build a self-elevating, platform-type multipurpose hoist vessel for wind farm installations. It will be the first of its kind to be built in Japan. The order is worth about USD 115 million. Equipped with a giant, fully revolving crane with a maximum lifting capacity of 800 tonnes, the platform vessel is designed to perform installation of large-scale marine structures offshore, e.g., 5-6 MW wind turbines and foundations. It is to be delivered in September 2018. The customer is the Japanese company Pent-Ocean Construction. The vessel will be built to a Gusto MSC design.

B+V to open refit facility in France

Mega-yachts | Blohm+Voss (B+V) has announced winning a tender for the set-up of a new maintenance and refit facility for mega-yachts in La Ciotat, in the south of France. The German shipbuilder will partner with La Ciotat Shipyards, which is providing a large dry dock and neighbouring workshop embedded within the existing shipyard. Blohm+Voss said it would use the new facility in the heart of the Mediterranean to maintain and service mega-yachts over 80m in length. Operation is planned to start in November.

Joint venture company

Coatings | Nippon Paint Marine Coatings Co Ltd of Kobe, Japan, and Wilckens Farben GmbH of Glückstadt, Germany, have announced the formation of Nippon Paint Marine (Europe) GmbH. The company will be based in Glückstadt/Elbe, near Hamburg. It will be responsible for all of Nippon Paint marine sales activity in Europe and Turkey. With about 35 experienced marine coating sales professionals based all over the continent as well as a dedicated team of coating advisors, the new company will ensure the continuity of both companies’ track record of success, technical innovation and service.
Transferring personnel offshore safely

New guidelines | A new guidance document has been published by the Marine Transfer Forum, an independent body established to focus on the transfer of personnel to and from offshore installations by marine methods. Titled "Offshore Personnel Transfer by Crane ± Best Practice Guidelines for Routine and Emergency Operations," it aims to support an international market that performs over 5 million passenger transfers every year. Developed by Aberdeen-based EnerMech, the classification society DNV GL, England’s Reflex Marine and Seacor Marine in Dubai, the guidelines draw on a broad range of expertise on safe and efficient marine transfer operations. The International Marine Contractors Association (IMCA), Institute of Occupational Safety and Health (IOSH) and the Netherlands’ Damen Shipyards also made key contributions, ensuring that the guidelines reflect best practice and are relevant to the growing marine renewable energy sector as well as traditional offshore sectors.

Finnish companies sign up with MV Werften for mega passenger ship

Global-Class | Finland’s Elo-omatic and Deltamarin have signed a large-scale engineering contract with MV Werften in Germany for the design of a Global-class mega passenger ship. The 200,001gt vessel for Star Cruises will be the largest passenger ship ever built in Germany and one of the largest ever built worldwide. It will be over 340m long and 45m wide. The ship order is an important boost for the entire European high-end shipbuilding industry, the companies note.

The new guidelines will help make offshore passenger transfers safer

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“Smart” shipping set to transform global supply chain

The master of the 19,600-TEU container ship was pleased with the progress of the voyage from Asia so far. His ship was about to pass the Strait of Gibraltar en route from Shanghai to the Container Terminal Burchardkai in the port of Hamburg.

He was expecting to be buzzed any time now by vessel controllers in Hamburg, whose responsibility it is to make sure that the arrival and departure of some of the world’s largest container vessels, as well as cruise ships and bulk carriers, are coordinated effectively. His ship, his experience told him, would now be permanently tracked as it proceeded across the Bay of Biscay and up the English Channel.

From previous voyages the master knew he would probably be asked to speed up or slow down as his ship made headway northwards. This would be to make sure that potential timing conflicts identified by Nautical Terminal Coordination (NTC) personnel in Hamburg couldn’t cause disruption as his vessel arrived in the estuary and made its way up the Elbe River.

The NTC was established by Hamburger Hafen und Logistik AG (HHLA) and Eurogate in October 2014. Today, its staff work around the clock to ensure the smooth operation of terminals within the port and to oversee cross-terminal coordination of the pre-arrival planning, arrival and departure of mega-ships. Early customers included the four container terminals in Hamburg and Hansaport, Unikai and, more recently, shipyard Blohm+Voss.

The Hamburg initiative isn’t unique. Other busy ports, including Singapore’s, operate similar systems. Martin Stopford, president of London-based Clarkson Research Services, believes that such arrangements will soon become standard in most ports and terminals, especially those managing container ships on tight schedules and large numbers of coastal vessels and ferries.

This, he says, is just one way in which “smart shipping” can make maritime transport more efficient. The world economy needs better sea transport, he told delegates at a Connecticut Maritime Association press conference earlier this year.
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and today’s sea transport model is unlikely to provide it. When shipping goes digital, Stopford says it will be as fundamental as the move from sail to steam.

Maritime digitalisation gathering pace

Until now, shipping has lagged behind other transport sectors. However, the process is now clearly under way and the pace of digitalisation is accelerating as more ships get connected. By 2020, the classification society DNV GL believes, most ships will be connected via satellite to shore-based offices, and for many there will be a constant flow of large volumes of data from ship to shore so that detailed analysis can assess ways in which improvements in ship operation can be identified and implemented.

Other transport sectors established reliable always-on connectivity some time ago. Rolls-Royce’s TotalCare programme is one of the best examples of how real-time connections can raise efficiency. Traditionally, airlines would buy engines, maintain them, buy spare parts from Rolls-Royce when needed and risk lost earnings and disruption to business if planes were late or couldn’t fly. They would pay a transaction fee to Rolls-Royce every time maintenance was required, covering spare parts and labour.

This was good for Rolls-Royce but bad for airlines. Any interruption to business meant lost revenue and disgruntled passengers. So the engine builder introduced ‘power-by-the-hour’ in what is known as an outcome-based business model. Through new agreements with airlines under its TotalCare programme, Rolls-Royce and its airline customers could meet their objectives at the same time.

The model is based on ‘continuous uptime’, a commitment by Rolls-Royce to keep aircraft flying without disruption. The company must do all it can to make sure engines keep running. Its revenue is therefore generated by meeting its customers’ aim of flying aircraft with as little downtime as possible.

Through the TotalCare programme, Rolls-Royce monitors thousands of aircraft engines round the clock and has the world’s largest database on aircraft engine performance. In fact, it knows far more about the engines than the airlines do themselves. And the company is now incorporating the ‘power-by-the-hour’ concept into its maritime product portfolio together with similar component-monitoring systems.

To be fair, there are some pretty sound reasons why shipping has been the last major transport sector to get connected. Flights are measured in hours; voyages in days, weeks or even months. It takes 42 days for a Valemax ore carrier to complete a voyage from Tubarão, Brazil, to Qingdao, China, for example. Some ships also sail through some of the most remote regions on the planet, until recently beyond the reach of satellites.

2016 a watershed year for smart shipping

However, rapid advances in satellite communications have transformed the picture. In fact, 2016 is likely to be marked as historic year in maritime satcom development because it paves the way for really smart shipping to transform business models in rather the same way as the Rolls-Royce TotalCare programme did in aviation.

Early in May, London-listed Inmarsat officially launched its Fleet Xpress (FX) service, which the company’s president,
Ronald Spithout, described as a paradigm moment in shipping and, quite literally, rocket science! FX operates over three, soon to be four, high-throughput satellites in Inmarsat’s recently launched I-5 constellation.

Combining high bandwidth available in the Ka-band frequency range with the lower throughput but ultra-reliable L-band, the FX service can reach virtually everywhere on the world’s seas and oceans, with the exception of small regions around each of the two poles. FX, Spithout said, is the only broadband satcom system available from a single operator that owns and controls its own high-bandwidth satellites. The two-waveband combination, he said, promises a new era for shipping to adopt new technologies and become more efficient.

One of the most innovative of FX features will enable third-party app providers to supply their own smart applications using the Inmarsat service. Apps are available either within an individual customer’s own service plan bandwidth or directly as a packaged product complete with bandwidth from app providers who have made their own individual arrangements with Inmarsat. The new service offers significant scope to improve the lives of seafarers through access to e-mail, social media, news, sport and films.

**Smart app potential**

For the first time, though, FX also enables the connectivity necessary for smart shipping to operate effectively. As well as providing robust communication links between ships and shoreside offices enabling real-time monitoring or frequent data feeds from shipboard sensors, FX also opens up a huge market for smart apps through which ship management at sea can be made more efficient.

Finland’s Eniram, for example, acquired by Wärtsilä at the end of June, is one of a number of third-party performance monitoring and optimisation specialists. The company has built a strong track record in the cruise sector with a variety of products based on real-time data. These include dynamic trim optimisation, engine and speed optimisation, and cargo management applications.

Of particular note is the company’s recent move into the real-time monitoring of boil-off on LNG carriers. On dual-fuel LNG carriers capable of burning gas, the boil-off can be used as fuel for the engine, but this isn’t possible for many vessels that can burn only conventional fuel.

An inability to handle boil-off effectively, therefore, can lead to losses running into hundreds of thousands of dollars on a single voyage. This, of course, has been a major concern among cargo traders who don’t know how much cargo ± and money ± they may have lost until the gas is discharged.

Knowing the rate of boil-off in real time is extremely helpful. Sensors monitor the boil-off on board ship and make the data immediately available to seafarers on board. With a short time lag of minutes, the data are also transmitted via satellite ashore.

As more data are gathered from more ships over time, a predictive tool could be developed with projections of likely boil-off rates for defined operating conditions, a certain cargo containment system, a particular route and a specific time of year. Some believe that this smart application could even lead to refinements in containment systems, including profile, material and insulation, to reduce sloshing and boil-off in future.

**More effective maintenance management**

New connectivity also opens up a range of opportunities for efficiency gains in maintenance management, which is likely to transform today’s survey-based maintenance regime. Classification societies are already addressing the issue, with DNV GL predicting that maritime VSAT network capacity could reach 220 Gbps by 2025. Digital models of ships and offshore assets and their systems are likely to be continuously updated and populated with data collected on board.

Vessel performance will be permanently monitored. Some ships may even be controlled remotely. The role of seafarers remaining on board will change, experts believe. They are more likely to be IT specialists and data analysts even if they also...
have a working knowledge of old-fashioned seamanship on deck and down below.

There will be real-time analytics for asset and integrity management. Christos Chryssakis, a DNV GL principal researcher, told journalists in London recently. There will be remote monitoring and control of propulsion and navigation systems, he said, and whole fleets will be managed from shore. There will be automated systems for cargo handling in ports and drones will be used as a new means of surveying ships.

Last December, drones were tested in surveys on board DNV GL-classed vessels at Remontowa Shipbuilding in Poland. Research is under way to design purpose-built mobile sensor platforms as they are known, specifically for the survey of ship structures. The specially adapted DNV GL drone, incorporating a powerful headlight, records a video of its journey around the ship, which can then be sent ashore for upload on the digital twin. Spatially aware cameras could also become a feature of these survey drones.

Varying levels of autonomy

Early in July, the classification society Lloyd’s Register (LR) launched a new system for categorising automation levels on board ships. Luis Benito, business development and innovation manager, described how the market is now demanding ships with varying levels of autonomy although, until recently, this had seemed unlikely. LR has set out guidance describing six autonomy levels (ALs) ranging from AL1 to AL6, a fully autonomous ship with no access required during a mission.

Today the market wants autonomous ships that can be operated with varying levels of control. So we have now described and delivered the levels required to make decisions enabling the design, construction and operation of autonomous ships, Benito said. Adding that the guidance had been peer-reviewed by leading technology companies, he said that the classification society believed that not only would cyber-enabled shipping be more cost-effective, it could also be safer.

OEMs – racing for a digital lead

Meanwhile, as the Internet of Things (IOT) continues to grow exponentially, original equipment manufacturers (OEMs) have launched their own real-time monitoring systems to track
component performance and identify exceptions that could indicate a requirement for service or replacement. Northern European automation, power and propulsion specialists are pioneering the drive towards digitalisation.

ABB, for example, has already opened three new integrated operations centres (IOCs) to track the performance of its components on board offshore and merchant vessels and provide permanent follow-the-sun support for its customers. So far, an offshore-oriented IOC has been established in Billingstad, Norway, while two IOCs ± one in Helsinki and another in Singapore ± are supporting companies in the maritime sector. A fourth IOC is likely to be commissioned in the balance of the year, probably in Houston or Miami, and the company is also considering setting up a fifth facility in China.

By the end of June, ABB was permanently monitoring about 600 ships, but it is aiming to increase the number to more than 3,000 by 2020. The IOCs on shore use what the company calls the IOT: service and people to integrate shipboard operations at sea with support services ashore.

Such integration, the company says, raises efficiency by improving energy usage and cutting emissions while simultaneously using condition-monitoring techniques to provide more effective maintenance management. The IOCs also help to prevent unexpected downtime as a result of poor component performance or breakdowns, thereby minimising delays and lost revenue.

Meanwhile, Wärtsilä Services, which provides life-cycle services for its customers, launched Wärtsilä Genius last November, a move to assist customers in optimising their operations and making the most of opportunities offered by digitalisation. Services offered by Wärtsilä Genius include a new offline vibration analysis service to track the performance of propulsion and other rotating equipment.

In addition, engine-efficiency monitoring is now available for dual-fuel engines, and the company’s condition-based maintenance service has been upgraded to allow follow-up of equipment condition on a daily basis as well as the existing monthly reporting. The company claims that additional insight on the condition of equipment will enable its engineers to offer expert recommendations on such issues as the optimisation of maintenance intervals.

Wärtsilä has already closed a number of deals with customers that incorporate aspects of its Genius programme. Last October, the company signed a ten-year maintenance agreement with semi-sub accommodation vessel operator Prosafe. The contract covers diesel engines on board Prosafe’s new flotel Safe Boreas, although similar agreements are being put in place as delivery of the Safe Eurus, Safe Notos and Safe Zephyrus take place during 2016.

In another deal, Wärtsilä will use dynamic maintenance planning to monitor and service a total of 30 dual-fuel engines on board six new LNG carriers for Bonny Gas Transport Limited, a subsidiary of Nigeria LNG. The Wärtsilä 50DF engines, five on board each vessel, will be continuously monitored to determine the actual maintenance required. As well as monitoring and servicing the engines, Wärtsilä will provide spare parts and support on inspections and service overhauls.
The next step in digitalisation

DIGITAL TWIN  The digital age is changing the economy. New ventures utilise the Internet of Things, “big data” and other technological advancements to rise to market leadership in ever shorter time frames. Digitalisation and Industry 4.0 – the fourth industrial revolution – are global trends that generate new products and services in ever-faster cycles, while asset-intensive industries such as the maritime and energy sectors exploit the opportunities offered by modern information technology. “Digital twin” technology, at present successfully utilised by large multinational companies, will move into the shipping industry in the foreseeable future. Maritime IT and communications correspondent Julie Ann Chan has explored its uses and spoken with the classification society DNV GL about its software platform COSMOS, which promises to make assets smarter, safer and greener.

3D modelling has long been used by engineers to create computerised images of existing industrial assets as well as ideas for new developments. So far, these models have relied on static data. Once created, they stay the same, whereas their physical counterpart is put to use and suffers wear and damage during its life cycle. Time and use continuously widen the gap between the asset and its digital model, decreasing the latter’s accuracy and value. However, precise information management plays a significant role during design, development and construction, but even more critically when an asset is put into the operational phase. The more that accurate knowledge is available, the better that decisions can be taken, often resulting in improved operational efficiency.

Where traditional models fail to reflect the current state of an asset, the digital twin as it is already utilised in other industries, promises to narrow the information gap and may eventually provide moment-to-moment insight into the physical object’s state and usage during and after its expected lifespan. The twin is a 3D model that is created and developed before the real object, and updated simultaneously with it. From the initial product design, through studies, testing and construction, the digital twin allows ideas to be developed, refined and validated before the object is actually manufactured. This virtual image serves designers, engineers, manufacturers and management as a tool whereby possibilities for execution can be exchanged and decided on. Once the object has been built, the digital twin provides insight into the real use of the asset and allows flexible customisation and dynamic optimisation of the design. In the same way, quality can be improved as modifications are tested.

Currently, the various stakeholders lose time, efficiency and sometimes even valuable data trying to make their information and input available to each other. With the digital twin, all data on the physical object are fed into a central cloud-based integrated data platform where information, concepts and analyses can be exchanged among specialised teams collaborating on designing, building and operating assets. It thus becomes a powerful tool for design, diagnostics and operational insight.

In its most advanced form, the digital twin is continuously fed with real-time information on the state or usage of the object, gathered by sensors deployed all over the physical asset. It therefore provides accurate and detailed data on characteristic parameters, such as energy consumption, error...
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Virtual models behave like their physical counterparts Image: General Electric

Virtual models behave like their physical counterparts Image: General Electric

Optimised operation, minimised downtime – a vision of the future?

What currently is still a vision of the future in shipping has already been put to use in other asset-intensive industries. General Electrics (GE), one of the pioneers in digital twin technology, is successfully utilising it in the aviation sector. A variety of sensors are deployed, for example, on the blades of aircraft engines. They measure everything from temperature and humidity to vibration, pressure, dust levels, and fuel consumption and quality, and feed the data into the model.

The digital twin already containing data on the physical design of a specific blade along with the actual operating conditions, operating environment, typical damage and points of failure as well as prior damage is kept up to date with the reality of the blade using the data from the sensors. This is where internet connectivity is crucial. An advanced information management system uses algorithms and big data analytics to translate the sensor readings, put them into context and extract relevant information so that decision-makers not in the vicinity of the asset understand what is actually happening.

On this basis GE can determine how the blade is performing, the cumulative level of damage to a particular blade, the best time to inspect or change it and what to expect upon inspection. The appropriate amount and type of spare parts can be arranged and the duration of maintenance predicted accurately. This enables the time and cost of the inspection to be optimised; downtime can be minimised as the operating time of the asset’s individual parts are maximised and the asset is operated with greater efficiency.

When the asset is operated more effectively, its environmental impact can be reduced and regulatory compliance infringements may be eliminated. A further advantage of the digital twin is that the value of an asset, its fitness for purpose and extension beyond design life can be more accurately determined. This may be important in mergers or when an asset changes ownership.

As with all technological advances, digital twin technology is conquering markets little by little. And although its comprehensive use is far from being realised, large companies such as US-based GE are placing tremendous importance on its development and roll-out. As it enters all sorts of markets, the possibilities of also using it in the shipping industry are being explored.

Digital twin in the maritime industry – a snapshot

Since digital twin technology is already more fully implemented in other industries, the shipping sector must overcome certain challenges in order to utilise it. While power plants such as gas turbines or wind farms are stationary, it is in the nature of vessels to move around, making continuous data transmission more difficult and costly. However, the aviation industry has shown that the difficulties can be overcome, and digital twin applications that monitor and analyse specific assets such as jet engines are of significant value. The shipping industry is beginning to develop its own solutions, implementing new technical developments to their advantage.

DNV GL is drawing on its experience with innovative solutions to bring the digital twin to shipping companies. Currently, not all possibilities of digital twin technology are being exploited. We at DNV GL, just as the rest of the industry, are working towards solutions that implement our vision in which the digital twin will accompany the physical object throughout its entire life cycle, from the beginning of the planning phase to the scrapyard, said Nikolaos Kakalis, manager of R&D and Maritime Advisory at DNV GL.

DNV GL has devised a computer platform called COSMOSS that generates digital twins for the entire machinery of a vessel and provides support to the shipowner, during both the building phase and ship operation. The solution depicts the behaviour of the vessel’s machinery and analyses phenomena such as thermodynamics, mechanics and electrical data. It also takes into account the operational profile of the vessel and optimises its use with respect to energy efficiency, emissions, cost and safety.

The digital twin is created long before its physical counterpart. During the first phase, ideas on the design of a new vessel are consolidated into a 3D CAD model. Not only the considerations of the shipowner and his engineers flow into the computer model, which is continuously updated and amended, but also the input of the shipyard. The digital model mirrors exactly what is going to be built at every stage of the planning phase, Kakalis explained. At this stage, the digital twin has a very important supporting function for the owner. It allows him to screen different building and design opportunities and to carry out optimisation processes on the physical asset before building commences.

Once the vessel is built, the digital model needs to be continuously fed with data in order to keep up with its physical counterpart state. DNV GL’s customers now use different methods of data collection. An advanced approach deploys sensors on the object, for example the machinery of the vessel, that meter everything from speed, fuel consumption, fuel quality and emissions to temperature, pressure and vibrations. In areas where the shipowner chooses not to equip his vessels with sensors, manual readings by a person in close proximity to the physical asset can serve as a substitute.
DNV GL's solution is flexible with regard to the data source. The technology is in its infancy and we have taken into account that not all shipowners will equip their vessels with sensors. We ask for the information that is relevant to study the operations of the vessel, including but not limited to operational efficiency, energy efficiency, fuel consumption, safety studies, reliability analyses, etc. How the shipowner chooses to collect and deliver the data is up to him, Kakalis said.

Whether the data are logged by sensors or by seafarers, Internet connectivity is required to transfer the information. Again, it depends on the individual shipping company how fast and how often these data are transmitted, which notably influences the accuracy of the digital twin. Manual readings that are sent out in the next harbour create an image of the asset's state that is already a few days or weeks old, while sensor-collected information that is fed into the digital twin in (near-) real time will provide a more accurate and up-to-date picture.

In the very near future we hope that sensors will be deployed widely and digital twin models updated more frequently and more timely, Kakalis said. What we see in other sectors is also possible in the shipping industry. DNV GL has also taken security aspects into account. Cyber security plays an important role, Kakalis noted. We understand that the information on the physical asset, whether read from sensors or manually, is very highly valued. The accuracy of this information is paramount if decisions are made based on it. At DNV GL we are taking steps to protect the shipowners' and our data from security risks.

DNV GL hopes that in the future the digital twin will consolidate all data sources into one seamless platform for collaboration across different departments and even stakeholders.

What to expect next

The digital twin as a continuously updating, dynamic, multidimensional data model of the physical asset is also expected to help shipping companies analyse and understand their asset's performance and turn this knowledge into better usage, more accurate maintenance and maximised operational efficiency in future. The digital twin has the potential to become the single source of all asset information, including up-to-date physical condition, operational state, production history, risk levels, remaining life estimate and structural reliability.

But new technology also comes with risks. To be useful, twin data need to be accurate; errors have to be minimised. In this respect, sensor technology isn't yet always reliable, said Dr Torsten Büssow, global head of Fleet Performance Management at DNV GL. Another concern, both of asset owners and technology providers, is cyber security, which is of tremendous importance when it comes to transmitting the collected data as well as the results of big data analytics. In order to protect sensitive production and operational data, comprehensive industrial security systems are critical. Effective solutions to protect data against security threats include the defence-in-depth concept, which encompasses structured security mechanisms ranging from passwords and firewalls to network intrusion detection systems and continuous security monitoring.

Technology keeps evolving, however. Improved and more reliable solutions are produced and brought onto the market in ever faster cycles. Companies, industries and whole nations are looking towards a digital future. Shipping companies striving to reduce costly operational issues and take full advantage of technological advances will explore the innovations that come with big-data technology and advanced analytics to reduce the operational risk of their assets.
The American cruise company Royal Caribbean Cruises Ltd (RCL) has contracted MAN PrimeServ to retrofit a total of 30 turbochargers on board four cruise liners. Two of the vessels are operated by Royal Caribbean International, the other two by Pullmantur Cruises, a wholly owned RCL subsidiary. The contract covers the upgrade itself, attachment kits and technical support. This upgrade is set to boost engine performance and extend engine life, making it an investment in sustainability, writes Denis Pissarski, business development manager at MAN PrimeServ in Augsburg, Germany.

Regardless of worldwide financial difficulties in the maritime market, the cruise industry is sailing ahead. The number of passengers is foreseen to increase from 23.2 million in 2015 to 24.2 million in 2016, resulting in an annual passenger compound growth rate of 6.55% from 1990 to 2016. A total of 27 ships are currently on order, including ocean- and rivergoing vessels. This clearly demonstrates a booming business. However, with this trend comes the responsibility to protect the environment, affecting shipbuilders, shipowners, manufacturers and passengers. To meet and even exceed environmental regulations set by the IMO as well as national and regional environmental bodies, it is necessary to invest in state-of-the-art technology. Additionally, a green image pays off in terms of passengers. Manufacturers need to continuously develop cleaner and more efficient propulsion systems, offering shipowners and shipbuilders the necessary equipment to achieve environmental standards. This modern equipment should only be limited to newbuild vessels, but also to existing ships. Thus, MAN Diesel & Turbo (MDT) service division MAN PrimeServ emphasises the development of retrofit solutions, enabling owners to upgrade their propulsion systems to the latest technology standards. One popular solution is to replace older-generation turbochargers with newer, more efficient ones.

**MAN PrimeServ retrofits turbochargers to latest generation**

RCL, with more than 3.7 million passengers the world’s second-biggest cruise company, chose MAN PrimeServ to retrofit the turbochargers aboard four cruise ships in its fleet. The contract covers the retrofit of a total of 30 turbochargers. The cruise ships Grandeur of the Seas and Enchantment of the Seas ± both equipped with four 12V48/60 MAN engines ± will each be retrofitted with eight TCA55 turbochargers, while the vessels Horizon and Zenith ± both equipped with two 9L40/S4B and five 6L40/S4B MAN engines ± will each be retrofitted with two NA40/S and five NA34/S turbochargers. The scope of supply covers the deliveries of turbochargers and accessories for installation, along with attachment kits to connect the turbochargers to the engines, technical advisory, thermodynamic matching and commissioning carried out by a MAN PrimeServ superintendent. The project is being handled by MAN PrimeServ Turbocharger headquarters...
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in Augsburg, in close collaboration with the local MAN PrimeServ team in Fort Lauderdale, Florida, and vessel crew as well as RCL maintenance team. A huge challenge for all involved is to retrofit the turbochargers during the regular sailing schedule. For RCL it meant having to keep state-rooms available for service engineers, resulting in less passenger disruption.

Each installation is scheduled to last approximately ten days per engine, requiring detailed planning especially in terms of logistics. The first installation took place aboard Enchantment of the Seas in December 2015. The genset-driven cruise ship, which sails between Miami, Florida, and Nassau, Bahamas, was built in 1997 and is equipped with four 12,600-kW 12V48/60 engines. The engines are directly connected to four 12,200-kW generators, supplying power for two electrical-driven propeller shafts. MAN PrimeServ’s team ± consisting of one superintendent from headquar ters and two service engineers from MAN PrimeServ in Fort Lauderdale ± attended the vessel to replace two NA40/S turbochargers with the more efficient TCA55 version on the first engine. Well-planned preparation was fundamental, as this was the pilot project and first engine to be retrofitted. The attachment kit had to be designed and produced and the newly delivered turbochargers needed to be dis-assembled for transportation reasons before loading on the ship. Specifically, the gas outlet and bearing casing were too big for the entrance, so they had to be taken apart ashore before loading. The overall delivery consisted of 18 boxes and pallets that had to be brought on board and stored. In general, a retrofit job is hardly daily, routine work as there is no plug and play solution for the conversion, said Mario Saller, superintendent at MAN PrimeServ in Augsburg and responsible for the first installation. Saller and his colleagues faced a tight deadline since the retrofitting had to be completed by Christmas 2015.

But even the best preparation doesn’t prevent unforeseen difficulties. We faced some challenges during installation due to unexpected design-related circumstances on board. A second big project on board ± the installation of an exhaust scrubber system ± required proper planning and communication with our customer regarding logistics and manpower, Saller said. Since every engine room or power plant is different, fitting a new turbocharger to an existing system varies. Especially the environmental circumstances and design of auxiliary and supporting systems for the engines can require modifications of one degree or another. Fundamental for successful completion in such a situation is close cooperation between RCL and MAN PrimeServ.

The general practice for such a job is to first dismantle and remove the old turbochargers, followed by the installation, mounting, commissioning and matching of the new turbochargers and their components, such as the charge air compressors, rotating elements and exhaust gas outlet compensators. The first installation was carried out successfully, though with a slight delay.

The next engine of the Enchantment of the Seas is

Enchantment of the Seas with retrofitted turbochargers

RCL crew attending second TCA training at the PrimeServ Academy in Fort Lauderdale
scheduled to be retrofitted in October 2016. Additionally, the Zenith’s first auxiliary engine will be retrofitted in August 2016, followed by its two main engines in September 2016. All other retrofits are scheduled for 2017.

Training at MAN PrimeServ Academy

It was agreed that the RCL crew would be trained at the MAN PrimeServ Academy in Fort Lauderdale to prepare them for operation and maintenance. The crew have already attended two TCA trainings, which were conducted solely for them. Further trainings will be held soon. Professional qualification by PrimeServ academies ensures both safe operation of the new turbocharger and high operation quality, resulting in reduced maintenance costs and downtime. MAN PrimeServ runs a network of 13 training academies worldwide, which generally serve three purposes:

➢ To train customer personnel in both operation and maintenance processes;
➢ To continuously develop MAN’s own employees to ensure they can provide the level of service that customers both expect and deserve;
➢ To promote the maritime industry to the next generation, working with schools, colleges and universities to create a sustainable industry.

The academies allow hands-on training on genuine equipment supported by simulators and auxiliary components to provide a comprehensive, practical experience.

Summary

Retrofitting a turbocharger is an effective way of extending an engine’s service life while also improving its performance, economy and environmental impact. Commercially, a retrofit may lead to fast spare parts delivery, less engine downtime and spare parts savings. From a technical point of view, a retrofit increases turbocharger efficiency, reduces exhaust gas temperatures and leads to increased air flow. Saller summarised the benefits for RCL: “The conversion of the turbochargers assures reliable spare parts availability and enhances the engine’s efficiency, leading to a reduction of fuel oil consumption.” The performance measurement of the Enchantment of the Seas revealed that the exhaust gas temperature decreased after the retrofit and that the charge air pressure followed test bed requirements.
Medium-speed engines for a variety of applications face several new challenges. Standards for reduced emissions along with requirements to simultaneously reduce fuel consumption further to comply with the Energy Efficiency Design Index (EEDI) CO₂ targets can only be met with advanced engine design concepts. From an economic point of view, newly developed engines need fuel flexibility to be more independent of varying fuel prices and the availability of various fuel types. This must not compromise engine reliability, maintenance requirements and, of course, production costs, however. Over the past decades, FEV has been involved in numerous large engine developments, including high-, medium-, and low-speed (two-stroke) engines. Based on this experience, FEV has developed a new medium-speed engine family (I6, I8, V12, V16, V20) covering a power range from 2 MW to 9.5 MW. A peak firing pressure capability of 250 bar and more than 70% commonality of parts among all engine variants are two major enablers of optimal ecological and economical ship operation.

The chosen bore-to-stroke ratio of about 1.25 in combination with a 45° cylinder bank angle for the V-type engines was found to offer the best balance for the anticipated power range, efficiency, compact engine package and weight as well as the wide variety of possible applications, including coastguard and fire-fighting ships, tugs, various commercial vessels, emergency generator sets, on- and offshore power plants and locomotives. A small engine width ± 45° bank angle ± is mandatory, especially for locomotive applications but also for parallel installation of several engines in one application. Developing the complete engine family simultaneously...
ensured the highest possible modularity. The engine family set-up for continuous operation in genset or main propulsion applications is equipped with a single-stage turbocharging system with the same turbochargers for the Inline 6 / V12 and Inline 8 / V16 engine versions. The inline engines are fitted with one turbocharger, while a two-turbocharger set-up was chosen for the V-engines. One common charge air cooler housing for all V-engines and one for the inline engine variants provides the turbocharger support. This complete charging system module can be installed either on the free-end or flywheel side, depending on the installation requirements. For highest power output and intermitted peak-power demands, sequential- and double-stage turbocharging systems have been configured to ensure high acceleration performance at low speed. The intake and exhaust manifolds are installed inside the V-engine and on one side for the inline engine, whereas the camshafts with valve train and fuel-injection equipment are installed outboard for the V-engines, and on the opposite side for the inline engines. This arrangement ensures the best possible accessibility for maintenance. The camshaft assembly consists of common cam segments for all engine variants and bearing journals with different bolt patterns in order to ensure the correct timing. Eccentric shafts, supporting the cam followers, offer variable valve timing for intake and exhaust valves. Variable intake valve timing for diesel/HFO and gas engines enables early inlet valve closure (Miller timing) for reduced NOx emissions at high-load operation and later intake valve closure for better performance at low-speed operation. Combined exhaust and intake-valve timing variability facilitates cam overlap reduction for dual-fuel engine variants in order to optimise gas admission to the cylinders. Hollow camshafts serve as the main oil gallery. This design solution avoids additional piping and increases torsional camshaft stiffness, which enables the installation of a conventional fuel-injection system especially for the dual-fuel engine variant. Additional
electronically controlled common rail injectors for small quantity pilot injections enable the ignition of the gas in gas-mode operation. The diesel and HFO engine variants are equipped with common rail fuel-injection systems.

One common front-end module for all V-engines and one for the inline engines house the torsional vibration damper, the pipeless oil pumps, the high- and low-temperature water pumps, the oil coolers and filters as well as the water and oil thermostats, and allow the installation of a support bearing in case of a 100% power take-off on the free end. The hydraulically pressed-on crankshaft drive flange is common for all cylinder variants and for rear- and front-end power take-off. The oil- and water-pump drive gears are identical for all engine variants (inline and V), and the high-pressure fuel pump drive is integrated in the camshaft gear train on the driving end of the crankcase. Due to the modular design, the inline engine gear train is realised as one-half of the corresponding V-engine gear drive.

The complete cylinder unit is common for all engine variants. The vermicular or nodular cast-iron cylinder head contains four valves, actuated via two pushrods and guided valve bridges. The gas engine variant with a spark-ignited pre-chamber combustion system uses the identical cylinder head design as the diesel/HFO engine. The cylinder head for the dual-fuel engine version only requires different machining for the additionally required pilot injector, whereas the casting can stay unchanged.

Using gas as fuel for marine engines is a step forward when it comes to achieving good fuel efficiency combined with low exhaust emissions. For the gas engine variants, the diesel fuel injector was replaced by a multi-component pre-chamber. The upper part of this pre-chamber assembly is equipped with a top-feed gas supply including a mechanical passive check valve and the spark plug. The pre-chamber itself is located in the lower part of the assembly. A novel 3D CFD simulation methodology – charge motion design (CMD) process – was applied, supported by experimental investigations on a single-cylinder engine, to optimise the pre-chamber layout. The final experimental results showed high combustion stability even at lean burn conditions and demonstrated that BMEP levels significantly above the state-of-the-art of more than 30 bar can be reached. Moreover, even with low-methane-number gas qualities, efficiencies above 45% were achieved while maintaining low hydrocarbon emissions and, above all, NOx emissions below TA-Luft (Germany’s Technical Instructions on Air Quality Control) limits.

A mid-stop cylinder liner concept ensures optimised cooling at top piston ring reversal, and the use of a carbon scraper ring enables long maintenance intervals. Due to separate liner housings for coolant supply to each cylinder, the complete crankcase can stay water-free, which avoids possible crankcase corrosion caused by bad coolant water treatment. The piston consists of a nodular cast-iron skirt and a bolted-on steel piston crown.

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The conventional connecting rod with inclined split line for the big end bearing cap enables a tighter engine package (width and height) compared with a marine type connecting rod design.

Intensive use of advanced simulation techniques (fatigue analyses, dynamic analyses of valve train, gear train and complete engine assembly, fluid flow analyses, gas exchange and combustion simulation, etc) as well as single-cylinder engine testing were enablers of a very efficient development process. A time schedule of about two years from project start to validation of the combustion development for three different applications and emission standards, mechanical cylinder unit validation by functional testing on the FEV single-cylinder engine and procurement as well as assembly of the first prototype engines (inline and V) sets a new benchmark.

The diesel/HFO engine family fulfills EU Stage IIIA, EPA Tier 3 emission standards for genset applications, IMO II for marine applications and EU Stage IIIA and EPA Tier 3 for locomotive applications with internal engine measures only and with very competitive fuel consumption of 183g/kWh for engines in this speed range. Depending on fuel availability and cost, meeting more stringent upcoming exhaust emission limits will be ensured with an additional SCR system for the diesel/HFO engine variants or by switching to dual-fuel or gas engine versions without any additional exhaust gas after-treatment systems.

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Maintenance of vessel generators to avoid major damage

SLOT WEDGES Over the past five years the German company Vogelsang+Abe (V+A) has seen an increase in contracts for ship engine repairs. Besides major damage such as short circuits requiring a complete rewinding of the stator winding, most of the problems are caused by loose or often missing stator winding slot wedges, writes Rüdiger Schulze, a sales and service engineer at V+A.

Two kinds of slot wedges are generally used: those made of a non-magnetic material (e.g., Isoval), typically found in smaller machines, or of a magnetic material (e.g., Magnoval), for larger machines.

The main function of the slot wedges is to secure the stator winding in the grooves of the lamination stack and limit movement of the winding in the groove as much as possible. In addition, the slot wedges protect the surface of the stator winding against environmental influences. Magnetic slot wedges also allow optimisation of the field distribution in the air gap between the stator and rotor as well as in the region of the lamination stack teeth.

During operation, the slot wedges are exposed to mechanical, thermal and magnetic forces that can cause them to loosen. The intense movement due to the operation of the magnetic field puts the greatest stress on the magnetic slot wedges. How extreme this force ultimately is depends, among other things, on how skillfully the slot wedges were manufactured and installed.

In most of the V+A cases from the shipping industry discussed here, the stator windings had simple, right-angled slot wedges that often showed poor bonding properties.

Locating the damage

The extent of the damage was ascertained by a visual inspection of the generator’s footer space. On the B-side, the covers on the exciter area were opened along with the access cover on the space heating. Considerable amounts of partly magnetic fibrous material were seen, particularly in the area of the space heating. This could clearly be associated with the slot wedges. A so-called knock test gives an exact picture of how many wedges are already loose. It requires pulling out the generator rotor, which generally is not part of a ship’s maintenance schedule. In most cases the appropriate attachment points are absent, the necessary materials and tools may not be available, or adequate space on board for the procedure may simply be lacking.

In addition, a partial discharge measurement can give information about the condition of the winding insulation.

Further recommended actions from the diagnosis are:

- On-site application of fresh resin to the loose slot wedges to temporarily ensure continued operation and stop progressive loosening of the slot wedges;
- Partial or complete replacement of the slot wedges on-site or in a qualified, specialised workshop.

In the V+A cases discussed here, a partial discharge measurement was carried out on all four generators, confirming the poor condition of the insulation and consequently making further inspection
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of the windings necessary. This yet again confirmed the poor wedging of the stator windings.

Adverse effects of loose slot wedges
Once a slot wedge has started to move, it’s just a matter of time before it partially or completely detaches itself from the groove. The loosened parts between the stator and rotor will wear down during operation.

Due to the tiny but constant movements, the lamination stack teeth will slowly wear down as well. This increasingly further loosens the slot wedges. Airflow will cause fine dust to spread throughout the whole generator. Contamination of the system generator with dust and fibrous material, especially between the winding and lamination stack, reinforces the stress on the winding insulation even further, constantly diminishing the insulation resistance.

Over time, the permanent stress due to mechanical vibration, electrical and magnetic field and temperature variations damage the winding insulation. This can lead to a failure in the stator winding and to major damage and operational failure of the system. The damage generally involves the complete stator winding, and at worst the lamination stack as well.

Repair options
If only the slot wedges are damaged or missing, the winding can be repaired by partially or completely replacing them. To do this, the generator rotor must be pulled out. In a partial repair, first the grooves with missing slot wedges are carefully examined for damage to the winding insulation. If there is damage, it must be decided whether it can be repaired, a partial replacement of the coil is possible, or a complete rewinding is required.

Onboard repairs are generally possible. It must be kept in mind, however, that a generator can’t be cleaned, dried and checked as effectively on board as in a qualified workshop.

It must also be carefully considered how much effort is necessary to dismantle the generator and bring it ashore. For smaller vessels in particular, this is usually only possible during a yard stay.

During removal of the slot wedges, a considerable amount of fine dust accumulates in all the small gaps, which can only be removed at great expense on board. Removal of the slot wedges is a task for qualified, experienced experts. There is always the risk of damage to the winding insulation, making rewinding urgently necessary. This risk is much greater when the work is done on board.

What’s more, a thorough electrical check, such as in a test bay, and a test run aren’t possible on board. So there are no, or very few, guarantees for the quality of repairs carried out on board.

Onboard repairs
Onboard repairs start with pulling out the rotor, followed by an examination and recording of the condition of the slot wedges. After that, the stator winding is superficially cleaned. If on-site conditions allow it and contamination isn’t too severe, then the stator winding is cleaned as thoroughly as possible. The slot wedges are removed ± either all of them or just the loose ones. Then measurements are taken, new slot wedges are prepared, and the grooves are checked for damage and cleaned. The exposed winding insulation is checked for damage. Finally, new wedges (impregnated with resin) are installed. After application of the

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insulating resin to the prepared wedges, drying takes about 24 to 48 hours, depending on conditions on board. Meanwhile, the rotor is checked, if possible, and the bearings are examined and, if needed, reconditioned. A test run follows reinstallation of the rotor. The onboard repairs take about five to six weeks.

**Workshop repairs**

When repairs are done in a qualified workshop, the generator ± depending on the type and the size of the ship ± is removed and transported to the workshop in its component parts or, as far as possible, intact. An electrical and visual diagnosis determines the extent of necessary repairs, followed by cleaning and drying the winding. After removal of the slot wedges ± either all of them or just the loose ones ± measurements are taken and new slot wedges prepared. The winding is then cleaned and dried. The exposed winding insulation is checked for damage to its layers. The workshop team installs the new wedges (impregnated with resin). A VPI (vacuum pressure impregnation) procedure is carried out to ensure that the resin reaches all areas of the lamination stack and winding. Hardening the winding by having it rotate in a circulating-air oven makes sure that the resin spreads evenly everywhere and won’t seep out of the stator winding.

After that, another electrical test of the winding is done. Parallel to the above-mentioned work, all add-on parts (bearings, cooler, terminal box, temperature sensors, etc.) are tested, examined and cleaned. If necessary, parts are reconditioned or replaced. All cabling is typically replaced.

Once these steps have been completed, come the reassembly and preparation for a test run in the test bay. The test run is logged and ± when necessary or desired ± class approval is provided in the test bay. After transport back to the vessel, the generator or its component parts are brought into the engine room, reinstalled and tested. The repairs take about six to seven weeks in all.

When a generator is dismantled on board, the following questions are important:

- Can it be dismantled in one piece (without taking out the rotor)?
- Does it fit through the engine room hatch in one piece or in its component parts?
- Are the junction boxes or entire top structure of the generator (e.g., cooler) built in or screwed in?

The obvious cause of the loose slot wedges in the latest generators repaired by V+A was insufficient bonding of the slot wedges to the lamination stack as well as V+A’s finding of a non-optimal choice of slot wedge geometry.

**Conclusion**

Generators should be regularly checked. Magnetic dust and fibrous material are a clear indication of slot wedge loosening. The easiest and least problematic onboard check in this regard is a regular visual inspection of the generator footer spaces. Ship personnel must be properly instructed on what to look for.

PD measurements go deeper and provide information on the condition of the insulation. Besides static measuring during idling, online measuring during operation is also possible. This is especially helpful when regular measurements are taken from the start so that a developing trend can be seen that quickly indicates any changes.

Despite the risks involved when removing slot wedges, new wedging is an inexpensive repair option for generators with damaged or loose slot wedges.

The age and the condition of the winding must also be taken into consideration. The expected lifespan of winding insulation under normal conditions is 25 to 30 years.

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Controllable pitch propeller with water-based hydraulic system

**ALTERNATIVE SOLUTION** | The German propeller manufacturer Otto Piening GmbH has announced that controllable pitch propellers can now be operated for the first time using a water-based hydraulic system instead of oil. The environmentally friendly solution has been certified by the classification society DNV GL and approved for the mega-yacht market as well as for research, naval and coastguard vessels.

Water as a hydraulic fluid offers users a whole range of benefits, the company notes. It is cost-efficient, mostly readily available and can be easily stocked. In the rare event of a system leak, there is no risk to the environment, which means the vessel is able to continue its journey. The entry of seawater into the hydraulic system is not critical, either. There are no legal restrictions regarding the operational area, and water, as a lubricant, is non-flammable.

Our PCP controllable pitch propellers have been optimised in further areas, said Mathias Pein, managing partner of Otto Piening, who has been pursuing development of this product since 2013 following numerous customer requests. The hub, for instance, has not only been improved in respect of its hub/diameter ratio while taking hydrodynamic aspects into consideration, its structure has also been revised to allow easier assembly and disassembly of the blades and pitch control mechanism.

Another new feature is that the blades can be mounted to the inside or outside of the hub using bolts. The requisite components are identical for clockwise- and counterclockwise-rotating propellers. This reduces the part count. Highly flexible seals at the blade roots together with the exclusive use of corrosion-resistant materials further characterise this type of propeller, Otto Piening points out.

The exhaustive series of tests under close supervision by DNV GL was performed using a five-blade controllable pitch propeller mounted on a 650mm hub. The forces acting during testing equated to an output of 3,300 kW at 440rpm.

A patent is pending for this novel technology, which will be presented to the public at this year’s SMM in Hamburg.

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**Schottel to rename its products**

**TYPE DESIGNATIONS** | Marine propulsion and steering system specialist Schottel is introducing new type designations starting September 1st. The German company says it is replacing the current names for more consistency and to ease orientation among the variety of products.

For all SRP, STP, SCD and SRE propulsion units, the SRP or STP abbreviation will be followed by a three-digit number. This will allow classification of the various types within the series. For example, the former SRP 1515 will now be referred to as SRP 460. All propulsion units with comparable input power follow this system: STP 460, SRE 460 and SCD 460, the number not being related to performance. The former SRP 4000 will be renamed SRP $10$ and the former SCD 4000 will also be given the number $10$.

All other products will retain their familiar names. After Schottel invented the rudderpropeller (SRP) over 65 years ago, the product range continued to grow, the company notes. Further drives based on the SRP principle were added, such as the STP and SCD. Today Schottel offers a comprehensive range of drives covering the complete input power spectrum.
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*“Chevron’s DOT.FAST Service makes it possible to monitor, both onboard and onshore, the total amount of adhesive, abrasive and corrosive wear.”*  
  
  — MAN Diesel A/S

Expansion of product portfolio

ALFA Laval Just in time for this year’s SMM, Alfa Laval, a global provider of specialised products and engineering solutions for heat transfer, separation and fluid handling, has announced the launch and upgrade of various systems.

With its new DuroShell plate-and-shell heat exchanger, the Swedish company says it will significantly strengthen its lead in LPG/E cargo liquefaction. DuroShell’s construction increases resistance to thermal and pressure fatigue.

The Alfa Laval DuroShell is a specially engineered plate-and-shell heat exchanger with unique design capabilities. Already used in the offshore oil and gas industry, it is now being introduced for demanding marine duties such as LPG/E cargo liquefaction, Alfa Laval notes.

DuroShell is said to strengthen the company’s leadership in heat exchangers for LPG/E cargo condensation, where the AlfaRex plate heat exchanger is standard today. Like AlfaRex, DuroShell is a laser-welded solution combining high thermal efficiency with a very small footprint. But whereas AlfaRex handles pressures of about 30 bar and temperatures down to -50°C, DuroShell withstands pressures up to 35 bar when titanium plates are used, along with temperatures as low as -198°C.

The robustness of DuroShell is the result of many factors, including the patented roller coaster pattern of its cut-wing plates, the company says. The roller coaster pattern ensures even expansion around the plate circumference, which eliminates potential weak spots and increases the heat exchanger’s lifetime. In addition, the entire plate pack is precompressed, minimising the effect of large differences and variations in temperature.

Further strength is added by the distribution tubes that extend through the laser-welded plate pack. These relieve stress on the plate pack itself, while ensuring the best distribution of media. Together with the roller coaster pattern, which creates high turbulence even at low velocities, the distribution tubes ensure excellent thermal performance, according to Alfa Laval.

FCM One Gas promises smooth high-pressure fuel gas supply Alfa Laval says its expertise in fuel conditioning is now also being applied in high-pressure fuel gas supply systems for LNG. The Alfa Laval FCM One Gas is the most recent addition to the FCM One family, the company’s latest generation of high-performance booster systems.

FCM One Gas is a complete fuel gas supply system for engines equipped with high-pressure ME-GI technology. As part of the FCM One booster family, FCM One Gas provides sophisticated automation for all start, stop and purging sequences. The result is smooth, automatic control of fuel pressure for the lowest possible energy consumption at any load, the company says.

One of the unit’s key strengths, it adds, is the LNG vapouriser, the proprietary Alfa Laval printed circuit heat exchanger (PCHE). Robust and highly compact, this diffusion-bonded heat exchanger handles cryogenic temperatures and pressures as high as 650 bar(g).

The efficient way to more cat fine protection Another new product is FlowSync, an automatic control system that synchronises the oil feed to Alfa Laval separators with the engine load. By matching the flow of fuel to the engine’s needs, it increases retention time in the separator bowl, giving the separators the best possible conditions for doing their job. FlowSync can optimise the entire fuel-cleaning process for the best protection and energy efficiency.

To increase the effectiveness of centrifugal separation, which remains the best defence against cat fine attacks, FlowSync takes fuller advantage of slow steaming. While slow steaming today is beneficial overall, it makes ineffective use of the fuel system layout.

Since most vessels use fixed-speed feed pumps, they experience a large overflow of separated fuel when slow steaming, said Mats Englund, application manager of Fuel and Lube Oils at Alfa Laval. At partial loads, the unconsumed fuel is returned to the settling tank, only to be pumped and separated again. Unfortunately, the resulting improvement in cat fine content is negligible.

When FlowSync is used, the fixed-speed pumps are replaced with variable-speed pumps. These are steered automatically by FlowSync, which matches their throughput to the engine load with an ample margin of safety. Automatic control is integral to achieving full benefit from the investment, Englund said. Because the crew is not always alert to changes in engine load, manually controlled variable-speed pumps tend not to be adjusted.

With FlowSync adjusting the separator feed rate, there is a very positive impact on separation efficiency. As the flow rate decreases, the fuel is allowed to spend more time in the separator bowl, which increases the separator’s ability to remove smaller and lighter particles. Though a properly operated separator removes nearly all cat fines larger than 10µm, cat fines smaller than 3µm are substantially more difficult.
FlowSync also offers benefits in regard to energy efficiency, Alfa Laval says. Because the feed rate is matched to the fuel consumption, there is minimal overflow from the day tank back to the settling tank and no re-pumping of previously separated fuel. This alone saves energy, the company notes.

A still greater amount is saved in the separator, where energy is used to accelerate the fuel, drive it through the disc stack and finally pump it out again. A separator consumes about 1 kWh per cubic metre of separated fuel, which means savings of 1 kWh for every cubic metre of reduction with FlowSync.

FlowSync is a single control system for multiple feed pumps and the entire fuel flow. It allows optimisation of the whole cleaning process, even when there are multiple lines of separators and tanks. Via the intuitive Alfa Laval Touch Control panel, users can choose to run more separators at reduced flow for maximum separation efficiency, or fewer separators at reduced flow for maximum energy savings.

**PureBallast offering expanding**

The Alfa Laval PureBallast offering also continues to develop and expand. Higher flows are now possible with a plug-and-play PureBallast 3.1 Compact solution, and a broad service offering is available to support PureBallast worldwide.

Alfa Laval has extended its line of skid-mounted PureBallast systems with the new PureBallast 3.1/300 Compact. Self-contained and ready to install, the system is the market’s smallest ballast water treatment solution for flows up to 300m³/h. Yet it offers the same reliable biological disinfection performance as its larger PureBallast counterparts.

To further support the growing market, Alfa Laval says it has expanded and consolidated its range of services for PureBallast. The Alfa Laval 360° service portfolio contains a broad selection of services to secure lasting performance, ranging from installation supervision and calibration to in-depth performance audits. For vessels whose systems have been inactive, there is even a recommissioning service to restore performance and prevent potential damage at start-up.
New resolution for sewage treatment plants in force since January 2016

The STP can treat wastewater from up to 2,000 people

Table 1: Stricter limits for nitrogen and phosphorus were set at the beginning of the year

<table>
<thead>
<tr>
<th>Parameter</th>
<th>MEPC.159(55)</th>
<th>MEPC.227(64)</th>
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</thead>
<tbody>
<tr>
<td>Thermotolerant coliforms [n/100ml]</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Total suspended solids [mg/l]</td>
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<td>35</td>
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<tr>
<td>BOD5 [mg/l]</td>
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<tr>
<td>COD [mg/l]</td>
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</tr>
<tr>
<td>pH</td>
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<td>6 – 8.5</td>
</tr>
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<td>&lt; 0.5</td>
</tr>
<tr>
<td>Nitrogen [mg/l]</td>
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<td>20</td>
</tr>
<tr>
<td>Phosphorus [mg/l]</td>
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<td>1</td>
</tr>
</tbody>
</table>

The most significant changes imposed by MEPC.227(64) have a direct impact on the design, construction and implementation of sewage treatment plants (STPs) on board vessels, points out Stefan Kunz, plant manager of Ocean Clean GmbH in Rostock, Germany. Initially, however, the resolution will only affect passenger vessel newbuildings that discharge treated sewage in special areas according to MARPOL Annex IV. A transition period for existing passenger vessels has been granted until January 1st 2018. An appropriate technology for nitrogen and phosphorus reduction must be retrofitted by then, otherwise discharging sewage would not be permitted. At present, the Baltic Sea is the only special area listed in Annex IV, though.

Ocean Clean GmbH is a leading manufacturer of maritime sewage treatment systems and is currently having three new types of STP certified under MEPC.227(64). To meet the ever-changing requirements of the market with the best possible equipment, a flexible plant design is important. This, Kunz says, is a main focus in Ocean Clean’s product portfolio. With the expansion of the product portfolio and the new UltraC N+P concept, these plants not only comply with the latest IMO MEPC.227(64) standards but also the stricter requirements of Chapter 4.2. Without applying chlorine or other chemicals, the EasyC-Series follows the well-proven principle of biological cleaning, Kunz notes. The equipment is available in sizes 1 to 5 and capable of treating sewage from up to 200 people on board. And its capacity will increase.

The UltraC-Series can treat sewage from up to 2,000 people. It uses the membrane concept and supporting biological stage. This plant type is available in sizes 1 to 50. Certification under MEPC.227(64) has already been received.

The integrated nitrogen and phosphorus stage of the UltraC N+P series is an extension of the UltraC-Series. This plant type is also available in sizes 1 to 50 and capable of treating wastewater from up to 2,000 people. Every Ocean Clean STP is completely designed and assembled in Germany and capable of treating greywater ± including galley and hospital water ± besides blackwater. By using stainless steel materials, Ocean Clean can offer a lifetime warranty for the tanks, Kunz says.
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Electronic system lowers lube oil consumption

CYLUBE | The Swiss engineering company Tekomar says it has developed a tool that significantly lowers a ship’s fuel and lube oil consumption ± and thereby raises efficiency ± without replacing the existing lubrication system. Called Cylube, it’s 70% more cost-efficient than any other system on the market, according to Beat Güttinger, Tekomar co-founder and head of global sales and marketing. Shipowners often hesitate to adjust the cylinder lubrication feed rate for fear of under-lubrication, Güttinger notes, and also because of the difficulty in determining the correct adjustments. With Tekomar Cylube, however, it’s a fast and easy procedure, he says. Tekomar Cylube acts as an electronically controlled system dependent on engine load, cylinder lubrication oil BN, and fuel oil sulphur content. The optimum feed rate is set via a monitor in the engine control room. With basic crew training, anyone can manage the system, Güttinger says, although it is usually operated by the second engineer. Hamburg-based Hansa Shipping GmbH & Co KG implemented Tekomar Cylube on six vessels earlier this year. According to Tekomar, Hansa Shipping’s selection of Tekomar Cylube for the vessels’ MAN B&W 7S70MC-C engines resulted in installation four to six weeks after the order (ship schedule permitting), immediate 100 litre/day cylinder lube oil savings, further 100 litre/day savings through step-by-step reduction to the minimum feed rate, and a payback time of only about a year. All parts are sent directly to the ship in a single box, Tekomar says. Installation and commissioning are carried out during normal operation without any off-hire period. Initial work begins during a port call. The engine is not immobilised at any time during the installation. Further work is completed while steaming. Final adjustments and commissioning take place during the next port call, followed by a short trial run. The entire process takes no more than three days.

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中国造船工程师学会
New tractor tug meets Tier IV emissions standards

**JENSEN MARITIME** | The Seattle-based naval architecture and engineering firm Jensen Maritime, a subsidiary of Florida’s Crowley Maritime Corp, has designed a new high-performance tractor tug for Vessel Chartering LLC that features some of the first Tier IV engines meeting higher federal air emissions standards among US tugboats.

The multi-purpose tractor tug, which is being built by JT Marine of Vancouver, Washington, was jointly developed by Vessel Chartering LLC and Jensen Maritime. The 33.6m-long vessel will feature the ship assist and escort capabilities of smaller harbour tugs, while delivering the improved towing performance and increased range of larger oceangoing tugs, according to Jensen Maritime. The escort capability was enhanced to provide support for assisting large, 18,000-TEU container ships due to an increased future demand in US West Coast ports of call. The design offers the flexibility to support ship escorts, assists and towing.

The engines are designed to meet the federal Tier IV standards, which incorporate the emissions-reducing performance requirements by the US Environmental Protection Agency (EPA). To meet the requirements, the two engines on this vessel use systems that clean exhaust gases after they have left the engines. This is the third tugboat designed by Jensen Maritime with engines meeting the Tier IV requirement. With new ballast water treatment requirements on the horizon from the EPA and US Coast Guard, the tug was designed without any ballast tanks, thereby eliminating the need for ballast water discharge and the potential transfer of invasive species. In lieu of ballast tanks, the tug will transfer fuel, as necessary, in order to maintain proper trim.

The tug is designed to carry up to 3,973.4 tonnes of fuel, 16,277.3 litres of fresh water, and up to 17,034.4 litres of urea, which is used for treatment of the main engine exhausts in order to meet Tier IV emissions requirements. A watermaker is being installed for potable water when out at sea. A large pilot house will provide all-around visibility, and the deckhouse has an open feel with a large mess and lounge area along with accommodations for a ten-person crew.

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Virtual ship to raise awareness,
fund good causes

THE PARTNERSHIP | This year’s Posidonia shipping and marine trade show in Athens marked the official start of The Partnership project, which aims to provide a platform for maritime technology suppliers to showcase the vast array of technology, knowledge and expertise required to operate today’s ships. It’s a virtual ship created from the six merchant vessel types: offshore support vessel, passenger vessel, container ship, bulk carrier, gas carrier and tanker.

The project was initiated by Finland’s Wärtsilä Marine Solutions, a global leader in complete life-cycle power solutions for the marine and energy markets; Podium 4 Ltd, a UK-based event agency for the maritime and offshore industries; and the British media companies Wake Media and Oakwood Agency.

It has been created to build relationships, serve as an educational resource and raise substantial funds for good causes, the project partners say. Through an exclusive sponsorship of each component and service on board the virtual vessel, participation in project events, special fundraising events and individual donations, The Partnership is seeking to raise up to GBP 1 million to support good causes chosen by the sponsoring companies.

Each component or service is exclusively sponsored by one supplier. The price of a sponsorship is GBP 625 per month or GBP 7,500 per year over the initial two-year project cycle. Similar to advertising, it’s the same price whether it’s for a main engine or a widget, but the difference is that the package offers companies so much more over a significantly longer period ± not just in print or digital, but in live events and in satisfying their corporate social responsibility requirements where they are supporting the creation of The Partnership as an educational tool and supporting good causes chosen by them, said Mike Porter, director of Podium 4. We’re approaching those companies we believe are best suited to the project and the components and services on offer. We’re not looking to get into any bidding wars, he added.

The official launch of The Partnership project took place at Posidonia 2016; the SMM 2016 international maritime trade fair in Hamburg is the venue for the launch of the virtual ship, which will be celebrated at a reception for sponsors, charities, supporting organisations, partners and VIPs. The ship delivery, i.e., the completion of the project, is scheduled for June 2018.

Asked what would happen if the project can’t find partners for all the relevant systems, Porter replied: If, at the end of the two years, we have components and services that haven’t been sponsored with definitions and supporting material agreed, then we’ll fill in the information gaps using our own industry experts. In Phase Two, the following two years, sponsors will be invited to continue their support. If, for whatever reason, they don’t wish to do so, then we’ll seek a new sponsor and review or revise the online information accordingly at that time.

The hybrid ship design, which forms the basis of the ship illustrated on The Partnership website, was developed by Wärtsilä Marine Solutions. Andy Ford, general manager of marketing for Europe, Africa and the Americas at Wärtsilä Marine Solutions, commented: Not only does the project provide a good platform for raising funds for good causes, it’s a great and modern digital enabler to promote and educate people about the currently available and emerging technologies relevant to the marine industry.

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Eco-compatible multi-purpose grease for maritime applications

BM 32-142 | Klüber Lubrication, a manufacturer of speciality lubricants, says it has developed a high-performance lubricating grease for maritime applications such as rolling and plain bearings in cranes, fairleads, winches and rudder systems of ships. Called Klüberbio BM 32-142, the new multi-purpose grease complies with the requirements of environmentally acceptable lubricants (EALs) as defined in Appendix A of the 2013 Vessel General Permit and can therefore also be used for components in contact with seawater, the company says. ‘Our new high-performance lubricating grease contains special additives that reduce wear, protect against corrosion and enable smooth operation even at extremely low temperatures’ said Dirk Fabry, marine business development manager at Klüber Lubrication. Moreover, its readily biodegradable base oil ensures high environmental compatibility. This makes Klüberbio BM 32-142 a real multi-purpose product for the marine industry.

The new grease can be used in a wide temperature range: from -40°C to 120°C. Besides its excellent corrosion and wear protection, the new operational lubricant offers a very good load-carrying capacity, thus extending the components’ service life and maintenance intervals, according to Klüber Lubrication.

Calculating the amount of oil prevented from leaking

OIL SAVINGS CALCULATOR | Canada Thordon Bearings has developed a bespoke modelling tool that it says is capable of calculating the amount of operational oil prevented from leaking into the world’s oceans with each installation of a seawater-lubricated propeller shaft bearing. The Oil Savings Calculator shows that more than 60 million litres of oil pollution have been saved to date, according to the company.

In our opinion the only acceptable propeller shaft stern tube oil leakage is zero, said Terry McGowan, president and CEO of Thordon Bearings. Thanks to those vessels that have already installed seawater-lubricated propeller shaft bearings, over 60 million litres (almost 16 million US gallons) of stern tube oil have been saved from entering our oceans, seas, lakes and rivers. The Oil Saving Calculator is updated constantly and will continue to track our contribution to removing stern tube oil from our waters with the greater goal of completely eliminating this source of pollution. Dr Karen Purnell, managing director of the International Tanker Pollution Federation (ITOPF), has expressed support for the initiative. As the world’s largest shipowner organisation, ITOPF supports measures designed to help our members and associates meet high environmental standards. Though our primary function is to promote effective response to marine spills of oil and chemicals worldwide, we also support the maritime industry in its efforts to reduce ship-sourced pollution and provide for more sustainable marine operations, she said.

ITOPF last year presented Thordon Bearings with an environmental award for its oil-free COMPAC propeller shaft bearing system for its part in reducing the amount of oil entering the sea annually. The success of this measure can now be determined using Thordon Bearings’ Oil Savings Calculator, Purnell said. The oil saving calculation is based on detailed statistical analysis of the number of vessels that have been built with or converted to seawater lubrication, the 300 days a year each vessel is typically operational and an average oil leak of 6 litres (1.6 US gallons) per day per vessel.

Independent research carried out by New York-based Environmental Research Consulting indicated in 2014 that the total amount of operational oil discharges from oceangoing vessels could be more than 240 million litres annually, Thordon Bearings says. To add perspective, the oil pollution from the Exxon Valdez spill in 1989 was 41.6 million litres. While 90% of all commercial ships continue to use an oil-lubricated propeller shaft bearing system, Craig Carter, Thordon Bearings’ head of marketing and customer service, believes the industry is in the midst of a technology transition that will eventually confine oil-lubricated shaft bearing systems to history. Recent changes to US Vessel General Permit requirements and the introduction of new Environmental Protection Agency rules have resulted in an unprecedented number of commercial vessels opting for seawater-lubricated bearing technologies, and while more can be done, shipowners are now much more aware of the positive contribution they can make in safeguarding the marine environment, he said.
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CBRN station for naval applications

CBRNflex3600 | Air conditioning and ventilation specialist Noske-Kaeser has introduced its new CBRN (chemical, biological, radiological and nuclear) station CBRNflex3600, saying it combines the advantages of the company’s established SLG door station and SLM modular station.

Current tests with the prototype prove a reduction in the space needed and in on-site installation time, increased flexibility, high connectivity to the ship’s systems and consequently the optimisation of costs, said Jürgen Matthes, general manager of Noske-Kaeser.

The new CBRNflex3600 integrates all components of a full-fledged CBRN system in one compact station, according to the Hamburg-based company. The station is equipped with sand filter, blast protection, pre-filter, pre-heater, high-pressure fan, STANAG (standardisation agreement) NATO filters and the necessary controls. Furthermore, the system is connectable to the ship’s IMCS (integrated monitoring control system) and HVAC (heating, ventilation and air conditioning) control system. Noske-Kaeser says that CBRNflex3600 will fulfil all necessary requirements for naval applications and the corresponding naval requirements. It allows fresh air filtration of up to 3,600m³/h. The new station is designed to successfully work under rough ambient conditions, especially in extremely hot and cold regions. The selection of high-quality, very resistant materials with a long MTBF (mean time between failures) and intelligent service arrangements in the station will ensure that the state-of-the-art CBRN system is also low-maintenance, Noske-Kaeser says. The company also provides on-site training and documentation according to the S 1000 D standard.

The new CBRNflex3600: a compact, flexible CBRN station, easily integrated into a ship’s structure and systems by plug-and-play technology.

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AQUALUMA UAS | The new Aqualuma® Ultrasonic Antifouling System (UAS) provides enhanced, targeted protection in all climates wherever it is needed ± the hull, running gear, prop, rudder, IPS drive, stern drive, sea chest, seawater piping, sea strainer, thruster, stabiliser and more, according to US-based Aqualuma. The system, which is scalable for any size vessel and hull composition (GRP fibre glass, carbon fibre, Kevlar, steel or aluminium), outputs a refined automated programme of short ultrasonic wave burst signals through ultrasonic transducers. The output from the Aqualuma UAS is up to 30% greater for the same or less input than competing systems, the company says. Each strategically placed transducer emits a specific digital low-power frequency, which is beyond the hearing range of humans. The ultrasonic waves are emitted to generate a barrier at a microscopic level of moving water, which destroys the food source, algae, to prevent unwanted sea growth. The system, Aqualuma says, extends the life of existing antifouling/bottom paint coatings; prevents barnacles; is simple to install; reduces running costs and haul-outs; improves fuel economy, performance and efficiency; and is eco-friendly.

Solvent-free, wet- and rust-tolerant coating system

CHEMCO | Scotland-based Chemco International has developed what it says is the world’s first solvent-free, wet- and rust-tolerant coating system for the protective and marine coatings industry. It comprises two products: Epo-chem™ RS 500P (primer) and Epo-chem™ RA 500M (topcoat). These products have been created with a view to existing and future legislation on the environment and health and safety of products, the company says. They combine to make one multifunctional coating system that has been extensively used for almost all vessel areas, including all tank externals, pipework (internal/external), decks, superstructures, void space, cofferdams and engine rooms. Any surface preparation method can be utilised for this coating system; however, substantial time and cost savings can be achieved when water jetting is employed, Chemco points out. The system exhibits exceptional adhesion to rusty or poorly prepared and wet surfaces. The unique wet- and rust-tolerant characteristics of this environmentally friendly system therefore allow the coating process to begin immediately after surface preparation, with no delay and no requirement for dehumidification, the company says. According to Chemco, the coatings have passed independent tests and have also been approved and utilised by almost all major shipping companies. They are supported by comprehensive and transferable guarantees for complete refurbishment, newbuild and, uniquely, for patch repair work.
SKF | Technologies and design engineering support from SKF are helping to enhance the reliability and reduce the life-cycle cost of propulsion units that will drive the most powerful LNG carriers in the world, the Swedish company says. The Azipod propulsion units, developed by Switzerland's ABB, are being installed on the 170,000m³ ice-breaking LNG tankers that will be used in the project to open up gas from the Yamal peninsula in the Russian Arctic and transport it to Asia and Europe.

The project, which will see the first vessels commissioned in South Korea in 2016, is expected to produce 16.5 million tonnes of LNG per year. As SKF points out, the environment in the region is extremely harsh and calls for machinery and components rugged enough to keep going in severe operating conditions at all times throughout the year.

According to the company, ABB Marine chose to work with SKF on development of its Azipod propulsion units for ten LNG carriers because of its application engineering expertise, particularly in demanding applications, and proven reliable innovations. Included in SKF's offering are custom-made thrust bearing arrangements, which incorporate housing and seals, and high-performance self-aligning CARB toroidal roller bearings for the propeller shafts. By implementing such products, ABB was able to build in superior operating reliability with a long service life, SKF says.

In addition, SKF is providing assembly and installation supervision in the ABB Marine factory. Besides the bearing arrangements supplied for the Yamal vessels, SKF says it has also delivered Turbulo Bilge water separators and SKF BlueMon, an environmental monitoring system for recording and mapping ship emissions.

The tankers will be operated by a joint venture between China LNG Shipping and Teekay LNG

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Green ship technology and digitalisation in the spotlight

The SMM trade fair will open its doors for the 27th time

INTRODUCTION | SMM (shipbuilding, machinery and marine technology), the leading international maritime trade fair, will take place from September 6th to 9th in Hamburg. More than 2,100 exhibitors and roughly 50,000 visitors are expected at the biennial show. In addition to an extensive exhibition covering the entire spectrum of the maritime industry, this year SMM will once again host four top-flight conferences: the Maritime Future Summit, gmec (global maritime environmental congress), MS&D (International Conference on Maritime Security and Defence) and Offshore Dialogue. International experts will present their approaches to digitalisation, efficiency, green shipping, maritime security and the offshore market. When the exhibition opens its doors on Tuesday, September 6th, the first conference will have already taken place the day before.

Shipping 4.0
Autonomous ships, smartonboard systems: At the Maritime Future Summit on September 5th, industry leaders will discuss the future of shipping. For the first time, SMM is hosting a conference dedicated to digital shipping. Cyber ships are a hot topic in the maritime business world today. Low-crew and no-crew concepts are buzzwords in the shipping sector, and some initial trials with unmanned ships are already being undertaken. Visionary ideas drive the evolution of humanity, and the maritime industry is no exception. With its Maritime Future Summit, SMM provides a platform for the industry movers and shakers to think the unthinkable remarked Bernd Aufderheide, president and CEO of SMM organiser Hamburg Messe und Congress GmbH. Two highly distinguished expert panels will discuss the topics building Ships for the Future and Digitalisation and Automation.

Green power ahead
This year’s gmec, on September 6th, will focus on alternative propulsion systems, digital transport control and refined measurement electronics. Leading experts will discuss how to improve efficiency in shipping while cutting emissions. The pressure on the industry is tremendous. On the one hand, the tough situation in the market forces shipping companies to keep prices for their services at competitive levels, which mainly means they have to increase efficiency and reduce fuel consumption. On the other hand, ever stricter international standards require investments in environmental technologies. Customers also expect the companies to demonstrate sustainable management and green propulsion is a major focus at SMM.

Three key issues will be on the agenda: harmful air emissions, big data and alternative energy.

MS&D: Strategies for maritime security
The responsibilities of navies and coastguards are becoming more complex and demanding. At MS&D, to be held in conjunction with SMM on September 7th, high-ranking experts will discuss current trends and future challenges. Whether it be protecting peace, fighting piracy and drug trafficking or guiding merchant vessels safely to their destinations, the range of responsibilities for navies and coastguards has changed significantly. Under the heading Naval Technology for Naval Operations, the opportunities and risks resulting from recent developments will be discussed at MS&D.

Offshore Dialogue: Future prospects
On September 8th, offshore sector players will meet in Hamburg to discuss current and upcoming needs and challenges in the industry. The wind energy and subsea mining segments in particular are raising the shipbuilding industry’s hopes. Both are in great need of specialised ships and advanced technologies. But what exactly does the market need to take off? What conditions must be met for the upswing to come? And how does digitalisation figure in this equation? Answers will be given at the Offshore Dialogue conference.

SMM Maritime Career Market
SMM will also once again address career options in the industry with an extra event this year: the Maritime Career Market (MCM). It gives up-and-coming young specialists a chance to meet possible future employers and provides the perfect platform to check out various career options. MCM will take place on Friday, September 9th. High school and university students get a 50% discount on the ticket price.
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Regardless of the commercial application, sea-going vessels have a lot to contend with. From fast service boats like wind farm supply vessels to ferries, fishing boats, rescue boats and tugs: all must deal not only with wind, weather and the sea, but also timetables and rising fuel and maintenance costs. The solution? Commercial nautical engines built to be robust, reliable, powerful and above all efficient. That’s exactly what you’ll find in the high-speed four-stroke commercial shipping diesel engines from MAN. Combine decades of expertise in high-volume engines, outstanding power output and low fuel consumption with a global service network, and you get 190 to 1,397 kW units guaranteed not to let you down on the high seas. To find the commercial engine tailored to your needs, visit man-engines.com

MAN Engines
3Si Group

Hall B1 / Stand 507

Safety and Survival Systems International (3Si) will be presenting four of its group companies at SMM Hamburg for the first time, showing the marine industry its complete capability to meet safety and survival requirements.

The group companies, which comprise Ocean Safety, International Safety Products (ISP), Revere Survival and Typhoon, will be showcasing a number of new and existing products and capabilities, which include SOLAS immersion suits, drysuits, SOLAS life jackets and the 3Si Guardian electronic range, which will be making its debut.

Also appearing for the first time at SMM will be the 3Si Constant Wear life jacket, ergonomically designed to allow uninhibited upper body movement and provide prolonged comfort. Designed for easy donning over heavy overalls, it comes in three variations, wipe-clean, nylon and PVC.

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The Constant Wear life jacket will be on show in Hamburg commercial maritime environments.

Available as a single-chamber 275N, the Challenger Worksafe Pro is constructed of highly durable but flexible PVC with an orange, wipe-clean cover.

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ABB Turbocharging

Hall A3 / Stand 202

ABB Turbocharging will formally launch its Marine Auxiliary Power (MXP) turbocharger at SMM, the group’s first turbocharger specifically developed for marine auxiliary engine applications. Combined, the MXP® attributes can deliver a 25% reduction in the total cost of ownership, according to ABB Turbocharging.

Previewed at the CIMAC Congress 2016 in June, the MXP has been developed in cooperation with IHI Corporation for small-bore medium-speed marine auxiliary diesel engine platforms with up to 2-MW power output operating on HFO. It is optimised for part-load engine operations (40-70%), saving fuel. ABB says it has been able to simplify the design, reducing the number of components by about 40% compared with turbochargers intended for general use. In addition, the MXP features standard screw sizes throughout, allowing maintenance to be carried out by the crew using standard tools. The MXP is designed for service with condition-based maintenance (CBM). IMO II compliant with no additional aftertreatment required, the MXP will be produced in at least three frame sizes, and commercially available in early 2017. ABB Turbocharging will also be showcasing the A100-M axial turbochargers ± the A170-M axial and A175-M axial ± introduced in 2015 to target the highest-powered medium-speed engines available. The products have been designed to meet demand for higher compressor ratios in single-stage turbocharging, and to match the special requirements of each diesel or gas engine. A typical marine application would be large medium-speed engines used on cruise ships, where the axial configuration ensures high turbocharger performance from units with compact dimensional envelopes, minimising the space requirements.

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ABB's new MXP turbocharger
ABS
Hall B3 / Stand 200

The classification society ABS will have technical specialists on hand from both its local Hamburg office and its Global Marine organisation to discuss a wide range of topics impacting the marine, offshore and naval sectors. From the latest advances in technology to the changing regulatory requirements, ABS can provide the assistance to meet today’s demands as well as future challenges. Topics include:

- Digitalisation: The next generation of safety systems and the use of data analytics to drive the future of class;
- Technology: Vessel performance management and the latest ABS projects impacting future fleet design considerations and energy efficiency;
- Environmental stewardship: Including LNG as fuel and EU MRV regulations;
- Software: Demonstrations of the latest fleet management software from ABS Nautical Systems.

www.eagle.org

Alfa Laval
Hall A1 / Stand 226

SMM 2016 marks the 100th anniversary of Alfa Laval’s first marine separator. This year, the company says, it will present more new solutions than ever before. Alfa Laval’s stand will showcase the latest innovations for new fuels, energy efficiency, environmental compliance and reducing operational costs, including new offerings in oil cleaning and service. Among the highlights will be the new Alfa Laval hydraulic control oil (HCO) filter, as well as the skid-mounted Alfa Laval PureBallast 3.1/300 Compact, the smallest ballast water treatment system on the market for flows up to 300m³/h.

To commemorate the anniversary, visitors will be invited to a 20-minute stand tour each day at 16:30. Afterwards, a happy hour will begin with a signature drink and the sounds of a period jazz band.

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Competence for Industry and Shipping
Alphatron Marine and Japan Radio Company (JRC) will have their second-generation bridges on display in Hamburg, featuring a new level of operational ergonomics and user-friendliness, suited for the working environment of all mariners and applicable to all types of vessels. The companies will be showcasing the new, fully integrated one-man bridge with three 46-inch screens for use in law enforcement, semi-military and/or coastal patrol vessels, combining radar, WECDIS (Warship Electronic Chart Display and Information System), conning, alarm monitoring and DP data in an easy-to-use format. A unique interfacing between thermal cameras and WECDIS allows full integration with the vessel’s tactical mission-specific parameters. The AlphaBridge Premium on show has five 46-inch screens, which provide a clear overview of all the navigation information. These monitors and the centre console offer the safest and most efficient operating environment possible and also allow access to all the control panels and other equipment on the vessel, such as the lighting and engines, the companies say. In the overhead of the AlphaBridge will be the AlphaLine Repeaters, a full lineup of instruments that are easy to operate via an intuitive colour touch-screen display, which is available in three standard sizes and two colours. Further exhibits will be the new 6.5-inch autopilot with rotating button and touch display and the new 5-inch VHF, which has been developed with the help of experienced captains operating on various types of vessels.

Lastly, the companies will be demonstrating the AlphaSSRS, a new sound system reception system designed to receive and detect foghorn signals from other vessels.

www.alphatronmarine.com
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Baumüller
Hall A5 / Stand 109

At SMM, the Nuremberg-based specialist for electric drive and automation systems Baumüller will be represented with its own booth for the first time. With its broad range of electronic drive technology ± from motors and inverters up to control systems ± Baumüller offers efficient alternatives to conventional ship propulsion. The spectrum of services covers inland vessels, yachts, tugboats, offshore vessels and the like. Baumüller integrates its experience with drives systems for shipbuilding and the whole of mobile drive technology and is a reliable partner for shipyards, system integrators and shipowners as well as a supplier of complete systems.

Baumüller’s high-torque DST2 motors feature specific wing mounts that make it much easier to integrate them into the ship design, the company says. Furthermore, Lloyd’s Register has confirmed that the high-torque motors meet the special requirements of the shipping industry.

Becker Marine Systems
Hall A1 / Stand 225 & Hall A5 / Stand 200.A

At SMM 2016, Hamburg-based Becker Marine Systems will be introducing a new product segment. The company will be represented at two stands at this year’s show, where both its traditional products and its experience with cold ironing using liquefied natural gas (LNG) will be highlighted. At the main booth, the three product lines Manoeuvring Systems Energy-Saving Devices and LNG Hybrid Concepts will be presented. Here Becker’s core products, the versatile high-performance rudders as well as the Becker Mewis Duct® and Becker Mewis Duct® Twisted energy-saving devices, will be on display.

In addition, Becker subsidiary Hybrid Port Energy (HPE) will be premiering an exhibition stand of its own. HPE will be presenting its alternative solutions for shoreside power supply, specifically dedicated to Green Propulsion environmentally friendly propulsion technologies. Along with the LNG hybrid barge, used to supply energy to cruise ships while berthed at port, the company’s portfolio includes the LNG PowerPac®, a specially designed modular container system used to supply power to container ships and other types of vessels.

www.baumueller.de

www.becker-marine-systems.com

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bobz GmbH
Hall B6 / Stand 200

bobz GmbH, a Hamburg-based specialist in maritime data transmission, is showing its expanded product range at this year’s SMM. In response to demand from customers, the company says it has launched new router solutions. The new shipznet router relies on LTE technology and has a tenfold higher transmission rate: nearly 300 Mbit/sec. The stand-alone version contains a proven antenna technology and is designed for customers who want to use their own SIM card. It offers four Ethernet ports, five SIM card sockets, the proven crew hotspot feature and will soon be available online. The new router will also be available without the popular, handy shipznet antenna as a single device for smaller installations. The new hardware can be purchased as an all-inclusive solution with different data packets from 1 GB/month. Starting this autumn, shipznet will also be offering significantly higher data packets of up to 200 GB/month. www.bobz.de

Böning
Hall B6 / Stand 308

The system provider from Germany will present the Böning SmartBridge at SMM, demonstrating how it takes its course away from isolated applications on the bridge. The comprehensive and clear user layout comes with freely configurable touch screens. Third-party systems like autopilot or VHF will either be integrated harmoniously or invisibly remote-controlled. Users can decide, according to their preferences, which display will show the locally captured and processed data of the radar, ECDIS, GPS, engines, navigation lights, power supply, operation liquids, CCTV, air condition and much more.

The homogenous operating concept improves the captain’s overview, and, thanks to its ergonomics, serves to increase security at sea. The multiple redundant systems and flexible software allow an individual character for a wide range of boat types and applications. The bridge will be on show both at Böning’s stand and, together with the INS Voyager Bridge, at Furuno’s stand (Hall B6 / Stand 100).

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At SMM 2016, marine glazing Brombach + Gess will be presenting two product novelties: the loggia cabin window and the composite panorama glass sliding roof.

The loggia cabin window has been developed for more comfort, transparency and privacy in passenger cabins. This new concept extends the area of the cabin by the size of the balcony, so the outer area of the cabin is designated as part of the cabin area and can be completely used as a private area. The new cabin type is outfitted with a horizontally divided panorama glass front. The upper part can be lowered and provides a glazed balastrade forming a cabin with open space. The area can be used as a loggia. In a closed position, the movable upper window and the fixed lower window align to form a perfectly flat facade.

The composite panorama glass sliding roof is an innovative, lightweight composite design. This special design solution allows weight savings of 40% compared with the total weight of a reference aluminium roof, and a mass reduction of 20 tonnes.

www.brombach-gess.de
Chris-Marine & IOP Marine  
Hall A3 / Stand 402  
Mobile workshop container A3 / FG.02

At this year’s SMM, Chris-Marine & IOP Marine will present their updated liner diameter measurement tool and electric honing machine, along with a mobile workshop concept, which can be used both on board and ashore. The liner diameter measurement tool has been further developed in close cooperation with MAN Diesel & Turbo and a variety of European ship operators. One of the new functions has attracted a lot of interest from shipowners who experience rapid piston ring and liner wear problems: Measuring 30 diameters at a given height, the contour measurement feature provides detailed information on wear patterns that cannot be obtained otherwise. This enables operators to identify clover leafing at an early stage, for example.

Chris-Marine also recently released an electric honing machine, the HON A. Over the liner’s lifetime, about 30% less lube oil is needed when honing is done every 15,000 hours, the company says.

Cathelco  
Hall B5 / Stand 129

Cathelco will be displaying its new Evolution ballast water treatment (BWT) system, which is currently being tested to the live/dead standard demanded by the US Coast Guard with the aim of gaining type approval by the third quarter of 2017. Based on a combination of filtration and UV technology, the Evolution system has capacities from 34m³/h to 1,500m³/h in a single unit and is available in skid-mounted and modular form. The UV chamber has been redesigned to increase the level of irradiation to meet the live/dead standard, while other improvements extend the exposure time with seawater. In addition to creating a helix flow as it enters the chamber, the water has its path interrupted to cause a lateral movement. This will bring organisms from the edge of the flow closer to the light emitted from the UV lamps in a repeating cycle as the water passes along the chambers. The unique Cathelco UV technology sensor system adjusts the UV dose precisely to changing water qualities. This is achieved by sampling seawater before it reaches the UV chamber and measuring the amount of UV light actually passing through it. This ensures accurate dosing to the prevailing conditions while economising on power wherever possible.

Cobham Satcom  
Hall B6 / Stand 407

New VSAT antenna systems will take centre stage at the Cobham Satcom stand during SMM 2016. For Ku-band services, the brand-new Sailor 900 VSAT High Power will be a highlight of the show in terms of satcom technology, according to the company. With integration of a new proprietary design 20-W block up converter (BUC), the Sailor 900 VSAT High Power makes it easier and less costly to ensure high availability of service and enables satcom service providers to deliver higher uplink bandwidths.

Innovation continues with Cobham’s brand-new 60cm VSAT antenna platform for new Ka-band high-throughput satellite (HTS) services. Recognised by the Mobile Satellite Users Association (MSUA) as the 2016 Top Maritime Mobility Satcom Innovation, Sailor 60 GX is designed for reliable operation on Inmarsat’s new Fleet Xpress. It shares the same unique, compact and lightweight carbon composite design as Sailor 60 VSAT Ka, which can be used on Telenor’s Thor 7 European services. Cobham will also focus on safety communication at its stand, with the brand-new Sailor 3965 UHF Fire Fighter, which is said to be the world’s first marine-approved portable radio made specifically for meeting the new SOLAS Chapter II-2, Regulation 10.10.4 – Fire Fighters Communication.
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Colfax Fluid Handling
Hall A2 / Stand 219

Colfax Fluid Handling will exhibit two advanced developments at SMM in Hamburg: the MI-D centrifugal pump with a capacity of up to 3,900 m³/h and delivery head of up to 50 m, and the turnkey version of the CM-1000 electronic pump controller for use in control cabinets. The MI-D pumps water for cooling and ballast systems. The CM-1000 for cooling water pumps can be pre-installed in new ships or installed as retrofits.

The six new sizes of the Allmarine MI-D series cover the needs of ships ranging from about 60,000 dwt to more than 200,000 dwt. The patented characteristics of the double-suction, symmetrical design with just one shaft seal, no internal bearings, and corrosion-resistant materials result in numerous benefits. Efficiency is greater than 80% and their NPSH values of below 4 m make these pumps ideal for ballast systems, the company says.

CM-1000 controls the flow of cooling seawater pumps according to the temperature of the fresh water and current cooling requirements. Condition monitoring keeps track of leaks, vibrations, and bearing temperature. New is the turnkey version with full electronics, including frequency converters in control cabinets. When the ship is at a standstill or slow steaming in a cold environment, CM-1000 now shuts down the pumps completely (all-off) and switches them back on automatically as required, greatly reducing energy consumption. Finally, Cooler Clogging Supervision monitors cooler status and supports the crew during planning and servicing of the cooling system.

www.colfaxfluidhandling.com

CR Ocean Engineering LLC
Hall B7 / Stand 312.5

US-based CR Ocean Engineering LLC (also known as CROE®) is one of the members of the Exhaust Gas Cleaning Systems Association (EGCSA) and will present its scrubbing system in Hamburg. Designed to be smaller, lighter and more efficient, the CROE scrubbing system requires very low backpressure, has an all-metal construction, requires no bypass, replaces the silencer and can run dry without concerns, according to its manufacturer. A complete wash-water treatment system is also provided by CROE as part of the scrubbing system supply. The scrubbing system is available in open loop (seawater), closed loop (fresh water) or hybrid configurations (able to switch from one configuration to the other on demand). It can be both retrofitted on existing ships and installed in newbuildings.

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Cummins

Hall A4 / Stand 208

Among the engine manufacturer’s products that will be on display at SMM is Cummins’ newest, largest and most powerful marine engine to date, the QSK95. It offers the benefits of smaller size, lower weight and better transient response while delivering a new level of serviceability, the US-based company says. With ratings from 2,386 to 3,132 kW, the QSK95 achieves a power output previously only available from larger medium-speed marine engines, while bringing the advantage of a lower capital cost. Nested cylinders and a 60° V enable a short, narrow engine block relative to other engines of comparable displacement. At just over 13,000 kg, the QSK95 weighs between 25% and 70% less than medium-speed platforms of similar power output. As operators continue to seek better vessel manoeuvrability, the QSK95 delivers faster transient response through a unique turbo arrangement and a dry system. By using one turbo per four cylinders, the QSK95 is able to utilise a small turbo model. The dry turbo housings and dry exhaust manifold maximise the available energy to the turbos, allowing them to spool up quickly, resulting in fast engine response.

Danelec Marine

Hall B6 / Stand 529

Danelec Marine will showcase its range of new VDR and ECDIS products, including VDR remote access, VDR conversion kits and a totally new ECDIS line. Danelec’s push-through and pull-through remote access packages use the ship’s VDR as a central data hub for shipboard systems and sensors. Danelec’s VDRConnect module collects, stores and distributes selective data sets through the ship’s satellite communications connection, either on-demand from shore or according to a dynamic condition-based programmed schedule. Danelec’s VDR conversion kits provide easy replacement of older VDRs. The kits include predrilled mounting brackets and universal connectors for all types of digital, serial and analogue signal sources. Danelec’s new-generation DM700 ECDIS meets the new IEC and IHO standards, which come into force in August 2017. Under Danelec’s servitisation strategy, all the products are designed and built for serviceability with the exclusive software advanced protection (SWAP) technology, and are backed by a worldwide service organisation and the industry’s most advanced interactive online service portal. The Danish company will also present the extensive cybersecurity counter-measures built into its products.
Data Modul
Hall B6 / Stand 402

Data Modul, a specialist supplier of display technology for industrial and professional applications, will be highlighting its innovative product developments for marine and industrial applications at this year’s SMM trade fair in Hamburg. On display will be Data Modul’s new range of 22in and 26in marine panel PCs with guaranteed long-time availability. Developed for ECDIS, radar and navigation applications, the new series is based on the latest wide-format industrial LED/TFT panels. The series features the proven fourth-generation Intel "Core TM processor with Intel Core™ i5 or i7 CPU for high computing performance and outstanding graphics. To meet the requirements of marine environments, the robust 128-GB SSD guarantees stable 24/7/365 function, the Munich-headquartered company says. Following IEC 60945 standards, both 22in and 26in panel PCs have an integrated loudspeaker as alarm system.

Data Modul’s HMI systems are manufactured at the company’s production facility in Weikersheim, Germany. It says its engineering expertise in touch and optical bonding technologies combined with fully automated production processes result in highest-quality HMI systems with PCAP multi-touch. They allow efficient use even with gloves, and unlimited function in spite of water drops or splashes on the cover glass, according to Data Modul.

Further brand-new products are open-frame monitors with 4K resolution (3,840 x 2,160 pixels) for precise colour and image performance as well as sunlight-readable TFT panels featuring brilliant colour reproduction for applications in extremely bright ambient light conditions.

www.data-modul.com

Deltamarin
Hall B1 / Stand 211

At this year’s SMM, Deltamarin will be presenting its latest developments both for the passenger and cargo vessel market. The DeltaChallenger is a futuristic design of a RoPax vessel, DeltaLinx is a compact ferry designed for short coastal routes, and DeltaSAFER has been created as a safe and affordable ferry design for the Asian market.

In the merchant vessel market, Deltamarin recently enlarged its Delta family based on continuous R&D work and the great success of the B.Delta bulk carriers. The Delta-series designs feature first-class fuel efficiency and environmentally friendly solutions. Now the Delta series also includes proven container vessel, tanker, chemical and LNG/multi-gas carrier designs. All future requirements such as LNG as fuel, membrane tanks and ice class have been taken into account.

www.deltamarin.com

Image of the DeltaChallenger
d-i davit international-hische GmbH

Hall B5 / Stand 223

A major manufacturer of lifeboat davit systems, d-i davit international-hische GmbH will be presenting a new type of hoisting winch able to handle boats up to 50 tonnes (safe working load) at SMM 2016. The increased lifting capacity is necessary due to the ever-increasing size of lifeboats on the world’s largest cruise vessels, currently being built at the STX France shipyard at St Nazaire, the German company says. Today the largest and heaviest lifeboats can accommodate 370 passengers and will exceed 440 in the near future. The new winch is capable of electrically handling a fully equipped boat, including passengers and crew, and is equipped with an automatic retraction system to lift the empty boat blocks about 2m to 3m upwards. This prevents the suspension blocks from hitting the boat when it reaches the water surface as the suspension hooks are being released. Although such systems already exist, this special device is an entirely new technical development by d-i davit international-hische GmbH, the company says. The world’s largest cruise vessel at present, Harmony of the Seas, has a total of 18 winches of this type. Its sister vessel will also be equipped with winches by d-i davit international-hische. The lifeboats are being installed in a freely hanging outboard position. The new winch has been designed according to the SOLAS/LSA-code with a capacity of 64 kilonewton metres, and it can be delivered for left- or right-hand execution. Its total weight is about 2,800kg.

www.di-hische.de

The new winch can handle lifeboats weighing up to 50 tonnes

Digital Ship

Hall B1 / Stand 401

Digital Ship will be holding two highly focused briefing sessions at Hamburg Messe und Congress GmbH (HMC) on September 8th, during the week of SMM. In the morning, the Connectivity Industry briefing, which is hosted by Intelsat, will look at how innovation and evolution in maritime connectivity is changing the landscape by improving operational agility, creating enhanced efficiency, and above all reducing costs for shipowners and managers. In the afternoon, the Cyber Challenge: Maritime Risk & Safety forum will look at how the industry is reacting to the increase in cyber threats from the growing use of cloud and IoT applications, the number of devices used, and larger ships but fewer crew ± meaning even more reliance on automation and remote monitoring.

www.thedigitalship.com

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Elcome International LLC

Hall B6 / Stand 123

At this year’s SMM, Elcome International LLC will introduce its new marine switchboard, airtime monitoring and control hub, calibration lab and electronics service offering PCB-level repairs. The company is a diversified turnkey solutions provider of marine electronics, electrical and safety systems for the maritime industry, with headquarters in Dubai. Elcome has expanded its maritime service reach across the region, having recently opened new offices in Egypt, Sri Lanka and Singapore.

www.elcome.com

DVV Media Group GmbH

Hall A1 / Stand 529

Along with its popular technical magazines Schiff&Hafen and Ship&Offshore, the Hamburg-based publishing house DVV Media will present its comprehensive range of maritime publications. For more than 60 years, the German magazine Schiff&Hafen has been providing its readers with relevant and reliable information on shipbuilding technology and shipping as well as offshore and marine technology. Its English-language sister publication, Ship&Offshore, focuses on current trends and innovations in the global maritime sector. In-depth technical articles on conventional and specialised shipbuilding, the shipping industry and offshore engineering technology are complemented by the latest news on orders and deliveries. Ship&Offshore is supplemented each year by at least four international issues, spotlighting specific maritime markets in countries such as China and Iran (2017), published in the national language. The weekly English newsletter New Ships is another exclusive information service, reporting briefly and accurately on the most important developments in the global shipbuilding industry. A new product, which will also be on display, is the database New Ships Orderbook, providing users with concise information on both confirmed and estimated orders of new-buildings worldwide.

During the four days of the fair, the DVV Media team will also produce the SMM Daily News newspaper. Another SMM highlight is the daily Press Lunch. Every day, the editors of Schiff&Hafen and Ship&Offshore will be available between 12:30pm and 1:30pm for talks and discussion at the DVV Media stand. Freshly tapped beer and finger food will be served.

www.schiffundhafen.de
www.shipandoffshore.net

DNV GL

Hall B4 / Stand 211

At this year’s SMM, DNV GL will be presenting modern classification solutions with a focus on digitalisation. This includes the deployment of drones in inspecting hulls and cargo holds, the use of high-resolution helmet cameras during visual inspections with subsequent integration of the imagery into a 3D ship model, as well as fleet performance management solutions for shipping companies (e.g., ECO Insight, ShipManager) to help increase the efficiency of ship operations. The classification society is also concentrating on alternative propulsion technologies such as battery and hybrid systems, and the use of LNG as a ship fuel.

Further topics that will be covered during the DNV GL Forum (East Entrance) and at the exhibition booth include cyber security, big data for performance optimisation, modern inspection methods, unmanned navigation, and modern emergency solutions.

www.dnvgl.com/maritime

DVV Media’s booth at SMM


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Evac Group
Hall A1 / Stand 233

The Finnish company Evac will be presenting its Complete Cleantech Solution, a five-system product array that includes waste, wastewater and water management systems specifically of interest to the cruise industry, Evac says. The one-stop-shop offering is suitable for vacuum collection of sewage and food waste, wastewater treatment, as well as dry, wet, and food waste treatment along with fresh-water generation, making it a complete waste, wastewater and water management package. According to Evac, its approach is simpler than those of competitive systems. It uses fewer process units and is easier to operate. Also on offer is a control system that takes care of the various functions. What’s more, Evac also eliminates the issue of compatibility of systems between multiple suppliers as service is available from one point of contact.

Evonik Resource Efficiency GmbH
Hall B7 / Stand 127

Germany’s Evonik will have its Avitalis™ ballast water treatment system (BWTS) on display. Earlier this year, the company submitted a letter of intent (LOI) to the United States Coast Guard (USCG) to officially announce its intention to apply for USCG type approval for the system. According to the LOI, Evonik has selected DNV GL as the independent laboratory (IL) to oversee and supervise the test programme. Meanwhile, shipboard testing for the IMO type approval has started on the feeder container vessel Helmut of the shipping company Jens & Waller. IMO type approval by the German authority BSH (Federal Maritime and Hydrographic Agency) is expected in the first half of 2017. The Avitalis™ BWTS will be manufactured and marketed exclusively by Evonik’s partner TeamTec AS, Norway. Evonik will focus on the production and supply of Peraclean® Ocean, the disinfectant utilised in the Avitalis™ BWTS.

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Fr. Fassmer GmbH & Co KG
Hall B4 / Stand 307

The Germany-based shipyard will once again showcase its expertise in its maritime product divisions shipbuilding, boats and davits as well as deck equipment. Fassmer develops, designs and manufactures a wide variety of special ships tailored to the requirements of its customers. The recently delivered passenger ferry Helgoland, which is equipped with a complex dual-fuel engines power system, demonstrates Fassmer’s versatile capabilities. Helgoland is the first LNG-powered ferry newbuilding under the German flag. Current orders for a complex 71m survey vessel and high-end SAR cruisers for the German search-and-rescue organisation complete the specialised product spectrum. The shipyard’s portfolio ranges from small rescue boats to large rescue and tender boats for cruise ships with a capacity of over 440 people. Its deck equipment, including all type of access systems, ranges from lightweight gangways to complex boat-handling systems and shell doors for yachts and other specialised applications.

Federal-Mogul Powertrain
Hall A3 / Stand 205

Federal-Mogul Powertrain will be showcasing its range of large piston rings for marine engines at SMM. The company says it has an unparalleled range of piston rings for both two-stroke and four-stroke large bore engines (LBEs). It is represented in the LBE market by the Goetze® and Daros® brands; the Goetze products fit bores from 145 to 640mm and the Daros brand spans bores between 260 and 980mm. Ring design for LBEs is increasingly driven by the need to minimise environmental impact through reduced oil consumption and pressure to cut operating costs. Federal-Mogul Powertrain satisfies these demands with ring geometries that optimise contact conditions with the cylinder bore and through the use of wear-resistant materials and coatings that promote longer life. The company’s galvanic coatings, such as GDC® (chrome diamond coating) and CKS® (chrome ceramic coating) may reduce the wear rate of both ring and liner. Its range of galvanic, thermal spray coatings and electric arc processes give the ability to select the optimum coating for each individual application. Some of the technologies developed are suitable for a wide range of applications; others are directed at specific sectors, such as eWAVE® for two-stroke marine vessels and the LKZ® oil-control ring for four-stroke engines.

Tests have shown that Federal-Mogul Powertrain’s eWAVE piston ring distributes oil over an area ten times the size of that achieved by conventional ring profiles, reducing wear and achieving oil consumption benefits of about 20%.
Fraunhofer IGD
Hall B6 / Stand 319

One of the focal points at this year’s SMM in Hamburg will be digitisation. In line with this, the Fraunhofer Institute for Computer Graphics Research (IGD) will be presenting its webVis/instant3D-hub platform for the shipbuilding industry. This solution can visualise 3D data of complex ship models at each stage of their life cycle anywhere and interactively in a web browser. The webVis/instant3Dhub solution offers an adaptive and secure visualisation system with a clear development and integration strategy and at a lower cost thanks to minimal requirements for the integrator.

www.igd-r.fraunhofer.de

Furuno Electric Co, Ltd
Hall B6 / Stand 100

At this year’s SMM, Furuno’s show highlight will be its INS (integrated navigation service) Voyager bridge. Together with Germany’s Böning Automotionstechnologie, the company will showcase the smart add-ons for operation and functionality.

On display will be the latest chart radar FAR-3000 series together with ECDIS, conning and alarm management system. All the equipment will be interfaced with Böning’s monitoring system and smart user interface with touch functionality embedded in a modern and user-friendly bridge console.

This year Furuno will showcase its technological expertise by exhibiting the solutions not only for the merchant marine market but also for mega-yachts, fishing vessels, satellite communications and disaster prevention.

www.furuno.com
GEA Group Aktiengesellschaft

Hall A3 / Stand 214

At the marine industry trade fair SMM 2016, GEA will be presenting solutions for processing fuel and lube oil. Under the designation Seaprotectsolutions GEA focuses on environmentally friendly techniques such as treatment of bilge and ballast water as well as oil and oil sludge. Further exhibits are components for air conditioning, cooling and refrigeration technology. All solutions target maximum availability and high efficiency to ensure trouble-free operation and simple maintenance at sea. Interested visitors can get an impression of the wide-ranging portfolio for cruise ships, ferries, container ships, tankers, fishing vessels, tugboats and many other special ships for offshore purposes at the GEA booth. GEA separators in the OSE series for fuel, lubricating oil and water treatment cover a range with a throughput capacity of up to 80m³/h. In cooperation with Trojan Technologies, GEA offers the BallastMaster marineX for treatment of ballast water. The model presented at SMM can process a throughput capacity of 150m³/h and effectively disinfect organisms with an UV-radiation grade of 44%.

The GEA Grasso LT series is an example of the many high-sea-capable screw compressors by GEA. It combines high performance with a long service life and covers maximum displacement volumes from about 800 to 11,500m³/h in 16 sizes.

Further exhibits at the show will be the piston compressors of the semi-hermetic series GEA Bock HG+4e and GEA Bock F16.

www.gea.com

Optional remote access to the GEA IO enables operators and service technicians to have their centrifuge directly under control.
German Dry Docks Group

Hall B4 / Stand 215

At SMM 2016, the newly established German Dry Docks Group in Bremerhaven will present its combined services to an international audience for the first time. Under the umbrella of the group, three specialists cooperate to offer a complete service spectrum in ship and engine maintenance. German Dry Docks specialises in docking, repairs and retrofits. Six docks and 1,600m of pier are available to customers. German Ship Repair and Rotterdam Ship Repair offer mobile, immediately available 24/7 service for port repairs of boats, engines and equipment along the German-Dutch coast as well as voyage repairs worldwide. MWB Power specialises in motors, governor service and drive systems. The company’s know-how ranges from simple repairs to the complete fitting of new engines and the conversion to alternative fuels. Each of the businesses operates independently. If necessary, the teams complement each other for comprehensive solutions.

www.germandrydocks.com

Aerial view of the German Dry Docks facilities in Bremerhaven, Germany

Guntermann & Drunck GmbH

Hall B6 / Stand 417

KVM systems have long been considered standard equipment in classical IT applications. Now that more and more computer systems are finding their way into maritime applications, manufacturer Guntermann & Drunck GmbH (G&D) has devoted its developments to the specific requirements of this industry.

At this year’s SMM, the IT specialist will present various novelties, including further improved CrossDisplay-Switching for intuitive switching by mouse or trackball, i.e., without the explicit manual operation of the KVM system, and scenario switching. As G&D notes, the applications for KVM systems and their functions are as varied as the application fields of seafaring itself, comprising the optimum implementation of ECDIS, special user processes on workboats as well as comfort aspects on super yachts. Redundancy concepts for KVM installations are essential since they guarantee maximum reliability of the IT equipment. At their stand at SMM, the KVM experts from G&D will demonstrate what such installations can look like, based on individual requirements and examples from their live installations.

Example of day and night scenarios: With a single command, all computers required for day or night shifts can be switched at once. In the same way, scenarios can be stored for harbours, at sea or for man-overboard manoeuvres.

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Halton Marine Oy

Hall B5 / Stand 221

As a result of continuous research and development work, Finland’s Halton Marine is introducing a completely new cabin ventilation system for cruise ships at SMM 2016. The company believes that the new system will become an extremely interesting choice for cabin ventilation in the future as it offers enhanced cabin air comfort with the highest operational efficiency. In practice this can mean lower investment and operational costs compared with more traditional systems such as fan coils. Halton will arrange a seminar on the new cabin ventilation system during SMM 2016. Participation requires pre-registration. For more information, contact haltonmarine@halton.com.

www.haltonmarine.com

Hatz

Hall A3 / Stand 201

The Marine Competence Centre of Motorenfabrik Hatz is presenting individual solutions for marine propulsion as well as for use in generators and pumps at SMM. The liquid-cooled three-cylinder Hatz 3H50TIC engine from the new H-series will celebrate its world premiere in the marine industry in Hamburg. Hatz will also show the bigger, marinised four-cylinder 4H50TIC as well as a propulsion solution powered by its air-cooled single-cylinder Hatz 1B50. The southern German engine manufacturer addresses boat manufacturers, shipyards and mariners with its product and solution portfolio.

By introducing the 55-kW powerful Hatz 4H50TIC in 2014, the company launched a completely newly developed engine generation. All engines are characterised by a conservative innovative concept, the common rail technology from Bosch, compact dimensions and the exclusive use of premium components. Thanks to iHACS (intelligent Hatz advanced combustion strategy), the engines comply with current exhaust emission standards, in part even without exhaust gas treatment, and performance at reduced noise and vibration levels are assured.

The start of the smaller three-cylinder model range in 2018 will be foreshadowed at SMM with the Hatz 3H50TIC. Thanks to the turbocharger and the intercooler, the engines have a maximum torque of 200 newton metres and a maximum power of 46 kW. This all requires an installation space of less than a fifth of a cubic metre. With a capacity of 1.5 litres and a maximum speed of 2,800 revolutions per minute, this three-cylinder engine sets new standards, according to the company.

www.hatz-diesel.com

Hamburg will see the world premiere of the liquid-cooled three-cylinder Hatz 3H50TIC engine

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Heinzmann Group

Hall A3 / Stand 108
Hall B6 / Stand 504

Germany’s Heinzmann Group offers a comprehensive range of propulsion control, engine control and automation systems for ships. Its members provide standard solutions as well as fully customised development projects. Heinzmann will have two stands at SMM 2016, each displaying a different range of products and systems. The stand in Hall A3 covers prime movers and propulsion systems. Among other things, Heinzmann supplies turnkey solutions, including CR conversion system, installation, commissioning and full lifetime service. A comprehensive engine upgrade will be on display.

For medium-sized marine engines of up to 350 kW/cyl, Heinzmann offers an extension kit for conventional diesel fuel-injection systems that provides precise injection timing over the entire engine operating range. Heinzmann will also be presenting its new, electronically actuated gas-injection valve MEGASOL 200 II Marine, applicable for marine gas and dual-fuel engines of up to 250 kW/cyl.

Heinzmann Group member Regulateurs Europa BV will exhibit its latest developments in digital and hydraulic governors and hydraulic actuators, one of which is the microprocessor-controlled hydraulic governor DG 2800.14. It can be used on diesel, gas or dual-fuel engines and steam turbines. DG 2800.14 consists of the RE 2800 series actuator and the Heinzmann digital DC 14 governor.

The stand in Hall B6 is dedicated to the SMM focus on marine automation and technology. The Heinzmann Group companies Regulateurs Europa Ltd and Heinzmann Data Process AS are presenting their combined expertise in integrated marine alarm monitoring and control systems.

Hempel AS

Hall B5 / Stand 216

Coatings supplier Hempel will exhibit its fouling defence coating Hempaguard® at SMM in Hamburg this year. Hempaguard® guarantees performance satisfaction and maintains fuel-saving ability at low speeds and during extended idle periods (for up to 120 days).

It retains its effectiveness when ships switch between slow and fast steaming, giving fleet operators unrivalled flexibility, Hempel said. Hempaguard® is said to achieve an average fuel saving of 6% across the entire docking interval.

Imes GmbH

Hall A2 / Stand 233

Imes GmbH in Kaufbeuren, Germany, is a specialist in the field of combustion pressure sensors and electronic engine indicating systems. In time for SMM 2016, Imes will launch the EPM-XP plus, a further development of its electronic indicator EPM-XP.

A battery-powered hand-held electronic device for periodic monitoring of cylinder pressure on two- and four-stroke diesel engines, EPM-XP has been available since 2008 and was the first electronic indicator that offered automatic P-comp calculation without TDC pick-up, due to a specifically developed mathematical algorithm. More than 2,000 units have been sold up to now. It is characterised by its high accuracy, reliability, longevity and cost-effectiveness.

EPM-XP plus additionally offers a vibro sensor for vibration analysis to diagnose abnormal combustion and valve leakage. All data can be transferred wirelessly to PC, tablet or smartphone. The EPM-XP plus app enables online measurements via EPM-XP plus on a tablet or smartphone. On a PC, online measurements are also available via WiFi or USB connection to EPM-XP plus.

Furthermore, IMES has increased battery capacity of the device to up to ten hours.
Quality Assurance is one of our priorities because maintaining the quality of the product throughout its entire lifecycle is vital for safety onboard vessels. Based on the mindset rooted in traditional Japanese craftsmanship, we conduct meticulously organized product inspection and testing before their shipment to maintain the quality standard of our product range. This results in minimizing the risk of equipment failure.

At the end of the day, it is in our vested interest, because seeking customer satisfaction is our goal. It matters to us all.
Inmarsat
Hall B6 / Stand 116

Visitors to Inmarsat’s booth at SMM can learn about the company’s maritime communications innovation Fleet Xpress and the efforts to increase cyber security. The satcom provider’s Fleet Xpress offering gained critical mass within weeks of its commercial launch with contractual commitments from SpeedCast International and Marlink, direct deals done with shipowners and internal service migration projections from Inmarsat.

Some 5,000 vessels have already committed to Fleet Xpress, which offers high-speed Ka-band with ultra-reliable FleetBroadband L-band service acting as unlimited backup, setting a new standard in broadband maritime communications, Inmarsat says. One owner that recently signed a contract is Nanjing Tanker Corporation, installing Fleet Xpress on 70 of its ships. An additional 2,600 existing Inmarsat Xpress-Link installations will convert to Fleet Xpress over the next three years, while service agreements already in place include container ships, bulk carriers, tankers and car carriers as well as cruise and yachting customers.

Fleet Xpress is enriched by Inmarsat Gateway, a unique service enablement platform giving shipowners and operators access to a new generation of value-added maritime applications and solutions, opening up vessels to the Internet of Things and paving the way for the connected ship. One of the first applications to be delivered through Fleet Xpress will be a cyber security service developed together with Singtel to reduce the risk of cyber-attacks on ships.

www.inmarsat.com

International Windship Association
Hall A5 / Stand 301

The International Windship Association (IWSA) groups technology providers, researchers and other industry supporters to facilitate and promote wind propulsion for commercial shipping worldwide. Its booth in the new Green Propulsion Hall will showcase four IWSA members’ new wind propulsion projects, complemented by an extensive series of wind propulsion presentations and panel discussions.

› Peace Boat’s Ecoship will be the world’s greenest cruise ship, a 55,000gt vessel carrying about 2,000 guests on four world voyages per year. Inspired by nature, its multi-layered eco-features combine energy efficiency measures with the use of renewable energies, including ten retractable sails, covering up to 10% of the propulsion needs.

› Norsepower’s rotor sail solution is the first data-verified and commercially operational auxiliary wind propulsion technology for the global maritime industry. In commercial operation aboard the Estraden, a 9,700dwt RoRo carrier, two of Norsepower’s rotor sails produce wind-assisted propulsion, reducing fuel consumption by 6.1%. This saving has been measured and independently verified by NAPA, a maritime data analysis, software and services provider. The data indicated achievable fuel savings of up to 20% per year on routes with favourable wind flows.

› The Wind Challenger project from the University of Tokyo has telescopically retractable rigid sails of glass fibre-reinforced polymer and steel spars inside. The four big sails (spanning a total area of 4,000m²) can drive an 84,000dwt bulk carrier at 14 knots (wind velocity 25 knots beam wind). However, the reef sail area is small enough in case of rough seas or mooring. The 40% scale model experiment on land has been carried out prior to set-up on the real ship.

› Denmark’s Blue Technology is developing a large multi-hull vessel that incorporates numerous key low-carbon design features. The innovative automated and segmented rigid sail provides the main propulsion, supplemented by electric hybrid engines backed by substantial power storage and generation capacity. Design innovations also reduce expensive terminal costs and the need for ballast, along with fuel and emissions reductions.

www.wind-ship.org

Visitors can get information about the Wind Challenger project (left) and Peace Boat’s Ecoship.
KBB (Kompressorenbau Banneitz GmbH)

Hall A3 / Stand 102

At SMM, the German turbocharger manufacturer KBB will be showcasing the ST7 cartridge from its ST range and K2B turbocharging solutions for the maritime market. The ST range with radial compressor has been designed for an engine output between 500 and 4,800 kW per unit at a maximum pressure ratio of 5.5. The company is further developing an update to its ST range, which will reach a maximum pressure ratio of 6.0:1.

KBB will also be exhibiting a scale model of its more recent K2B “knowledge to boost” two-stage turbocharging system. The model consists of the HPA7000 (first stage) and the HSR6 (second stage): The HPA7000, the larger of the two units, is a low-pressure turbocharger and the HSR6 is a high-pressure turbocharger. The K2B range is the eighth generation of turbochargers produced by KBB.

The year 2014 saw the first series application of the K2B two-stage turbocharger on a Yanmar six-cylinder main propulsion MDO/HFO engine with a significant reduction of fuel, the company says.

Kelvion

Hall A3 / Stand 216

Under the motto “Green is the colour of our solutions” Kelvion will be presenting components to enable the marine industry to enhance its efficiency and/or reduce NOx and SOx emissions. On display at this year’s trade show SMM will be the MGO plate heat exchangers, among other things. Pre-assembled on a rack, they serve to cool low-viscosity gas oil, thereby minimising the formation of sulphur compounds in fuel tanks. In addition, high-pressure exhaust gas recirculation coolers, which effectively reduce nitrogen oxides in the exhaust of large diesel engines, will be on show.

Further exhibits include the Kelvion shell-and-tube seawater coolers with vacuum systems, which function as surface condensers, and the Kelvion marine gas oil cooling system, which filters gas oil and moderates its temperature, increasing its viscosity and improving its calorific value.

A world premiere will be the presentation of the Bloksma FlowBox. This maritime cooler for tugboats, freighters, dredges, and supply ships develops a greater cooling effect than conventional box coolers thanks to demand-controlled forced circulation of the cooling seawater.

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www.kelvion.com
KET Marine
Hall A3 / Stand 413

KET Marine specialises in supplying spare parts and services for Westfalia and Alfa Laval separators and will showcase its expertise in Hamburg. Its portfolio includes a large pool of exchange bowls for both Westfalia and Alfa Laval ± balanced, tested and delivered from its workshop between Rotterdam and Antwerp. The Dutch company also offers complete engineering and service solutions, both on board and by 24/7 remote support.

Klüber Lubrication
Hall A3 / Stand 309

Under the motto ! Closer to you! Klüber Lubrication will be presenting its latest EALs (environmentally acceptable lubricants) for ships and offshore installations. They comply with the 2013 Vessel General Permit requirements of the Environmental Protection Agency (EPA) in terms of biodegradability, minimal toxicity and bio-accumulation. The focus will be on the readily biodegradable, high-performance gear oils Klüberbio EG 2, which offer a high load-carrying capacity, shear stability and compatibility with seals, thus ensuring reliable operation of gears, thrusters and bearings. Klüberbio EG 2 oils are approved by well-known manufacturers of propeller shaft seals and thrusters. In addition, they comply with the EU Ecolabel requirements. The new environmentally sound high-performance lubricants Klüberbio LG 39-700 N and Klüberbio LG 39-701 N, which contain a base oil made from 100% renewable raw materials, reliably protect open drives from wear, even at very low temperatures. These EALs also meet requirements for OSPAR conformance, including Norway Yellow 1. Excellent performance, also under extreme operating conditions, is what the eco-compatible multi-purpose grease Klüberbio BM 32-142 provides to rolling and plain bearings. Special additives reduce wear, protect against corrosion and enable smooth operation of highly loaded bearings even at extremely low temperatures.

Kongsberg Maritime
Hall B6 / Stand 104

Efficiency, integration and performance are in focus for Kongsberg Maritime at SMM, where it plans to reveal a new, holistic approach to helping vessels operate smarter in the realms of energy, operation and handling. With the aim of reducing the number of suppliers a yard or shipowner needs to work with, Kongsberg Maritime has spent over a decade building up its Full Picture technology portfolio by delivering reliable, innovative solutions across the board ± from navigation to automation, cargo handling and training. The company says the Full Picture is expanding this year with full integration of energy solutions. This is a natural extension of Kongsberg’s EPC offering and will expand the company’s focus to include development and delivery of energy and power solutions designed to provide tangible return on investment while reducing shipping’s environmental footprint. Switchboards will be a key product line; however, Kongsberg will be looking at energy management for better efficiency in all areas of a vessel’s operation.
Leistritz Pumpen GmbH
Hall A2 / Stand 215

At this year’s SMM 2016, Nuremberg-headquartered Leistritz Pumpen GmbH will demonstrate a recently designed anti-cavitation system on a model of a cargo pump. The automatically controlled system comprises a Leistritz L2 or L5 screw pump (depending on the flow rate) driven by an electric motor and with a variable frequency drive. Leistritz L2/L5 pumps ± with medium-lubricated, epicycloidal, self-gearing profiles ± have no external timing gears and are thus four times more reliable thanks to just one double-acting shaft seal and one ball bearing instead of four each, according to Leistritz. Since there are no power losses from power transmission, a cooled oil bath isn’t necessary, and both the ball bearing and the mechanical seal can be easily maintained and replaced. The pump and motor have a misalignment-tolerant coupling allowing removal and reassembly of elastic parts by detaching them from the metallic half-couplings. Supervision is facilitated by the automatic system, which controls such critical conditions as an overheated mechanical seal and bearing; it also monitors and displays conditions including pump inlet/outlet pressure in a separate control room. The anti-cavitation system monitors vibrations on the pump with a sensor welded to its casing.

Lloyd Werft Bremerhaven AG
Hall B4 / Stand 319

Lloyd Werft Bremerhaven will be showcasing its expertise in the segments repair, conversion, refurbishment, interior renovation and completion of ships of all types and sizes up to 110,000gt. The shipyard has two dry docks and a floating dock capable of handling ships with a draught of up to 11m. Some 400 qualified personnel, 1,400m of quayside and a spectrum of cranes with a wide range of capabilities are available for all ship services. A new design centre for shipbuilding was opened this year. Because of its modern workshops and shipyard facilities, Lloyd Werft is capable of carrying out a variety of customised tasks. One of its additional strengths is building high-value luxury yachts to individual customer requirements.

The RoRo vessel Primula Seaways was lengthened at Lloyd Werft in Bremerhaven
MacGregor
Hall A1 / Stand 423

In Hamburg, MacGregor, a brand of Cargotec, will be demonstrating its commitment to tackling inefficiency and waste within the industry. The MacGregor range of products comprises hatch covers, cranes, equipment for RoRo ships and ports, systems for securing cargo, bulk cargo handling equipment for ships and terminals as well as offshore and maritime logistics solutions.

Maersk Fluid Technology
Hall A5 / Stand 210

Maersk Fluid Technology (MFT) will be introducing the new Sea-Mate B1000 onboard cylinder oil blending system, developed for medium-sized two-stroke engines, at SMM. MFT’s blending-on-board (BOB) systems now cover engines with a bore ranging from 480 to 980mm. BOB blends recycled system oil with a high base number (BN) oil, to produce an optimum cylinder lubricant to match fuel sulphur content and operating conditions. Because the BN is matched precisely to the application, feed rates can be kept to a minimum, cutting lube oil consumption by up to 50%. In addition, because the system oil taken from the engine is frequently replenished, it is maintained at the correct viscosity, cutting friction and lowering fuel consumption by up to 1.5%. Maintenance and waste oil disposal costs are reduced, while time between overhauls can be increased.

MAN Diesel & Turbo
Hall A3 / Stand 200

MAN Diesel & Turbo is using its stand at SMM 2016 to introduce a number of new products and initiatives, including MAN Cryo, its new, marine fuel gas supply system business. MAN Cryo enables the company to supply cryogenic equipment for the storage, distribution and handling of liquefied gases, including natural gas, while promoting its fuel-bunkering capability and its engine’s ability to meet IMO Tier III legislation.

The MAN Diesel & Turbo stand will also have a special display devoted to its high-speed portfolio, featuring an MAN 175D engine, MAN Renk gearbox and MAN Alpha propeller, showcasing its ability to provide complete propulsion solutions within the segment. The display will also showcase the company’s new MAN D2676 LE443 engine, the latest generation of inline six-cylinder engines for workboats. It generates an output of 537 kW (730hp) at 2,300 rpm with a cylinder capacity of 12.4 litres. The company’s two-stroke unit will be displaying its new Mk 10 design platform, which has a host of new design features that have brought about a significant reduction in weight. A key innovation of the new platform is its combined, simplified FBIV (fuel booster injection valve)/TCEV (top controlled exhaust valve) component.

MAN 175D engine will be on display at SMM
MAN Engines
Hall A3 / Stand 200

MAN Engines will be presenting its latest generation of inline six-cylinder diesel engines, the D2676 for workboats, at SMM in Hamburg. The basic six-cylinder engine has been tried and tested in a wide range of on- and off-road machinery since it was first introduced in 2007. Its robustness and reliability in workboats has also been demonstrated in extensive field trials in ferries, pilot boats and high-speed catamarans.

Designed for use in vessels such as passenger ferries, pilot boats, fishing trawlers and lifeboats, the engine provides a range of outputs from 323 kW to 588 kW (440 to 800hp) for light-, medium- and heavy-duty applications.

The new D2676 engines also offer the wide torque plateau that is characteristic of MAN marine engines. This ensures maximum torque over a broad engine speed range at the lowest specific fuel consumption.

Marlink
Hall B6 / Stand 415

Marlink will emphasise the ability of its Sealink multi-band satcom services to support crew welfare during this year’s SMM. Both a new crew media content delivery platform and telemedicine service are in the pipeline and expected to be available soon.

After a busy summer that included extensive new satcom and business-critical solutions contracts signed with several big-name shipping companies such as John T. Essberger (JTE) Group, Stena Line, CMA CGM and MSC Cruises, Marlink will also focus on changes to its data allowance package portfolio. Sealink data allowance packages offer a controlled, cost-effective way to flexibly manage satcom connectivity according to a vessel’s particular bandwidth needs. Marlink will expand the portfolio to include a wider range of packages in parallel with doubling the burst speeds available. The idea is to deliver a smoother online experience for both operational and crew communication, while keeping costs the same.

www.marlink.com
This year’s SMM will see special attention to the digitalisation of processes and sensor systems providing real-time data. Against this background, Martechnic® is planning to showcase its new test device Iron Check E, which offers vessel operators an optimised semi-automatic testing and digital read-out of test results. The electronic version is based on the proven measurement method (patent pending) of iron concentration in cylinder drain oil. The test device is especially useful in the light of the challenging issue of cold corrosion in two-stroke marine diesel engines and enables regular monitoring directly on-site, the Hamburg-based company said.

Manually prepared cylinder drain oil samples are placed into two chambers of Iron Check E for automatic heating and measuring processes. The iron content (total and/or corrosive) is determined by means of the built-in chroma meter with LED transmitted light source ranging up to 1,100 mg/kg. The data are automatically displayed and saved.

For continuous real-time condition assessment of lube and hydraulic oil, Martechnic® offers advanced sensor technology either as part of the MT Modular Monitoring System or as individual products with customised options.

www.martechnic.com

Metawell GmbH

Hall B5 / Stand 110

Germany’s Metawell will present its sound-reduction panel Metawell® Alu-Silent to the shipbuilding industry for the first time at SMM. The panel is already being used in some rail vehicle projects. Metawell® Alu-Silent is an aluminium sandwich panel with excellent corrosion protection and high rigidity. Considering its weight and thickness, it has an enormous sound reduction index, according to the company. Two types are offered:

- a panel thickness of 11.5mm with a weight of 20kg/m² and a weighted sound reduction index (Rw) of 38 dB
- a panel thickness of 6mm with a weight of 10.9kg/m² and Rw of 32 dB.

The high Rw is achieved by filling the corrugation channels of the panels with a special acoustic material. The good static values and high fire ratings of the well-established Metawell® panels remain intact, the company says. The panel’s height and weight can be adjusted to customer requirements, and the Rw to between 28 and 40 dB as needed.

www.metawell.de

The Metawell® Alu-Silent panel in different variations
Minimax Fire Solutions International GmbH

Hall A1 / Stand 227

Minimax offers tailored fire-protection solutions in accordance with safety regulations by national and international classification societies as well as SOLAS and IMO recommendations. The Minifog Marine XP water mist system meets the demand for minimised space and weight on ships and complies with the highest safety requirements, the company says. Compared with traditional sprinkler systems, Minifog Marine XP requires up to 90% less water in case of fire. A single Minifog Marine XP sprinkler in ship cabins can provide coverage of up to 32m². That means the sprinklers can be installed at 6m intervals in corridors.

Minimax also offers an alternative solution for use in engine rooms on ships and offshore platforms ± the MX 1230 marine extinguishing system with the tested and proven extinguishing agent Novec™ 1230. As this extinguishant is neither corrosive nor electrically conductive, no damage can result in the engine room from short circuits or residue on sensitive components. This makes MX 1230 marine systems perfectly suited for effective protection of such components.

Navico

Hall B6 / Stand 222

SMM 2016 will provide Navico a first opportunity to display the new Simrad® R3016 12U/6X IMO SOLAS CAT 3 radar system for the commercial shipping market, which became available in the summer of 2016.

Bringing together the latest Simrad radar and display technology, the new R3016 12U/6X is aimed at commercial vessels under 500gt, which are required by SOLAS to have minimum capacity for 20 acquired targets, 20 activated AIS targets, and 100 sleeping AIS targets.

The R3016 12U/6X features a 12-kW X-band transceiver and a 6ft open array scanner designed for high reliability and low maintenance. Also included is the completely new Simrad R3016, a compact control unit with a 1366x768-pixel high-definition 15.6-inch diagonal widescreen display.

The radar system is built around a new-generation digital processing user interface featuring enhanced target-tracking capabilities and advanced automated tuning controls. Its control unit incorporates the display, controls and processor in a single integrated system. No bulky additional PC processor is required, while installation costs are further reduced using easily routed Ethernet cabling and a compact, bulkhead-mounted power supply unit.

Navico’s new Simrad® R3016 12U/6X IMO SOLAS CAT 3 radar system

www.navico.com
Noris Group GmbH
Hall B6 / Stand 302

A holistic solution provider of sensors, signal processing, automation and visualisation for ship propulsion and marine engineering, the Nuremberg-based Noris Group has developed a wireless sensor system with a passive, superior transponder as its basis. The concept, which will be shown at SMM in Hamburg for the first time, operates without its own energy source. In this measurement technique, a coil is mounted on a moveable part (e.g., a flywheel or piston rod) and is used as a transducer for the measurement data. By means of this movement, the transducer constantly passes the sensor element, and is thus supplied with energy via electromagnetic induction. This energy is sufficient to detect the measurement data from a measuring element (e.g., Pt100) and store them in a transponder. As soon as the transducer passes the sensor element, the measurement data are retrieved from the transponder and transmitted to the sensor element with a frequency of 13.56 MHz (ISM band). Consequently, the transponder saves and wirelessly transmits the data from, for example, temperature, acceleration and pressure-measuring elements as well as from sensor combinations to a receiver at regular intervals.

Noske-Kaeser
Hall B5 / Stand 231

Noske-Kaeser, a global technology leader in the fields of firefighting and CBRN (chemical, biological, radiological and nuclear) protection, air conditioning, ventilation and refrigeration, will be presenting an extensive range of innovative technologies for surface and submarine navigation at this year’s SMM in Hamburg. The Hamburg-based company will be informing interested maritime and industrial parties about new developments as well as tried and tested systems, including what it says are globally unparalleled solutions such as HyFEx® and CBRN-flex3600. Another in-house development is Nitrex®, described by Noske-Kaeser as the world’s only nitrogen fire-fighting system and specifically developed for the machine and battery compartments of submarines. Unlike CO₂ solutions, it is absolutely harmless to humans and the environment, the company says.

Meet our coupling experts at SMM Hamburg.
September 06th-09th, Hamburg, hall A3, booth 327

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www.reich-kupplungen.com
Ocean Signal
Hall B5 / Stand 527

UK-based communication and safety at sea specialist Ocean Signal and AMI Marine, a leading manufacturer of marine electronic equipment, are launching a new partnership at this year’s SMM. The two companies will be announcing a collaborative project relevant to commercial vessels of 3000gt and over that will enable the integration of the technology behind Ocean Signal’s range of GMDSS and safety equipment with AMI Marine’s years of experience in VDR (voyage data recorder) system design. Combining the specialist knowledge and extensive technical background of the two companies, the cooperation will facilitate a unique capability to incorporate the latest technology within new solutions to fulfil demand for next-generation, mandated equipment. Ocean Signal designs industry-leading safety devices, including EPIRBs, PLBs and MOBs, featuring superior operational and battery life, compact size and simple operating controls, for both the commercial and leisure sectors. Specialising in interfaces, repeaters, advanced docking systems and alarm systems, AMI Marine has a growing portfolio of VDRs, including its X-Series VDR, which meets new mandates for VDRs as defined by IMO Resolution MSC.333(90).

www.oceansignal.com
www.amimarine.net

Parker Kittiwake
Hall A3 / Stand 209

Parker Kittiwake, a leading global manufacturer of condition monitoring technologies, will once again be exhibiting at SMM. For more than two decades, Parker Kittiwake has been designing, developing and manufacturing condition-monitoring and test equipment for lube oil, hydraulic oil and fuels. The new Parker Kittiwake cat fines test kit represents a breakthrough in the early detection of one of the industry’s most potent sources of mechanical failure, the company says. By using a simple pre-mixed chemical bottle test, which detects the presence of cat fines in a representative sample of fuel oil, operators are able to identify the presence of abrasive and potentially damaging components before they enter the system, thereby avoiding potentially catastrophic failure. Proactive condition monitoring is an integral part of maximising operational efficiency. With the launch of the Parker Kittiwake cat fines test kit, engineers can now take timely action to minimise the likelihood of damage, and avoid the associated costs, downtime and challenges that infrastructure damage causes.

www.kittiwake.com

The cat fines test kit will be on display in Hamburg

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www.kittiwake.com

The cat fines test kit will be on display in Hamburg
Pleiger Maschinenbau
Hall B6 / Stand 324

The German company Pleiger will show SMM fairgoers a selection of its electro-hydraulic actuators, which control globe, butterfly and ball valves with diameters between DN25 and DN1000. They are used for handling liquid and gas cargoes as well as ballast water, blackwater and greywater, and for the control of fuel oil tanks. The major benefit of the Electro-Hydraulic System (EHS) is that – thanks to its decentralised design with superposed hydraulic power pack – the shipyard is spared the time-consuming installation of long hydraulic pipes. Significant leakages and contaminations are therefore impossible.

Pleiger not only delivers the actuators, but also the control electronics and, if requested, the corresponding valves. At SMM the control modules of the latest generation (CM4) will be presented. They allow adjustment of individual actuator functions and run times via a handy sized parameter-setting tool.

Podszuck® GmbH
Hall B7 / Stand 117

Podszuck’s product range includes single- and double-leaf A-60 hinged and sliding fire doors, single- and double-leaf A-60 hinged lightweight fire doors, single-leaf A-30 and B-30 hinged fire doors, spray-weather tight doors, spray-weather tight wheelhouse sliding doors, galley sliding doors, lift doors, container doors, C-class fire doors and H-120 fire doors. Recent developments include the A-60 offshore doors with A-60 windows, bullet-proof A-60 doors, blast-proof A-60 doors as well as A-30/A-60 doors with round corners, A-30/A-60 doors with internal hinges and A-30/A-60 doors with an internal door closer.

ProfiSeal
Hall A3 / Stand 406

ProfiSeal, a company in the Deutsche Yachten ± Superyacht Germany Working Group, will present what it calls the world’s first fireproof bulkhead seal for drive shafts on commercial and seagoing ships, mega-yachts and special craft. The seal is resistant to fire over 60 minutes at 950°C, making it A-60 classified.

Podszuck will showcase its range of doors at SMM
Raytheon Anschütz
Hall B6 / Stand 304

At SMM 2016, Raytheon Anschütz is presenting a suite of latest navigation systems, including the new Synapsis NX integrated navigation system (INS) and the next generation of smart heading and radar sensors. This generation of navigation systems and sensors can be easily integrated into various system environments, both in newbuildings or as retrofits. Synapsis NX is type-approved according to INS performance and test standards, offering better situational awareness, safety and simplified operation. Featuring an advanced network infrastructure and smart system components, the INS enables radar video, sensor data and charts in a redundant and highly capable LAN navigation network. Synapsis NX also integrates a capable service tool and features new concepts for touch-screen operation as well as new applications such as a versatile situation awareness, sea space surveillance and SAR display.

Raytheon Anschütz is also exhibiting the latest in heading and radar sensor technology at SMM among other things, the new Standard 30 MF gyro compass and the NautoScan NX network radar. This next generation of sensors is characterised by a reduced need for maintenance, lower service costs and the possibility of sharing data and status information via Ethernet. This not only enhances system performance but also adds value through optimised data processing and usage by a respective end-user application.

www.raytheon-anschuetz.com

Renk AG
Hall A3 / Stand 207

Propulsion specialist Renk has built new facilities to test gears and large electro-mechanic systems. The four new test fields at its headquarters in Augsburg, Germany, enable a full-load test of marine gears with up to 12,000 kW and fully automated data capturing of all relevant parameters, such as power, speed, temperature, pressure, noise excitation and vibrations. Extensive tests of components mitigate the risk of onboard failure; the integration of related components in a marine power train, such as electric motors and drives or couplings, makes the test even more efficient. The test facilities are also accessible for other customers for testing products built by third parties. Applications such as direct electric drives (DEDs) for vessels, variable frequency converters and wind turbine components are well suited for the facilities.

In April 2016 the advanced electric drive AED©, Renk’s compact, lightweight and low-noise alternative to DEDs was successfully tested with 4,000 kW. At SMM, Renk will be showing live impressions of the test facilities, the AED© and its wide range of products for the maritime power train.

Meet us at the SMM 2016
Hall S Stand 122

www.renk.eu
Rivertrace Engineering
Hall A1 / Stand 313

UK-based Rivertrace Engineering will be showcasing its Smart Cell 15 ppm oil content monitor (OCM) and its Smartsafe ORB (oil record book) bilge overflow security system at SMM.

By utilising smart cell detector array technology the Smart Cell 15 ppm OCM analyses all three oil types (HFO, diesel and emulsions) simultaneously without the need for re-calibration.

A manual cell-cleaning device is included as standard to easily enable routine maintenance. Optical cell fouling is recognised as a leading cause of monitor malfunction or incorrect readings. By simple operation of the manual cleaning device, the smart cell remains in optimum operating condition.

The Smartsafe ORB bilge overflow security system was developed in response to customer request, the company says. It records the oily water discharge process of any oil-water separator (IMO-MEPC 60.33 or 107.49), thus avoiding the common mistakes of manual entries and log variations in the oil record book.

Rivertrace also notes that the Smartsafe ORB offers protection against magic pipes and system manipulation. The easy-to-use touch-screen monitor system works with any separator and bilge alarm.

www.rivertrace.com/en-gb

Rolls-Royce
Hall A3 / Stand 305

Rolls-Royce will be presenting new MTU-brand propulsion systems designed to meet IMO III and EPA Tier 4 emission regulations for commercial, offshore and military vessels as well as yachts at SMM.

With a number of technical advances incorporated in the turbocharger system, the combustion process and in the fuel injection system, the Series 4000 engines that Rolls-Royce will be marketing have now been further optimised and will deliver increased performance (1,380 ± 3,200 kW) for workboats, offshore vessels, ferries and government vessels. With the new SCR exhaust gas aftreatment system, which has also been developed by MTU, the advanced engines will meet IMO III and EPA Tier 4 emission requirements. An additional diesel particulate filter is not required.

The Series 4000 engines for yachts will be slightly modified and marketed with MTU’s SCR system, which will meet IMO III regulations as of 2017. The new MTU gas engine will meet IMO III emission standards with no additional exhaust gas treatment. Its performance and acceleration behaviour are similar to the excellent characteristics of a diesel engine.

Rolls-Royce will also be presenting its current portfolio of medium-speed marine engines, bridge systems and propellers.

www.rrpowersystems.com

Rockson Automation GmbH
Hall B6 / Stand 332

Just in time for this year’s SMM, Rockson Automation GmbH, a Kiel-based producer of automated systems, has enhanced its proprietary system Evolution V5 to include the latest in functionality. Among the new features are a scalable extension alarm system and customised sequencing for pumps, valves and clutch control. Rockson has also polished up its marketing with a new website, revamped product sheets and written a new corporate brochure, which will be presented at its first-ever independent stand at SMM.

www.rockson.de

Podszuck
Hall B7 / booth 117

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Experts in Heat Exchange.
R+S solutions Holding AG
Hall B6 / Stand 209

Germany’s Scholl Energie- und Steuerungstechnik GmbH ± part of the R+S Group ± has developed modern shore-connection boxes for both electricity and water supply for inland waterway vessels. The new system, which is controlled and monitored using GSM technology and will be on display in Hamburg, is safe and easy to operate, the company says. The connections for the supply are housed in outdoor enclosures that are tamper-proof and designed for maximum safety. The portfolio of Scholl Energie- und Steuerungstechnik includes technology boxes with currents from 32 to 660 amp at 400-V alternating current. Protection is guaranteed through circuit breakers. It is not possible to switch on the system without a cable connection to the ship, and risks due to the removal of live connection cables under load are mitigated. The offer also includes water service boxes with flow rates of 25m³ per hour. The boxes are double-walled and heated, so no humidity can build up inside. The materials used are aluminium and stainless steel.

The shore-connection boxes can be activated via a smartphone app, the Internet and by phone. After use, an automated e-mail with the current consumption values is sent. No additional staff are required for operation at the berths.

www.rs-ag.net

The shore-connection boxes will be on display at SMM

RWO GmbH Marine Water Technologies
Hall A1 / Stand 218

The seawater reverse osmosis SRO-COM

At this year’s SMM, RWO, a Veolia Group company and one of the leading providers of water treatment systems on ships and offshore platforms, will be presenting the CleanSewage water treatment system CS Bio, the seawater reverse osmosis SRO-COM and a further development of the oily water separator OWS-COM.

Compared with other systems, the CleanSewage Bio water treatment system with its one-sided access can save up to 25% in space, according to RWO. In addition, it requires substantially lower maintenance and enables a faster restart. The CleanSewage Bio is also easy to use for operators and crew. The system features a hygienic no-touch cleaning system and intuitive status control with all information available at a glance.

www.rwo.de

The seawater reverse osmosis SRO-COM is a desalination system aboard ships. RWO now offers a smaller version of the system with a capacity of up to 60m³/day. The new product advantages are simple, proven technology without the use of chemicals, quick installation, modular design, low maintenance costs, no downtimes as well as high performance and water quality.

The RWO oily water separator OWS-COM has been optimised with new filter cartridges, among other things. This increases operational reliability and reduces operating costs in a service life that is more than twice as long. Due to its compact design, the OWS-COM is equally suited for newbuildings as well as retrofits.

www.rwo.de

SB Broneske (Schwingungstechnik-Broneske GmbH)
Hall A4 / Stand 305.1

An elastic support specialist for exhaust pipe systems, SB Broneske will be showcasing its product and service portfolio at SMM. In April 2016, the German company received a Bureau Veritas type-approval certificate for its new, flexible, fireproof and watertight penetration. It complies with the test requirements for sealing systems of bulkhead and deck penetrations based on IMO 2010 FTP, Resolution MSC.307(88) Annex I, Part 3. In May, SB Broneske was awarded the EC Certificate of Conformity Quality System (Module D) for its flexible, fireproof and watertight bulkhead and deck penetration. DNV GL certified that SB Broneske maintained and applied a quality system in compliance with the requirements of the Marine Equipment Directive MED 96/98/EC. In June, SB Broneske received the Bureau Veritas certification in accordance with DIN EN ISO 9001:2015. This certification of the management system is valid for the design, production and sale of elastic support, pipe penetrations and expansion bellows on board ships, and other applications.

www.broneske.de/en

www.rs-ag.net

www.rwo.de

www.broneske.de/en
Schaaf GmbH & Co KG
Hall A4 / Stand 305

The patent-pending innovation GripCon sets new joining standards using high-pressure technology, says its developer, Schaaf GmbH & Co KG. Since there are no conventional bolt connection elements, unprecedented construction possibilities arise, with one- and two-sided connections. GripCon is mounted like a normal bolt in the component, comparable to a stud, without any projecting elements. This not only increases efficiency, but also saves a lot of space. GripCon technology is based on both the ExpaTen bolt, which has undergone long-term testing and is certified by classification societies, and on the shaft connection GripLoc. This combination results in fewer connections, extremely high torque transmission ± even with sudden changes of rotational direction ± and quick and safe installation, disassembly and reinstallation even after years of use. Thanks to simplified installation procedures due to high-pressure technology and 100% complementary mounting tools, customers can carry out the installation themselves. Costs are saved through a reduction of lay days for maintenance and repairs as well as mounting times for newbuilds.

Schoenrock Hydraulik
Hall B5 / Stand 131

Schoenrock Hydraulik Marine Systems, located in Schenefeld, Germany, is unveiling two new systems of electrically driven, watertight sliding doors at SMM. Both ± the double-motor system and the electric sliding door surrounded by a watertight hull ± are tailor-made solutions in response to demand by maritime customers for greater safety and a short installation time. They are specifically designed for the yacht and cruise vessel sector. For increased safety, the modified electrical, watertight sliding door incorporates a spindle-driven arrangement with two independent electric motors. Both units are linked to the spindle via a clutch/gear combination and guarantee continued function of the door after malfunction of one motor. RINA-classed cruise vessels in particular have a need for this. The door can be delivered with either a rubber or metal-metal sealing, the latter reducing life-cycle costs as no change of a sealing is required. This new door type is a further development of Schoenrock's standard door Shiptight and designed to shorten installation time on yachts and cruise vessels as much as possible. The door blade moves inside a watertight steel cover, allowing a shipyard installation team to connect longitudinal and traversal bulkheads merely by welding to the cover without any further consideration of moving and maintenance areas. Since all electrical components are exactly the same for both the covered and non-covered door type, the type combination can be chosen according to each customer's wishes.

www.schaaf-gmbh.com
www.schoenrock-hydraulik.com
Schottel
Hall A4 / Stand 306

Under the slogan "Proven Schottel quality has a new name!" the manufacturer of propulsion and steering systems for ships and offshore applications has introduced a new nomenclature effective September 1st 2016, replacing the current product designation system for a simpler one. At SMM 2016, Schottel will showcase its latest innovations, including the highly efficient electric Schottel EcoPeller (SRE), a thruster optimised for the open sea and coastal operating conditions. Furthermore, the electric Schottel rim thruster (SRT), a space-saving lower-weight drive that converts electrical energy directly into propulsion without transmission losses, will be on display. With its minimised noise and vibration levels, the thruster is ideal for vessels frequently operating in DP mode or whenever utmost comfort is needed, according to Schottel.

The company will also present application-related solutions, such as a rudderpropeller (SRP) for shallow-water operation, e.g., push boats, or an SRP with PTI, a compact hybrid drive especially suitable for vessels with highly variable work cycles. In addition, scale model tugs will provide an overview of the eco-friendly tug solutions Schottel has on offer.

www.schottel.de

Schwepper Beschlag GmbH & Co KG
Hall B5 / Stand 122

Among the exhibits Schwepper will be showcasing at this year’s SMM are its newly developed solenoid locks and a complete range of system components in aluminium to build stairways.

The solenoid locks can be integrated into electronic operation systems in order to lock/unlock all or pre-selected locks by pushing a button. This concept can be integrated into the back- sets of 55 to 100mm stainless steel locks.

The newly added components for designing and building aluminium stairways meet a long-standing demand from the industry, the company says.

www.schwepper.com

Seagull Maritime
Hall B7 / Stand 117

Seagull Maritime celebrates its 20th anniversary this year. At SMM, the company will be emphasising how the recruitment, training and retention of competent crews on board are keys to success in shipping today.

Seagull Maritime will be showcasing the latest tools and reports available via the Seagull Competence Manager, which allow owners to identify training and competency gaps in individuals and at ship level, and to take appropriate action.

Interfacing the Seagull Training Administrator with any crewing system has never been easier than with Seagull Maritime’s newly developed Web API, developed to save time and avoid double data entries.

New and revised titles are added every quarter to the Seagull Maritime library of e-learning modules and maritime training films, with latest releases including an onboard course on fatigue management.

SMM also provides an opportunity for Seagull Maritime to present its latest developments in type-specific ECDIS training modules. In addition to Kelvin Hughes, Tokyo Keiki, JRC, Consilium and Maris, the company recently released training for Transas, Sperry Marine and Wärtsilä SAM Electronics.

www.seagull.no
Servowatch Systems Ltd

Hall B1 / Stand 528

Servowatch, a leading supplier of integrated ship control systems, will be using SMM to launch its Winmon™9 automation and control software. Winmon™9 is a singular, end-to-end software solution offering new and enhanced features that deliver significant end-user benefits, the company says. It provides continuous and secure operation of vessel machinery and subsystems through its single development environment that ensures simple yet flexible programming. Among the systems powered by Winmon™9 is ServoFusion, an advanced turnkey solution tailor-made for the complex automation and integration requirements of individual operators of specialist tonnage such as naval and specialist commercial vessels. For a cost-effective, off-the-shelf alarm, monitoring and control system solution for less complex commercial ships and yachts, Servowatch offers its ServoCore solution. Another innovation at the show will be the new trim and draught stability optimiser for SWATH vessels, ServoTrim.

Shell Marine

Hall A4 / Stand 210.1

Shell Marine will present the Shell Lube Monitor at SMM for the first time, a new cylinder-monitoring service that runs in tandem with the Shell Rapid Lubricants Analysis (RLA) cylinder check, which is being rolled out globally in the second half of 2016. The Dutch business reckons to have analysed over 50,000 cylinder drain oil samples via Shell RLA, identifying potential oil or equipment issues before they become critical. Many shipping companies use Shell RLA in their planned maintenance regimes. Its use has grown rapidly, with MDT and Wärtsilä now recommending cylinder drain oil analysis in light of changing demands placed on marine engines. Shell Marine expects to analyse about 18,000 cylinder drain oil samples in 2016 alone. Shell Lube Monitor allows customers to evaluate Shell RLA data and data generated from Shell Onboard Alert iron analyser and Shell Onboard Plus BN test kit, to strike the best balance between cylinder oil cost and engine reliability by optimising feed rates. Shell Lube Monitor offers an easy-to-read report and includes a complete engine overview, historical data from on board and the lab and, most importantly, comments from Shell experts highlighting areas of concern or possible optimisation opportunities.

www.servowatch.com
Sick

Hall B6 / Stand 602

Sick will be presenting its Mar-sic ship emission measuring device, an innovative solution for reliable measurement of emissions from ships according to MARPOL Annex VI and MEPC.184(59). Marsic is type-approved by DNV GL and measures both SOx and CO2 upstream and downstream of the scrubbers, and NOx upstream and downstream of SCR (selective catalytic reduction) plants. In addition, it can be used for process measurements such as CH4 in LNG (liquefied natural gas) and dual-fuel engines. At low cost and with little maintenance, a single gas analyser can serve up to four measurement points and measure up to nine components simultaneously: SOx, CO2, CO, NO, NOx, NH3, CH4, H2O, and O2. Maintenance onboard is also quick and easy. With Marsic, a conscious effort has been made to avoid the use of moving parts.

www.sick.com

Siemens AG

Hall B6 / Stand 318

To make maintenance work in the dock as quick, smooth and reliable as possible, Siemens has developed a unique logistics concept based on a modular container solution. It involves customising a standard sea freight container and equipping it for repair and maintenance work. By using standardised modules, Siemens says, it is able to achieve highly efficient import/export handling processes at any time of the day or night. The concept helps Siemens shorten maintenance times by up to 15%, create improved access and reduce risks during maintenance work. Siemens will be presenting the service container in the open air area in front of Hall B6 at this year’s SMM in Hamburg. Siemens will also be showcasing its wide portfolio of electrical products, systems, solutions and services for the entire life cycle of maritime applications. This includes the Siemens PLM (Product Life-cycle Management) software, the pod drive solution Siship eSipod and the Siship EcoMain system platform. The company will also be presenting customised gear units for maritime applications.

www.siemens.com

SKF Marine GmbH

Hall A1 / Stand 210

SKF exhibits at this year’s show will include two new launches: a new design of the Simplex Intermediate shaft bearing and the SKF Dynamic Stabilizer Cover (DSC). The redesigned Simplex Intermediate shaft bearing can be mounted on SKF Vibracon chocks ± self-levelling, height-adjustable and reusable chocks that are used for mounting all types of rotating or critically aligned machinery. Simplex Intermediate shaft bearings have a short shell length and can be aligned precisely in order to avoid edge loading. They were specifically developed for the shaft line of ship propulsion systems. This latest version has a new housing design, which features reduced weight and compactness for easy installation and maintenance. The DSC closes the hull of the SKF retractable fin stabilisers. The DSC comprises two inflatable cushions fixed to the stabiliser fin box. If the stabiliser is not in use, the cushions are inflated by high-pressure air in order to close the hull. This improves flow profile and reduces fuel consumption. To bring the stabilisers into use, the cushions are deflated ± allowing the fin stabiliser to move past ± and then re-inflated to re-close the hull. Other new products that SKF has launched during the year and that will be on display at SMM include the Turbulo Sludge Buoy ± a mechanical device that separates oil and water, eliminating manual draining. Also on show is the SKF Marine Condition Monitoring Route Kit ± a sophisticated condition monitoring and condition-based maintenance solution that has cloud connectivity to cut downtime and boost fleet reliability. Furthermore, the company will present its environmental monitoring system that ensures compliance with environmental regulations by storing and mapping a ship’s emission data: SKF BlueMon.

www.skf.com
Stentor Industries BV
Hall A4 / Stand 309

At the beginning of 2016, the Dutch company Stentor expanded its portfolio with third-party engineering services and products for maritime steel constructions. The manufacturer of propulsion-related components provides support for new-buildings as well as overhaul and maintenance projects. Both turn-key projects and individual fabrication are on offer. Stentor’s scope of work covers complete engineering, drafting work, component manufacturing as well as on-site installation and surveys.

www.stentorindustries.nl

Thermamax GmbH
Hall A4 / Stand 110

At SMM 2016, Thermamax will be presenting proven and new insulation designs for increased engine room safety and efficiency. An engine model fitted with a Tmax-Insulation enclosure will show visitors the properties and benefits of the Mannheim-based company’s easily maintained, 100% SOLAS-compliant insulation systems for marine engines. Highly effective insulation systems from Thermamax ensure a constantly safe process and retain the optimum system temperature required for clean combustion. Multi-section Tmax-Insulation enclosures impact the surface temperature of the engine and associated exhaust components to make sure that the 220°C limit specified by SOLAS isn’t exceeded. Visitors to the Thermamax stand can also get information on new 60°C insulation designs that will make it possible to continuously maintain the surface temperature of an insulated engine at below 60°C. This will prevent combustion of flammable gases in the engine room. Thermamax will also present a new design study for a marine engine enclosure. Using existing production methods, design engineers at Thermamax have developed a novel concept for the insulation system. The enclosure will dispense with soft, rounded elements and be based on large-area, edged 2D-triangular sections.

www.thermamax.de
Transfluid Maschinenbau GmbH

Hall B2 / Stand 324

Advanced tube-bending technologies are an efficient alternative to welding large tubes. At this year’s SMM trade show in Hamburg, the German tube-processing machine specialist Transfluid will be presenting its advanced bending machines and software solutions. The bending machines of the company’s "t-bend" product line allow high-performance processing of tubes with diameters of up to 325mm. This, according to Transfluid, results in significant time and cost reductions. Flanges can be welded to a straight tube before bending. Through an internal link to the corresponding CAD programs, isometrics can be directly processed in the Transfluid t-project bending software. The mobile tablet version t-project draft increases flexibility with special requirements, especially if data have to be entered manually aboard a ship. The software allows isometric measurement and input of tubes. Then the data are sent to the production department directly by e-mail, where production can start while further tube geometries are recorded on the ship. The option of end-forming processes, e.g., for forming flanges, is another benefit. Transfluid bending technologies enable optimised processing of large tubes and tubes with small diameters. Narrow radii are possible even in CuNiFe and stainless steel pipes, saving additional space on board.

Uni-Geräte GmbH

Hall A2 / Stand 220

Uni-Geräte, a German specialist for safety shut-off valves and flow control valves for fuel-handling systems, will be showing SMM visitors its new PX range of pneumatically actuated gas valve units designed for installation inside housings. Thanks to their compact design, the range ± designed for operating pressures above 5 bar ± is an ideal solution for restricted spaces such as in marine engines, the company says. Every Uni-Geräte product is subject to thorough individual and final tests based on the certification of established quality-management systems according to ISO 9001:2008, and the ATEX, PED and GAD directives.

Union Instruments GmbH

Hall B7 / Stand 117

Reduction of pollutant emissions requires reliable gas analysis. On the occasion of SMM, Union Instruments is introducing INCA Maritime ± a rugged and accurate four-component gas analyser in cassette construction. Its modular design should significantly facilitate its use in OEM solutions as well. The device, which was developed for emission monitoring on ships and other applications, analyses the O₂, CO₂, SO₂ and NOx concentration and combines a high-performance analysis with a compact construction and special sensor technology, comprising innovative multi-shell temperature stabilisation and a very powerful processor with a mathematical coprocessor. This, according to the manufacturer, enables reduction of the known physically induced temperature and ageing effects of the sensors to an unprecedented degree and corrects them with analysis methods such as the spline function ± a highly accurate and cost-efficient, versatile, and durable instrument technology.

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UT 99 AG
Hall A4 / Stand 409

At SMM 2016, the Swiss company UT 99 will once again put its efficient oil mist eliminators on display.

Two years ago, UT 99 presented the world’s first oil mist eliminator for crankcase (combustion engine) and lube oil tank (gas and steam turbines) ventilation with classification approval from DNV GL.

Due to consequent and continued developments, UT 99 managed to successfully undergo RINA type approval for its oil mist eliminator for diesel, gas and dual-fuel engines, UPF-844-MZ, in March 2016. Additionally, UT 99’s latest generation of oil mist separators, UPF-SauKuL and UPF-CCV-450, will be presented at the booth. These are highly efficient passive oil mist separators for the ventilation of small crankcases (combustion engines up to 500 kW and 3 MW, respectively) and housings of auxiliary equipment (tanks, gears, clutches).

www.ut99.ch

VDMA German Marine Equipment and Systems
Hall A1 / Stand 518

The website german-marine-equipment.de offers manufacturers and customers all over the world comprehensive assistance when they are looking for an appropriate maritime supplier from Germany. The directory covers all sorts of parts, components and entire systems from the wide range of products and services provided by the world-leading German maritime industry. Marine Equipment and Systems, part of the German Engineering Federation (VDMA), the largest industrial association in Europe, represents the interests of its some 240 member companies. The updated directory will be shown at the VDMA’s central stand at SMM. German marine and offshore equipment suppliers make up the most important business segment in the maritime industry. These manufacturers have a total workforce of approximately 70,000 and account for sales of about EUR 12 billion with a value-added share of often 70% and more of the construction of ships and offshore installations.

www.german-marine-equipment.de

Viking Life-Saving Equipment
Hall B1 / Stand 504

Visitors can also try Viking Nadiro Drop-In-Ball™ technology, an innovative lifeboat hook system that is safe and easy to operate and can be fitted/refitted to almost any brand of lifeboats. Additionally, a brand-new generation of combined anti-exposure and immersion suits (PS4190/91) will be introduced. These SOLAS/ISO dual-approved suits perform across multiple marine applications, offering unmatched safety, comfort, functionality and freedom of movement.

With a series of live demonstrations, Viking Saatsea will offer a sneak peek into the future of onboard eTraining, including STCW refresher courses and OODTPs for ERRVs. Training can be tracked, assessed or scheduled from any onshore or onboard location.

www.viking-life.com
Voith
Hall A4 / Stand 203

At this year’s SMM, Voith will be presenting propulsion concepts for numerous applications. Voith is exhibiting propulsion systems such as the Voith Schneider Propeller (VSP), the Voith Inline Thruster (VIT) and the Voith Linear Jet (VLJ). Once again, the company sets standards for reliable, efficient and safe vessel propulsion systems and concepts. Exhibits include a model of the Carrousel RAVE Tug owned by Dutch towage and salvage specialist Multirash BV, which features VSP propulsion units. Individual service solutions offered by Voith are the second focus at SMM. They support the customer from initial counselling to engineering and the development of holistic maintenance and service concepts. Unplanned downtimes can thus be avoided and life-cycle costs are reduced. Regular evaluation of propulsion system data supports the development of dynamic maintenance cycles and enables preventive maintenance. Individual retrofitting solutions allow Voith to modernise propulsion systems and increase their energy efficiency and environmental compatibility. Novelties at the Voith booth will be a daily forum, panel discussions and presentations of best-practice examples. Together with vessel operators and renowned shipbuilding industry experts, Dr Dirk Jürgens, head of Research and Development at Voith Turbo Marine, will discuss current requirements for vessel propulsion systems as well as efficient and environmentally friendly concepts. The session will be held daily at the booth at 2:30pm (on Friday at 11am).

Wärtsilä
Hall B6 / Stand 312

At SMM 2016, Wärtsilä will be emphasising its capabilities in digitalisation and its thought leadership on the future of global shipping. The company’s technological developments are aimed at meeting the demands expected to be prevalent in 2020 and beyond. Wärtsilä’s complete offering of products, systems and solutions is designed to comply with future needs and trends. Like the rest of the marine industry, Wärtsilä moves with times. That’s why this year visitors will find the company at the Wärtsilä Digital Lounge, where the new Wärtsilä Touch Screen will be launched. The company will also showcase interactive, transparent screen technology enabling browsing through a selection of the various offerings in the Wärtsilä portfolio along with the new Wärtsilä Nacos Platinum 2.1 bridge exhibit. And Wärtsilä will be manning a coffee stand outside Engine Hall A4 to promote The PartnerShip programme.

WinGD
Hall B2 / Stand 111

Winterthur Gas & Diesel (WinGD) will be showcasing its next-generation, two-stroke, low-speed gas and diesel engines. They are used for the propulsion of all types of seagoing ships worldwide, such as oil and product tankers, bulk carriers, car carriers, general cargo ships and container ships. WinGD started the development of large internal combustion engines in 1898 under the Sulzer’s name. Its headquarters are located in Winterthur, Switzerland. At SMM 2016, WinGD will be exhibiting together with the China State Shipbuilding Corporation (CSSC). It will demonstrate the latest low-speed, low-pressure dual-fuel X-DF technology as well as the Generation X engines.

Wiska Hoppmann & Mulsow GmbH
Hall B6 / Stand 202

At SMM 2016, Wiska will be showing its expertise in LED technology. With its searchlights, floodlights and multi-purpose fixtures both for above and below deck, the shipbuilding supplier from Hamburg is a reliable partner when it comes to maritime lighting. With respect to special requirements, Wiska also offers expert solutions for hazardous areas and will showcase its know-how in lighting and CCTV camera surveillance technology.
Gateway to Iran

**IRANIMEX** | The 18th Iran International Maritime & Offshore Technologies Exhibition ± Iranimex 2016 ± will take place from October 18th to 21st on the Gulf island of Kish. Europort, organised by Ahoy Rotterdam, has become the official and exclusive international partner of Iranimex. The new partners say that under the brand ‘Iranimex powered by Europort’ they’ll combine the blueprint established for previous Iranimex events with the international expertise the Europort name conveys.

**Maritime and offshore prospects**
Iran sits on the third-largest oilfield in the world and holds the second-largest reserves of natural gas globally. It has a coastline of almost 6,000km and is strategically connected to the Caspian Sea, Persian/Arabian Gulf and Indian Ocean. Port development will lead to a growing fleet of work- and patrol boats, as well as dredging operations. Offshore exploration and expanding oil and gas needs will require new ships, platforms and services. In the years ahead, hundreds of ships and platforms are expected to be added to the Iranian fleet, supported by an investment guarantee of USD 120 billion already announced by the Iranian government.

**Economic opportunities**
Following the lifting of trade sanctions in January 2016, funds have quickly been released that make Iran one of the most exciting maritime and offshore growth prospects in the years ahead. Pent-up demand to modernise the nation’s infrastructure and transport capabilities is encouraging an unparalleled eagerness to convert international business opportunities into firm contracts. The strength of demand for technological renewal triggered an order for 118 Airbus aircraft within days of sanctions being lifted, while government interests are currently seeking USD 2.5 billion in investment to modernise the National Iranian Tanker Company (NITC) fleet.

**News from the Iranian market**
The country is set to get its first floating liquefied natural gas (FLNG) terminal early next year, according to Ali Kardor, vice president of finance and investment affairs at the National Iranian Oil Company (NIOC). Kardor said Iran was in talks with an undisclosed Norwegian company on a plan to build the terminal in the Gulf, Iran PressTV reports. Under the plan, the Norwegian company is to send an FLNG ship to Iran’s Gulf ports by March 2017. Iran is keen on using the FLNG capacity to boost its LNG exports to Europe and the Far East.

Following the lifting of sanctions, Iran accelerated talks with Belgium, France and Germany on construction of LNG tankers, including floating LNG units and floating production, storage and offloading units (FPSOs) as the NITC was gearing up to enter the LNG market. Iran is seeking to build a capacity to export 40 million tonnes of LNG a year, according to NITC managing director, Ali Akbar Safaee.

**Renewed orders**
Meanwhile, the Islamic Republic of Iran Shipping Lines (IRISL) is in talks with South Korea’s Hyundai Heavy Industries (HHI) to purchase three ships of more than 14,000 TEU. In 2008, IRISL ordered some ships in its sister yard, Hyundai Mipo Dockyard, but that order was suspended when sanctions kicked in. Now, IRISL wants larger ships, which is under the purview of HHI’s shipyard source said. The deal between the two companies comes amid the shipping industry’s slump in global demand, which is having a knock-on effect on container shipping. The UK’s Port Technology International previously reported that the top three shipbuilders may merge operations in order to deal with the decrease in revenue. IRISL’s decision to place the order is in line with its previous announcement to acquire more than 575,000 TEU in container ship capacity to be operational by 2020.
The lifting of international nuclear-related sanctions on January 16th 2016 represents a significant step forward in terms of Iran’s re-engagement with the international community and re-entry into the global oil and gas market. Iran has announced ambitious oil and gas production targets, and has produced a list of 50 oil and gas projects, worth an estimated USD 185 billion, which it plans to offer to foreign investors. However, despite these positive developments, a number of barriers to entry remain for investors in the post-sanctions environment, which are likely to restrict Iran’s ability to increase its output in the short to medium term.

Despite maintaining a relatively conservative outlook for drilling and production when compared with the Iranian government’s targets, DW does expect to see substantial growth in activity within the offshore sector over the next two to three years. This rise in activity will be driven predominantly by Iran’s flagship South Pars gas and condensate field, in addition to projects such as the Abouzar and Forouzan field developments. Towards the end of the decade, offshore activity is forecast to decline, with the majority of the key offshore projects, including upcoming phases of South Pars, due to have come on stream by this point.

### Positive outlook for offshore drilling and production

Iran’s offshore production is forecast to rise significantly over the 2016 to 2022 period, due mainly to additional output from the giant South Pars field. DW expects total offshore gas production to rise at a 9% CAGR (compound annual growth rate), reaching just under 4.0mboe/d in 2022. Several phases of the South Pars field are forecast to come on stream or increase production over the next six years, including phases 20-24 and 13 in 2016 and 14 in 2017. Overall, South Pars is expected to account for an additional 1.7mmboe/d in natural gas output over the next six years. Additional natural gas production is also expected to come from key projects such as the Lavan and Forouz B field developments. Condensate production from South Pars is also expected to contribute to rising offshore liquids production over the next six years. Total offshore liquids production is forecast to rise at a 4% CAGR over 2016-2022, with output peaking at 1.9mmbbl/d in 2019. Additional projects contributing to this rise in production include the Abouzar and Forouzan field developments. Iran has also announced that it intends to offer its South Pars oil layer project to foreign investors. Due on stream in 2017, this project is expected to contribute an additional 54kbbl/d in offshore oil production once fully operational. A floating production, storage and offloading facility (FPSO) has been
acquired for the project, and is expected to be delivered to Iran in mid-2016. Upside potential for offshore oil and gas production in Iran also comes from projects such as the North Pars, Golsan and Ferdowsi field developments. These projects were previously stalled due to the international sanctions imposed against Iran; however, the National Iranian Oil Company now intends to auction them to foreign investment.

Offshore drilling activity in Iran has declined over the previous four years, following the tightening of international sanctions in 2012. Notably, the number of offshore development wells drilled declined by 21% from 2012 to 2015. This trend is expected to be reversed over the next two years, with the total number of offshore development wells drilled forecast to rise by 82% over 2016-2017. This expected rise in drilling activity can be attributed predominantly to the South Pars development. The total number of offshore development wells drilled is forecast to peak at 86 in 2017. Post-2017, DW expects to see a decline in offshore drilling activity, with the majority of key offshore projects due to have come on stream by this point. Consequently, the number of offshore development wells drilled is forecast to decline by 26% between 2017 and 2021. An uptick in offshore drilling activity is expected towards the end of the forecast period in 2022, driven by the delayed Phase 11 of the South Pars development, as well as smaller projects such as the Hormuz and Alfa field developments.

Barriers to entry remain in the post-sanctions environment

Despite this positive outlook, DW’s drilling and production forecast for Iran remains relatively conservative when compared with the government’s target of increasing total oil production to 5.7mmbbl/d by 2018 and gas production to 9.2mmboe/d by 2021. Notably, Iranian nuclear-related activities remain subject to a monitoring period of 15 years under the terms of the Joint Comprehensive Plan of Action (JCPOA) signed in 2015. Thus, there is the potential for sanctions to snap back and be re-introduced should Iran fail to meet its commitments under the agreement. Moreover, despite international nuclear-related sanctions having been lifted, a number of bilateral US sanctions against Iran remain in place. These include a trade embargo against Iran and a prohibition preventing US citizens from engaging in transactions with Iranian financial institutions. Consequently, foreign banks are taking a cautious approach with regard to processing Iranian payments, due to concerns over breaching US sanctions. A degree of uncertainty also remains surrounding the structure of the new Iranian Petroleum Contract (IPC), which was introduced at a conference in Tehran in November 2015. Although the new model represents an improvement over the previous buy-back structure in several respects, with IOCs involved in all phases of development under a joint investment structure, more granular details on the terms of the contract are still required.

Forecast increase in offshore drilling activity to contribute to growth in key markets

The expected rise in offshore drilling activity in Iran is forecast to have a positive impact on demand for offshore rigs. DW expects the total number of contracted offshore rigs to increase by 29% over 2016-2017, with rising demand driven by projects such as South Pars, Abouzar and Forouzan. DW expects the total number of contracted offshore rigs to peak at 34 units in 2017. Demand for offshore rigs is forecast to decline marginally towards the end of the decade, with the majority of the phases of the South Pars development expected to be on stream by 2018. Despite this decline, the number of contracted offshore rigs is expected to remain relatively high compared with the 2011 to 2015 period. This is due to projects such as the delayed Phase 11 of the South Pars development and the Hormuz field development. The tightening of international sanctions has restricted Iran’s access to new technology and financing for offshore projects, resulting in delays to planned offshore projects. Consequently, Iran has sought in recent years to develop its own construction capabilities for offshore rigs.

Rising offshore drilling activity is also expected to contribute to growth in offshore oilfield services expenditure in Iran in the coming years. Following a 14% decline between 2011 and 2015, due to the tightening of international sanctions, DW expects total offshore oilfield services expenditure to rise by 21% from 2016 to 2018, peaking at USD 1.34 billion in 2018. Expenditure is forecast to decline marginally towards the end of the decade, following an expected reduction in offshore drilling activity. Offshore rig and crew services represented 63% of the market between 2011 and 2015 and will continue to dominate offshore oilfield services expenditure over the next four years. The market for coiled tubing services is expected to see the strongest growth through 2020, with expenditure for this service line forecast to rise at a 14% CAGR. This jibes with the increasing demand for the advanced application of coiled tubing services in well completion and workover activities in Iran. In the offshore sector, there is also expected to be an increase in demand for technology that enhances drilling performance, such as managed pressure drilling (MPD) systems.

The number of fixed platforms installed in Iran has risen significantly over the 2011 to 2015 period. DW expects to see a further increase of 23% in the number of installations in 2016, with a large proportion of platforms to be installed allocated to the South Pars development. Platform installations are also expected in 2016 for the Forouzan and Lavan fields. Post-2017, demand for fixed platforms is expected to decline significantly, given that the majority of key offshore projects in Iran are forecast to be operational by this point. Consequently, DW expects the total number of fixed platform installations to fall by 64% between 2017 and 2020. Capital expenditure on equipment, including both new (greenfield) platforms and retrofit replacements, is expected to rise by 30% over 2016-2017, reaching a peak of USD 5.1 billion in 2017 before declining significantly towards the end of the decade. Despite this overall trend, total capital expenditure between 2016 and 2020 is expected to increase by 36% compared with the 2011 to 2015 period. In the offshore rig sector, Iran has been focusing in recent years on developing the technology required to construct fixed platforms indigenously. For example, in September 2014 an agreement was announced whereby Iran Offshore Engineering and Construction Company would construct five of the platforms required for the South Pars development.
IRANIMEX 2016
18 - 21 Oct. 2016 - Kish Island

Your gateway to Iran!

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Exhibition highlights latest component technology advances and customised developments

WINDENERGY | This year’s wind industry fair WindEnergy Hamburg will be held from September 27th to 30th. Hamburg Messe und Congress (HMC), organiser of the global business platform for the on- and offshore wind industry, expects more than 1,200 exhibitors from over 30 nations, who will be presenting their latest products and services in nine exhibition halls on some 65,000m². This year, for the first time, the conference WindEurope Summit will be held in the German port city in parallel with WindEnergy Hamburg. WindEurope was previously known as the European Wind Energy Association (EWEA).

WindEnergy Hamburg will once again feature national pavilions ± a total of 18 are currently registered. The largest, filling an entire exhibition hall, is Denmark’s, with 90 exhibitors, HMC said. The partner is DWEA, the Danish Wind Export Association.

Other European pavilions include Belgium, the Netherlands, the United Kingdom and Turkey. The wind energy markets in North and South America will showcase their expertise with pavilions from Argentina, the United States and Canada. Asia will be represented with a pavilion from China.

The list of exhibitors includes leading international turbine manufacturers, equipment suppliers, service providers, project developers, energy companies and specialist companies from all other areas of the wind industry. Fairgoers will find focal areas in the exhibition halls for all key subjects, such as drive systems, electronic components, safety, finance and insurance. There will be several exhibitors in the Smart Energy area in one of the halls who will be presenting distribution, storage, and power production and load control solutions. Numerous exhibits, from special-purpose bolts to multi-tonne gearbox systems, will demonstrate the impressive range of the value chain.

Both the on- and offshore market will be covered at WindEnergy Hamburg. Exhibitors concentrating on offshore wind turbines and planning, installation and operation of offshore wind farms and the required logistics will be based in three of the exhibition halls. Players such as Adwen and MHI Vestas Offshore will be present along with specialist groups from a number of countries, e.g., the Belgian Offshore Cluster.

A whole series of exhibitors from the maritime industries are once again taking the opportunity to fly the flag at two leading industry shows by HMC, namely SMM from September 6th to 9th and WindEnergy Hamburg. An attractive supporting programme for the fair gives international visitors an ideal environment for in-depth networking, HMC noted.
Approval for floating foundation

The classification society Bureau Veritas has issued approval in principle (AIP) for the WindFloat floating offshore wind turbine (FOWT) foundation. Designed by California-based Principle Power, Inc, a technology and services provider for the offshore deepwater wind energy market, the WindFloat consists of a ballasted floating platform that supports a multimegawatt wind turbine generator.

FOWT technology will help exploit clean renewable offshore wind power, said Mathieu de Tugny, senior vice president and head of the offshore division of Bureau Veritas. It offers substantial advantages over fixed offshore wind turbines as the entire unit can be assembled ashore and FOWTs can be installed in deep water and areas with varied underwater landscapes. There is also a much lower environmental impact from their installation.

De Tugny said, getting people safely onto and off of unmanned platforms and wind farm towers offshore has become a big issue. Walk-to-work OAS can provide significant safety, operability and/or cost advantages over more traditional personnel transfer methods such as personnel basket or capsule lifts, step-over from high-speed crew transfer vessels and helicopter transfers. We see a lot of new vessel types emerging with these motion-compensated gangways, and it is imperative that the industry has a standard against which to assess their safety and to help develop safe new designs. Two different offshore access technologies have emerged: passive transfer gangways, which are first connected to the offshore installation and then put in free-flow mode for personnel transfer, and active transfer gangways, which remain motion compensated during personnel transfer, the classification society noted. The safety issues and critical components, which differ from one category to the other, require special attention to ensure safe and reliable operation, it added.

With these new guidelines, the regulatory gap into which personnel transfer between offshore support vessels and offshore installations could fall has been closed, de Tugny said.
A new era in local position referencing

SERVICE VESSELS  Standard navigation and positioning techniques in the offshore oil and gas industry aren’t optimised for use inside a wind farm. Unlike an offshore supply vessel servicing an oil platform, which may have one or two approaches per day, wind service vessels may visit as many as 50 wind turbines in a single day. This requires fast and efficient turnaround times without compromising safety. The following article by Sasha Heriot, Tom Coggins, Milijan Mudrinic and Andrew Stead from UK-based Guidance Marine, Hendrik Busshoff from Germany’s Bernhard Schulte Ship Management and Ole Morten Husøy from Norway’s Marine Technologies discusses the challenges of existing position reference systems, including laser and DGPS systems, and considers the use of a new type of sensor that utilises the physical environment rather than discrete targets from which to reference position.

A vessel typically approaches a wind turbine in DP mode at a distance of 100m and then keeps station at a distance of about 10m while walk-to-work bridges are deployed and crew are transferred. While the use of laser- and radar-based position reference systems is common in the oil and gas industry, they aren’t optimised for the offshore wind industry. The number of targets required to cover a typical wind farm, along with the close proximity of workers to targets due to the restricted space on a typical wind turbine, present particular challenges to the successful operation of these sensors.

A new type of radar sensor is therefore presented here that doesn’t use an active target, but rather the local environment as its target ± in this case the leg or tower of a wind turbine. This removes the need for physical targets to be installed, which makes the vessel completely independent and can increase safety and decrease turnaround times.

Navigating in wind farms
DP2 vessels typically have two DGPS sensors and one local position reference sensor (PRS) [2] that is usually based on laser technology to enable the vessel to approach and keep station at the
wind turbine. With the recent appearance of SOVs (service operation vessels) purpose-built for wind farm applications, the development of a purpose-built PRS is just a logical continuation.

**DGPS reference sensors**

Differential GPS sensors provide higher accuracy (<1m) compared with traditional GPS (20m) and are relied on for both navigation and timing. DGPS, however, suffers from vulnerabilities. A paper produced by the Royal Academy of Engineering in 2011 lists no fewer than 24 failure modes, which in the most dramatic cases can result in thousands of metres in error or total loss of signal [3]. Using DGPS for navigating at sea isn’t immune to any of the vulnerabilities [4]. The problem is well recognised, and incidents resulting from

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DGPS failure have been recorded during station-keeping in recent years [5]. In close proximity to an asset this presents a recognised hazard.

**Laser position reference sensors**

Unlike DGPS, which provides a global position, laser systems give a local position relative to a fixed target. The fixed targets for a laser PRS are reflective tape or prisms. The distance is calculated by measuring the time of flight of the reflected light. For a laser PRS to be effective, the following conditions must be met:

- Direct line of sight must be maintained between the laser sensor and reflector,
- The reflector must ideally be at a similar height to the sensor (within its specified tilt range),
- No other reflectors should be in the vicinity of the target reflector,
- The reflector should be well maintained and clean.

Laser PRSs were developed for the oil and gas industry, and typically one or two reflectors are attached around the exterior of the oil platform. Prism reflectors offer high brightness of the return signal compared with reflective tape; however, tape targets are much more common due to their lower cost (about GBP 500) compared with prism targets (about GBP 1,500) [6]. A well-known issue with tape targets is that they can be difficult for the sensor to differentiate when other reflective surfaces are in the vicinity. Although this isn’t generally an issue in the oil and gas industry, it’s difficult to avoid in the offshore wind industry due to the proximity of the operations to the targets.
The other major difference between the oil and gas industry and offshore wind industry is the number of reflectors required. Target installation could cost in excess of GBP 200,000 on a typical 100-turbine offshore wind farm.

Owners and operators of offshore wind farms are imposing cost constraints on reflector targets, and proposals for cost-effective solutions have been put forward [7]. One proposal suggests placing strips of retroreflective tape around the tower of the turbine, whereas a second proposal suggests hanging a single retroreflective tape target from the transition piece landing platform on a rope. While significantly reducing the cost of reflectors, these concepts are inadequate due to the risk of obscuration and weak return signal, which increases the risk of a dropout ± this may result in a loss-of-position incident. Weak reflector targets in the vicinity of an access platform also pose a high risk of walk-off incidents ± a situation in which the sensor locks onto high-visibility clothing of work personnel rather than the actual target. This is a real scenario when workers are transferring to or from the vessel and turbine. It could result in vessel movement on DP, and the consequences of such an incident when a motion-compensated bridge is deployed could be serious. Not only could both the vessel and wind tower be damaged, but there is also a potential for serious injury or loss of life. Installation of prisms on all wind turbines would solve these issues. Some wind farms are installing prisms [8]; however, few are implementing this solution due to the high cost.

“Targetless” PRS system

Guidance Marine is the first company to offer a local DP PRS solution that removes the requirement for targets altogether. The system consists of two RangeGuard sensors connected to a control unit, which in turn is connected to the bridge and the DP system of the vessel. The small, lightweight radar sensors are mounted onto the side of the vessel pointing in the direction of the transition piece, and simple geometry determines the range and relative position of the vessel [9], as shown in Figure 1.

The RangeGuard sensors are 24-GHz licence-free FMCW (frequency modulated continuous wave) radar transceivers. Their maximum range is 300m and they have an accuracy of ±2cm + 0.1% [10]. They are configured such that they have an azimuth beam angle of 110° and a vertical beam angle of 11°. Individually, each sensor reports the range to the nearest object, in this case the transition piece, which can be displayed on the user interface. Working in tandem, they provide the relative position of the vessel, which can then be used in the vessel’s DP system.

Data collection

First sea trials were undertaken in August 2015 on the Bernhard Schulte-managed vessel Ocean Zephyr, shown in Figure 2. The Ocean Zephyr was fitted with two prototype wide-beam RangeGuard sensors as shown in Figure 3. The sensors were hard-wired to a processing module, which was located in the deck IT room. To support the trial, two IP video cameras were also installed (separate from the RangeGuard system). The video recorder...
was also installed in the deck IT room. A bridge monitor was installed running on a Guidance Type 3 Marine Processor (T3MP).

The sensor beam patterns were arranged so that the minimum operating range (for beam overlap) was approximately 8m with the maximum being significantly greater than 50m (the motion-compensated walkway operates between 10m and 30m).

Data were collected from both the RangeGuard sensors and video cameras continuously for a two-week period from August 19th 2015 to September 2nd 2015.

Range data for the two sensors are shown on a display of the bridge as illustrated in Figure 4.

Results

Raw radar data are processed in the control box connected to the RangeGuard sensors using a target-tracking algorithm. The raw data show all the radar return signals. An example of the raw data is shown in Figure 5.

The algorithm can identify and track peaks in signal level. Currently ten targets are tracked simultaneously, although more targets could be tracked if required. For these trials, the nearest peak is selected; depending on the application, however, the largest peak may be more relevant.

By locking on the nearest peak, plots can be created that show distance from the wind turbine vs time. Figure 6 shows the distance-time chart for approach to a wind turbine from one of the sensors.

The 10m spikes in distance at around 10:07 are attributed to the algorithm jumping between the legs of the turbine, and the spike of around 1m at 10:40 is attributed to the algorithm jumping between the main leg of the turbine and the boat landing attached to it. Understanding these phenomena has enabled the algorithm to be improved.

A second approach and departure is shown in Figure 7.

During the approach between 8:10 and 8:13, the range data jump. At this distance (120m to 70m) the angle of approach means that two legs of the substation switch between the nearest peaks. As it moves closer, a single peak is identified and is tracked for the duration of the operation.

Figure 6: The vessel approaches the wind turbine. It can be clearly seen when the vessel is moving and keeping station on DP. The Ocean Zephyr has both DGPS and CyScan laser PRS.

The vessel moves very close to the substation at 08:38 to 10m, which is then followed by a rapid departure. The RangeGuard loses signal at 300m range.

Similar data were obtained from both sensors. Data collection against different targets has allowed the algorithm to be modified specifically for this application so that the jumps in range have been eliminated. This, however, highlights the challenges that must be overcome with an environmentally referenced sensor and the importance of live sea trials.

DP integration

Guidance Marine is working with Marine Technologies (MT), which is integrating the RangeGuard sensor raw data into the DP system. A position telegram, also known as a DP string, has been provided to MT. This is a string of ASCII (American Standard Code for Information Interchange) characters supplied by the RangeGuard control unit to communicate information to the DP system. The DP string can output a maximum of ten features (or peaks) from each sensor into the DP system, from which the nearest peaks will be identified, and simple mathematics calculate the range and bearing of the vessel to the wind turbine or leg.

The distance r from the midpoint of the sensors to the target is given by Equation 1:

\[
r = \sqrt{\frac{1}{2} r_r^2 + \frac{1}{2} r_L^2 - h^2}
\]

Equation 1

Where 2h is the distance between the two ranging sensors, \(r_r\) is the distance from the left-hand sensor to the target and \(r_L\) is the distance from the right-hand sensor to the target.

The bearing \(\theta\) to the target from the midpoint of the sensors is given by Equation 2:

\[
sin \theta = \frac{r_r - r_L}{r - 2h}
\]

Equation 2

where r is defined in Equation 1.

The sensor data are sampled three times per second. With ten features/peaks identified every second and up to four sensors connected, it means that there could be over 100 messages per second to the DP system if required. Full DP integration has been available since the second quarter of 2016.
Discussion

This work has demonstrated the concept that an environmentally referenced sensor system can be used for local position DP referencing. Being completely independent of mounted targets, and based on radar technology, it provides an additional form of redundancy to the DP system. RangeGuard also introduces a new method of data acquisition, thus it doesn’t have many common failure modes with DGPS or laser system. The common problems that occur with mounted targets are negated and maintenance of targets is no longer required. This results in an overall more robust redundancy concept at sensor level.

The RangeGuard system uses simple geometry, and the wind turbine legs or towers provide excellent referencing targets for the sensors. When approaching a wind turbine, there is generally only one nearest target and the RangeGuard can easily lock onto this. More complex structures are possible and have been demonstrated with the substation approach in Figure 7. Work is under way on developing the algorithm to eliminate the significant jumps in range seen in Figure 7 when selecting different legs of the substation. It should be noted, however, that when the vessel is in close proximity to the substation, the sensors do lock onto a single target and continue to lock onto this target during departure. Data collection in more complex environments is currently under way.

Conclusions

A new type of PRS for offshore wind DP operations has been described. Based on radar technology, it is unique in that it doesn’t require any physical targets located on the wind turbine. Instead, it uses radar reflections from the environment to measure range to the nearest objects. This has the potential to significantly reduce costs and improve safety during offshore wind operations.

Trials on the Ocean Zephyr have demonstrated that stable range data can be gathered from the RangeGuard microwave sensor, which has enabled development of the target-tracking algorithm. The algorithm now performs at an acceptable level to enable DP integration.

After the promising results obtained during the trials on the Ocean Zephyr, Bernhard Schulte decided to make full use of the potential of RangeGuard and install a fully DP-integrated system on its SOV newbuilding Windea La Cour. The technologically highly advanced vessel set sail this summer, and RangeGuard ideally complements and expands its capabilities.

References

Novel floating concrete platform for deeper waters

WINDCRETE  A new spar-type floating substructure made of concrete for offshore wind turbines could help move wind farms to deeper waters while providing a cost-effective and robust alternative to steel. Called Windcrete, the substructure has been developed by a small group of professors and researchers at the Polytechnic University of Catalonia in Barcelona, Spain. It’s described here by project members Climent Molins, Alexis Campos and Santiago Angel.

In the past 30 years wind energy has evolved from an experimental technology sector to mainstream projects. When onshore projects began to grow, some resistance came from communities that didn’t want to have giant steel turbines in sight, so developers turned to the sea. Denmark, a pioneer in wind energy overall, established the first offshore wind farm in 1991 with only 5 MW of power from eleven turbines. Twenty-five years later, the same amount of power is produced by a single turbine, and the average project delivers about 400 MW. The most recently constructed wind farms have 8-MW turbines with rotor spans reaching 164m.

The offshore wind industry has so far relied on foundations to build its wind farms. It’s a booming industry, with new projects constantly being announced. Yet in the foreseeable future, sites where fixed foundations are economically and socially viable will be exhausted. There are two main reasons for this. First, after a certain water depth the foundations become more difficult to install and the submerged structure is too big for production of economical electricity. And second, due to some communities’ unwillingness to have wind turbines in sight.

Building wind farms farther offshore can help overcome these obstacles. Furthermore, capacity factors can be higher in these areas as wind can be stronger and more constant. This type of wind farm requires a completely different technological approach. As depth increases, traditional foundations become prohibitively expensive, in which case floating substructures, or floating foundations, offer immense opportunity.

Floating foundations provide several advantages over fixed-bottom technologies. They are ideal for greater depths as the substructure itself is shallower than the depth of the sea. Because of the absence of an underground foundation, which is the most widespread system using driven piles, less geotechnical research on the site is needed. This means less preparation, a shorter project duration, fewer dangerous tasks and lower negative environmental impact (such as sound vibrations that need to be controlled with a bubble curtain).

Furthermore, the structures can be towed to the site in a greater state of completion, which can mean less specialised crews and ships. The construction and towing process can be seen in Figure 1.

Several floating foundation designs have been adopted from the offshore oil and gas industry. These include tension-leg platforms (TLPs), semi-submersibles and spars. These concepts have achieved different levels of development and have received significant investment from governments in Europe, the UK, US and Japan. Currently there are a couple of demonstration projects in the pipeline, the most advanced being the Hywind, created and funded by Norwegian giant Statoil, whose first pilot park is under construction in Scottish waters. Construction of the first large demonstration project in French waters has also begun, using the Ideol concept and with significant investment from France’s EDF Group and the local government. At the same time, several demonstration projects are being developed in the US and funded by the US Department of Energy.

Windcrete has changed previous design paradigms in the floating offshore wind sector, both for foundations and materials. Most existing designs use steel in semi-submersible or TLP arrangements, while concrete arguably has geometries that would test the material’s limits. Windcrete has achieved the crucial combination of using a simpler, cheaper material, such as concrete, in a way that makes the most of its durability, and a geometry that exploits its mechanical properties and minimises stress concentration.

Created by an expert team of researchers in structural engineering, Windcrete was designed from the beginning using methodical, in-depth and result-optimising methodologies. It went through pre-design for sizing, with checking for water interactions and
coupling wind and turbine effects. At the same time, low capex was part of the optimisation process from the start [2].

The spar configuration has seen extensive use in the oil and gas industry, and now - characterised by simplicity, stability and reliability - will start serving the renewable energy sector as well. Windcrete uses the lessons learned in this industry over more than 30 years.

Furthermore, implementation of the technology has been found to be economically feasible. In a recent study by the University of Stuttgart [1], the costs of offshore wind were analysed in depth and compared. Windcrete was found to be competitive, with an LCOE (levelised cost of electricity) of about EUR 0.12 per kilowatt hour in certain conditions, making it affordable in existing feed-in tariffs that other offshore wind projects have received.

Regarding the sustainability of Windcrete, a recent study showed that it produces fewer emissions over its lifetime than steel competitors. This is achieved mainly due to the longer lifespan of the structure and the bigger turbines it is expected to carry, which means it will generate significantly more electricity per gram of CO₂ produced during construction and installation.

To summarise, there are several benefits of concrete over steel for this application. There has been extensive experience of concrete structures behaving significantly better in marine conditions as regards durability and service. The lack of corrosion on concrete and the proven technologies and designs that protect the rebar in it can enable a lifetime of more than 50 years and reduce required maintenance.

What's more, scalability is a major advantage of the concrete configuration. More specialised labour is needed to create complex metal structures than efficient concrete ones, so Windcrete structures require less-skilled personnel and also have increasing economies of scale from their formwork, for example. This means that in a market where welders sometimes have to be flown in at considerable cost, Windcrete can use local labour and thus boost the local economy.

It is already been mentioned that in order to install Windcrete, a far simpler procedure can be expected than for the fixed foundations currently used. This means the high complexity and large size of the ships recently developed for offshore wind farm installation would be needed. More common towboats would be required for transportation, and the aim is that both erection and installation be carried out by medium-size boats. Nevertheless, the shipbuilding industry can make a tremendous contribution when it comes to installation of the turbine, nacelle and blades. It has been planned that a specially designed catamaran carry out this procedure. The turbines would need shorter towers than those in current technologies as the substructure can be submerged more deeply, therefore lowering the turbine height. The catamaran will hold the substructure and provide a working platform for installation of the turbine. The procedure is illustrated in Figure 2.

The technology’s proof of concept has been achieved in the laboratory and a mid-scale prototype carrying a 2-MW turbine has been designed. The aim is to test and prove the technology and installation procedure in real marine conditions while gaining valuable knowledge for a commercial version carrying an 8- or 10-MW turbine.

References

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Approximation of DP capability on offshore vessels

**DESIGN PROCESS** Dynamic positioning (DP) is of growing interest to shipyards. Due to the high complexity of a DP system, few institutions are able to estimate the station-keeping capability of ships. In the design process of a DP-capable vessel, a shipyard is therefore dependent on them, e.g., an experienced DP system supplier. This means it must provide a third party with confidential information, and receives the results without knowing how they were calculated. The German shipyard Fassmer has developed its own solution to this problem, writes Philipp Schütte in his bachelor’s thesis presented for the Interdisciplinary Studies Course in Naval Architecture and Ocean Engineering at the Bremen City University of Applied Sciences.

The Fassmer shipyard in Berne, Germany, regularly designs and builds vessels requiring DP capability. Its design department developed a DP-capability analysis tool allowing assessment of the manoeuvring qualities of a design at an early stage without the help of third parties. The calculation is based on the formulations of IMCA 140 [7]. All necessary inputs are known, or at least can be approximated, at a very early stage of the design process. The DP-analysis tool was coded in Python 3.4 using several Python modules, all of which are open source, resulting in a cost-effective, affordable solution. The problem was solved using two different approaches. Both have significant advantages and disadvantages and will be discussed below. The results were validated by comparison against DP-capability plots calculated by experienced DP suppliers.

In contrast to the common boundary conditions in design, e.g., cargo capacity or ship speed, a vessel’s station-keeping ability is relatively hard to predict. This is especially true for shipyards that don’t deal with DP every day. The designer might not even be able to make a rough estimate. This is due to the high complexity of force modelling and the superposition of forces that act on a vessel. Another difficulty is a comprehensible and comparable presentation of the results. Therefore an internationally recognised standard is needed.

The International Marine Contractors Association (IMCA) published the guideline IMCA 140 to unify the production and presentation of DP-capability plots. These plots show the station-keeping ability of a vessel on a polar plot with the maximum permissible environmental forces over the angle of attack. The environmental forces are assigned to wind speed. According to the guideline, higher wind speeds lead to higher waves, while current speed is constant. These plots are called DP-capability plots.

Even though the static formulations of IMCA 140 aren’t an exact representation of a vessel’s station-keeping ability, capability plots are recognised in the industry. So IMCA 140 has been used as guideline for development of the tool.

**Environmental loads**
During operation, the DP vessel is exposed to several environmental forces that are known to interact with each other. The most significant forces are wind-, current- and wave-imposed forces. The interaction between wind and waves is widely recognised; in fact, wind is the main reason for the existence of surface waves. However, waves are also known to interact with current if they are not collinear [1]. IMCA 140 assumes all environmental forces to be collinear; therefore interaction effects among environmental forces can be neglected. Another simplification in the IMCA 140 guideline is replacing fluctuating environmental loads with a one-minute mean. This simplification is common for wind and current loads. In force modelling of them, the dynamic pressure is multiplied by a significant area and a drag coefficient. In DP, the ship is typically constrained in surge,
sway and yaw. So only drag coefficients are needed to model wind and current forces. These coefficients are often derived from a series of model tests. The use of proper coefficients is vital for the quality of the station-keeping prediction. IMCA 140 suggests using Nienhuis coefficients [2]. For current forces this works well. Nienhuis publication provides sets of coefficients for five different ship types. However, the work lacks trustworthy coefficients for wind forces. Wind coefficient data from Blendermann [3] were therefore used.

Contrary to other environmental forces, wave forces are transient, so a different approach was used. Wave forces can be assumed to consist of three components:

- A mean displacement, resulting from a constant load component. The so-called mean wave drift force. This drift force is caused by non-linear (second order) wave potential effects.

- An oscillating displacement of the structure at frequencies corresponding to those of the waves; the wave-frequency region. These are linear motions with a harmonic character, caused by the first order wave loads.

- An oscillating displacement of the structure at frequencies which are much lower than those of the irregular waves; the low-frequency region [4].

The last two forces need to be considered in static analysis because they oscillate with a zero mean. In operation, these forces have a large influence on the movement amplitude of the vessel. But they are counteracted by the DP system because this would lead to excessive fuel consumption and other negative side effects.

The wave-drift force results from the reflection of incoming waves in the waterline of a ship. A very large ship with vertical walls in very small waves acts like an upright wall standing in the water; the incoming waves are totally reflected. With increasing wave energy, the ship will start to follow the waves; the incoming waves pass the ship and the wave-drift force declines. If the ship completely follows the waves, the wave-drift force will disappear.

The presence of the wave-drift force has long been neglected because it can't be explained by linear wave theory. The order of magnitude of the wave-drift force can be the same as that of the current force in special cases, which can be seen in Figure 1. Generally, the wave-drift force is one magnitude smaller than the first-order wave forces [4].

Since the wave-drift force is connected to the ship's movement, a hull model is required for exact calculation of these forces. In the very first step of design, no such...
information is available; consequently, a simpler approach from Fujii and Takahashi [5] was used. With this approach, the formula for a ship in very short waves, derived by Maruo [6], is multiplied by a reduction factor for the ship’s wave response.

Functional loads
Functional loads are loads that are induced by the DP system, in this case only the propulsion system. Other functional loads such as anchor-handling or pipelaying operations are neglected. A wide variety of thruster types is available on the market and employed in DP systems. In IMCA 140, efficiency coefficients are presented for tunnel thrusters, rotatable thrusters, gill jets and rudder main propeller assemblies. The largest discrepancies in station-keeping calculations may originate from the thruster model. Model testing of desired thrusters and thruster assemblies should be carried out to increase the calculation’s precision [7]. However, to get an initial idea of the resulting forces for different thruster set-ups, the method from IMCA 140 is sufficient. The thrust force is the thruster’s power multiplied by an efficiency factor, e.g., 0.177 kW/kW for steerable thrusters. Since all environmental and functional loads relate to mean values, a certain allowance must be assumed for varying loads in operational conditions. IMCA 140 suggests that varying loads may be 15% - 17% higher than the time average [7].

Programming
The tool was coded in Python 3.4. Python is an easy-to-learn programming language that has become widespread since its advent in the 1990s. Due to the wide range of modules for computational science and visualisation, it enjoys great popularity among scientists and students. Use has been made of the modules NumPy 1.9.2, SciPy 0.15.1 and Matplotlib 1.4.3. The tool’s structure can be seen in Figure 2. On the left side are the input data, which are subdivided into basic hull data, thruster set-up and environmental forces.

Since the tool is designed for use in the very first steps of ship design, only limited hull data input is required. Furthermore, a ship type needs to be selected, which will determine which coefficient sets will be used for the calculation of environmental forces.

The input of thrust forces consists only of the location, type of thruster and maximum power output of each thruster.

The input of environmental forces is defined by IMCA 140’s wind and wave correlation data and the ship type. It is customary to plot the DP capability of a vessel for wind speeds of 70m/s and higher. It is highly doubtful that any DP vessel would be used in such conditions. Moreover, IMCA 140 only gives the correlation of wind and waves for wind speeds up to 35m/s. Since the tool’s output should be comparable with other DP capability plots, the information given by IMCA 140 was extrapolated for higher wind speeds.

Each type of thruster is associated with control parameters that enter the set of equations as unknowns. Possible control parameters are propeller speed, propeller pitch and steering angle for rotatable thruster or rudder propeller assemblies. As mentioned above, the DP system only controls the sway, surge and yaw motions of a vessel; this results in a set of three equations. A single rotatable thruster with CPP would saturate this set of equations. A typical OSV has two steerable thrusters aft and one or more transverse thrusters at the bow, so the resulting set of equations is oversaturated.

This problem can be dealt with in two possible ways: one is to simplify the problem until there are just as many unknowns as equations, the other is to solve the system indirectly with numerical methods. Both methods have their advantages and disadvantages.

A simplified solver can only handle a limited amount of thrusters. For an OSV with two steerable thrusters and one bow thruster, we obtain no fewer than five unknowns: two steering angles and three load factors. If the steerable thrusters work in each other’s direction, their thrust is nullified. This is often made use of by tugs in narrow waterways. Assuming the OSV would always go full ahead with its steerable thrusters, the set of equations can easily be solved. While this may not depict the actual operating conditions, it is sufficient to provide valuable insight into the vessel’s DP capability at an early design stage. With a Newtonian non-linear solver from SciPy, the solution is found within 0.0005s for a single angle of attack and a single wind velocity, on an average desktop machine. With 19 angles of attack and a step width of 0.1m/s for the wind velocity, we obtain a runtime of 54 seconds to generate a full DP-capability plot.

Although the simplified solver is limited to no more than two steerable and one transverse thruster, several transverse thrusters can be substituted for a single vir-
tual thruster, having the same total force and moment as the original thrusters. This way the solver can take a more or less unlimited amount of thrusters.

If a vessel with more than two steerable thrusters or rudder propellers assemblies is to be calculated, one can get around formulating the mathematical problem in the form of an optimisation problem. In an optimisation algorithm, a cost function is compared with boundaries and/or constraints. The equations mentioned above are then considered as constraints, the available power as a boundary condition. The cost function represents the solver philosophy; in the simplest case it is the product of the load factors.

The solution that satisfies the constraints and boundaries at the lowest cost is considered to be the optimal solution. SciPy offers various optimisation algorithms; in this work the Sequential Least Squares Programming (SLSQP) algorithm is employed because it is the only one that handles equality constraints as well as boundaries. The calculation time per run is between 0.05 and 2.5 seconds. For a full DP-capability calculation, this yields a runtime of 7 minutes, rapidly increasing with the amount of thrusters.

Validation

While working with DP system suppliers, Fassmer noticed that for the same vessel, every supplier presents different estimates of station-keeping ability. Almost every supplier uses its own software and obtains different results than its competitors. It is therefore difficult to compare DP plots from different sources. Possible reasons for variations are:

- Differences in environmental modelling,
- Differences in thruster modelling,
- Differences in modelling interaction effects,
- Different thrust allocation algorithms.

However, to validate the quality of a station-keeping tool, results need to be compared with others. The results obtained from the developed script are compared with the results of DP-capability analysis performed by Norway’s Kongsberg Maritime AS. Kongsberg’s calculations were published on the Internet by the shipowners.

Figures 3 to 6 show the results. It is clearly noticeable that there is some deviation between the plots from the tool and the results from Kongsberg; however, the overall tendencies are comparable. Furthermore, there are no big differences in the use of the simple solver and the optimisation solver. For Ship 2, it seems that Kongsberg limited the calculation to wind speeds of 72m/s.

Conclusion

The validation shows satisfying results for the developed tool in providing valuable information for the ship designer at an early project stage with minimum input data. This information is well suited to be used by the designer in estimating the influence of design changes as well as in an early selection of propulsion alternatives. While the tool can replace the work of more sophisticated software in use by experienced DP system suppliers, it can give a useful benchmark to the designer. The objective of gaining some independence from the system supplier was achieved. Given a development time of nine weeks and very low costs, this can be seen as an extremely cost-effective and successful solution. However, much more research can be done on this topic, including further refinement of the analysis tool.

References

Simulating an FLNG unit in waves with STAR-CCM+

PRELUDE FLNG  The world’s first floating liquefied natural gas (FLNG) platform, named Prelude, is currently being built by the Technip/Samsung Consortium (TSC) in South Korea for a joint venture of Royal Dutch Shell, KOGAS and Inpex. In a scientific study undertaken by the Australian Maritime College (AMC), numerical simulation was used to investigate how various wave scenarios will affect the motions and operations of such a facility. The computations were performed using STAR-CCM+. Here Dr Max Haase and Yuting Jin, a PhD candidate at AMC, describe the process and results.

To be deployed 475km off the western coast of Australia, Prelude, the world’s first FLNG platform, is about to revolutionise the way natural gas is produced. The largest offshore facility ever constructed, Prelude has a length of 488m, a width of 74m and weighs about 600,000 tonnes. Still in an early stage of development, FLNG technology will allow freshly extracted natural gas to be processed and stored on board before being loaded onto LNG tankers, thereby enabling the exploitation of offshore resources that had been too costly or difficult to develop previously.

The Prelude FLNG project, initiated by a consortium in which the energy group Royal Dutch Shell is the majority shareholder, is the first of its kind. In principle, the FLNG processing units are similar to the FPSO (floating production, storage and offloading) facilities used for oil extraction, although Prelude FLNG will work on a much bigger scale. The natural gas produced at the field will be cooled to -162°C, turning it into a liquid and reducing its volume by a factor of 600. The liquefied gas can then easily be stored in tanks and loaded onto liquefied natural gas (LNG) tankers for onward transportation.

To reach the full potential of this technology, it must be ensured that in extremely adverse weather conditions, such as storms and heavy seas,

- the ship’s structure is able to withstand the enormous strains;
- it is possible to maintain operations with as little disruption as possible, including the docking and loading of the LNG tankers.

To gain detailed knowledge of the likely conditions and ensure undisrupted operation, the AMC, a specialist institute at the University of Tasmania, has analysed how such gigantic FLNG facilities behave at sea in a scientific project involving numerical simulation and experimental validation.
The project

The three-year research project started in March 2014. The initial phase, which has now been completed, consisted of investigating the influence of different wave frequencies on the motion response of the FLNG unit.

In the second phase, which is still in progress, the primary focus is on operational aspects of the facility, specifically on the interactions between the FLNG facility and the much smaller LNG tankers and supply ships during approach and mooring. These include the emergence of frequencies causing pitching and rolling movements, and undesired resonance waves.

The aim of the project is to provide specific information to help with the development of the following target areas:

- Planning: determine design configurations suitable for critical conditions;
- Operation: establish efficient procedures for safe operations;
- Crew training: enable precise and practical crew training.

CFD simulations at AMC Search

The AMC specialises in shipping and maritime engineering. The institute has an extensive range of testing equipment, including a 100m-long towing tank, a circulating-water tank, a cavitation tunnel and a 12x35m model test basin. It also has access to a computing capacity of over 1,500 cores.

AMC Search, the commercial arm of the institute, has been making the acquired knowledge and the techniques...
developed from research and experimental testing available to the maritime industry in Australia, New Zealand and across the world for over 30 years. CFD has played an increasingly important role due to more sophisticated requirements in performance evaluation and design optimisation, which cannot be achieved by model testing in a timely and cost-effective way. At AMC Search, STAR-CCM+ is a popular choice for CFD studies because of its versatile simulation capabilities, user-friendliness and computational speed.

Towing tanks versus simulation
Towing tanks have been a reliable tool for ship design, optimisation and performance assessment for over 150 years. Over time, the procedures used have proved their value and achieved a high degree of accuracy. However, model testing is typically not available until a late development stage, when design and construction are well under way. In addition, the construction and alteration of the prescribed scale models can be both time-consuming and expensive. Overall, the flexibility and ability to innovate as required in today’s development cycles are clearly limited by the sole use of towing tanks. Furthermore, they are limited to scale models that are significantly smaller when compared with the full-scale device, potentially restricting the ability to investigate innovative designs.

As a result, a growing number of engineers are turning to numerical simulation to assess complex systems at a much earlier stage of the design process. Simulation software, such as STAR-CCM+, has proved to be as accurate as towing tank tests and, given realistic assumptions, allows ships and offshore platforms to be simulated at full scale, thereby eliminating some uncertainties introduced by the scaling process. Scale model testing remains relevant in terms of not only demonstrating software robustness, but also the validity of assumptions relied on in carrying out various design investigations.

Analysis
The dimensions of the computational domain for the full-scale calculations were 3,000x800m. For these calculations, meshes from to 4 to 12 million cells were used depending on the wave frequency being investigated. A total of 40 calculations were performed. The calculations took about 700 hours using between 48 and 64 cores. Although the Prelude FLNG operates in water depths between 200m and 300m, a water depth of between 80m and 800m was simulated in order to assess the shallow-water effects that may occur during tower tank tests and lead to inaccuracies.

The following STAR-CCM+ features were used:

- Overset mesh: The overset mesh capability permitted easy positioning of the LNG tanker in the vicinity of the FLNG unit, for example to analyse the effects of approach and mooring (e.g., resonance waves).
Motion model: The dynamic fluid-body interaction (DFBI) model was used to account for the coupling between waves and ship movement.

Wave model: The non-linear Stokes 5th order wave model was chosen for its accurate representation of wave movements in open water. The wave height, set at 4m, was determined using BMT Global Wave Statistics for the sea area of interest. Particular attention was paid to wave damping in order to avoid unwanted wave reflection.

VOF model: The volume of fluid (VOF) multiphase model was used in order to correctly capture the interface between water and air, as well as to accurately depict the interaction between the hull and the free surface.

The simulations revealed that:
- the wake from the FLNG overlays the ocean waves and forms a relatively calm area;
- with high-frequency ocean waves, steep waves (with deep troughs and sharp crests) are formed around the FLNG.

Future investigations will look at how the berthing of LNG tankers and supply ships will affect this configuration, in particular how to avoid resonance waves between the different hulls, how to control the pitching movement of the ships involved, and whether regulations need to be adopted to make the operation safe.

A comparison of simulation and model test results, at a model to full-scale ratio of 1:100, shows excellent agreement over the entire frequency range. It highlights the impact of a limited water depth especially on the pitching movement of the FLNG for waves of low frequencies (Figure 5).

Conclusion
This study demonstrated how the use of CFD simulations can help engineers make decisions concerning not only hull design and layout configurations, but also ship operations.
At AMC Search, these results will be used to develop recommendations and operating guidelines for three target areas: planning, operations and crew training.

Figure 5: FLNG pitching rate obtained through both simulations and experiments, plotted against the wave frequency.
Dockwise pushes the boundaries in Aasta Hansteen T&I project

MARIN Several years of preparations are behind the complex Aasta Hansteen Transport & Installation (T&I) project, which will culminate in a unique catamaran floatover operation. In light of this, the Maritime Research Institute Netherlands (MARIN) has been contracted by Dockwise, a wholly owned subsidiary of Royal Boskalis Westminster NV, to carry out an entire range of simulation services. The two are working closely together to create a dedicated training programme for the Dockwise team.

With a length of 198m, diameter of 50m and operating displacement of approximately 150,000 tonnes, the Aasta Hansteen platform will be the world’s largest spar hull and the first of its kind on the Norwegian continental shelf. The Statoil-operated platform is a spar FPSO with gas production through SCR risers and 25,000m³ of storage capacity for condensate. The Aasta Hansteen gas field is owned by Statoil, together with ConocoPhillips, OMV (Norge) and Wintershall. Being built by Hyundai Heavy Industries (HHI) in South Korea, the platform is set to be transported by two of the world’s largest heavy-lift carriers, the Dockwise Vanguard (spar) and Dockwise White Marlin (topside), and installed in water depths of more than 1,300m.

Bas Polkamp, Dockwise’s senior project manager, and tow master Capt Hans Bosch have outlined the importance of simulation exercises, especially for the intricate catamaran floatover operation. Aasta Hansteen has to be one of the most complex offshore projects ever carried out, pushing the boundaries in every sense. The topside (100m x 50m x 56m) alone weighs 25,000 tonnes, while the spar hull weighs 47,000 tonnes and is 198m long and 50m wide. Additionally, the location itself is in challenging waters, with depths of a staggering 1,300m plus. The 52,183-tonne Dockwise Vanguard is also a unique vessel and has been designed to be able to handle a spar hull in a horizontal position.

Unimaginable forces
Polkamp explained that Dockwise’s core activity involved moving large production platforms or floating structures using its fleet of semi-submersible transport vessels and installing large topside facilities on fixed jackets and floating structures, so it is used to handling these immense structures. But despite the company’s dec-
ades of experience, this project is still in a league of its own.

Given the huge structure, moving and installing it involves almost unimaginable forces. And when it comes to installation, the sea state, currents, wind and waves are major factors, and this makes the need for simulation exercises an absolute necessity, Polkamp said. He explained how the T&I would be carried out. A key part of the project is the catamaran operation, and although Dockwise has performed this delicate procedure in the past, the Aasta Hansteen takes it to another level. Dockwise has to transport both the topside and spar hull to an inshore location near Stavanger, Norway, and combine the two elements in a state-of-the-art floatover operation.

The location was chosen because the fjord gives protection against swell, waves and other environmental actions and at the same time provides sufficient depth for the spar hull, Polkamp said. In addition to this, Dockwise has to transport the living quarters from the Netherlands to Ulsan, South Korea.

Following the transport of the living quarters, Dockwise Vanguard first has to carry out the horizontal transport of the spar hull from the yard in South Korea to the fjord near Stavanger. The hull will be upended and submerged (the spar hull will have a freeboard of 6m when ready for mating with the topside and will eventually be submerged 198m) by Technip and installed in an anchor spread to fix it to the seabed. The hull is then ready to accommodate the topside. Dockwise will then carry out the next phase and transport the topside from South Korea. Dockwise’s new vessel and one of the largest in its fleet, White Marlin, will carry out this transport, and then the topside will be installed on the hull.

Transport of the hull of the Lucius spar (2013)

Topside mating operation

However, because Dockwise cannot sail its ship over the spar hull, an alternative approach had to be designed for installation of the topside. We will be using two of our smaller, Swan (S-class) vessels. Large steel nodes will be mounted on the topside, and once White Marlin arrives in Norway with the topside, the two S-class vessels will manoeuvre alongside. The two vessels will have been fitted with four enormous support structures for the nodes, which include leg mating units. They are tailored precisely to manage the weight of the topside and the prevailing dynamic of wind, weather, waves and currents, Polkamp said.

Once the two ships have been positioned on either side of the White Marlin, they are raised and Dockwise will retract the White Marlin to create the catamaran configuration by ballasting the White Marlin down and the two S-class vessels up.

This results in a catamaran structure with the topside linking the two hulls. Dockwise then deploys tugs to move the topside into position above the spar hull and couple them together. Although this is not the first time we have deployed this catamaran configuration, it is the first time we have been doing it with such a huge 25,000-tonne unit, Polkamp remarked.

Twelve vessels

Capt Bosch explained that some twelve vessels would be involved, including the Dockwise Vanguard, two S-class, White Marlin, and then four tugs will be rigidly connected and two auxiliary tugs will assist, alongside smaller line handlers and personnel transfer vessels. This is precision work. We first have the transfer from the White Marlin onto the two S-class; we take the White Marlin out of the catamaran phase and then there is the moment when we
are physically moving over the spar. It is the combination of physically bringing her over the spar by manoeuvring but also by connecting all the mooring lines to fix it in its final position.

Years of preparation, precision calculations and simulation exercises are all vital to the success of the project, both Bosch and Polkamp pointed out. MARIN is involved in several aspects of the project. The scope ranges from a motion verification study, to ensure the proper transfer of findings from the engineering phase to the operations phase, to simulating the transfer of the topside from the White Marlin to the two Swan vessels to create the catamaran configuration. MARIN and Dockwise will also simulate towing the catamaran vessels to the spar using the tugs and installing the topside on the spar via the floatover method. Crucially, the simulations will look at various ways of how all the procedures can best be done given the operational parameters (wind, wave, current) and the available catamaran and tug capabilities.

Matching reality
Polkamp said it was vital that engineering matched reality. Essentially, we wanted MARIN to help us examine three critical aspects ± manoeuvrability, the feasibility of the marine spread and how the team behaves. It is all about risk mitigation; we wanted to assess the configuration with the rigid-connected tugs, manoeuvrability and how we can best position the vessels ± the whole dynamics of the configuration. Simulations are also important as a marketing tool, Polkamp added. This project has many of the major players involved. We are keen to show them that we deliver state-of-the-art engineering, and show them what we are capable of operationally. Both HHI and Statoil are very keen to see the simulation exercises and will be attending some of the training days at MARIN.

Creating the team
The simulation exercises are also very important when it comes to building the right team, Bosch emphasised. With any project there is the added complexity: people. We want to find the best team. We have learnt from other projects, where we carried out simulations at a much later stage, that the earlier they take place, the better. Simulations make things run a lot easier. You need to have good cooperation and understand each other. If you simulate in the preparation stages, it is possible to get a very good team at an early stage of the project. Everyone involved has to know exactly what they are doing.

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New crane saves rig time and boosts safety

SMARTCRANE | GustoMSC, a Dutch design and engineering company, launched the SmartCrane at this year’s Offshore Technology Conference (OTC) in Houston. Designed for being retrofitted to existing cantilever jack-up rigs, instantly increasing efficiency, or fitted onto a new-building design, the solution offers unique features that directly address the call for cost reduction from operators, the company said.

Two elements were high on the agenda when developing the SmartCrane: facilitating SIMOPS (simultaneous operations system) independently of any operation in progress on the drill floor and easing material handling underneath the cantilever or between the work platform and drill rig. Enabling a wire line operation away from the drill floor is a huge advantage in development drilling and plug and abandonment operations, notes GustoMSC. The SmartCrane allows wire line through its moveable arm with the hoisting point underneath the cantilever. In this way, wire line operations can take place on one well while development drilling or plug and abandonment operations are going on at another well. The savings in rig days for a plug and abandonment operation can amount to about 10% compared with the conventional way, in which all activities such as logging and cementing must be performed in a sequence on one well from the drill floor, GustoMSC says. The SmartCrane enables several activities to take place at the same time on one well, or preparatory work on one well while the drill floor is working on another well.

In addition, the SmartCrane provides a 2-tonne hoisting capacity underneath the cantilever at any position outside the drilling riser, and also is able to reach to the main deck of the rig. It can therefore transfer containers and other pieces of equipment (<20t) from the main deck of the rig to underneath the cantilever and vice versa. This, GustoMSC says, is a unique feature that greatly enhances safety and efficiency as crane access to the wellhead from the drilling rig is difficult due to the area being blocked by the cantilever.
New heavy-duty robot system with maintenance-free energy supply system

DRILLING OPERATIONS The Norwegian company Robotic Drilling Systems has developed a robot system for the automation of drilling operations on oil and gas platforms. Energy chains from igus help to provide a reliable power supply under extreme conditions, writes Tim Schneebeck from the Cologne-based company’s marine engineering department.

More and more processes in the oil and gas industry are being automated in order to achieve higher clock speeds, relieve people from heavy work and save costs. The start-up company Robotic Drilling Systems AS (RDS) in Stavanger, Norway, has developed robots with the goal of achieving a fully automated drill-floor operation on oil rigs.

The robotic systems work in various conditions and must therefore be insensitive to salt water, corrosion, mechanical stress and extreme temperatures. In addition, the work processes on an oil rig are so complex that up to 100 axes need to be coordinated in handling the drill pipe. What’s more, energy, media and signals must be guided reliably to the robot’s grippers.

A core component: a heavy-duty robot

RDS has developed a whole family of robots to meet these requirements and undertake subtasks of automated drilling. The central drill-floor heavy-duty six-axis robot with a load capacity of 1,500kg on the outstretched 3m-long robotic arm and a newly developed spinner-gripper combine the elements of handling drill string objects such as stabilisers and crossovers and spinning in/out the objects to the drill string. (Figure 1). The fully automated pipe handler takes out the segments from a finger board (storage system) or from a conveyor on deck and supplies them to the robot. Another RDS robot system, the electric roughneck, and a pipe-handling robot support the central heavy-duty robot in handling and making up the stand. All systems work together to ensure that the entire drilling process is carried out without human intervention. According to the manufacturers, such a system operates up to 40% faster and saves between USD 10 million and 20 million per year.

Energy and signal supply through rotary module and energy chain

The seventh axis of the drill-floor robot is a heavy-duty linear system on which the entire robot moves. This poses a challenge for the engineers to provide the moving energy...
and signal supply in extremely confined spaces. In addition, high explosion protection requirements are needed in this area. For the linear movement of the seventh axis, the energy supply was implemented relatively easily: Lightweight energy chains made of plastic have proved themselves in numerous similar applications and enable the simultaneous guiding of cables for energy, data and media. More challenging, however, was the task of supplying the energy and signal supply to the rotational axis of the robot base.

**Complete solution for complex tasks – including engineering**

This requirement is met by a rotary module from igus (Figure 2). It is an energy chain that is side-mounted and operates with a reverse bending radius (RBR). This means that the chain links can move in both directions, unlike conventional linear movements. The cables and hoses are securely guided in the chain with locking separators, and the chain operates in a round guide trough.

In the RDS robot, this rotary module has been integrated into the robot housing, which called for complex engineering and real tinkering due to the extremely limited space. This task was accomplished at igus by the team from the Project Engineering division. The result is a complete solution in a special robotic installation, in which Chainflex® cables from igus (Figure 3), which are certified for fire hazardous areas and also according to NEK 606, are also used next to the rotary module. The cables were developed from scratch for moving applications and are noteworthy for their long service life, even under extreme conditions. For all cables in the range, igus guarantees a lifespan of 36 months, and 403 cables in the range have already been certified by DNV GL.

The energy chains are delivered in Stavanger already assembled as ReadyChain® systems including connectors. This simplifies installation. It also ensures that all ports and connectors meet the special requirements of electrical explosion protection. Corrosion resistance is also very important, especially in offshore applications. The maintenance-free plastic energy chains can be used for this with no restrictions. Depending on customer requirements, igus undertakes all activities, from planning to complete installation on-site even on the high seas, because the service staff is certified for work on oil rigs.

**Vertical movement**

Components from igus are likewise used in the other automation units of the unmanned oil drilling process. Energy chains are used on both the electric roughneck and the pipe handler ± 25 units in total. They are installed on the masts, i.e., on the vertical axes of handling systems where the stand is taken from the storage and supplied to the central robot (Figure 4). Here, too, freedom from maintenance, resistance to sea water and mechanical stresses as well as explosion proofness and offshore approvals are critical for the selection. The robot system developed by RDS is not only suitable for installation on new oil rigs, but also for retrofits. It creates new criteria for assessing the profitability of exploration projects ± an important factor given currently low oil prices. The jury of the Vector Awards, initiated by igus, presented the system with the 2016 Golden Vector Award. After extensive testing, a first practical installation was put into operation in September 2015 on a rig in Norway (Figure 5).
Offshore Dialogue at SMM

OFFSHORE PLAYERS | Offshore players will meet on September 8th for the Offshore Dialogue conference at SMM in Hamburg, the leading international maritime trade fair, to discuss current and expected challenges facing the sector.

About two years ago the price of crude oil hit rock bottom and the offshore industry, especially the oil and gas segment, suffered a severe blow. Business has been more or less stagnant since then. The oil super majors have cut investments. Shipbuilders, suppliers and associated services are largely sitting idle. But there are signs of a possible upswing. The 2016 Offshore Support Vessel Global Market Outlook, published by the Indian market research organisation Wise Guy Reports, expects the offshore supply vessel (OSV) market to grow 5.7% annually, reaching a volume of USD 43.07 billion by 2022.

Focus on forward-looking topics

The Offshore Dialogue conference is titled Offshore Industry ± Quo Vadis? and will consist of three panel discussions. The first, Subsea Technology ± Experience and Challenges, will address prospects for subsea mining and subsea gas installations. Remotely operated, towed seafloor vehicles will be presented ± machines towed by surface craft. They represent an alternative approach to mining raw materials from subsea deposits. Another key technology to be discussed is heavy-lift cranes. Speakers include Baard Alsaker, vice president of R&D and Technology at MacGregor, a global offshore supplier, and Basil Zweifel, segment head of Oil & Gas Production at MAN.

The second section, Health, Safety & Environment ± The Human Factor, will focus on specialised offshore vessels for enhanced safety at sea. A major topic of discussion will be whether it is possible to leverage synergies between the oil and gas industry HSE standards and those of the offshore wind sector. The panel discussion will also address specialised training for employees working in the demanding offshore sector, as well as the question whether offshore work will be performed from fixed platforms or service vessels in the future. Sybrand Boschma, offshore specialist at the Dutch shipbuilding group Damen, and Michael McDonald, general manager at the Denmark-based technology consultancy Force, will provide valuable insight.

The third expert panel, titled Digitalisation Offshore 4.0 ± Challenge and Opportunity, will explore some future perspectives for the industry. Big data, Smart maintenance concepts, optimised logistics for offshore wind farms and cyber security for the offshore sector are key items on the agenda. Juan Gallego, remote diagnostics expert at the Swedish component manufacturer SKF, will represent the practical side of things. The scientific aspects will be covered by Prof Dr Carlos Jahn, head of the Fraunhofer Center for Maritime Logistics and Services in Hamburg and a top-level expert. Kenneth Richardson, executive vice president of Global Offshore at Houston-headquartered ABS, will share his views from the perspective of a classification society.

Innovation wanted

We only through the most innovative technologies that will be able to secure our leading international position and enter into emerging markets successfully, said Uwe Beckmeyer, parliamentary secretary at Germany’s Federal Ministry for Economic Affairs and Energy, which is sponsoring the conference. Our goal is to support the maritime sector in developing new technologies that are economically attractive. To accomplish this, the maritime industry must cooperate closely with the offshore wind sector and the scientific community, added Beckmeyer, the federal government coordinator for the maritime industry. He is to open the conference with a keynote address.

OFFSHORE ENERGY | This year’s Offshore Energy Exhibition & Conference (OEEC), to be held on October 25th and 26th at Amsterdam RAI, is expecting more than 11,500 visitors, 650 exhibitors and 1,200 delegates. Over an exhibition area of 23,500m², the ninth edition of the show will bring together offshore professionals from 86 countries. Two of the major subjects this year will be current oil prices and the rise of the renewables, which, according to the organiser Organising, will see the industry entering a new area. This is also the theme of the conference programme, which will cover topics such as subsea processing and infrastructure, decommissioning, knowledge management, asset integrity, supply chain optimisation and LNG.

New this year will be the Offshore Energy Opening Gala Dinner on October 24th, during which the Offshore Energy Awards will be presented. The latest addition to the list of country pavilions at the OEEC is coming from Iran, supplemented by two technical conference sessions on the opportunities of doing business with this country. The Offshore WIND conference (OWC) will also again be part of OEEC. Taking place on October 24th and 25th with speakers from leading companies such as Dong, Siemens and Vattenfall, it will further strengthen OEEC’s connection to renewables. The renewables sector will also be in the limelight at the Marine Energy Event, organised in partnership with EWA (Dutch Energy from Water Association) and the Ocean Thermal Energy Conversion (OTEC) Symposium, which is an annual meeting that brings together the OTEC industry, researchers and market experts from all over the world. The second day of this year’s OTEC Symposium, October 26th, will be held at OEEC.

More information can be found at www.offshoreenergy.biz.
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Compact multi-role utility vessel is unveiled

UV2410 | Damen Shipyards Group says work will start shortly on the first of a new class of Damen utility vessels: UV2410. This multi-role platform is the result of extensive consultation with customers in the aquaculture industry in the United Kingdom and Norway, the Dutch shipbuilder says. It was important to them that the rule length of the new vessel be no more than 24m and, for UK customers in particular, that it fit within the 200gt limit. Feedback indicated that within that maximum length possible, protected deck space and good seakeeping were top priorities along with ample accommodation, Damen says.

With the wide beam of 9.5m and minimal superstructure, this vessel provides 120m² of unobstructed deck space, yet still has comfortable accommodation for up to six crew. “We designed this vessel to be versatile and adaptable to meet a wide range of客户需求,” said Lodewijk van Os, product director of workboats at Damen. “The design is optimised for a wide range of roles including maintenance support, oil recovery, diving support, buoy handling, safety standby, ROV support, surveying and much more.” The design is also ideal for aquaculture, with easy access to the waterline amidships via steps and a 3m opening in the bulwark, and the capability of mounting dedicated equipment including up to two cranes. In fact, the deck is pretty much ready for anything: A-frames, winches, davits for rescue boats, task-specific containers and many other types of equipment can be quickly added and removed as the vessel receives new assignments.

UV2410 shares many of the attributes of other vessels in Damen’s workboat ranges. In addition to aquaculture companies, Damen says it envisages that the UV2410 will be attractive to port authorities, governmental organisations, marine contractors and anyone involved in varied, water-based maintenance operations.

Life jacket tailored for offshore demands

UNITOR | Wilhelmsen Ships Service (WSS), a Norway-based provider of products and services to the shipping industry, says it is launching a life jacket specially designed to safeguard workers in the harshest offshore environments. The Unitor inflatable life jacket features what the company says is class-leading buoyancy, a Hammar automatic hydrostatic release system and a design that is rugged yet also light and comfortable to wear when performing demanding offshore tasks.

There is no shortage of life jackets on the market, but few that are created to match the unique requirements of working offshore. “We designed the Unitor inflatable life jacket very light, easy to put on and easy to wear, allowing both free movement and optimal protection. It features a patented interlocking lobe bladder that inflates automatically ± although only when needed, not in rain, spray or humid conditions ± and self-rights the user in under five seconds, even when unconscious. It is high-visibility, heavy-duty and compliant with ISO 12402-3 regulations, offering what we believe is the best protection on the market today.”

The innovative design of the life jacket forms an effective wave barrier. This ensures that regardless of whether the wearer is conscious or not, water is not channelled towards the face, protecting air flows, according to WSS. In addition, the company says, the life jacket’s 170N buoyancy rating compares favourably to the industry-standard 150N, providing extra safety for larger operators or those carrying tools.

Unveiled for the first time at the recent Australasian Oil and Gas Exhibition and Conference (AOG) in Perth, the life jacket is protected by a heavy-duty nylon cover, offers manual inflation, features reflective tape and also comes with a whistle for attracting attention. Unitor is a proprietary brand owned and supplied worldwide by WSS.
Acquisition and integration of meaningful performance data

**FUEL CONSUMPTION** Several strategies to reduce a ship’s fuel costs have been employed in recent years, ranging from operational measures such as slow steaming and trim and route optimisation to alterations, particularly on container vessels, including de-rating the main engine, adding a new propeller or bulbous bow. However, the first step is establishing a basis for better understanding how a ship performs at sea and how much fuel it consumes under certain loading and operational conditions, writes Michael vom Baur from Hamburg-based Hoppe Marine GmbH, a specialist in measuring and control technologies for maritime applications.

The measuring, reporting and systematic analysis of various performance parameters is summarised by the term Performance Monitoring (PMO). Meaningful PMO is a mandatory prerequisite for:

- creating a knowledge base for optimising fuel consumption;
- complying with charterers’ increasingly challenging reporting requests, judging how the crew has used optimisation potentials during the charter period, and quality-ranking benchmarks for future ship selection;
- rejecting charterers’ fuel claims (in time charters);
- verifying the functionality of retrofitted propulsion-improving devices (before/after), also in connection with loan financing for such devices/ conversions;
- monitoring the hull-fouling condition to decide when to clean/paint next, a prerequisite for performance-based contracts with paint suppliers;
- enabling fleet performance improvement by transparent competition between crews of sister vessels;
- integrating ship performance information in operators’ fleet-monitoring centres and in future ‘big-data’ strategies.

Monitoring vessel performance is not a new invention. Dedicated inspectors and fleet managers have done this in the past, mainly by analysing manual noon reports. However, anyone involved in such analyses knows that this often resembles a cloud of scattered points in a diagram where a nice (e.g., speed-power) curve would be expected. This scatter is obviously caused by the relatively high uncertainty of manual readings in combination with low observation frequency. Trying to identify parameters such as fuel consumption differences due to trim optimisation via noon reports is tantamount to looking for the proverbial needle in a haystack. Meanwhile, several experiences and studies have demonstrated how automatic and frequent (hourly or less) data acquisition can reduce the overall uncertainty of PMO and thus enable a much higher-resolution performance picture.

Even automatically recorded performance data have considerable sources of uncertainty, caused by the measuring methods, the quality and actual condition of the sensors and the consistency and synchronicity of stored data, for example.

The increasing challenge of providing precise performance analyses, which could even have commercial or legal ramifications (e.g., for performance-based hull coating contracts or charterers’ fuel claims), was the impetus for developing the ISO19030 standard [2], intended to give methodical guidance and uncertainty information on measuring changes in hull and propeller performance. This recently released international standard allows several PMO approaches and a comparison of uncertainties to be expected for each method; it will most likely be quoted as a basis for onboard measurements in most commercial agreements based on ship performance. The ISO 19030 default method defines parameters to be measured and recorded at least once every 15 seconds:

- Primary parameters: speed through water (STW), delivered power;
- Secondary parameters: engine speed, engine load, hull resistance, trim, mean draught, crosswind, wave height, crosswind direction, airspeed, air temperature, barometric pressure, and others.

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- Primary parameters: speed through water (STW), delivered power;
Secondary parameters: shaft revolutions, relative wind speed and direction, speed over ground (SOG) and ship heading, rudder angle, water depth, draught fore and aft (static), seawater temperature.

Primary and secondary parameters are to be stored in packages under a common time stamp. The secondary parameters, which could also be augmented by information such as ship roll, pitch angles, dynamic trim, etc., are recorded to enable filtering according to ISO 19030 reference conditions for a comparison of apples with apples. Thus their consistency and completeness are as important for a precise PMO analysis as the primary parameters.

Even the most sophisticated and glossy performance analysis software will deliver unreliable and misleading results if the data acquired on board are of inferior quality, fragmentary and/or inconsistent. The impact of low-quality onboard data has often been underestimated since systematic PMO is still a relatively new task with only limited operational practice. However, with growing experience it is becoming evident that greater emphasis must be placed on the acquisition and integration of meaningful performance data on board.

Although bunker prices are almost back to pre-2005 levels, PMO has meanwhile become an important element in most leading ship operators’ activities and plans.

**Data acquisition sources on board**

Typical sources for the acquisition of primary and secondary ISO 19030 parameters and further key data on board are as follows:

- **Direct acquisition sources:**
  - Shaft power meter: torque, rpm,
  - Flow meters (Coriolis or volume-counter type),
  - GPS (time, position, SOG),
  - Dynamic trim,
  - Ship motion,
  - Individual nautical instruments (e.g., speed log, anemometer, wave radar),

- **Bundled sources (e.g., via AMS, VDR or ECDIS):**
  - Nautical data,
  - Draught indication,
  - Tank content data (mass of liquid in tank),
  - Main and auxiliary engine data,

- **Further sources depending on operator request:**

The state of the art in measuring the above factors, and therefore the uncertainty of the measuring methods, varies considerably. The weakest parameter in the chain is certainly the speed measurement (STW), mostly done today with Doppler logs, which often lack sufficient precision and reliability. These devices have been used on board for many years but often weren’t considered a key measuring system and thus didn’t receive the necessary attention and maintenance by the crew because SOG appeared to be the much stabler parameter. On the other hand, a precise STW measurement is a must for comparative PMO analyses.
All of the sensors involved have individual characteristics and uncertainties that depend on their measuring method, design, long-term stability, sensitivity and robustness vis-à-vis external environment changes, age (e.g., mechanical wear) and actual maintenance status.

For automatic PMO data acquisition, the sources considered must be able to export analogue or binary signals, which will be digitised via I/O units and communicated to the data collector via defined and described interfaces using standardised protocols. Typical interfaces are RS485, RS422, CAN Bus, Ethernet and Maker Bus standards. Typical protocols are NMEA183, MODBUS TCP/IP, MODBUS RTU, UDP, OPC UA or Maker Bus protocols.

The parameters to be measured have individual and different physical characteristics, which may require different sampling frequencies to provide the required accuracy and catch possible dynamic effects. While, for example, the shaft revolutions cannot physically fluctuate significantly in 10s intervals, the rudder angle or motion parameters can change significantly in the same interval and should therefore be acquired in higher frequency. However, all data must finally arrive in the database in a defined (datasets) with a common time stamp, based on signals acquired in different frequencies. Evident that certain preprocessing operations are necessary to generate such datasets and achieve full data integration.

Last but not least, the datasets must be compressed and stored on board to enable efficient shore transmission whenever connected in feasible time slots at reasonable telecommunication costs.

Challenges and requirements
Collecting data on board appears almost trivial; however, the devil is in the details. Since data acquisition almost always goes down to PLC level, the programming and interface handling happens at machine code level, which isn’t very user-friendly. Furthermore, support by the OEMs isn’t always sufficient and sometimes no longer available for older vessels. The fact that dozens or hundreds (including engine data) of signals are typically recorded illustrates the magnitude of the challenge, which demands effective talents from the project engineers.

A particular challenge is the implementation of stable data acquisition on existing ships. Data sources such as sensors and meters on older vessels may lack precision and haven’t been designed to share data with other systems. Frequently observed problems include:
- Different OEMs with different interpretations of data bus protocols;
- No standard for signal names, and makers that are often neither disciplined nor consistent in using such names;
- Sensors or meters lacking appropriate interfaces to be integrated in a data bus communication system;
- The ship’s main automation system not supporting modern interfaces and bus technologies, and often not being well documented (including insufficiently documented deviations between sister vessels);
- Software and interface descriptions of older systems sometimes no longer being officially supported by the makers;
- Sensors or meters found to be not well maintained or that have already reached the end of their life cycle and are thus not reliable data sources;
- Volume flow meters that are often worn out and no longer properly calibrated after years of operation;
- Some flow meters not distinguishing between forward and backward flow and thus sending misleading results during pulsation in the fuel cycle (in particular if the flow meter location wasn’t selected with necessary care);
- Older tank and draught sensors sending deviating/interrupted data due to electric or pneumatic problems;
- Shaft power readings (in particular from strain gauge meters) drifting over the years and that can hardly be recalibrated;
- Doppler logs (STW) that are sometimes mounted by the yard in zones with unstable flow, etc.

Many of the problems listed above have the potential to create totally misleading results or even jeopardise the entire PMO efforts. Frequent temporary recording interruptions of certain parameters may create difficulties in the later analysis tools; they have to be identified, properly dealt with and checked for completeness and plausibility on board.

Considering the above, it becomes evident that reliable data acquisition and integration on board is a necessary prerequisite and key for meaningful PMO analysis. The reality regarding standardisation of protocols is currently poor and thus the data integrator will bear most of the burden in project implementation, which requires a respective strategy and considerable experience.

Strategy for plausible and consistent data
Under the brand name Maihak, Hoppe Marine has developed a reliable and flexible data acquisition, preprocessing and storage concept that can integrate all kinds of data sources. Digitised basic signals...
are first acquired by a PLC-based system (HOMIP) that is independent of frequent operation system software changes at PC level. The recorded data are made available for further processing and integration. Several computed values (KPIs) can also be visualised at HOMIP level along with standardised reports and trend graphs via a web server.

In a second step, the basic data are checked for completeness and (optionally) for physical plausibility, consolidated and compiled in datasets with a common time stamp and compressed for shore transmission before being stored as raw data in a PC-based proprietary database (Maihak/Hoppe iDBS). From this database the time-stamped datasets can be transmitted at any time when connected to an identical database in the operator’s office ashore, where they are then available for display (e.g., on user-defined dashboards) and analysis.

The intelligent preprocessing, which can be applied in the second step, aims to provide cleaner and physically plausible raw data by intelligent, parameter-individual aggregation for short time windows, in line with the physical characteristics of the signal, and by removing outliers that violate the physical continuum characteristics of the respective parameter. This preprocessing does not correct measured data but supports necessary averaging processes when consolidating data with different sampling frequencies.

In the later analysis process, ISO19030 recommends using only comparable raw data obtained by filtering according to reference conditions (e.g., weather), rather than applying correction computations to normalise all raw data to reference conditions. This approach will reduce the volume of eligible data and consequently the sample sizes considerably, but does not add new uncertainties created by theoretical correction methods (e.g., for ship resistance in sea state). When acquiring data automatically with reasonable frequencies, there will be sufficient data available.

The recorded data are then implemented on a 2,500-TEU container vessel in September 2011. Since then, nearly 100 ships have been equipped with different PMO expansion levels under the Hoppe brand Maihak, so far integrating up to about 300 signals per vessel from sources such as individual sensors (Hoppe/Maihak and external makes), AMS, VDR, loading computer and Hoppe’s HOSIM motion reference units. The recorded results have been carefully evaluated and have formed the basis for further developments. During this phase, Hoppe Marine has developed a standard analysis catalogue, a tool that enables quick analyses and verification of recorded performance data, also as a service for shipowners.

One of the important findings from long-term comparative analyses of STW and SOG with statistical methods for different vessels was that Doppler speed logs can have dynamic errors that are speed-dependent (Figure 4). Based on this insight, the quality of STW measuring can be assessed and checked against a vessel’s individual characteristics and possibly recommendable corrections on board. The STW measurement is the weakest link in the measuring chain, so such plausibility checks are an important contribution to enhance precision.

Further regular checks when assessing automatically recorded performance data should be made with the shaft power meter. The zero rpm torque values, which are sampled during port periods, should be observed over time; any deviations are a hint that recalibration is needed. In addition, the possible individual offset of the sensor should be assessed by using the linear relation between rpm and the square root of torque. Additional validations, e.g., of flow-meter data, are also strongly recommended.

**Conclusions**

Collecting, integrating, preprocessing and storing PMO data on existing vessels require solid knowledge about ship operation and theory, sensors, IT interface and database technologies. The challenges involve judging the reliability and uncertainty of existing sensors on board and understanding older automation systems or individual manufacturer interpretations of different communication protocols to ensure that any data transmitted to shore are as complete as possible and contain consistent, plausible and meaningful information. Frequently incomplete datasets can not only create empty diagrams and dashboards but also jeopardise entire long-term analyses.

Data acquisition and integration on board can be a headache for the crew; hence it should be planned and implemented by an experienced specialist entity. Applying intelligent pre-storage preprocessing but also regular, longer-term plausibility analyses can significantly reduce uncertainties and thus enhance understanding of the operational processes and quality of data.

**References**

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The future of satellite communications

OUTLOOK The future looks bright for the maritime communications market. Rising demand for better and faster connectivity on ships and offshore platforms has unleashed the potential for upgrading capabilities and technologies. At this year’s Posidonia shipping and marine trade show in Athens and in the run-up to SMM in Hamburg, the global maritime industry’s most important trade fair, Ship&Offshore spoke with some of the top players in the industry about the latest developments and prospects.

A major topic in the satellite communications market is the high potential for VSATs (very-small-aperture terminals). Back in 2010, fewer than 10% of all ships were equipped with one. In 2013, there were approximately 17,000 such terminals on board ships. By 2020, 40,000 VSATs are needed, however, according to Intellian Technologies’ vice president for Global Satcom, Jon Harrison. Intellian Technologies is a leading provider of maritime satellite communications antenna technology. Shipping companies are slowly migrating their services from FleetBroadband to VSAT. Harrison said 2016 was the best year ever for the company, which plans to go public around October this year.

New antennas presented at Posidonia
At Posidonia, Intellian Technologies presented its 1m and 60cm GX antennas – both purpose-designed for the new age in broadband-enabled maritime communications.

Intellian’s latest antennas are the critical link to Fleet Xpress, the broadband satcoms service delivered through the Inmarsat GX satellite constellation, which brings commercial shipping and offshore subscribers high-speed data transfer between ship and shore, the company says.

Fleet Xpress, which was launched in March, is said to open up unlimited possibilities for maritime applications and the real-time monitoring and data analysis that will enable smarter and more efficient shipping.

The power of “big data”
Meanwhile, Inmarsat Maritime is heavily marketing its Fleet Xpress solution. Fleet Xpress delivers high-speed data transmission with unmatched reliability, switching automatically between Ka-band and Inmarsat FleetBroadband L-band services to ensure constant coverage, the specialist for global mobile satellite communications says. High-profile customers and technology partners are swiftly committing to shipping’s new era of connectivity through a series of agreements to use the world’s first global maritime high-speed broadband service from a single network operator. Inmarsat Maritime’s Fleet Xpress has unleashed the power of “big data” to enhance vessel efficiency, while delivering transformational but cost-controlled connectivity to the maritime industry, the company adds.

“Fleet Xpress alters the asset management capabilities and frontline working experience of an entire industry,” said Inmarsat Maritime’s president, Ronald Spithout. “It will optimise vessel safety, security and efficiency, and meet the connectivity needs of the modern seafarer that have for too long been overlooked.”

Separate agreements announced in June with VSAT service providers Marlink and SpeedCast International suggest that leading maritime value-added service providers agree. Both companies already describe Fleet Xpress as key to their maritime services portfolios. SpeedCast says the service is fully integrated within its SIGMA gateway, while Marlink emphasises access to a range of options that include its XChange communication management platform, with “bring your own device” crew connectivity.

SpeedCast and Marlink have committed to roll out Fleet Xpress to approximately 2,000 vessels each over the next five years. Gerbrand Schalkwijk, chief sales officer at Inmarsat Maritime, says the maritime package has been eagerly anticipated by an industry seeking to take advantage of high-speed Ka-band with...
“We have worked with Marlink for four years. When we implemented our strategy to future proof our fleet with high-bandwidth communication on board, we decided to test a few other VSAT providers, but Marlink’s excellent service support made the selection process easy. Improved control and management of networks from ashore is a big plus, but more importantly, Marlink VSAT gives our crew members access to modern, reliable and fast communication services that can even be accessed from their own devices."

Martin Henry, Fleet Technical Director, Carisbrooke Shipping Ltd.

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www.marlink.com
Inmarsat’s network operations centre at its headquarters in London

ultra-reliable FleetBroadband L-band service acting as unlimited backup. We expect up to 1,000 ships will be using Fleet Xpress before the end of 2016, he remarked.

For the first time, he says, ship/shore connectivity is so reliable that service agreements can include network availability guarantees with a minimum and maximum of data throughput that customers know in advance what they are paying for.

Fleet Xpress also brings Inmarsat Gateway access, which effectively connects ships to landside offices via VPN, opening up a new world of content-rich applications for shipping.

Life at sea transformed

Ship crews working today will be among those feeling the most significant transformation due to Fleet Xpress, Inmarsat says. The seafaring life still consists of extended periods of working under pressure, punctuated by opportunities for intense boredom. It also continues to involve long periods of separation from family, friends and the world at large, adding up to a burden of isolation.

This is despite the fact that, according to the Maritime Labour Convention: Every seafarer should have reasonable access to ship-to-shore telephone communications, e-mail and Internet facilities, where available, with any charges for the use of these services being reasonable in amount.

Drew Brandy, senior vice president of Inmarsat Maritime, points out that 73% of all seafarers take ship-shore connectivity into account when deciding which ship to join, according to the 2015 Crew Connectivity Survey by Futurenautics. The same survey reports that seafarers bring three communication devices on board a ship, on average, with 77% now carrying a smartphone.

Meeting seafarer expectations of access to VOIP and video chat services will be a key plus point for the Fleet Xpress broadband because owners will be able to do so without compromising their operating costs. The migration of existing customers from XpressLink Ku-band services to the Ka-band based Fleet Xpress will double the bandwidth available at no additional cost, according to Brandy.

Critical momentum

If emerging crew attitudes are a spur and global end-user agreements suggest shipping is easing into the Ka-band era, the recent appointment of Satlink Satellite Communications as a further Inmarsat partner may also be telling. Satlink, whose Satbox and Tracklite service will become integrated features of Fleet Xpress, is the largest single XpressLink provider for Inmarsat globally. Its customer base includes MSC Shipmanagement Ltd and Columbia Shipmanagement Ltd. Inmarsat Maritime has separately disclosed intentions to transition more than 2,600 existing XpressLink installations and convert its committed XpressLink backlog to Fleet Xpress over the next three years.

Enhancing guest connectivity

Satellite connectivity solutions provider Marlink meanwhile reports it is launching next-generation connectivity for MSC Cruises’ fleet with multi-band VSAT services. Under the agreement, MSC Cruises will provide dynamic bandwidth to its twelve ships as well as the next-generation ships still under construction, including MSC Meraviglia and MSC Seaside. No matter the itinerary of the ships, the bandwidth will be able to accommodate seasonal fluctuations, thus optimising the dedicated cloud of bandwidth available exclusively for MSC Cruises, ensuring that all of the Geneva-based company’s ships are covered by one of the satellites that create a global service. MSC Cruises extensive bandwidth upgrade has been implemented to meet the growing demand from guests for fast social media and web access, access to work and streaming services. Ship&Offshore was told by Knut Natvig, Marlink’s press and PR director, on the sidelines of Posidonia. The Norwegian company’s new services will provide unmatched levels of connectivity for MSC Cruises’ guests.

With several hundred Mbit/s available in Marlink’s Sealink Cloud, MSC Cruises will deliver a whole new online experience for guests who require cost-effective, reliable Internet access for various usages while enjoying their holidays.

Marlink says it will install a cutting-edge multi-band satellite communications solution that combines capacity on new Ku-band high-throughput satellite (HTS) and traditional Ku-band wide-beam satellites. The new services will allow fast, reliable access to the web ± including social media sites ± for guests across MSC Cruises’ modern cruise ships. The upgrade builds on MSC Cruises already highly advanced VSAT network with new high-throughput modems and network configuration designed to handle huge amounts of capacity from different satellite operators.

Connectivity is today one of the most important aspects of the cruise guest experience. In order to provide seamless global access with high availability for all users, together with MSC Cruises we are currently deploying the most advanced cruise ship VSAT network seen to date, said Tore Morten Olsen, president of Marlink’s maritime business. MSC Cruises will be the first fleet-wide VSAT network to dynamically integrate a cloud of satellite capacity, ensuring the availability of high bandwidth for thousands of guests, wherever they are cruising.

This latest service upgrade for MSC Cruises also includes satellite backup services for MSC Cruises’ offices on shore and integration of terrestrial services for improved redundancy.

Marlink and Telemar join forces

Apax Partners, which recently acquired Marlink, has signed an agreement to acquire Telemar Group from its current shareholders. The combined activities of Telemar and Marlink will create the world’s leading maritime communications, digital solutions and servicing specialist for all customer segments at sea, the companies say. Marlink and Telemar customers will benefit from an unmatched integrated servicing offering, covering all existing maritime communication and navigation technologies. The newly combined group will generate USD 450 million in revenues with more than 800 employees worldwide serving at least one in three vessels operating globally.
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Marine electronics market can expect moderate growth

The marine electronics market can expect moderate growth of 2% to 4% until 2020, according to a recent forecast by Jose Herrero, managing director of Navico's commercial marine division. Navico is a provider of marine electronics and parent company of the Lowrance®, Simrad®, B&G® and GoFree® brands.

Herrero said total annual sales of marine electronics on vessel bridges in commercial and recreational vessels had risen to a combined total of about USD 3.2 billion. This sum is shared among major suppliers such as Navico, Furuno, JRC, Garmin, SAM Electronics, Raytheon Anschütz and Transas.

Navico's portfolio comprises radar systems, ECDIS, GPS and AIP solutions, gyro compasses, autopilots and instruments. Currently, it has 4,000+ ECDIS, 30,000 radars and 40,000 autopilots in service. In 2015 the company’s revenue was about USD 308 million, and it is expected to rise to USD 325 million this year, according to Herrero.

The expected increase, he explained, is due to the growing world fleet and higher replacement rate on the heels of demand for higher reliability. Radar systems, for example, will see a shift from pure radar to integrated solutions (radar and ECDIS).

Recent product launches and acquisitions

Navico recently launched the GoFree brand to drive the development of cloud-based digital solutions and apps across its product range. As part of its growth, it acquired Contour Innovations, a leading cloud-based digital mapping provider. Navico has also increased its focus on the commercial marine market and, as part of this, acquired both Maritime Information Systems® and Consilium® radar business.

One new product that has been launched is the Simrad® M5027 optically bonded HD monitor for the commercial marine market. The 27in Simrad M5027 marine monitor is designed to meet the colour-calibration requirements of ECDIS systems and the size requirements of 320mm CAT1 radar systems.

The Simrad M5027 monitor is built for long-term, reliable operation with an optically bonded LCD as standard. Optically bonded displays eliminate the air gap issues of condensation, overheating and contamination common in lesser-quality displays, Navico said. Reliable touch-menu controls and IPX6-rated water-resistant flush mounting also contribute to its long-life design.

Earlier in the year, the company had announced the launch of the Simrad® R3016 12U/6X IMO SOLAS CAT3 radar system for the commercial shipping market. The new R3016 12U/6X IMO type-approved radar solution is ideal for use aboard CAT3 SOLAS vessels, workboats, tugs and coastal fishing boats. Its 12-kW X-band transceiver and 6ft open array scanner are designed for high reliability and low maintenance, Navico said. Alongside the 6-ft array comes the new Simrad R3016, a compact control unit with a 1366x768-pixel high-definition 15.6in diagonal wide-screen display. It features a 180mm, highly detailed radar PPI that allows ample space for additional vessel data, radar settings and target-tracking information.

The R3016 12U/6X IMO SOLAS CAT3 system is said to deliver outstanding radar performance for demanding commercial customers. Built around a new-generation digital processing user interface, it features enhanced target-tracking capabilities, extremely clear target definition, and advanced automated tuning controls delivering a power solution in a compact package.

The new radar system brings an innovative level of simplicity in system design and installation. The R3016 control unit incorporates the display, controls and processor in a single integrated system. Installation costs are further reduced with easily routed Ethernet cabling and a compact, bulkhead-mounted power supply unit.

The R3016 control unit conforms to IPX7 water-resistance standards; in addition, the 12U/6X antenna is designed for maximum reliability, driven by a brushless motor, robust mechanical gearbox and transceiver that incorporates a long-life magnetron.
Electronic products unveiled at trade show

ACR ELECTRONICS | The safety and survival technologies specialist ACR Electronics introduced a new professional-grade EPIRB (emergency position-indicating radio beacon), SART (search-and-rescue transponder) and series of LED personnel distress lights at this summer’s Posidonia shipping and marine trade show in Athens.

The GlobalFix V4 EPIRB’s robust internal 66-channel GPS provides faster acquisition from a cold start, accurately fixing the location of the vessel in distress, according to Florida-based ACR, a Drew Marine company. The coordinates are then transmitted via a 406-MHz distress signal to search-and-rescue authorities, with a 121.5-MHz homing signal further guiding searchers to the position.

Manual activation of the EPIRB is simple and there is a protective keypad cover to help prevent false alarms. The device has a user-replaceable battery pack with a ten-year replacement interval. It also has an energy-efficient, four-LED array strobe light and a new wrist strap for hands-free carrying in an evacuation.

The Pathfinder™ PRO SART is a fully approved SART that complies with IMO SOLAS regulations and is suitable for all commercial vessels mandated to carry a SART, including vessels that must conform to the Global Maritime Distress and Safety System (GMDSS) and those carrying more than one life raft. It is waterproof to a depth of 10m and operates between -20°C and +55°C.

Manually activated, the device can be used on ships, lifeboats and life rafts. It transmits a series of pulses that are displayed on a ship’s radar screen as a line of dots, providing a bearing to the survival craft. When powered on, the SART remains in a standby mode until it is automatically activated by an X-band radar sweep that may come from any vessel in the vicinity.

The user-replaceable lithium battery provides over 96 hours of operating life in standby mode and twelve hours of active operating life while being interrogated by radar, ACR says. The batteries have a five-year storage life before any significant reduction in capacity.

Ideal for attaching inside life jackets, ACR’s series of waterproof LED personnel distress lights include the C-Strobe™ and water-activated C-Strobe™ H20 strobe lights, as well as the new LED C Light™ and C Light™ H20 steady-on personal distress lights.

The USCG/SOLAS-approved, multi-function C-Strobes feature 45-lumen LEDs that operate typically for 120 hours continuously in strobe mode, ACR says. The slim and lightweight design fits easily in a pocket or attaches to a life jacket, with integral lashing loops and Velcro® strap available for mounting flexibility.

Available in two models, the manually activated C-Strobe features an easy twist on/off activation. The water-activated C-Strobe H20 model features three modes of operation: strobe, steady-on and SOS. It can be activated with a simple push of the on/off button or, when in the armed position, can be activated automatically when immersed in water.

ACR’s new USCG/SOLAS-approved LED C Light and C Light H20 waterproof steady-on personal distress lights have a 20-lumen LED that typically operates for 30 hours continuously. The C-Light is manually activated, while the C Light H20 version can be activated by pushing the on/off button or is activated on immersion in water when in the armed position.
Advanced maritime simulation and training centre opens

CSMART | Carnival Corporation’s new world-class Centre for Simulator and Maritime Training (CSMART) has opened in Almere, the Netherlands, near Amsterdam. The largest facility of its kind, CSMART has implemented the innovative Integrated mission simulation academy solution from marine IT specialist Transas. Miami-based Carnival recognised that in order to improve safety at sea, a step change was needed in the way seafarers are trained. The new training environment concept is the result of almost two years of intensive research and development. As described by Transas, CSMART houses navigational and engine room simulators in various configurations, from classroom stations to part-task and full-mission solutions, interlinked to provide training and assessment for the entire crew. Through cooperation with the US computer technology company Dell, Transas says it reduced the number of physical machines by 77% from 650 to 150 and cut energy consumption by 30% compared with a traditional set-up by virtualising simulation tasks into a Nvidia Grid system. Full interswitching capabilities in which any task is available on any screen within the simulator (Black Box IP-matrix) enable 0% downtime, a key requirement due to the high number of seafarers with limited training windows, according to Transas.

To ensure realistic team situational training for engine room and machinery functions, Transas has implemented high-tech gamification technology with a 3D walk-through of engine compartments including the CCTV camera technology, similar to that used at the European Space Agency’s operations centre, observes and records everything on the bridges and in the engine room to allow full-picture team training. Access is available to any task on any screen within the simulator, while the CCTV provides professional broadcast, AV control, recording and archiving systems with full synchronisation of all workstations, cameras and audio, Transas said.

To fully integrate a range of complementary expertise in floating and fixed structures, as well as near-shore and coastal wave modelling. This, the company says, allows BMT to offer specialist advice and simulation systems to cover a whole range of interdependent issues that impact planning, design, operability, safety and training in ports, terminals and shipping. Dr Phil Thompson, managing director of BMT Ship & Coastal Dynamics, commented: This new operation will allow us to bring together well-established and recognised teams with a tightly integrated and coordinated focus on our key markets. Combining these three teams, originating from BMT ARGOSS, reflects BMT’s growth expectations. BMT’s Rembrandt navigation simulation system will form part of the new company’s portfolio. With a proven track record of over 25 years in supporting the development of new ports and terminals and more recently in the FSRU and FLNG sectors, its credibility is further evidenced by the large number of gas carrier and cruise shipboard system installations, the company says. This type of tool supports the teams in assessing navigation, access channels, berthing, piloting, training and incident reconstruction. Expertise in offshore, coastal and near-shore wave environments further support assessments for operability, moored ship response and the impact of coastal or near-shore operations in shipping and port developments. BMT’s Search and Rescue Information System (SARIS) will complete the company’s portfolio of services.

BMT launches new operating company

SHIPPING MARKET | BMT Group Ltd (BMT), a London-based maritime design, engineering and risk management consultancy, has announced the launch of a new commercial operating company that will focus on providing highly specialised services to the global shipping and ports market. BMT Ship & Coastal Dynamics will bring together BMT’s current teams based in the United Kingdom and the Netherlands to fully integrate a range of complementary expertise in floating and fixed structures, as well as near-shore and coastal wave modelling. This, the company says, allows BMT to offer specialist advice and simulation systems to cover a whole range of interdependent issues that impact planning, design, operability, safety and training in ports, terminals and shipping. Dr Phil Thompson, managing director of BMT Ship & Coastal Dynamics, commented: This new operation will allow us to bring together well-established and recognised teams with a tightly integrated and coordinated focus on our key markets. Combining these three teams, originating from BMT ARGOSS, reflects BMT’s growth expectations. BMT’s Rembrandt navigation simulation system will form part of the new company’s portfolio. With a proven track record of over 25 years in supporting the development of new ports and terminals and more recently in the FSRU and FLNG sectors, its credibility is further evidenced by the large number of gas carrier and cruise shipboard system installations, the company says. This type of tool supports the teams in assessing navigation, access channels, berthing, piloting, training and incident reconstruction. Expertise in offshore, coastal and near-shore wave environments further support assessments for operability, moored ship response and the impact of coastal or near-shore operations in shipping and port developments. BMT’s Search and Rescue Information System (SARIS) will complete the company’s portfolio of services.
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