

# MARINE MAINTENANCE

## TECHNOLOGY INTERNATIONAL

APRIL 2017

**PREVIEW**  
**Marine Maintenance World Expo and Conference**  
Your guide to this year's must-attend event, p42



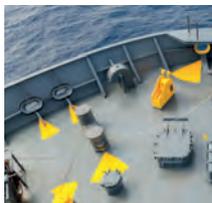
# Performance ops

## Keeping an eye on vessel fleets



### NDT

Using ultrasonic and acoustic emission testing for diagnosis



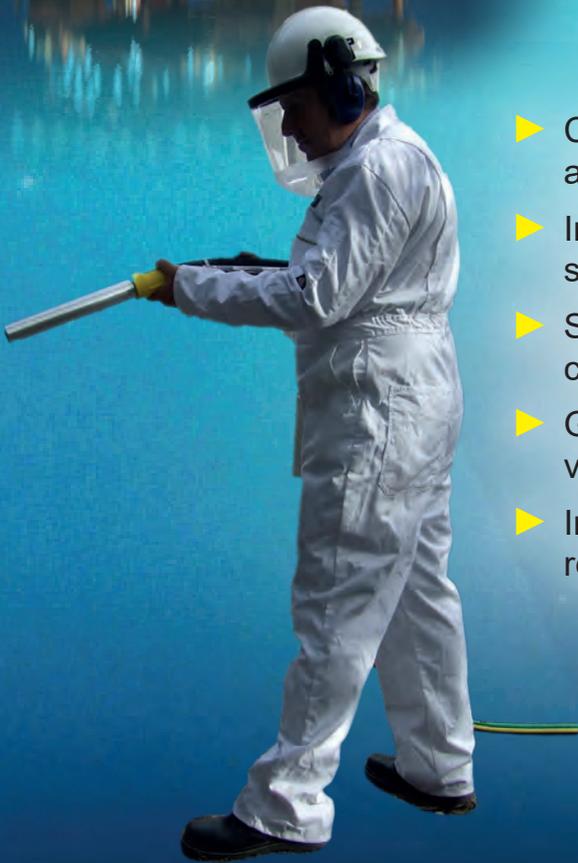
### Safety on deck

The latest coatings can minimize falls on vessels



### Remote monitoring

Watching from afar can prevent turbo failure



- ▶ Clean, dry, low dust, reusable abrasive blasting system
- ▶ Increased coating life from superior surface preparation
- ▶ Superior chloride removal than conventional abrasive blasting
- ▶ Greater operator safety & visibility in confined environments
- ▶ Increased productivity through reductions in down-time



# EnviraSponge

Low Dust Advanced Surface Treatment Technology

[www.envirasponge.com](http://www.envirasponge.com)  
[sales@envirasponge.com](mailto:sales@envirasponge.com)  
Tel: +44 (0)114 2540600



10



04



20



32



42

## In this issue

- 04 Distance learning**  
Remote monitoring helps to get the right solution deployed
- 10 Conditional love**  
The latest in condition-based monitoring of equipment
- 20 Rust busters**  
Low-dust techniques for coatings and rust removal
- 26 Sole power**  
Glow-in-the-dark and high heat are new tech for deck coatings
- 32 Listen carefully**  
Acoustic emissions testing is a powerful diagnostic technique
- 68 Ultrasonic antifouling**  
Electronics provides a low-maintenance antifouling solution
- 71 Chain drum surface prep**  
A new chain-drum machine for coatings removal
- 72 Network skills**  
Staying network-connected pays dividends for monitoring assets
- 74 Cold and deep NDT**  
An underwater NDT specialist provides customized solutions

- 76 Vapor blasting**  
A faster, more environmentally friendly surface-prep technique
- 78 Anti flash rust prevention**  
A proven additive prevents flash rust when blasting with water
- 79 Predictive maintenance**  
Software for a condition-based approach to asset management
- 80 Software for fleets**  
Fleet asset management systems to support a ship's entire life
- 81 Ultrasonic diagnosis**  
Condition monitoring for valves with acoustic emissions testing
- 83 Surface prep without dust**  
An ATEX-approved preparation system for all areas of a ship
- 84 Sponge blasting**  
Abrasive sponges create a low-dust surface-prep environment
- 84 Leading from the front**  
Nor-Shipping is the shipping industry's premier event
- 88 In brief**  
Important quotes and statistics from this issue

### EXPO SPECIAL

Your 20-page guide to the must-attend events at the Amsterdam RAI, June 6-8

- 42 Marine Maintenance World Expo and Conference**  
A preview of some of the highlights visitors can look forward to in Amsterdam
- 60 Electric & Hybrid Marine World Expo**  
Learn about and discuss tech for electric and hybrid marine propulsion systems for ships
- 64 Autonomous Ship Technology Symposium**  
Discuss and debate the technological, regulatory and legal developments making unmanned ships a reality
- 66 Maritime & Naval Test & Development Symposium**  
The only conference for the next-generation tools and techniques for durability, performance and seaworthiness



# Welcome to the Marine Maintenance World Expo and Conference 2017 show issue

**F**our fantastic, free-to-attend maritime events are being hosted in the Amsterdam RAI in the Netherlands this year on June 6-8. The focus of the Marine Maintenance World Expo and Conference will be the next generation of technology, tools and condition-based maintenance. Visitors will discover how to reduce equipment failure and operating costs as a growing field of software is designed to provide critical oversight, monitoring and life-extension of marine assets. The conference will feature more than 40 presentations from leading industry experts, and provide the most important international meeting place to discuss and debate ideas, discover new concepts, and network with like-minded industry professionals. Turn to page 42 to begin reading our extensive show preview and conference speaker line-up.

Running alongside Marine Maintenance World Expo and Conference, Electric & Hybrid Marine World Expo is the world's only international conference and exhibition dedicated exclusively to electric and hybrid marine propulsion systems, technologies and components. The event will see more than 40 of the world's leading experts present technical papers on the latest and next-generation technology that will power ships of the future.

Again in Amsterdam after last year's success is the Autonomous Ship Technology Symposium, which will bring together ship designers, fleet owners, naval architects, classification societies, equipment manufacturers and maritime research organizations

to discuss and debate the technological, regulatory and legal developments necessary to make autonomous and unmanned ships a reality.

New at the RAI will be the Maritime & Naval Test & Development Symposium, the world's only conference dedicated to discussing the latest and next-generation validation tools and techniques designed to help guarantee the durability, performance and seaworthiness of new vessels of all sizes, including their onboard systems and new components. This unique conference will also discuss innovative testing and simulation tools that can reduce product development cycles, plus techniques to reduce product failure and ensure optimum operational efficiency.

The four events look set to attract an expected 3,500+ attendees from all over the world, so if you haven't already secured your ticket, visit [www.marinemaintenanceworldexpo.com](http://www.marinemaintenanceworldexpo.com) now!

While you're waiting for the marine extravaganza at the RAI, you're sure to find something of interest in this issue. On page 4, we look at the recent changes to predictive/condition-based maintenance. The greater integration of shore-based staff monitoring operations and suggesting when action is needed has led to engine and turbocharger manufacturers expanding their services.

Sticking with monitoring, *Conditional love* on page 10 looks at how software and monitoring service providers collect data from navigation equipment, fin stabilizers and refrigeration, then analyze the data ashore and report problems back to the crew before they become aware of them.

Prompt fault diagnosis is of course hugely beneficial. Modern fault detecting using acoustic emissions finds the small sounds that can be detected with special equipment. Our report on acoustic emissions and its cousin, ultrasonic testing, begins on page 32.

All over the vessel, a steady footing on deck is important and our report, *Sole power*, on page 26 uncovers some new technologies such as glow-in-the-dark, which can improve safety; and a really high temperature-resistant covering for aircraft carrier decks.

Low-dust technologies for coatings removal include water vapor and abrasive sponge blasting, which can both substantially reduce airborne dust. Read our report on page 20.

You'll find exhibitors showing the products we've written about in this issue at the forthcoming Expo, where you can learn much more. I look forward to seeing you all in Amsterdam!

Michael Jones, editor



Editor: **Michael Jones**  
([michael.jones@ukimediaevents.com](mailto:michael.jones@ukimediaevents.com))

Production editor: **Alex Bradley**  
Chief sub editor: **Andrew Pickering**  
Deputy production editor: **Nick Shepherd**  
Senior sub editor: **Christine Velarde**  
Sub editor: **Alasdair Morton**

Art director: **Craig Marshall**  
Art editor: **Andrew Locke**  
Design contributors: **Andy Bass, Anna Davie, Louise Green, James Sutcliffe, Nicola Turner, Julie Welby, Ben White**

Head of production and logistics: **Ian Donovan**  
Deputy production manager: **Cassie Inns**  
Production team: **Carole Doran, Bethany Gill, Frank Millard, George Spreckley**

Circulation manager: **Suzie Matthews**

Publication director: **Aboobaker Tayub**  
([aboobaker.tayub@ukimediaevents.com](mailto:aboobaker.tayub@ukimediaevents.com))  
Publication manager: **Oliver Taylor**  
([oliver.taylor@ukimediaevents.com](mailto:oliver.taylor@ukimediaevents.com))

CEO: **Tony Robinson**  
Managing director: **Graham Johnson**  
Editorial director: **Anthony James**



**MEDIA & EVENTS**  
Published by **UKI Media & Events**, a division of **UKIP Media & Events Ltd**  
ISSN: 2049-8152 (print); 2049-8160 (online)

Contact us at:  
**Marine Maintenance Technology International**  
Abinger House, Church Street, Dorking,  
Surrey, RH4 1DF  
tel: +44 1306 743744  
fax: +44 1306 742525

The views expressed in the articles and technical papers are those of the authors and are not endorsed by the publishers. While every care has been taken during production, the publisher does not accept any liability for errors that may have occurred.  
Copyright ©2017

**Subscriptions**  
**£80/US\$104**

Printed by **William Gibbons & Sons Ltd**,  
26 Planetary Road, Willenhall, West Midlands, WV13 3XT, UK



## ULTRASOUND MGPS

*Highly effective and efficient against  
biofilm, fouling, and marine growth on...*

*hulls  
box coolers  
LT-coolers  
strainers  
fresh water generators  
propellers  
bow thrusters*

## HASYTEC DBP

- *Reduces the costs of fouling and bacteria prevention*
- *Reduces operational costs*
- *Reduces the Total Cost Of Ownership*
- *Environmental friendly and sustainable*
- *Maintenance free*

**DYNAMIC  
BIOFILM  
PROTECTION**





# Distance learning

**As technology on board ships increases in complexity, so do the routine maintenance and repairs required. Remote monitoring can help to ensure the right solution is deployed at the right time**

Bill Thompson

The traditional approach to maintenance of machinery on board merchant vessels is to rely as far as possible on the ship's own engineers to carry out routine maintenance and running repairs. Ships are generally equipped with workshops, housing a range of tools and machines, and spare parts are carried on board.

This practice continues but, as in other areas, replacing a faulty item rather than repairing it is gaining favor. To some extent this is a result of higher levels of technology on board. A job that could have been carried out with hammers, files and spanners in the past now also needs sophisticated measurement and calibration equipment to maintain compliance with environmental or safety regulations. The trend is underlined, though, by repair decisions being made from a distance, rather than leaving the engineers on board to solve the problem.

Condition-based monitoring and preventive maintenance have been with us for many years, but the desire to cut costs and the ability for shore-based specialists to monitor and control maintenance have put more emphasis on this approach.

Major machinery suppliers can offer a remote monitoring service, tied in with instant advice on spotting potential problems, so that repairs can be arranged in a timely manner, and on directing onboard work from the supplier's own service center. Even large fleet operators see the benefit in this – Stena Line has recently signed a contract with MAN Diesel & Turbo to provide its PrimeServ online service to two passenger and vehicle ferries sailing between the Netherlands and the UK. Both ships, Stena Hollandica and Stena Britannica, are powered by four MAN 48/60CR engines.

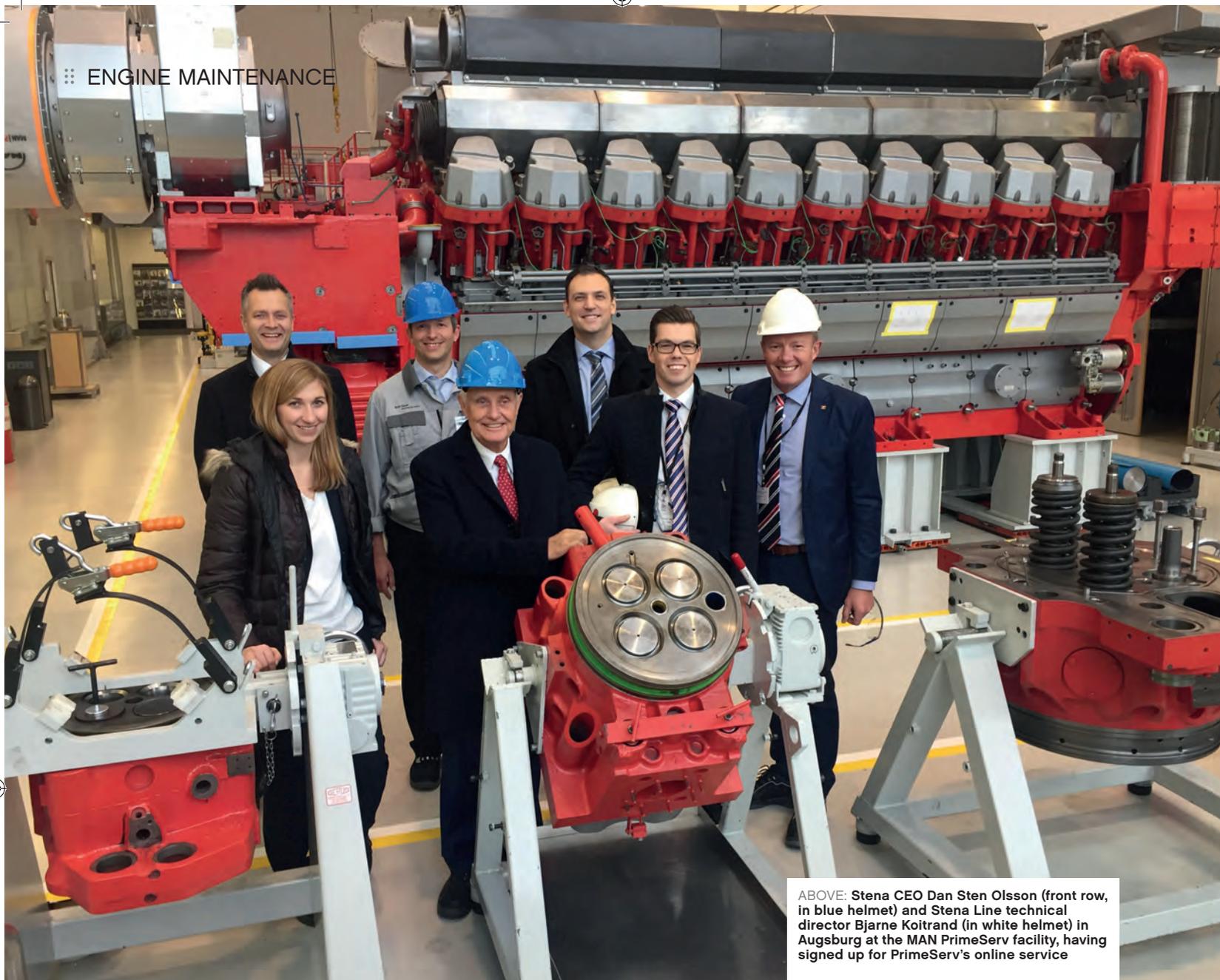
Dan Sten Olsson, Stena CEO, believes such services have a strong future: "Digitization is the direct communication of the truth and opens up fast adjustments and improved performance by automation or improved human judgment."

According to MAN PrimeServ's Wayne Jones, "We have a clear strategy regarding the development of our digitization program, where we already monitor over 200 installations worldwide. We can even keep track of the assets on our smartphones. We will shortly move into Phase 2.0, where we

MAIN IMAGE: Ramform Titan is one of the eight seismic vessels under the service agreement between Wärtsilä and PGS

BELOW: The Sjurdaberg's new MAN radial turbocharger





ABOVE: Stena CEO Dan Sten Olsson (front row, in blue helmet) and Stena Line technical director Bjarne Koitrand (in white helmet) in Augsburg at the MAN PrimeServ facility, having signed up for PrimeServ's online service

will further extend our online services to our two-stroke installations. Our customers are extremely pleased with our concept.”

The PrimeServ Online Service provides remote monitoring of engines and turbochargers automatically and continuously. The company says that constant monitoring of key engine and turbocharger performance data facilitates optimization of any inefficient operation modes in good time, maintaining availability and reliability. The data interfaces that have been integrated into MAN Diesel & Turbo engines since 2000 can be upgraded to facilitate online access, making engine and turbocharger operating data and additional information available to PrimeServ specialists for analysis over secure data connections.

PrimeServ, the MAN Diesel & Turbo service subsidiary, continues to operate conventional machinery maintenance contracts, though one of its latest breaks

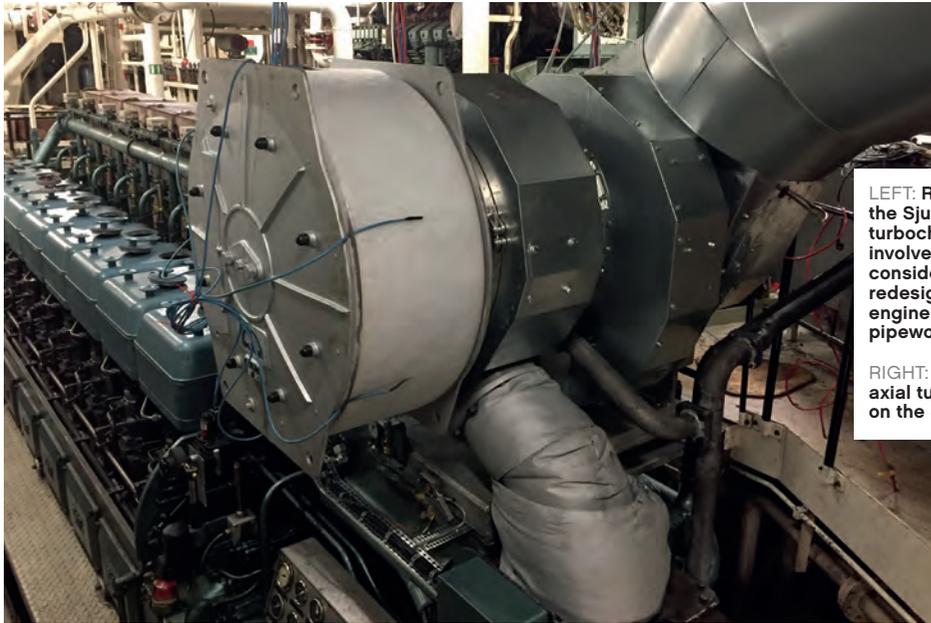
new ground in another fashion. A new 10-year maintenance agreement with Teekay Shipping is the first to cover MAN B&W's low-speed dual-fuel ME-GI engines on three LNG carriers in the Teekay fleet – the Oak Spirit, Creole Spirit and Torben Spirit. The new EMC (engine management concept) contract covers the provision of spare parts, maintenance management and the servicing of each vessel's two 5G70ME-GI dual-fuel main engines. According to the terms of the

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

Jeffrey Ang, head of MAN Diesel & Turbo in the Asia-Pacific region, says, “With Teekay nominating us as their preferred service provider, this contract will undoubtedly add momentum to our efforts to expand the EMC's reach within the gas engine segment.”

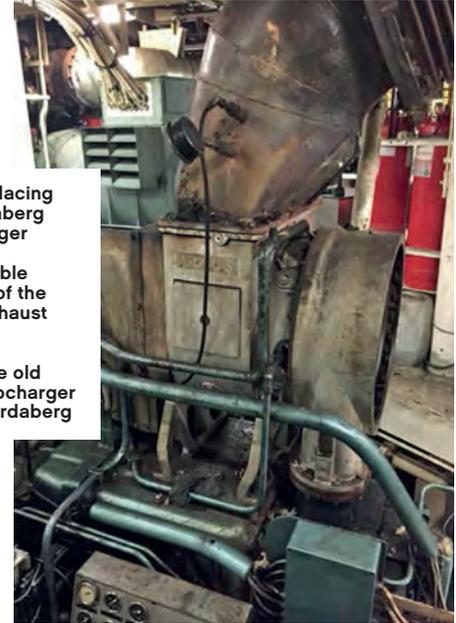
**Digitalization is the direct communication of the truth and opens up fast adjustments and improved performance by automation or improved human judgment**

Dan Sten Olsson, Stena CEO



**LEFT: Replacing the Sjurdaberg turbocharger involved considerable redesign of the engine exhaust pipework**

**RIGHT: The old axial turbocharger on the Sjurdaberg**



The EMC is a service model customized to suit individual customer requirements. Operating on a fixed budget, MAN PrimeServ takes care of equipment, planned and unplanned maintenance, the dispatching of personnel and the provision of spare parts. The company describes EMC as "a paradigm change within maintenance" in the shipping industry, pointing out that shipowners have traditionally taken care of maintenance themselves in what is generally a conservative industry. By pooling common resources and knowledge across all the PrimeServ global centers, it believes customers can enjoy a considerably higher level of service than would be available from individual PrimeServ hubs.

MAN Diesel & Turbo sees major opportunities for gas-fueled tonnage as fuel prices rise and exhaust-emission limits, such as the upcoming 0.5% fuel sulfur cap, tighten. Research indicates that the ME-GI engine delivers substantial reductions in

CO<sub>2</sub>, NO<sub>x</sub> and SO<sub>x</sub> emissions, with negligible fuel slip, and the possibility, through the ME-LGI variant, to burn LPG, methanol and other liquefied gases.

MAN's service experience encompasses its turbochargers as well as the engines themselves. With over 10,000 TCR turbochargers in the field, clocking up an estimated combined total of over 200 million operating hours, the company claims a huge insight into their overall performance. Many TCR turbochargers have been running for more than 10 years and have already encountered their second major overhaul.

#### North Sea retrofit

An example of MAN's turbocharger service came from the recent retrofit on a North Sea trawler, the Sjurdaberg, which was built in 1985. Its 9L28/32 Alpha medium-speed engine was originally equipped with an NA34/K turbocharger, and it was decided to replace it during a refit with a modern TCR20 radial unit, which is smaller in size, more efficient and offers a shorter reaction time to load changes. The job was completed by MAN Diesel & Turbo in Frederikshavn in just five weeks from initial inquiry to commissioning. The job was far from straightforward, as the change from an axial to a radial unit meant major redesign of pipework and auxiliary systems, but the improved performance meant that the modification proved highly worthwhile.

Another major machinery supplier, Wärtsilä, offers similar service agreements. A noteworthy recent contract is with PGS Geophysical, under which Wärtsilä will take care of the maintenance of engines and propulsion systems on board PGS's fleet of

**BELOW: Fishing trawler Sjurdaberg has received a new lease on life following a turbocharger refit**



**MAN HAS MORE THAN 10,000 TCR TURBOCHARGERS IN THE FIELD, CLOCKING UP AN ESTIMATED COMBINED TOTAL OF OVER 200 MILLION OPERATING HOURS**

**LEFT: A new 10-year maintenance agreement with Teekay Shipping is the first to cover MAN B&W's low-speed dual-fuel ME-GI engines on three LNG carriers in the Teekay fleet – the Oak Spirit, Creole Spirit (pictured) and Torben Spirit**



**WARTSILA IS COOPERATING WITH CRUISE LINE CARNIVAL CORPORATION IN A 12-YEAR AGREEMENT WORTH €900M**



All engine maintenance and monitoring work for 79 of Carnival Corporation's vessels will be handled by Wärtsilä (Pictured: Carnival Dream)

eight seismic vessels, securing maximum uptime as well as safe and economic operations. The three-year agreement, signed in December 2016 and including an option for two more years, includes optimization of operations and maintenance of the Wärtsilä engines and propulsion systems, enabling PGS to potentially control operational costs over the life of the vessels.

Four vessels will be connected to Wärtsilä's condition-based maintenance (CBM) solution, to provide extended times between overhauls. Automatic transfer of data from the installations to Wärtsilä's CBM center enables online monitoring and troubleshooting. Wärtsilä analyzes the data and provides advice on the optimization of operating parameters as well as preventive maintenance recommendations. In the second phase of the contract, Wärtsilä and PGS will identify how PGS can use Wärtsilä's



ABOVE: Tallink Grupp's new ro-pax ferry, Megastar, is powered by Wärtsilä dual-fuel engines which operate primarily on LNG. The ship began operating in the Gulf of Finland in early 2017

**Ensuring the availability and reliability of a large, globally operating fleet requires a wide service network, which we are able to offer**

Hans Petter Nesse, director of Wärtsilä Services for Norway

digital solutions to further secure maritime uptime and minimize risk and costs.

"Ensuring the availability and reliability of a large, globally operating fleet requires a wide service network, which we are able to offer," says Hans Petter Nesse, director of Wärtsilä Services for Norway. "With Wärtsilä's advisory service and support, PGS is able to concentrate on what it specializes in – offering seismic services for its customers."

"Reliability and safety of our fleet is essential, as it ensures that we can deliver services, as promised, to our customers," says Håkon Matheson, global sourcing manager of PGS Geophysical.

Another recent maintenance agreement for Wärtsilä is a five-year contract with Estonian Tallink Grupp for the new ro-pax ferry, Megastar. The ship, powered by Wärtsilä dual-fuel engines operating primarily on LNG, began operating in the Gulf of Finland in early 2017. Under the agreement Wärtsilä says it will optimize performance, enhance availability and reliability, and improve financial predictability. The service agreement includes CBM and 24/7 online remote support, including spare parts supply, for the three 12-cylinder and two 6-cylinder Wärtsilä 50DF engines, two fixed-pitch propellers and propeller shaft lines, the

Nacos Platinum integrated navigation system and external communication facilities.

Wärtsilä is also working with Carnival Corporation in a 12-year agreement worth €900m. According to the agreement, all engine maintenance and monitoring work for 79 of Carnival Corporation's cruise ships will be handled by Wärtsilä, and ongoing planning will be a collaboration between both companies. The agreement includes Wärtsilä's dynamic maintenance planning and CBM for about 400 Wärtsilä engines. The company points out that with this many engines, even small improvements in efficiency can provide substantial annual savings in operational costs. \\\



**HOLDTIGHT**

**NEW PRODUCT OFFERINGS  
VISIT BOOTH M3020  
TO LEARN MORE**

**In the toughest conditions,  
HOLDTIGHT® was there first.**

**NO SALT. NO RUST. ONE STEP.**

For more than three decades, HoldTight®102 salt remover/flash rust preventer has set the standard of performance worldwide.

[www.holdtight.com](http://www.holdtight.com) | [info@holdtight.com](mailto:info@holdtight.com)



Recommended industry-wide



**Mimic**

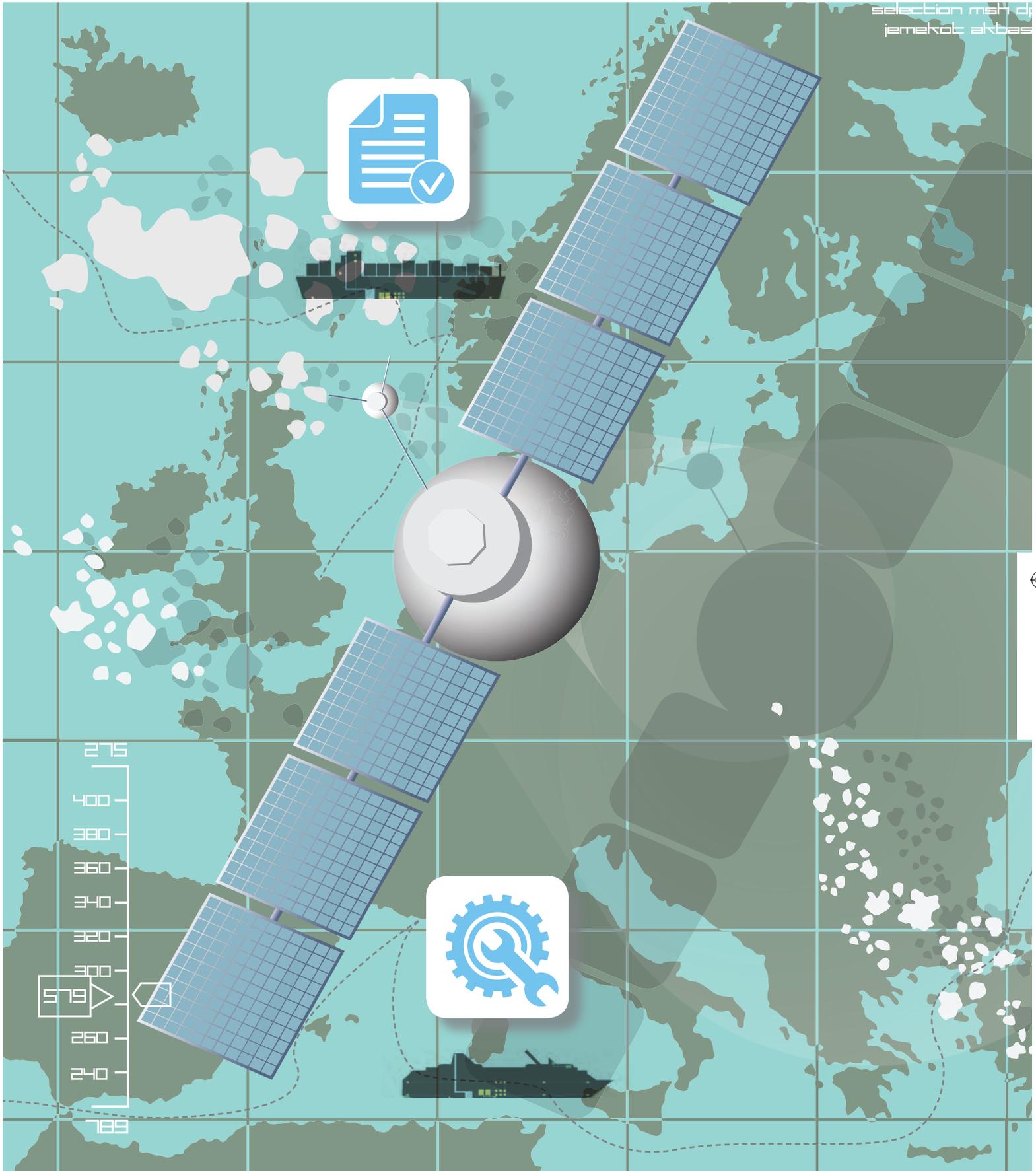
- Efficiency, Performance and Turbo Charger Monitoring
- Mimic Condition Monitoring Software & Services
- Now supplied with new Fleet Analysis Module

**James Fisher Mimic  
Monitoring Your Future**

[www.jfmimic.co.uk](http://www.jfmimic.co.uk)

CONDITION-BASED MAINTENANCE  
Predictive analysis

selection mah di  
jemekot akbas





**The latest methods of condition-based monitoring of equipment on vessels can now offer operators even greater cost savings and improved efficiency**

Mike Garside, Marine Maintenance Technology International

# Conditional love

**L**ike driverless cars, automated shipping seems to be a matter of 'when', not 'if' or 'how'. The shipping industry is notoriously conservative, but a high-tech future is quite possibly just a generation away, in what is being called the Fourth Industrial Revolution. Environmental, regulatory and – importantly – economic forces are the key drivers.

Maintenance strategies are already moving quickly in this direction. Large fleet operators are increasingly signing service agreements for high-tech specialists to bring in advanced monitoring and analysis systems. The Internet of Things might someday include your fridge sending out an order for fresh milk, but it can already monitor wear on pistons and bearings, and radio ahead for replacement parts.

Predictive maintenance is in the vanguard of the marine Internet of Things. As the number of onboard engineering crew has reduced drastically, often down to three or four people, maintenance strategies have had to become smarter.

The most basic strategy – corrective or breakdown maintenance – means waiting for the failure to happen: engineers agree it is by far the most expensive strategy. Preventive or scheduled maintenance, based on running hours or calendar intervals, is better – but it is carried out irrespective of the condition of the machinery; parts are simply replaced according to schedule. Condition-based maintenance requires machinery to be checked regularly, but it means problems can be dealt with at an early stage. Predictive maintenance goes a stage further with the help of more advanced monitoring and data analysis.

The trend is clearly visible in the offerings of service companies, who are moving from offering spare parts and servicing to advanced monitoring and fully integrated onshore operations.

A new Survey Arrangement Machinery Condition Monitoring service announced by Caterpillar Marine Asset Intelligence and MaK, working with DNV GL, uses predictive analytics to validate equipment condition.

## CONDITION-BASED MAINTENANCE



Image © Caterpillar

ABOVE: Remote monitoring stations can view a wide range of data transmitted by a fleet and suggest prioritized actions for ships' engineers

The service aims to avoid unnecessary maintenance expense by right-sizing maintenance to the equipment's condition and not to the calendar.

Caterpillar highlights another less obvious factor: "In addition to maintenance costs, comprehensive reliability studies have shown that human intervention is a key factor in over 80% of failures. By using data analytics to validate equipment condition, unnecessary human intervention and open-inspect activities can be avoided or deferred."

The project is starting with a customer operating a vessel powered by the new MaK M46 DF dual-fuel engine. Ken Krooner, technology and operations manager for

Caterpillar Marine Asset Intelligence, says, "This is going to be a major step forward for many shipowners and their operations in the future. This effort enables operations and maintenance leaders to make better decisions using data and analytics, helping to drive reduced cost, downtime and risk."

### Planned service

MacGregor, part of Cargotec, is meantime offering simplified planned service agreements intended to give lifetime support to customers' equipment, while reducing the burden of maintenance administration. The agreements have three levels of cover: inspection only; inspection and maintenance; or inspection, maintenance



and repair. The most comprehensive agreement covers all costs of inspections and preventative maintenance, labor, travel, maintenance and repair at a fixed rate.

With equipment on more than 1,800 vessels already covered by the company's traditional contracts, John Carnall, senior vice president, Global Lifecycle Support at MacGregor, says, "Market conditions have changed a great deal since we launched our MacGregor Onboard Care planned maintenance concept in 2004. There is an industry-wide shift toward new technologies and processes designed to increase efficiency and drive down operational costs.

"The new service agreements provide considerable savings on spare-parts pricing,

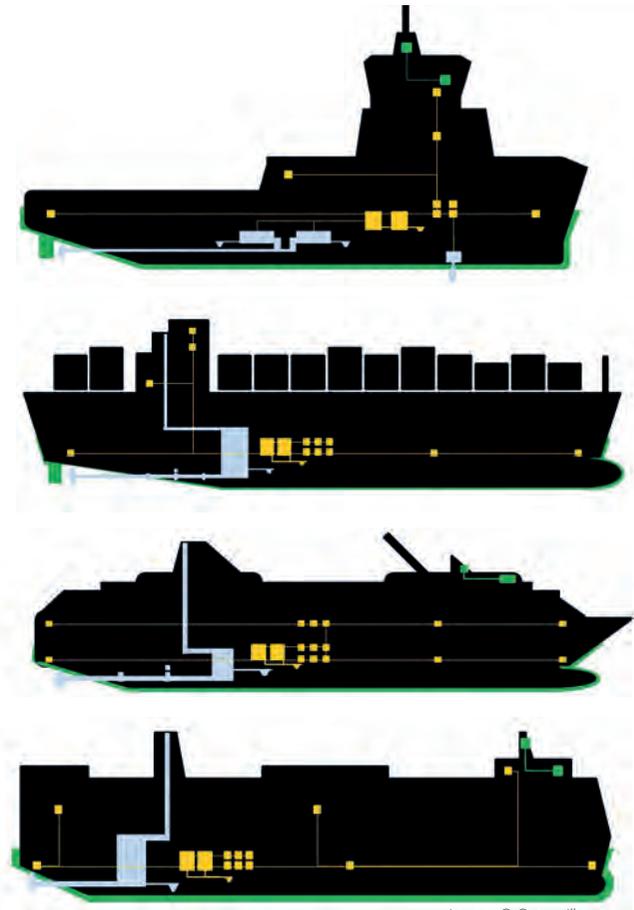


Image © Caterpillar

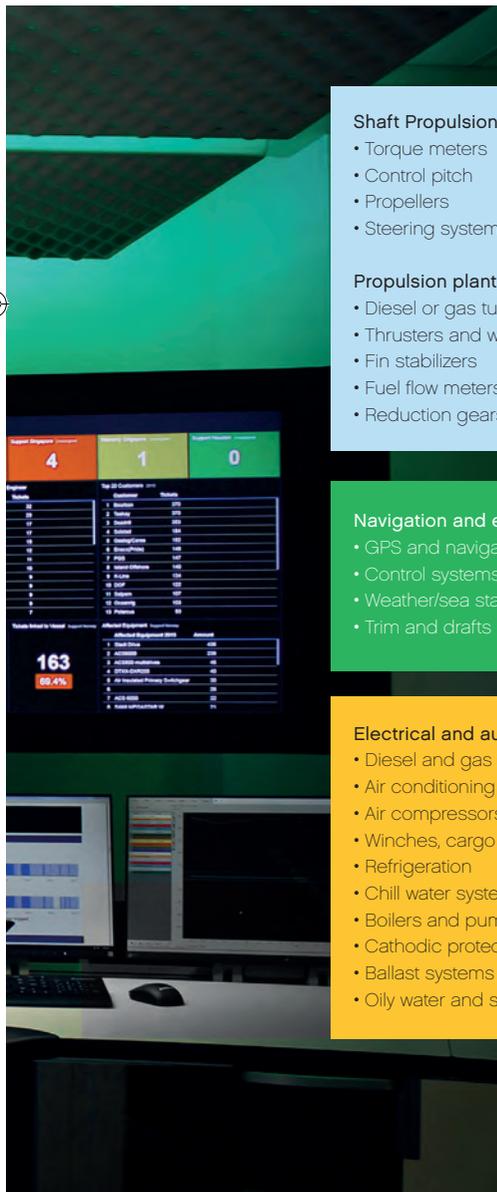


Image © ABB

**Shaft Propulsion**

- Torque meters
- Control pitch
- Propellers
- Steering systems

**Propulsion plant**

- Diesel or gas turbine engines
- Thrusters and waters-jets
- Fin stabilizers
- Fuel flow meters
- Reduction gears and transmissions

**Navigation and environment**

- GPS and navigation systems
- Control systems
- Weather/sea state
- Trim and drafts

**Electrical and auxiliaries**

- Diesel and gas turbine generators
- Air conditioning
- Air compressors
- Winches, cargo systems
- Refrigeration
- Chill water system
- Boilers and pumps
- Cathodic protection
- Ballast systems and treatment
- Oily water and sewage systems

**ABOVE: Many vessel types can have data monitored which is configured to the equipment aboard**

**LEFT: A central monitoring room can track data received from ships around the world and send reports back when operational anomalies are seen**

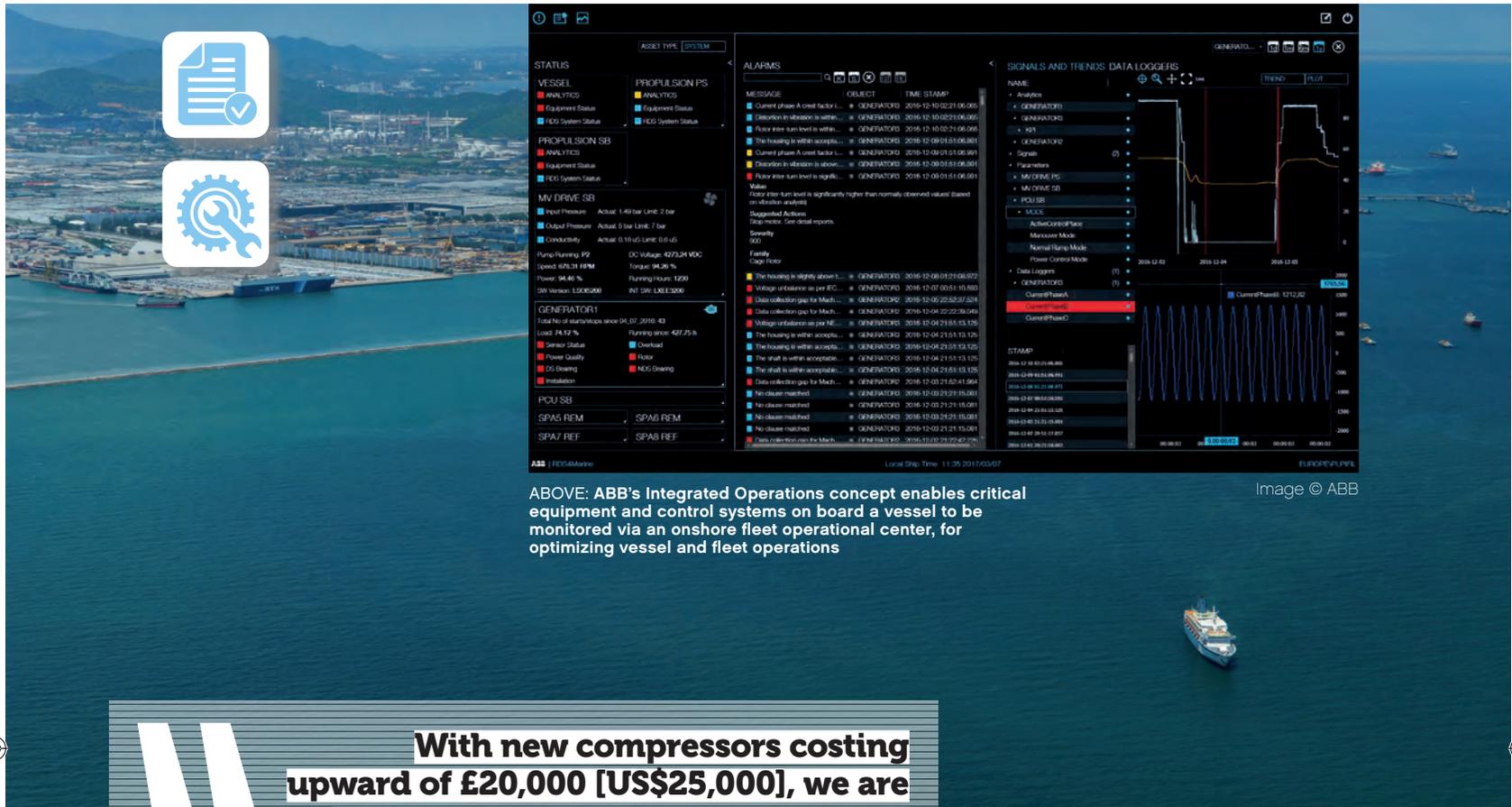
fixed rates that make budgeting simple and predictable, and we shoulder the burden of maintenance administration."

OEMs are also giving longer support and going digital. Rolf Bosma, head of service sales at ABB Turbocharging, says there is increasing demand for lifetime support and maintenance contracts: "It is not only a contract for the base services; people are requesting coaching and help for lifecycle programs. What we offer now is from the start of operation all the way to 15 or 20 years.

"At the moment we are developing all sorts of apps, and this is the future, to gain every percent of efficiency. With the latest model of turbocharger we have an app that gives information for the ship's crew on how to do maintenance.

"With the app you can get information, you can do condition-based maintenance, you can select parts, and you can even order parts. The future is definitely digital."

Shipboard maintenance of some equipment is simply not feasible. Oceanic



ABOVE: ABB's Integrated Operations concept enables critical equipment and control systems on board a vessel to be monitored via an onshore fleet operational center, for optimizing vessel and fleet operations

Image © ABB

## With new compressors costing upward of £20,000 [US\$25,000], we are seeing more shipowners implement preventative maintenance measures

David Lloyd Oceanic Technical Solutions

Technical Solutions decided instead to provide a compressor overhaul exchange service for refrigeration units, based on compressor running hours.

David Lloyd, Oceanic Technical Solutions' technical director, says, "While a lot of shipboard machinery is designed to operate with minimal maintenance, refrigeration compressors are required to have periodic overhauls based on the number of running hours, but due to the complexity of twin-screw compressors, the knowledge and skill to perform these overhauls is limited in vessel crews.

"Many of the compressors in service are older units and it is becoming increasingly difficult to find spare parts as some manufacturers no longer exist. And with new compressors costing upward of £20,000 [US\$25,000], we are beginning to see more shipowners implement preventative maintenance measures."

Oceanic delivers a completely overhauled compressor in exchange for one that has

exceeded working hours and requires refurbishment. The company's workshop overhaul involves a complete strip-down of the compressor, cleaning and chemical dipping to remove rust and dirt, and replacement of all bearings and seals with genuine or OEM spares parts, and comprehensive repainting.

Lloyd continues, "Our scheduled maintenance plan and compressor exchange service can prevent mechanical failures from happening, ultimately saving shipowners from incurring unbudgeted additional costs."

### Integrated operations

Predictability and controlled lifetime costs have obvious advantages for operators, and they are made more feasible by improved satellite connectivity at sea and cloud computing. A White Paper by ABB's Richard Windischhofer, senior vice president, business development and integrated operations, and Mikko Lepistö, senior

vice president, vessel information and control, predicts a revolution from the office to the propeller: "Planning, operational tasks, and decision making will be carried out by involving more people and information, and by creating virtual teams whose members are located on board, on shore at the owners' offices, and at the suppliers. Improved connectivity, teamwork and availability of information means a big change for an industry that used to operate in a very fragmented and isolated manner."

The paper highlights the problem of ships running as self-sufficient units: "Whenever there is a technical issue, it is the crew's job to try solving it first themselves, and if they can't, they contact their shore-side technical department or the equipment manufacturer. The fact that vessels are moving and need to keep their schedule makes it difficult for anyone to organize the right support, in the right place, at the right time. Also the crew keeps changing, which means that the person who knew the system on board best, might not always be there."

Windischhofer and Lepistö foresee seamless integration involving operations, commercial and technical planning, and maintenance: "One of the biggest operational improvements lies in the integration of the

**FREE  
TO ATTEND  
EXHIBITION!**

# MARINE MAINTENANCE WORLD EXPO AND CONFERENCE 2017

## **INCLUDING**

**\*THE BEST CONFERENCE  
YET!** New and exclusive  
presentations! All-new  
speaker line-up!  
Brand-new  
sessions!

# AMSTERDAM

**REGISTER NOW FOR YOUR  
FREE EXHIBITION PASS  
AND BOOK YOUR  
CONFERENCE PASS  
ONLINE NOW!**

**6 - 8 JUNE 2017**

AMSTERDAM, THE NETHERLANDS

## **CALLING ALL SHIPYARD AND DRY DOCK OPERATORS AND FLEET MAINTENANCE MANAGERS!**

The boutique exhibition and conference dedicated to marine maintenance and repair tools, technologies and services

**\*Conference rates apply – see website for details**

**Held alongside Electric & Hybrid  
Marine World Expo 2017!**  
**electric  
& hybrid marine  
WORLD EXPO 2017**



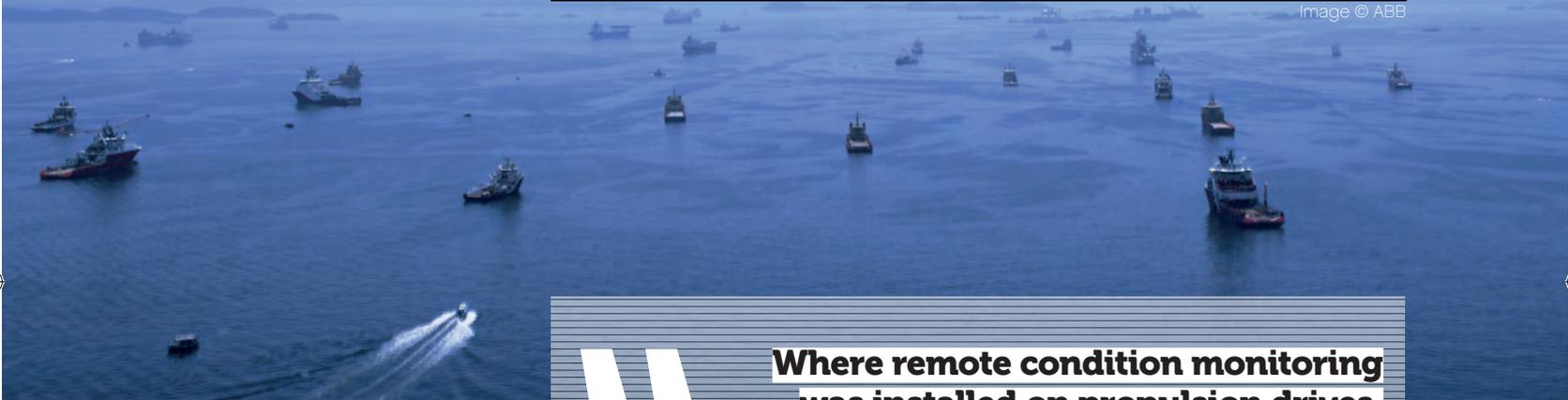
[www.MarineMaintenanceWorldExpo.com](http://www.MarineMaintenanceWorldExpo.com)



RIGHT: External information, such as weather or cargo load parameters, can be combined with information on the ship's process and propulsion in ABB's monitoring software



Image © ABB



**Where remote condition monitoring was installed on propulsion drives, the number of onboard visits by service engineers was cut by 70%**

operations taking place on board the vessel and on the shore-side, from anywhere, and with anyone who is critical to the value chain, such as original equipment manufacturers like ABB.

"The vast majority of today's technical operations will be planned maintenance work that is performed every 5-10 years, and technical problems during operation will be solved through remote diagnostic services. Reaching aviation-standard safety and fleet availability will be the target.

"For example, we can monitor the Azipod propulsor's oil and bearing temperature, moisture and particles in oil, vibrations of bearings, RPM, and other Azipod propulsor parameters. In the electrical system, we can monitor, for example, motor winding temperatures, the water pressure of the cooling system of propulsion drives, monitor critical alarms, actual values like RPM, power, torque, and events such as unbalances, the status of the satellite link, and the status of the RDS system on board. We monitor fuel consumption, propeller power, hull condition, chillers, hotel load, machinery, boilers, fresh water production,

voyage speed, RPMs and weather, and we forecast the motion."

By the end of 2015, ABB already had 100 skilled service engineers supporting 500 customer vessels equipped with some form of monitoring, by phone and on-call technical support. In the future, the company says the same amount of engineers and technical experts will be able to support a far higher number of vessels at sea, provided that a remote connection exists. Where remote condition monitoring was installed on propulsion drives, the number of onboard visits by service engineers was cut by 70%.

**The future**

By 2020, ABB aims to be connected to 3,000 vessels, with online integration to the 20% of customers who already have a modern operations center. It also expects integrated operations features to be included in every

new vessel. By 2025, it foresees considerably lower failure rates due to preventive monitoring, and many customers using joint software, communication and order processing tools. By 2030, the company aims to have supplied vessels with technology that enables remote and autonomous operation of selected functions on board the vessel, and monitoring of all critical subsystems in real time.

"Integrated operations is defined as a way of operating that allows ships, onshore operations and ABB to operate on the same information and communication technology backbone to deliver troubleshooting, tech support, condition monitoring, performance monitoring and analytics, and condition-based maintenance, in a seamless and fast manner that improves operational costs and safety on board the vessel, but also onshore," conclude Windischhofer and Lepistö. \\\

# MARINE MAINTENANCE WORLD EXPO AND CONFERENCE 2017

FREE  
TO ATTEND  
EXHIBITION!

# AMSTERDAM

REGISTER **NOW** FOR YOUR  
**FREE** EXHIBITION PASS  
AND **BOOK** YOUR  
**CONFERENCE PASS**  
ONLINE **NOW!**

**6 - 8 JUNE 2017**

AMSTERDAM, THE NETHERLANDS

## THE BEST CONFERENCE YET!

### NEW AND EXCLUSIVE PRESENTATIONS!

### ALL-NEW SPEAKER LINE-UP!

### BRAND-NEW SESSIONS!

The very latest maintenance and repair technologies under discussion

\*Conference rates apply – see website for details

Held alongside Electric & Hybrid  
Marine World Expo 2017!

**electric**  
& hybrid marine  
WORLD EXPO 2017



[www.MarineMaintenanceWorldExpo.com](http://www.MarineMaintenanceWorldExpo.com)

# MARINE MAINTENANCE WORLD EXPO AND CONFERENCE 2017

# AMSTERDAM

**6 - 8 JUNE 2017** AMSTERDAM

**CALLING ALL SHIPYARD AND DRY  
DOCK OPERATORS AND FLEET  
MAINTENANCE MANAGERS!**

The boutique exhibition and conference dedicated to marine maintenance and repair tools, technologies and services



[www.MarineMaintenanceWorldExpo.com](http://www.MarineMaintenanceWorldExpo.com)

**FREE  
TO ATTEND  
EXHIBITION!**



**REGISTER NOW FOR YOUR  
FREE EXHIBITION PASS  
AND BOOK YOUR  
CONFERENCE PASS  
ONLINE NOW!**

# THE NETHERLANDS

**THE BEST CONFERENCE YET!**  
**NEW AND EXCLUSIVE PRESENTATIONS!**  
**ALL-NEW SPEAKER LINE-UP!**  
**BRAND-NEW SESSIONS!**

The very latest maintenance and repair technologies under discussion

\*Conference rates apply – see website for details

*Held alongside Electric & Hybrid  
Marine World Expo 2017!*  
**electric  
& hybrid marine**  
WORLD EXPO 2017

**40+**  
speakers  
**+ Expert Panel  
Discussions!**



∴ SURFACE CLEANING AND PREPARATION

**Blasting technologies**

# Rules

# Shot buster

**Abrasive blasting is an effective method of removing contaminants and smoothing surfaces, but it is not without its problems. Could low dust methods be a better solution?**

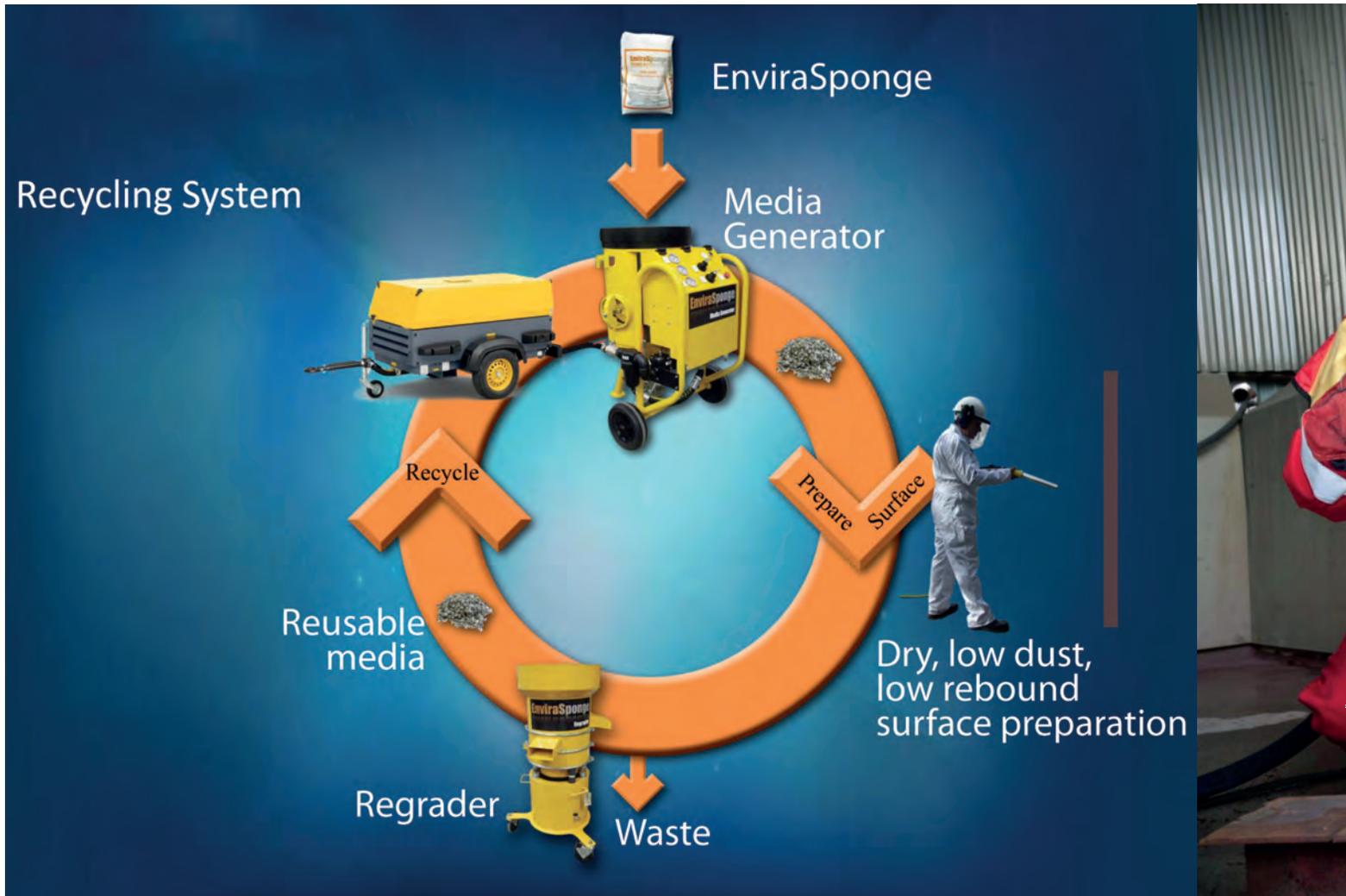
**Bill Thompson**

**I**t is common practice in the marine industries to use abrasive blasting as surface preparation before applying paint to metal, both for the initial application and when preparing to refinish surfaces. It is highly effective in removing surface contaminants, including old paint and rust. It will also smooth out rough surfaces, such as welds, and can roughen smooth surfaces to provide a key to improve the adhesion of coatings. A variety of media can be used, with varying abrasive properties, typically propelled by compressed air or by high-pressure jets of water.

Highly abrasive media include metal shot and sand, while less abrasive alternatives include glass or plastic beads, soda \*washing? baking? caustic? coke?\* and organic matter such as ground-up nut shells. Most marine applications call for high levels of abrasiveness, which can normally be safely used for external surfaces like decks and hull sides, but are less suitable for internal

blasting, such as the interior surfaces of ballast tanks. However, environmental considerations can also limit the use of blasting, because it normally produces dust, which can be harmful.

For treatment of smaller objects, many of the environmental considerations can be overcome thanks to blasting taking place within a controlled environment such as a blast cabinet. But the likes of ships and offshore rigs cannot be physically contained, so this brings problems such as the impact of dust and blasting media on the operators. Silica sand, once widely used in shipyards as a blast medium, has been shown to cause silicosis, a potentially fatal condition, which has led to many countries banning its use. But subsequent studies have linked alternative media, commonly used as substitutes for silica sand, with equally toxic by-products. Additionally, when old coatings are stripped they can also cause toxins to be released into the atmosphere.



ABOVE: EnviraSponge traps the dust and contaminants in the sponge media. The regrader removes them, enabling the sponge-coated abrasive to be reused  
 RIGHT: EnviraSponge media generator



To limit the dust problem, water is often used as a propellant rather than air alone. Water and the abrasive media are mixed in the form of a slurry. This has the added benefit of potentially giving a finer finish because of the flushing action of the water. To accelerate the slurry, compressed air may be introduced at the blast nozzle, which enhances the cleaning while still providing the cushioning effect of the water.

This process is often called vapor blasting. It is considered safer, as the ricochet effect is reduced due to the water's cushioning, and the angle at which the medium strikes the surface is changed,

striking the surface at an angle rather than perpendicularly. This results in a more even finish, with a satin polished appearance.

Vapor blasting is said by its proponents to be well suited to marine and offshore applications, as it is nearly dust-free, cleans by the flow of water rather than by impact, degreases as well as blast cleaning, and because the water has a lubricating effect between the surface and the medium, it can offer a longer media life and produces a 'softer' finish with no media impregnation.

International vapor blasting specialist Graco, based in Belgium, claims that its EcoQuip abrasive blast system is faster than dry blasting, is easier to use, and has proved more reliable in the field. The EcoQuip 2 system features increased blast pressures, a ventless pot and simplified controls. The company says it produces up to 92% less dust than dry blasting, leading to less need for containment and clean-up, and is at least as fast. Applications include removal of old protective coatings and scale, removal of



corrosion, removal of soot and smoke, and preparation of steel surfaces for coating.

Even when dust can be reduced by wet blasting, it is still essential for operators to wear appropriate personal protective equipment. But in a shipyard or offshore environment there are other workers nearby, sensitive components and systems that need protection, not to mention nearby factories and housing. So rather than just protect the blasting area and those working therein, the industry needs to find a cleaning and preparation method that is as effective as abrasive blasting but reduces the hazards.

**Alternative technique**

Sponge blasting would seem to offer a solution to many of the problems associated with conventional blasting. Several companies offer sponge blasting media and equipment. We spoke with Liam McCann, product manager at EnviraSponge in the UK about the advantages of the system and its suitability for the shipbuilding, ship repair and offshore industries. EnviraSponge is part of international group Hodge Clemco, which manufactures and supplies abrasive media, blast machines, blast cabinets, paint spray equipment, abrasive media recovery and personal protective equipment. This, as McCann points out, means that the company's scope of supply covers the whole spectrum of abrasive blasting, meaning it can advise on the optimum solution for any particular application, without being biased toward any one technique.

In the EnviraSponge system, the abrasive medium is contained within a sponge coating, with the actual abrasive and the

sponge type varying according to the particular application. When shot-blasted against a surface, the sponge flattens and exposes the abrasive, which cleans the surface. As the sponge rebounds it expands back to its original size, causing a vacuum inside that captures the dust particles.

On steel and most other metallic substructures the EnviraSponge process removes scale, rust and paint coatings and gives an SA2.5 or SA3 surface quality finish/cleanliness. Depending on the surface hardness, air blast pressure and selected sponge abrasive type, a surface roughness/profile up to 125µ can be achieved. The system enables abrasive blasting without the requirement for dust extraction equipment, saving time and expense.

When the used sponge medium is collected and put through the regreder, the dust and other foreign particles are screened out so that the sponge can be used again. Its ability to perform dry and its proficiency in cleaning in confined spaces mean that it is well suited for use in enclosed environments such as ballast tanks. Because there is



ABOVE: EnviraSponge has developed a special fire-retardant, high-visibility blast suit for personal protection on offshore rigs

ABOVE RIGHT: Graco's EcoQuip vapor blast equipment in use on a ship project

RIGHT: The EcoQuip 2 EQ400t elite, Graco's largest towable abrasive blasting trailer with integrated blast system and diesel compressor



RIGHT: The EcoQuip EQ2 Twinline operates two pots and two nozzles on one skid using a single compressor to double the production rate



little natural airflow through such places, extracting dust produced by conventional methods is difficult, but with sponge media the hazardous material is trapped in the sponge, easing removal.

Unlike conventional hard abrasives, which ricochet great distances, the sponge media transfers its energy upon contact by flattening out. This has particular importance for ships and offshore rigs in that it can be used near sensitive equipment without risk of mechanical damage, and other work can continue near the blast area. Because it is a dry, relatively clean process, EnviraSponge can even be used near sensitive electrical equipment without having to shut it down. This, McCann says, is particularly beneficial when performing routine maintenance on offshore oil and gas rigs, with minimal disruption to operation.

McCann points to another benefit of EnviraSponge in the oil and gas industry: "Because of reliability issues with alternative, more complex systems that contain multiple valves, rigs have to carry

## Contaminants are absorbed and trapped, and carried away from the substrate for easy disposal

two or even three sets of blast machinery. EnviraSponge is a pressure blasting system, simple in configuration, with none of these complexity issues, so just one set of equipment will suffice."

Personal protection is still important, and the company has addressed the needs of the offshore industry in this respect. Offshore operators involved in blasting need a fire-retardant suit for general safety, a high-visibility jacket for moving around the rig, and a blast suit to protect themselves against blast media. EnviraSponge has developed a suit that combines all these requirements and offers the added benefit of keeping the operator dry during wet blasting.

Due to the capillary effect of the hydrophilic cell structure of the pre-polymer material, contaminants are absorbed and trapped, and carried away from the substrate for easy disposal.

The nature of the sponge matrix enables the abrasive to carry out its cleaning function, but due to the media's resilience, by the time it bounces off and hits other areas, most of the energy has been dissipated and the rebound is minimal.

McCann says that EnviraSponge has supplied media and equipment to several prominent oil and gas operators, as well as commercial and naval shipyards in the UK and further afield. \\\



# Vapor Abrasive™ Blasting

Maximum blast power, Minimal dust

## ECOQUIP™ 2

- ▶ Same performance as sandblasting
- ▶ 92% less dust minimizing tenting and containment
- ▶ Up to 75% of blast media savings



**DISCOVER** HOW **ECOQUIP™ 2**  
**OPTIMIZES YOUR BLASTING JOB**



[www.gracoblasing.com](http://www.gracoblasing.com)

DECK COATINGS  
Safety on deck



## On vessels of all sizes, the risk of potentially dangerous falls on deck can be minimized by using the latest anti-slip coatings available

Mike Garside, Marine Maintenance Technology International

The most common cause of injury at work is said to be a trip or a slip on smooth, wet, greasy or frosty surfaces. Deck coatings particularly need to guard against this with effective anti-slip properties. The simple way to achieve this is by adding aggregate to the top coat, but special demands from niche sectors are increasingly common, and new technologies are emerging to fulfill them.

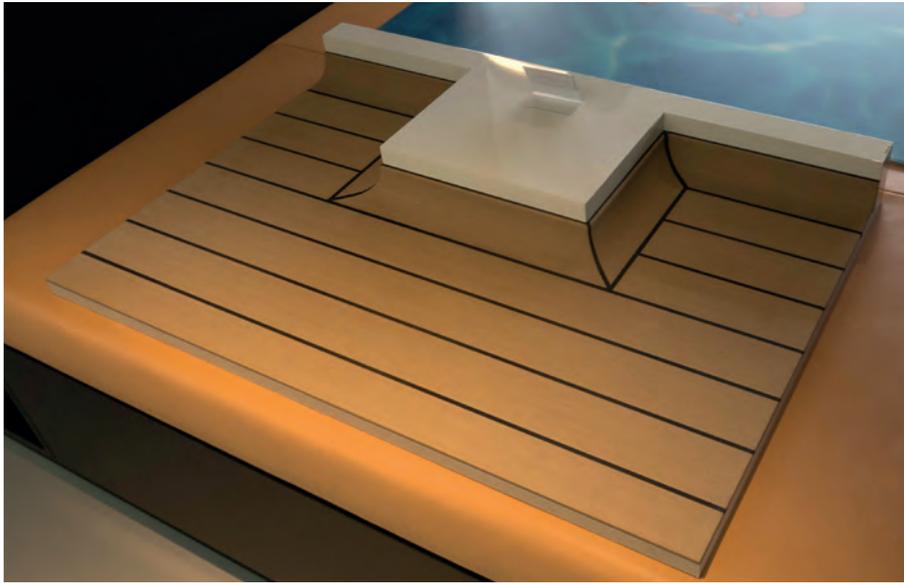
The cruise industry needs decks that are safe for passengers, but they also need to feel soft and look attractive. Passengers often wear casual footwear, so rough aggregates are out of the question. Trawlermen in work boots need non-slip coatings to be effective against decks running in water in violent seas. Non-skid and corrosion protection properties are vital for deck coatings on cargo ships, particularly if the cargo is oil or chemicals. Livestock carriers have animal effluent to cope with. Aircraft carriers need non-slip decks for the benefit of flight crews and to

enable aircraft to take off and land without risk of skidding – and new vertical landing aircraft need deck coatings that can withstand their high temperature exhausts.

Deck coatings also need to be durable, since re-coating is time consuming and interrupts most other work. Quick preparation and fast drying can be added to the list of requirements, since everyone wants to walk where you've just painted. Specialist markets appear to be willing to pay for more expensive deck coatings that will last longer and fulfill definite needs.

### Cruise decks

Dutch-based Bolidt serves a large portion of the cruise market. The company is currently providing deck coatings for all the new-build passenger vessels in France, every ship being built at Meyer Werft in Germany and Meyer Turku in Finland, all the Viking river cruisers, and Holland America's fleet. Bolidt now supplies between 70% and 80% of the cruise and river cruise market.



Jacco van Overbeek, director of the maritime division at Bolidt, says the past year has been busier than ever, with 46 ships coming into dry dock for resurfacing with the company's products. But the business started though with strictly functional coatings.

"When Bolidt started providing deck coatings, the existing technologies were sand and epoxy tar, and our first products were preparation coatings to level and provide corrosion protection underneath teak or rubber top coats," van Overbeek says.

"The first business was in livestock carrier ships, where very durable protection was needed against the urine and animal waste, and heavy wear. From there, the company moved into fishing and navy ships, where heavyweight protection was essential. Resin-based coatings turned out to be very suitable for these strictly functional applications and very long lasting," says van Overbeek. "I have yet to see a renewal needed even with ships working for 10 or 15 years, some as long as 20 years, with the same deck coatings."

Along with offshore, this functional end of the market still accounts for 15-20% of Bolidt's production, but the company is now best known for its innovative and often highly decorative resin deck coatings for cruise ships. These design coatings started about 30 years ago, and the resin technology has gradually taken over from the earlier hard surface systems.

"The use of resin to create a combination of slip resistance, durability and design started with ships produced at Meyer Werft for the Royal Caribbean, Celebrity and Carnival cruise lines," van Overbeek continues. The technology has now

**ABOVE: Bolidt's Future Teak deck covering is a popular choice in the cruise sector**

**RIGHT: Heat testing of Bolidt's Future Teak, which offers a more environmentally friendly option to natural teak**

**BELOW RIGHT: (Three photos) A recently completed installation of Chemco's wet- and rust-tolerant Epo-chem flooring system**



advanced to include a combination of softness and ease of cleaning. Our Future Teak products are the more recent additions. They are very popular with the mega-yacht industry as well as cruise lines. Future developments are coming in the form of self-cleaning decks, where we can now overcome the difficulty of combining anti-slip qualities with self-cleaning."

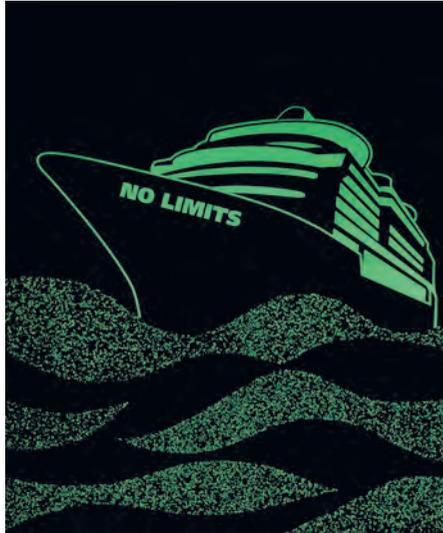
Glow-in-the-dark coatings, using similar technology as the luminous hands of a watch, are also coming for the new Harmony-class ships, for both decorative and safety reasons. Applications include providing floor lines to follow in the event of electric light failures, and glow-in-the-dark paints around pools. Areas marked off can be invisible during the day, but have visibility at night.



**We can now overcome the difficulty of combining anti-slip qualities with self-cleaning**

Jacco van Overbeek, Bolidt

BELOW: Bolidt's glow-in-the-dark coatings can be used to mark emergency routes, walkways or the edges of swimming pools. Seen here at night-time (top) and daytime (bottom)



**Functional requirements**

The demand for functional coatings on navy and fishing vessels and work boats has not changed greatly over the years, but reduced weight and ease of maintenance are being requested. Some navies, for example, now want roller-coated top layers that can be easily repaired at sea.

Fishing fleets demand durability above everything, as boats will typically come into port to unload and need to be back at sea the following day. Although resin coatings are more expensive, there is an attraction for fleets that are more interested in the fact that they can be used 24/7 without repair and long intervals between renewals – and they can be used both indoors and out. Non-slip characteristics are also very important, as workers and forklift trucks need to be able to move around safely at sea.

**Making contact**

Technically, non-slip characteristics are determined by the coefficient of friction (COF) obtained by the coating surface: as two rough surfaces move against each other, they stick and prevent motion.

COF is impacted by wear on the surface, exposure to the environment, and build-up of contaminants from a lack of cleaning. Manufacturers are now tending to focus on ease of application and maintenance, since the best practical opportunity to coat the deck may be while at sea.

Norwegian chemicals company Jotun says its new non-slip coatings are specifically designed for use at sea. Unlike most trowel-applied non-slip coatings, the company's Jota Armour is spray applied and achieves a high build in just one coat. One advantage of this simpler process is that no training is necessary, and a ship's crew can paint a deck using a simple gravity feed hopper gun. A company spokesperson says, "Being tolerant to high solids and surfaces, Jota Armour flows into a consistent film and penetrates deep down into the substrate to provide excellent adhesion. While high surface preparation standards will improve performance, this may not be an option. Jota Armour can be applied to a sound surface down to St2."

The preparation standard St2 can be achieved through hand and power tool cleaning, which removes poorly adhering mill scale, rust, coatings and foreign matter. Without magnification, the surface will appear to be free from visible oil, grease and dirt.





HMS Queen Elizabeth will feature a new non-skid, thermal gas wash-resistant flight deck coating for vertical landings of the F-35 fighter

### Tolerance levels

Ian Gold, marketing coordinator at Chemco, whose wet-and-rust-tolerant coatings are becoming increasingly popular for use on decks, says, "The coatings we utilize for decks on all types of ships are the same Epochem coatings that we use inside of tanks and for external structures. The unique characteristics of these products allow them to be used in almost all vessel areas. To make your products non-slip, you simply add an aggregate. There are various aggregates available dependent on application area.

"Our deck products are designed to have the capability firstly of being anti-corrosive coatings for almost all areas of a vessel, including decks, tank internals and external structures. Various topcoats can be applied, which as a whole can offer long-term maintenance-free protection."

The products are compatible with most protective coatings, including shop primers, and can be used equally well for replacements as on new-builds. They can also be applied over both wet and rusty surfaces and over previously sound coatings. Gold continues, "The Chemco systems are non-porous and form a full barrier between the substrate and the outside atmosphere, which offers an in-service life of over 20 years. A substantial percentage of Chemco's work is in over-coating old steel and new primed steel. However, this depends on the required work program of new building, steel replacement, or general upgrading of the substrate.

**A full barrier between the substrate and outside atmosphere offers an in-service life of over 20 years**

Ian Gold, Chemco

"At this time, the market is most volatile, as are world currencies, and the various types of vessels can fluctuate in income depending on world economies. For example, at present, tanker business is just above board, dry bulk is very poor, and container ships have a dependency on world market trading. Trying to predict the market is a real crystal ball scenario."

### Flight decks

At the extreme end of functional non-slip requirements are the flight decks of the UK's two new aircraft carriers, which have a completely new coating developed by Monitor Coatings of North Shields, UK.

The HMS Queen Elizabeth and HMS Prince of Wales, the Royal Navy's biggest ever ships, have 19,500m<sup>2</sup> flight decks from which the new F-35B Joint Strike Fighters (JSF) will operate, using their short take-off and vertical landing (STOVL) capability.

The non-slip coatings that could cope with the old Harrier jet would be unable to cope with the 920°C high-pressure jet efflux from the Joint Strike Fighters, particularly

on their vertical landings. The new coating is a thermal metal application, using a combination of aluminum and titanium and able to withstand temperatures up to 1,700°C. The downward exhaust from a vertical-landing JSF is considered to be considerably higher than the aging AV-8B Harrier STOVL attack jets.

The specialized coating is applied to specific landing spots by a robotic spray that fires metal, atomized from wire, through a jet of plasma at temperatures of almost 10,000°C (18,000°F). The molten droplets flatten and quickly solidify, creating a tough but rough 1.2mm coating, bonded to the steel of the deck.

In the first application of its type, the arc spray system moves across the deck like an inkjet printer. Ian Booth, managing director of the Aircraft Carrier Alliance, says, "Working with experts in the UK, we have developed a unique coating to provide the necessary protection to the flight deck of the aircraft carriers and this will ensure they can deliver the UK's carrier strike capability for the next 50 years." \\



[www.rustibus.com](http://www.rustibus.com)

## THE BEST SOLUTIONS FOR SURFACE PREPARATION AT SEA.



**AN EFFECTIVE AND POWERFUL METHOD**  
of removing coatings and rust.



Before



After

BERGEN

SINGAPORE

ANTWERP

HOUSTON

DUBAI

KUALA LUMPUR

# InfoSHIP®

The software to optimise your fleet technical management and your energy cycle to obtain relevant saving in ship operations

[www.gruppo-ib.com](http://www.gruppo-ib.com)

MARINE MAINTENANCE  
WORLD EXPO AND  
CONFERENCE 2017

visit us at stand  
**M4040**



**RINA SERVICES**  
classification, certification, inspection & testing

# Ultrasonic

Ultrasonic and acoustic emission testing are well-established tools but have had limited use in the marine industry. That is now changing

Mike Garside, Marine Maintenance Technology International

# en carefully

**U**ltrasound can be used to detect a variety of seal integrity issues including air, steam and gas leaks, tightness (as with hatch covers), valve leaks and steam trap problems. It also reveals electrical failures in switchboards, problems with bearings, shafts and gearboxes, and cavitation issues. In many cases ultrasound enables detection of problems at an early stage, well before equipment is entering its first stages of physical wear, hence its importance as a condition monitoring tool. Ultrasound can be applied in the form of occasional inspection or continual monitoring.

Acoustic emission (AE) occurs in solids and occurs when the material undergoes irreversible changes in its internal structure, such when a crack forms or there is plastic deformation due to aging, temperature changes or mechanical forces from external sources, such as damage from impact or wave forces. AEs are transient elastic waves caused by the rapid release of local stresses. The event releases elastic energy, which is then propagated as a sound wave that can be detected at frequencies from 1kHz to 1MHz. The three principle uses of AE are locating sources, evaluating

mechanical performance and monitoring the health of structures.

Both techniques rely on high-frequency ultrasound waves. The range for AE is wider and can vary from 20-200kHz; ultrasound testing (UT) usually refers to signals in the range of 36-40kHz. UT relies on creating an ultrasonic sound with a transmitter, which is detected outside a sealed zone. AE listens for the transient sounds made by equipment or structures as they occur.

#### **Detecting faults, predicting failures**

Ultrasound detectors sense high-frequency signals and convert them into corresponding

audible sounds while maintaining their original characteristics and qualities. They give the ability to predict failures, control energy costs and detect defects at an early stage. Different ultrasonic sounds are associated with different problems. For example in structural monitoring a sound like an egg frying suggests cavitation within a pump, while clicks and grinding suggest impact or friction between surfaces.

Ultrasound techniques can be used independently or in combination with other techniques such as vibration monitoring. In a more sophisticated mode, dynamic sound signals can be captured for failure-mode analysis with advanced software.

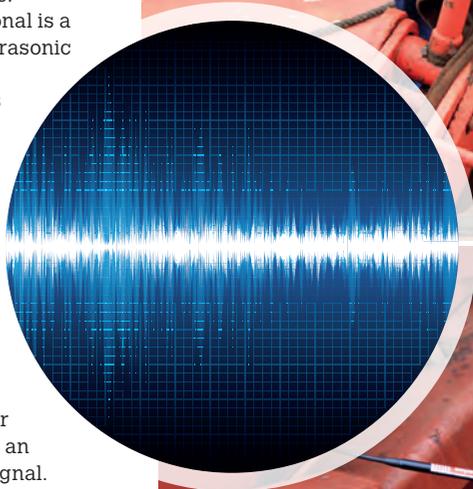
Belgian-based SDT International is a manufacturer of high-quality ultrasonic testing gear and a provider of tailor-made ultrasound solutions to both the shore-based and marine industries. Well-known applications in the marine domain include hatch cover tightness testing, where SDT played a pioneering role in engineering an ultrasound tightness testing solution as an alternative to traditional hose testing.

In hatch cover testing an ultrasound generator/transmitter is placed in the hold to fill it with an artificially created ultrasound signal. If there is a discontinuity in the sealing system, the sounds will pass through and enable the operator on the other side of the seal (on deck) to detect the leaky spot with pinpoint accuracy.

Walter Verloesem, SDT's manager of marine applications and a trainer for its hatch cover tightness program, says that checking the tightness of hatch covers is a widely adopted application of ultrasound in the marine industry. "It meant we could bring extra safety and security to hatch covers, and it is now a very established procedure and the preferred way of testing hatch cover tightness by manufacturers, insurers and surveyors.

"The field of condition-based monitoring and maintenance is growing rapidly and there are many more techniques available now," continues Verloesem. "Ultrasound is common on land, but now we are seeing a big take-up in the marine sector. It is not yet widespread in shipboard use, but the possibilities are being understood more and shipowners are showing growing interest in including ultrasound in their condition-monitoring toolbox.

"We are seeing interest for applications including monitoring and checking



TOP: The demand for ultrasonic hatch cover testing is increasing, mainly within the scope of cargo loss prevention initiatives or cargo claim investigations

LEFT: Leaky hatch covers can impact the classification and statutory status of ships

RIGHT: Acoustic emission (AE) testing, used in conjunction with vibration testing, is ideal for engine inspections

bearings, electrical switchboards, seals, piping, valves, steam systems and lubrication systems," he adds. "As well as monitoring the health of equipment with handheld or magnetic sensors, recent developments include the possibility of continuous monitoring of equipment by means of permanently installed sensors that are placed in strategic positions on the equipment – a big step forward in the field of remote condition monitoring."

### Electrical failure warnings

Ultrasound solutions reveal electrical fault conditions such as partial discharge (corona), partial arcing (tracking) and arcing discharge inside metal-clad switchgear, around substations, and in overhead transmission and distribution lines.

Verloesem continues, "Inspection of a switchboard can be done without even opening the cabinet, and is highly recommended prior to opening panels for

## Upcoming electrical failures don't necessarily generate heat that could be detected with thermography

Walter Verloesem, SDT



infrared inspections. Upcoming electrical failures don't necessarily generate heat that could be detected with thermography."

#### **Better greasing for rotating parts**

Bearings, or in fact anything that generates friction, are also suitable for testing. Any piece of rotating machinery will have its own typical baseline signature, and this signal pattern can be stored. Ultrasound inspection will then reveal changes in the signal pattern caused by changes in friction. These can be measured on the spot, in real time, and do not need to be enhanced or subjected to time-consuming analysis techniques. In the case of a bearing running low on lubrication, it is straightforward to add more grease until the signal pattern returns to the baseline, thus avoiding the risk of over-greasing. As such, ultrasonic

bearing monitoring allows lubrication of bearings based on their condition rather than on a fixed time-based schedule.

Another advantage is that ultrasound performs extremely well on low-speed rotating equipment such as steering gear, winches, cranes and ramps, whereas other techniques such as vibration analysis do not always give the required result.

#### **AE: finds early faults better**

Verloesem points out that AE testing is not just an investigative technique: "It is most useful for identifying defects in their infancy, earlier than other inspections such as thermography or lube oil analysis."

So far only a few vessels make extensive use of the techniques, but Verloesem says applications will increase: "The new area is condition monitoring using ultrasound.

Remote monitoring is a definite possibility, and SDT supplies the necessary equipment and support. The cost of equipment and sensors is not great as they are all available off the shelf, so it would be perfectly viable to implement the technology quite widely and quickly. The speed of uptake is not really price-related. It is more a matter of confidence and trust in the technology.

"Ultrasound is really one of the cheapest methods for condition monitoring, with the additional advantage that it gives instant information and feedback. It is not necessary to process results for analysis. If you see a deviating pattern from the ultrasound scanner then you know immediately that something is happening.

"However, for those who want to embark on a high-level conditioning monitoring program, SDT has developed powerful

# Be a **LUBE**Expert®



## Grease Bearings Right



**Right** Lubricant



**Right** Location



**Right** Interval



**Right** Quantity



**Right** Indicators

Use ultrasound to optimise your acoustic lubrication program and keep you ship's machinery in perfect condition.



Ultrasound Solutions

[sdtultrasound.com/lubexpert](http://sdtultrasound.com/lubexpert)

**FREE SERVICE!**

# LEARN MORE ABOUT OUR ADVERTISERS **NOW!**

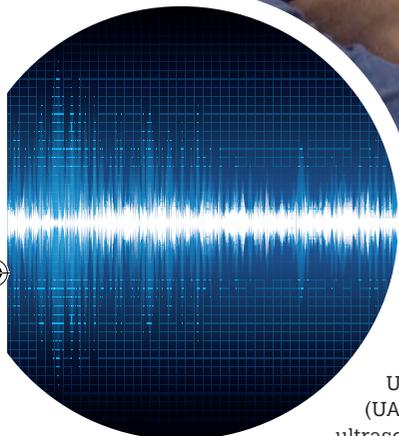
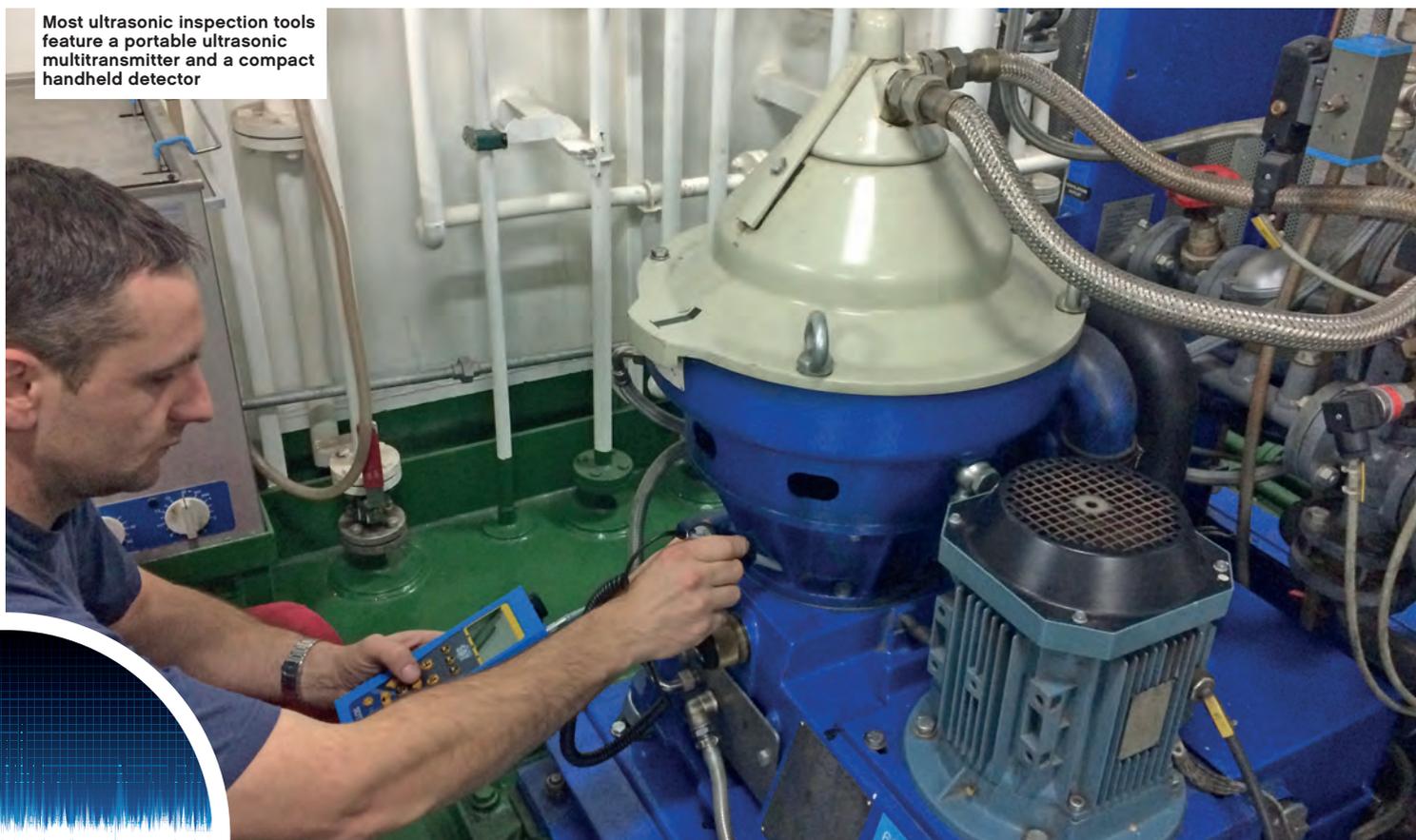
Visit [www.ukimediaevents.com/info/mmm](http://www.ukimediaevents.com/info/mmm) to request exclusive and rapid information about the latest technologies and services featured in this issue

## MARINE MAINTENANCE

TECHNOLOGY INTERNATIONAL

[www.ukimediaevents.com/info/mmm](http://www.ukimediaevents.com/info/mmm)

Most ultrasonic inspection tools feature a portable ultrasonic multitransmitter and a compact handheld detector



ultrasonic measurement management software – SDT Ultranalysis Suite (UAS) – that allows ultrasonic maintenance technicians to maintain their

systems by creating a database and collecting, managing and analyzing data in an easy and reliable way. UAS not only manages your ultrasound measurements but also vibration, temperature and rotational speeds.”

**Pressure testing with AE monitoring**

Asset protection specialist Mistras has developed AE testing into a sophisticated set of tools for long-term monitoring of bridges, oil and gas platforms, and large equipment such as dockside cranes. Director Tim Watson says, “There are short and long-term uses for AE testing. Short-term use includes testing things like pressure vessels, and long-term use would include things like structural monitoring in an offshore installation, detecting the development of cracks or corrosion.

“Traditionally AE might be used in controlled conditions to identify issues developing during a pressure test. But in the mid-1990s we were asked to develop ways of testing the integrity of large structures, and that is a very different type of application.

**Other techniques wouldn’t particularly tell you if the cracks are growing, as AE would**

Tim Watson, MISTRAS

On a ship or a bridge, the external stresses continually vary according to conditions – things like waves, traffic volumes and speed through the water. Monitoring therefore needs to occur over a period to take these things into account – it is not the same as monitoring a fixed item.

“For a floating structure we often interface with the designers to install permanent monitoring detectors at key points, which can then operate over a 10- or 20-year design life.”

**Sounds of cracks**

The system can be likened to earthquake monitoring: a signal is detected by multiple sensors and then triangulated to show the position of the defect or issue – for example a crack, corrosion or line break.

Watson says the sounds are quite distinctive: “When corrosion is occurring, there is a fizzy popping sound like the noise of Rice Krispies in milk, but a small break might sound more like dry

spaghetti cracking. The size of the signal is proportional to the size of the crack and the type of metal. Iron tends to be brittle and gives a single crack. Steel fails more gradually, so there are many little cracks that build up to a crescendo at the point of total failure. Wires snapping make a ‘ping, ping, ping’ sound as individual strands go.

“The computer receiving signals on-site can do a fair amount of interpretation right there, and the more intelligent systems we have now can identify problems quite precisely, with the benefit of the lab testing we’ve done on corrosion embrittlement and other issues. But it still requires human review of the computer analysis and interpretation of the results.”

**Slow speed stress diagnosis**

Mistras has developed a service specifically to assess the condition of azipod bearings, and has so far carried out more than a hundred such operations. Watson says it is now quite straightforward and can easily

RIGHT: Ultrasonic inspection is ideal for detecting electrical faults such as partial discharge (corona), partial arcing (tracking) and arcing discharge in electrical equipment



be done within 24 hours: “We have had a lot of success testing low-speed stresses, for example on the bearings of azipods. For that we put sensors around the top of the azipod and then do 360° rotations. We can then analyze the sounds, quantify the bearing condition and assign a rating from A to E. Silence would indicate that everything is in good condition and well lubricated. Any light clicks or grinding suggest a degree of problem, and we can predict when a replacement will be needed.”

**Structural in-situ assessments**

Monitoring a ship’s hull for structural integrity is quite feasible by installing permanent sensors in key places. Some oil and gas platforms are already monitored on a continual basis in this way, with detectors placed around key areas identified as potential points of risk. “It is really a question of risk. We are monitoring in real-time and if there is a progressive failure we can detect it and predict how long we have before it becomes critical, in time to do something about it,” says Watson.

“One difficulty with offshore platforms is that the loading is beyond our control, due to external factors such as wave movements. Frequently we might do an installation in summer and have no data to report, as there is no strain and nothing happening. But the sensors start to report in winter and we can

tell if any cracking is happening, and how quickly. It is particularly useful for areas where there is a problem of accessibility.

“On an offshore platform we might use three to five sensors for each particular area. The precise placement of the sensors, and an understanding of the results, depends on the geometry of the area. For a suspension bridge it is quite simple – you would just have a line of sensors. But a platform is more three-dimensional. We might also need to use guard sensors to identify if any noise is coming from outside, such as from the propellers.

“To monitor cracking we might want to place a number of sensors at 1-3m from the selected point. For corrosion the distances would be an order of magnitude smaller, but to monitor for something like a break in an anchor chain it would be an order of magnitude larger.”

**AE plus other NDT techniques**

The technology has limits, but there is obvious potential for combining AE testing with other methods. Watson continues, “You wouldn’t really use AE to test for physical problems with a weld, but you might use it in combination with radiography or vibration testing. Other techniques wouldn’t tell you if the cracks are growing, as AE would.

“The sounds we are detecting travel out from the defect, so we can triangulate to the

source but not tell you, for example, how big the crack is – just that cracking is occurring.

“A technique like vibration monitoring would be the more obvious choice for monitoring equipment such as an engine or a gearbox, but the techniques can be used in tandem – we have installations around turbines that can detect cracks on stator blades and leaks. Like when driving a car, there are some things you might not notice at low speed because the frequency is too low and vibration might not be detectable.

“We monitor crane structures for cracking, and things like ore unloaders and the large cranes at ports that tend to be in heavy continual use. They have very little downtime and a failure could be catastrophic in business terms, so continual monitoring makes economic sense.

“There is also a crossover with strain monitoring. By itself it gives limited information but if we measure strain at the same time as cracking, we can advise on the severity and how long it will be before the issue becomes serious. This can result in extending the lifetime of equipment as we can sometimes see that the issue is only developing slowly. Sensors might be also left in place as a safety measure. This combination also helps in fatigue analysis. A combination of strain monitoring and AE testing is more of a complete solution that enables more informed business decisions.

“There is certainly huge potential for more use of AE on floating production storage and offloading (FPSOs) and floating platforms. Many FPSOs have had previous lives as tankers and a history of different types of stress, so testing the tanks makes good sense. Failure of anchorages or moorings has also been an issue historically, and monitoring of chains for breaks can prevent potentially massive incidents.”

**We have installations around turbines that can detect cracks on stator blades and leaks**

Tim Watson, MISTRAS



SRO Provides Calm Waters  
For  
Maximo Marine Data  
Replication



Extend your network to the edge of your operation

Visit [www.srosolutions.net](http://www.srosolutions.net) Call +44(0) 845 408 4250 Email [info@srosolutions.net](mailto:info@srosolutions.net)



FROM THE PUBLISHER OF MARINE MAINTENANCE TECHNOLOGY INTERNATIONAL MAGAZINE

# *the* **FUTURE** *of* **T** **TRANSPORTATION** *World Conference*

**5-6 JULY 2017**  
*COLOGNE, GERMANY*

*Eight streams, over 160 speakers, live technology demonstrations, PLUS meet the companies shaping the future of transportation in our exhibitor zone!*



©PLP Architecture



©Lilium GmbH

# 2020-2030 AND BEYOND...

## *“Disruptive Change at Multiple Levels”*

### STREAMS

**Legal & Technical Issues of Autonomous Vehicles** How to build a pan-European set of rules and laws governing autonomous and driverless cars, and what changes are necessary in current regulations.

**Vision Zero** Is the zero vision a reality on the surface and in the air?

**Quantum Shifts** Remarkably simple changes that would radically transform surface congestion.

**Environmental Sustainability** How highways of the future will need to evolve into highly automated and intelligent super-fast transportation networks.

**The Challenge for Rail** How the rail industry can survive the challenge from new forms of transport, including high-speed (platooning) autonomous vehicles and PATS.

**Infrastructure & Project Funding** Where will the investment for the future of transport come from and what business opportunities will new mobility solutions create?

**Changing Landscape for Car Manufacturers** Who will manufacture the vehicle of the future and what opportunities are there for ride-sharing platforms and fleets of autonomous vehicles?

**Getting Transportation Off the Ground** We will be looking at the technologies and enablers of PATS and at how PATS will fit into the urban landscape.

10%  
EARLY BOOKING  
DISCOUNT!

...GO ONLINE FOR THE FULL SPEAKER LINE-UP AND **TO REGISTER!**

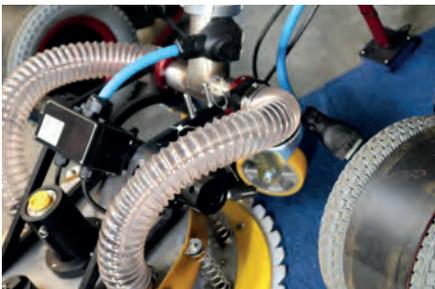
[WWW.THEFUTUREOFTRANSPORT.COM](http://WWW.THEFUTUREOFTRANSPORT.COM)

# MARINE MAINTENANCE WORLD EXPO AND CONFERENCE 2017

# UNMISSABLE: THE MARINE INDUSTRY EVENT OF THE YEAR

Amsterdam once again hosts Marine Maintenance World Expo and Conference, which will highlight the latest new technologies and solutions designed to maximize fleet availability and reduce maintenance costs

by Anthony James



The dates for your diary for this year's Marine Maintenance World Expo are June 6-8, 2017, with the show once again returning to the RAI Amsterdam, at the heart of one of Europe's most cosmopolitan and entertaining cities.

"This year's Marine Maintenance World Expo & Conference is shaping up to be the biggest and best that we've ever staged!" says Graham Johnson, managing director of UKi Media & Events, the company that stages the global event. "We've got brand-new, exclusive papers being presented by some of the most respected names in the business, plus we've got some of the very best technologies being exhibited around the conference, too."

Read on to discover more about the individual technologies on display, which range from the industry's first collision-tolerant inspection drone, through to the latest intuitive condition monitoring software, as well as a full range of maintenance, repair and inspection solutions designed to increase efficiency and fleet availability.

The dedicated conference (rates apply) takes center stage, with over 40 speakers sharing the latest maintenance innovations and trends over the full three

days of the event. Star speakers announced to date include Patrik Strand, portfolio manager, digitalization, services, Wärtsilä Corporation; Matt Smith, lead machinery specialist investigations, fleet services, Lloyd's Register Marine & Offshore; Dr Axel Homborg, associate professor, Netherlands Defence Academy; and Steve Pascoe, Babcock engineering services innovation lead, Babcock International Group.

Key topics under discussion in 2017 include: intelligent ship technology, IoT and big data analytics for smarter fleet maintenance; innovative inspection approaches; data-driven maintenance; and innovative corrosion detection and repair.

Note that Marine Maintenance World Expo & Conference has been specifically designed for fleet maintenance managers, dry dock and shipyard owners and operators, fleet operations directors, vessel owners and operators, and offshore platform and wind farm owners and operators. Visitors will see a handpicked collection of the latest innovations and technologies, including the latest in engine maintenance, lubricant analysis, condition-based monitoring, hull blasting, non-destructive testing, parts cleaning, ship repair, coatings and more.

See the full speaker  
line-up on page 52

Three-day conference  
featuring over 40 speakers

BOOK ONLINE NOW!  
[www.MarineMaintenanceWorldExpo.com](http://www.MarineMaintenanceWorldExpo.com)



10% discount for group  
bookings of 2+ delegates

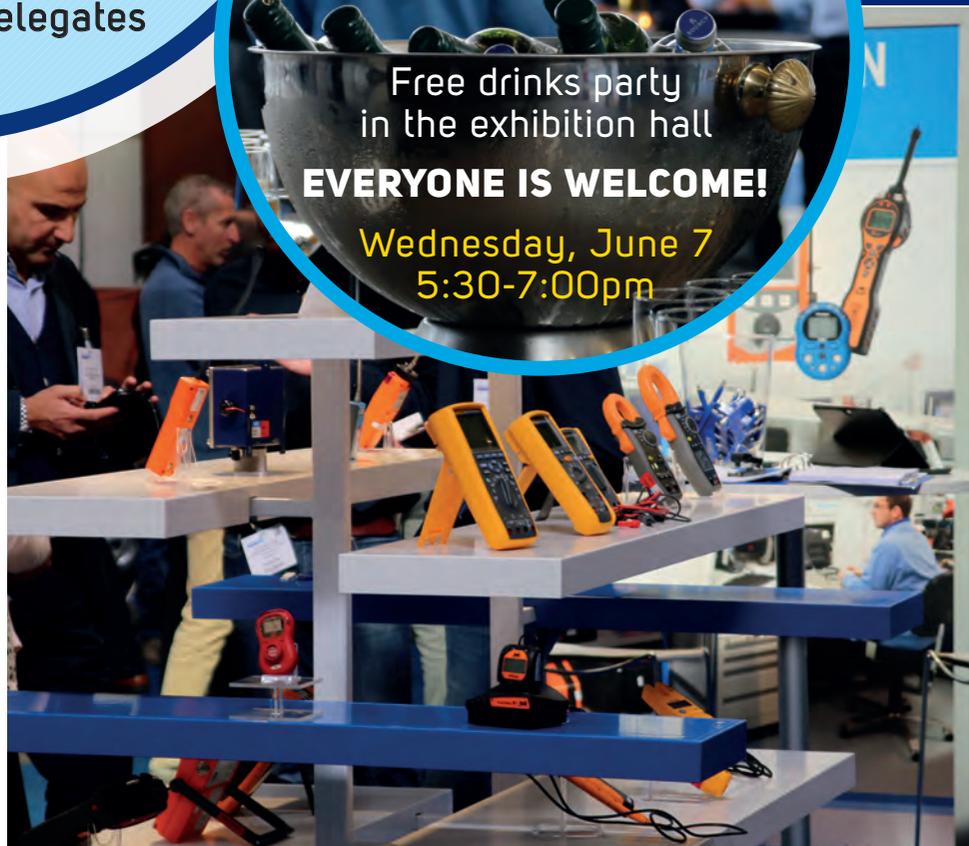
Exhibition entry  
is free – register  
online now for  
your free pass!

Free drinks party  
in the exhibition hall  
**EVERYONE IS WELCOME!**

Wednesday, June 7  
5:30-7:00pm

Visitors will also enjoy unlimited entry to the neighboring Electric & Hybrid Marine World Expo. Johnson explains, "Marine Maintenance World Expo & Conference attendees also enjoy free access to Electric & Hybrid Marine World Expo, ensuring visitors and delegates will see more next-generation maintenance and repair technologies than ever before. And with the additions of the Autonomous Ship Technology Symposium and the Maritime and Naval Test and Development Symposium – the latter being dedicated to the design, development and validation of marine systems and complete vessels – the World Expo is truly unmissable in 2017!"

Featuring advanced electric and hybrid next-generation marine propulsion systems, Electric & Hybrid Marine World Expo will see an expected 120+ exhibitors from more than 20 countries and 3,000 attendees, with more brand-new propulsion technologies on display than ever before.





LEFT: A collision-tolerant drone will allow previously difficult-to-access areas to be easily and rapidly inspected

FREE  
TO ATTEND!  
REGISTER  
ONLINE  
TODAY

## Marine inspection drone

Flyability // Stand M3000

Flyability is showing the first collision-tolerant flying robot designed for marine inspection professionals – Elios. For the first time, access to complex, cluttered or indoor places is possible and the unit should unleash the potential of UAVs in a number of applications where their use was previously too dangerous or simply impossible.

Drone technology is steadily being incorporated as a sustainable practice for asset managers in various industries. Current solutions are unable to operate close to structures or in contact with operators, restricting effective inspection in complex environments. While conventional methods are still required, preliminary inspection can be performed at lower inspection cost and downtime. Risks are also decreased by avoiding confined space entry and remotely accessing boilers, tanks, pressure vessels, ballast tanks, tunnels and other complex environments inside plants or hazardous work environments.

Inspection of ships' ballast tanks for general integrity, corrosion status as well as the monitoring of the anodes within the ballast usually requires three to four workers and extensive safety equipment such as gas and oxygen monitoring detectors, ropes, flashlights and harnesses. Flying in complex and pitch-dark confined spaces, Elios has demonstrated its capacity to deliver a quicker and safer method to inspect these tanks. The robot's collision-tolerance allows navigating safely in contact with the structures, rolling on the walls when required. The onboard LEDs require no external lighting.

By allowing drones to fly safely in cities, inside buildings, and in contact with people, Flyability enables new interactions and services with UAVs and solves the two most critical issues of one of the fastest growing industries: collision and injury risks.

## New lubrication paste for seal rings

Abcon // Stand M4070

Abcon will show a new product specifically designed to help protect seal rings. "When assembling systems with rubber seals on moving parts, much higher protection can be established by using Abcon Marine-Seal Protect+," explains Lasse Christensen Dyrbye, assistant sales and marketing manager. The new product is a complex Teflon-based lubrication paste, which protects against initial running in problems of stern tubes and other machinery, even after long periods of standstill, and provides long-term lubrication of components that are otherwise difficult or impossible to lubricate after initial assembly. It can be applied using a brush.

"From Abcon Marine's long experience as the world's leading supplier of stop-leak additives, we have seen numerous examples of leakages shortly after dry-docking," continues Dyrbye. "It can only be due to insufficient lubrication of the seal rings. At standstill the

pressure from the seal rings slowly presses the oil film out. Afterwards, during the first revolutions the rubber friction produces heat between it and the shaft resulting in a damaged surface."

Abcon has over 20 products covering a broad range of applications ranging from stop-leak additives, to preventing leaks, thereby avoiding untimely dry-docking. In addition, the Danish company will display its Teflon-based multi-lubrication products, which have an extremely high film strength. The company currently delivers to more than a 100 vessels a year.



Abcon's Marine Seal Protect+ lubrication paste

## Tailor-made HVAC solutions

### Heinen & Hopman // Stand M1010

Whether you are having difficulties with your chilled water systems, your air-conditioning is not working properly or you simply have a question about some aspect of your HVAC system, Heinen & Hopman has a 24/7 global service network at your disposal. Since its engineers have advanced expertise in and of HVAC systems, from installation to service, they are aware of the different problems that can be encountered on board. Hence customers can rest assured that these true problem-solving professionals will have the answers they require.

At this year's Marine Maintenance World Expo, Heinen & Hopman will reveal two packages that will make your maintenance jobs easier, particularly for customers that wish to do the work themselves, but don't have the right tools.

The first, a new rotary tube cleaner, comes highly recommended by chief engineers working in the maritime industry. Using this compact and lightweight product, engineers can easily clean straight tubes in

shell and tube heat exchangers, which not only extends the lifetime of the condensers, but also saves time. Simultaneously, the service space needed for cleaning is greatly reduced compared with cleaning by hand with a brush and rod.

A product specifically developed for marine use, Heinen & Hopman's refrigerant recovery package enables customers to handle gas recovery from a vessel's refrigeration system in a controlled manner. The system has all the features a field service technician needs – compactness, portability and is easy to operate for faster evacuation times.

Purging a system of refrigerant is often necessary when carrying out repairs. An investment in approved equipment to perform this task saves the ship operator money that would have otherwise been spent on new refrigerants to refill the system. Heinen & Hopman's refrigerant recovery package comprises a complete set of approved equipment for efficient and effective onboard recovery, recharging and reuse of refrigerants.



Heinen & Hopman's new rotary tube cleaner for cleaning straight tubes in heat exchangers



InfoSHIP ELB is designed to electronically record daily operations

## Bilge and sludge management

### IB // Stand M4040

EXHIBITOR SPOTLIGHT

In a world that is placing ever more emphasis on rules and regulations, ship officers are committed to registering several internal forms and log books in hard copy.

To support the market with the right solutions, IB developed InfoSHIP ELB (Electronic Log Book), a system designed to electronically record the daily onboard operations, part of the new InfoSHIP EVO software. In day-to-day operation, bilge and sludge management has become an even more important record for a ship. The attention paid to these is particularly important for reporting, controls from the office, environmental impact, and to reduce the possibility of regulatory infringements.

InfoSHIP ELB-ORB (Oil Record Books) is specifically conceived for common tank operations such as daily soundings and monitoring the congruence between the production of bilge and sludge, and the current storage capacity of the ship. It is intended to prevent missing ORB data, failure to document entries, falsification of log entries, and discrepancies. The system allows all users to improve their record-keeping operations to comply with regulations and it can control data coherence, ensuring that the info inserted is reliable. Simplification in data entry activity enhances daily reporting tasks, with the benefit that it is less time-consuming, and consequently reduces the workload of the officers on board.

IB products are a reference point in the marine market, bringing a high level of control and efficiency to all fleet technical processes and improving decision making.

## Sophisticated engineering polymers

### Nylacast // Stand M2045

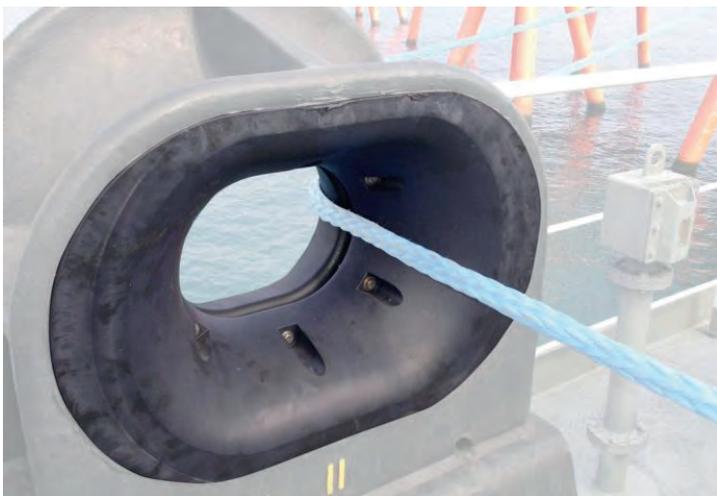
Engineering polymer specialist Nylacast will display its latest range of sheaves, guide rollers, bushes, wear pads, spooling shells, fairlead rollers and chock liners.

With over four decades of engineering excellence, including the pioneering of a range of distinguished engineering polymers, Nylacast holds the unique ability to provide full engineering solutions from initial concepts and raw chemistry through to end components while meeting customers' requirements.

The versatility and advantages that engineering polymers are able to provide for marine and port applications makes them ideal for use on tankers, container ships, ferries and LNG carriers, through to port and docking equipment. Nylacast has delivered numerous engineering solutions proved to substantially increase the performance and efficiency of operations and applications in addition to providing increased safety for personnel.

Dedicated to customer satisfaction through delivery of full engineering solutions. Nylacast works with all levels of the supply chain and at every stage, from concept design to solution.

Typically, the use of engineered polymers results in lower whole-life costs, less maintenance and longer life for the components. In addition, carefully chosen polymers will weigh less, suffer from less corrosion, wear less and deliver better performance.



ABOVE: Nylacast's low-friction Chock Liner is proven to significantly increase mooring line life



Free drinks party  
in the exhibition hall

**EVERYONE IS  
WELCOME!**

Wednesday, June 7  
5:30-7:00pm

## Exhibitor spotlight Condition monitoring software and services

### James Fisher Mimic (JFM) // Stand M3060

EXHIBITOR  
SPOTLIGHT

James Fisher Mimic (JFM) will showcase its new generation of Mimic products and services at Marine Maintenance World Expo, including the Mimic BluPacc starter kit (featuring a Bluetooth portable accelerometer), which includes the Mimic Data Collector app and the Mimic Mobile Alarm app – a simple, all-in-one data collection solution.

The handheld Mimic BluPacc enables customers to have a cost-effective solution to vibration monitoring. Low cost, pocket size, robust construction and very portable, this wire-free accelerometer fulfills every requirement of a comprehensive vibration monitoring program. It can be used as a standalone product (with the Mimic Data Collector app) or integrated as part of a complete monitoring solution.

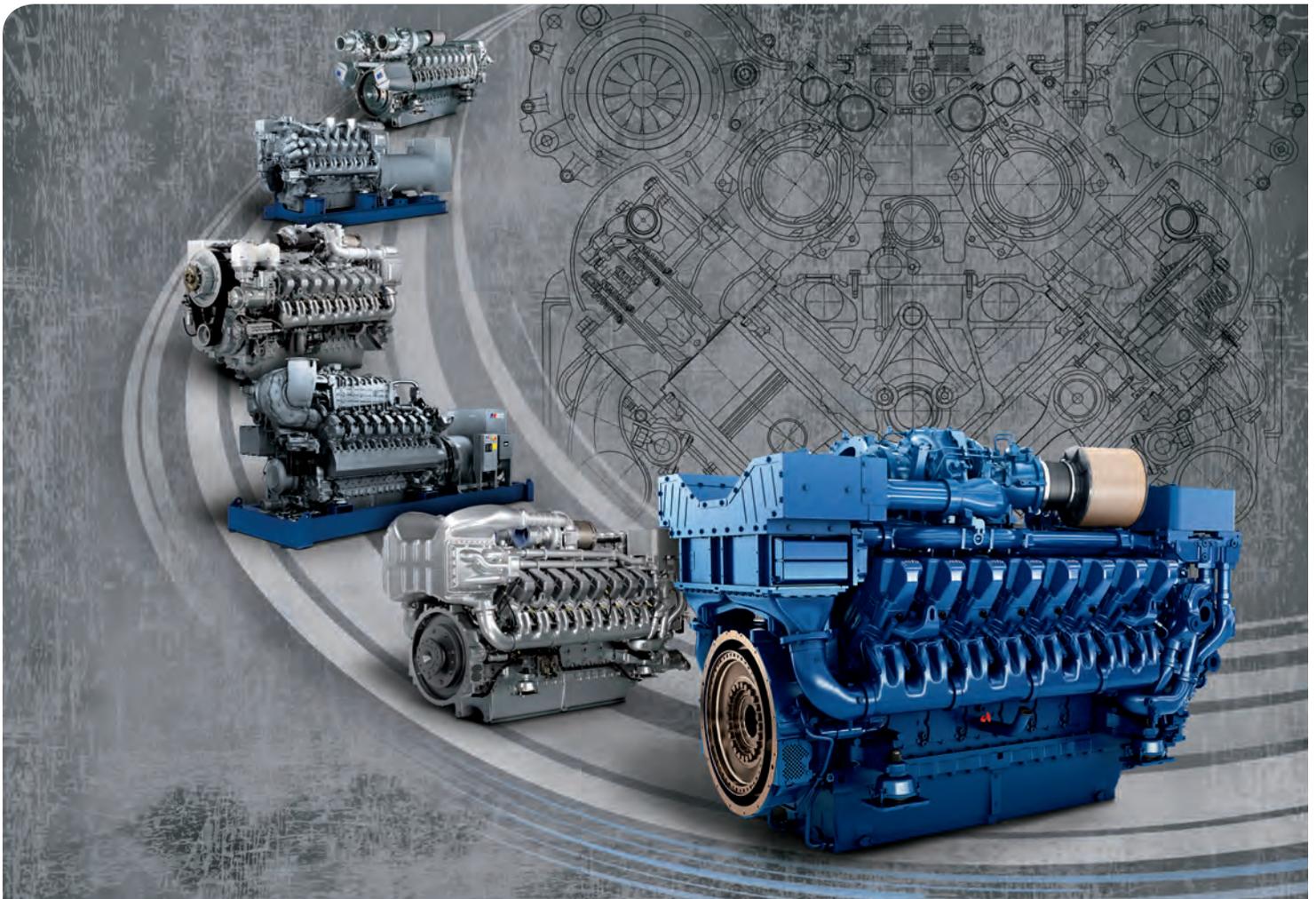
The Mimic Data Collector app transforms a simple Android mobile telephone or tablet into a powerful condition monitoring handheld data device to collect performance and vibration data. The app can be used in conjunction with the BluPacc as a standalone monitoring product or integrated with the Mimic Condition Monitoring Software Suite to provide fully integrated, comprehensive condition monitoring.

Developed in response to industry requirements, the Mimic Mobile Alarm app delivers real-time threshold exception notifications direct to a user's Android mobile device, outlining machinery performance and areas of concern as part of the overall condition monitoring.

Expo visitors can enjoy live demonstrations of the Mimic BluPacc Starter Kit and see JFM's latest Mimic 4 condition monitoring software suite. The Mimic 4 viewer is a new browser-based environment providing an innovative simple but powerful data analysis tool.



RIGHT: Mimic's BluPacc Starter kit contains a Bluetooth portable accelerometer that can link to an Android device



MTU Series 4000

# Legendary. Since 1996.

Since 1996, more than 37,000 MTU Series 4000 engines set the standard for efficiency and reliability again and again. With technologies like common rail fuel injection, turbocharging, exhaust gas aftertreatment and advanced electronics, highest quality standards and legal requirements are met alike. Learn more about the legend and the latest MTU Series 4000 marine diesel engines at [legendary.mtu-online.com](http://legendary.mtu-online.com)



*Power. Passion. Partnership.*

## Marine fuel uplift and confined space cleaning

Crown Oil Environmental // Stand M4045

Crown Oil Environmental will be in Amsterdam to profile and demonstrate its wide range of marine services, from marine fuel uplift to confined space cleaning (bilge cleaning and ballast/marine tank cleaning) and dockside quick-response services.

"Even if you only have a limited window of time at the dock, we can clean your ballast tanks and deal with your marine fuel contamination," explains Tom Walsh, business development manager. Services are available at any UK port within 24 hours of receiving a call.

The company can analyze and test the contents of the tank using its own dedicated laboratory, which enables it to devise a method and timescale to meet the needs of even the most demanding timing constraints in the shipping industry: "We can offer a range of products and services based on the individual circumstances of the project, both internal confined space cleaning or non-man entry methods can be achieved by our highly skilled engineers," continues Walsh. "All of our equipment is regularly updated and H&S equipment will always meet or exceed

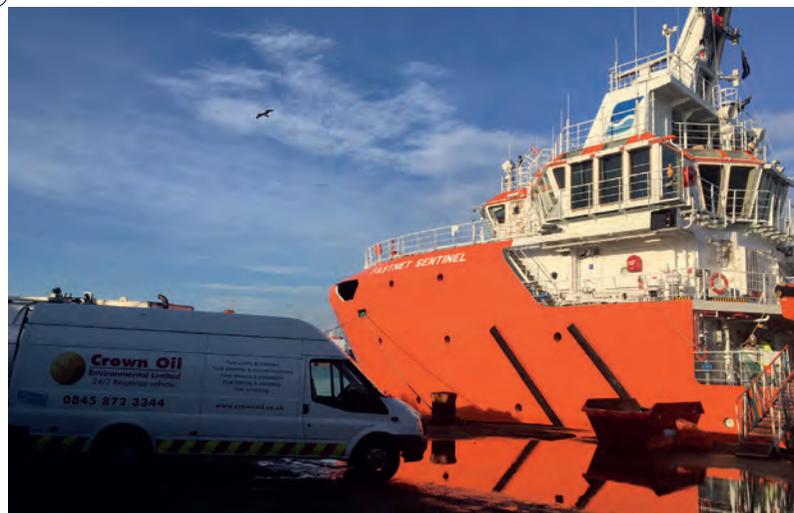
regulations. While in the tanks we can also offer inspections that outline any areas of concern and recommendations."

Crown Oil Environmental Ltd is a specialist in cleaning and degassing of industrial and marine tanks. "We can deal with varying sizes of storage tanks regardless of whether they contain hazardous or non-hazardous products."

The company can also offer a rapid response to uplift fuel from ships in dock; if there is a change in charter/off hire, fuel uplifts are often a requirement. "We have a fleet of tankers and engineers to facilitate the safe and efficient uplifts in a time-limited situation," says Walsh. "As we are also a fuel supplier we can arrange a new fuel delivery once we have completed the uplift."

A common issue for many vessels can be contamination by water. "Brokers and shipowners from around the country send us fuel samples to check the fuel quality on board. We can determine whether the fuel falls within the marine fuel specification, and what our recommendations would be if not. Fuel quality at ports throughout the world can differ greatly, so keeping a check on what is in your ship's tank is of great importance."

ABOVE: Specialists in cleaning and degassing marine tanks, Crown Oil Environmental can be dockside in 24 hours to any UK port



## New ways to protect against wear at sea

MetaLine // Stand M2020

For many years, MetaLine has adopted an unusual approach to surface protection. Elastomers – rubber-like coatings – are seamlessly sprayed, completely unstressed and extremely low density. It's all about absorbing and no longer deflecting destructive force effects of the flowing media.

Since it was launched on the market in 2004, the concept has successfully established itself and is continuously being put to new uses – both offshore and onshore. With an approximate specific weight of only 1.05g/cm<sup>3</sup>, MetaLine 785 achieves about 25% greater erosion resistance than 316L (saltwater-resistant stainless steel), with a density of 8g/cm<sup>3</sup>.



Under almost all climatic conditions, such as heat and extreme humidity, it can be applied on-site – without vulcanization. The treatment is applied without any solvents, using an innovative cartridge spray process – in a similar way to paint. It is dry to the touch within five minutes.

When it comes to maximum surface efficiency, extremely smooth surfaces are the order of the day – with rubber-like properties. This long development project has resulted in approximately 30 times greater erosion resistance than the commonly used ceramic coating treatments supplied by British and American companies.

MetaLine's principle uses include repairs and first coats applied to seawater pipes, pumps, filters, propulsion systems and rudder blades.

Preparation requires abrasive blasting, followed by with chloride neutralization. Both procedures are vital for a successful lasting application.

FREE TO ATTEND!  
REGISTER ONLINE TODAY

FREE  
TO ATTEND!  
REGISTER  
ONLINE  
TODAY



LUBExpert measures each stroke of grease and provides feedback to its effect on the bearings

## Bearing re-lubrication and greasing assistant

SDT International // Stand M2030

SDT International will present LUBExpert, a unique solution to a most misunderstood maintenance task onboard ships – bearing re-lubrication.

LUBExpert combines SDT's strong measurement capabilities and a clever, easy-to-use operator interface to create an onboard lubrication assistant to help you use the correct amount of grease.

With only a few machine parameters, LUBExpert monitors each grease gun and its effect on bearing friction and temperature both before and after, with bearing conditions reported with a 'good', 'bad' or 'suspect' status report.

SDT's experience and equipment failure reports indicate that greasing of onboard equipment and machinery is still a challenge. The company says this new equipment helps crew to grease bearings correctly and with confidence, with dedicated Ultranalysis Suite (UAS) software powering the enhanced data management aspects.

SDT's simple, innovative and high-quality products contribute to the overall reliability of shipborne equipment and its maintenance, facilitating environmentally friendly operation of ships, giving vessel owners and managers a competitive edge.

EXHIBITOR  
SPOTLIGHT

## Stop leak additives

Lindemann Marine Products // Stand M3035

First-time exhibitor Lindemann Marine Products will present its latest stop-leak products, which prevent oil leakage and water ingress in subsea propulsion systems such as stern tubes, bow thrusters, CPPs, stabilizers and rudders.

These include MPS 896 Special Mix, which came to life out of the need to make a more water-resilient product for systems with lip-type seals suffering from water ingress.

MPS 896 Special Mix has a higher concentration of PTFE and another additive, which gives the paste a different structure that helps it cling to the rotating shaft with a firm grip. "This ensures that the higher level of PTFE is interlocked right in front of any given slip between the lip and the shaft," explains Michael Mosko Jensen, marketing manager. "It also contains a seal revitalizing additive, which preserves or restores flexibility of the rubber seals without swelling."

Lindemann's MPS paste is compatible with most oil types, and also contains a seal revitalizing additive, and is compatible with FKM and NBR elastomers. "MPS polishes surfaces and fills in cracks of up to 2mm," adds Jensen. "It also has anti-corrosion and EP properties, enhances corrosion protection and allows increased loads. Come by our stand to hear how we help our customers deal with leakage problems. Furthermore, we'll demonstrate the working principle of our MPS 898 Special Mix and show the full range of our stop-leak additives."

## Surface preparation additive

HoldTight Solutions // Stand M3020

HoldTight Solutions will present its HoldTight 102 additive for use in the surface preparation process prior to coating application, for the removal of soluble salts and contaminants.

The Houston, Texas-based manufacturer of additives will be introducing an additive that prevents flash rusting for approximately 24-72 hours after blasting. This is typically accomplished with HoldTight 102 being diluted in the blast water for either wet abrasive blasting, ultra-high pressure (UHP) water jetting or pressure washing after completing dry abrasive blasting.

Benefits are a surface clean of soluble salts and contaminants, better coating adhesion, reduced risk of coating failure, and extended time between blasting and priming as flash rusting will be prevented. This gives the contractor better control of labor costs and provides the end customer with an improved coating job.

HoldTight 102 is perfect for painting and maintaining both ship exteriors and interiors including ballast tanks and cargo storage. With 30 years of experience, HoldTight Solutions is recognized as the industry leader for this type of additive.



LEFT:  
Lindemann  
MPS 896  
Special Mix has  
a high PTFE  
level and an  
additive that  
helps it cling to  
the rotating  
shaft

# ELIOS

INSPECT & EXPLORE INDOOR SPACES



THE COLLISION-TOLERANT UAV  
DESIGNED FOR INDUSTRIAL  
INSPECTION PROFESSIONALS

**ACCESS CONFINED & COMPLEX SPACES**

**OPERATE EASILY WITHOUT RISK TO WORKERS**

**REDUCE DOWNTIMES & CUT INSPECTION COSTS**



SAFE DRONES  
FOR INACCESSIBLE PLACES

[WWW.FLYABILITY.COM](http://WWW.FLYABILITY.COM)

## Contamination and corrosion expertise

FREE  
TO ATTEND!  
REGISTER  
ONLINE  
TODAY

### ECHA Microbiology // Stand M5028

ECHA Microbiology helps the industry solve their microbiological contamination and corrosion problems, including microbial contamination in marine fuels and engine lubricating oils, hydraulic oils and stern tube lubricating oils; and microbial corrosion in ballast tanks, cargo tanks, bilges, stern tubes and cooling systems.

For over 30 years the company has developed and supplied technical products (including onboard test kits), technical consultancy, laboratory analysis and training services. By helping its customers understand and avoid the consequences and costs of microbiological contamination, ECHA increases operational safety, efficiency and dependability.

"Microbiological contamination costs the marine industry millions of dollars every year and instances of blocked filters, tank corrosion and even engine failures are still on the rise," says Mike Harwood, sales and marketing manager.

At the Marine Maintenance World Expo, visitors to ECHA's stand will



ABOVE: The Hy-Lite 2 can detect microbial contamination in fuel and other oils

see the latest onboard test kits for fuels, oils and water, its latest sampling devices and bottles, as well as its range of fuel and oil biocide additives.

Visitors will also discover how ECHA provides key services to the marine industry, such as laboratory analysis, training courses, ship and platform surveys, and an expert witness service.

"ECHA spends all its time solving fuel quality problems or is engaged in research and development, and as such is regarded as one of the world's leading authorities on the causes and consequences of microbial contamination – as well as the solutions."

## Ultrasound technology to prevent biofouling

### LG Sonic // Stand 3010

The marine industry globally spends billions of dollars in addressing fouling, using a variety of protection methods such as coatings. The disadvantage of these is that they can be harmful for the environment, expensive or ineffective. To provide an environmentally friendly and effective solution to these problems, the Dutch company LG Sonic will present a new solution to prevent the growth of biofouling by using specific ultrasonic parameters at this year's Marine Maintenance World Expo in Amsterdam.

LG Sonic will reveal how, working with the Royal Dutch Navy, it plans to start a project to apply this ultrasound technology on a 130m-long frigate to measure the effectiveness of LG Sonic devices as an alternative to antifouling coatings.

The solution will use a system that transmits ultrasonic waves of specific frequencies throughout the ship's hull.

In October 2016, LG Sonic received the P J S de Jong Innovation Award for this biofouling control project. The jury recognized the biofouling prevention technology from LG Sonic for its relevance and international potential.

The company has been manufacturing ultrasonic biofouling prevention systems since 1999.

RIGHT: An LG Sonic Ecohull ultrasonic transducer helps prevent biofilm build-up



## Speaker spotlight



**Steve Pascoe, Babcock engineering services innovation lead – Babcock International Group, UK**

Thursday, June 8, 2017

### What is the subject of your presentation?

Laser ablation is the process through which a pulsed laser beam sublimates a coating material from its underlying substrate. Within the naval marine environment, paint removal remains a labor-intensive task utilizing several different methods that many seem outdated. These methods range from shot blasting to the use of a needle gun. Laser ablation represents the future for both paint removal and general-purpose cleaning of contaminants. After paint is ablated away, the surface retains an optimum

level of paint adhesion for recoating. As a general-purpose cleaner of components, laser ablation can save countless man-hours compared with traditional methods.

Can you give a clear example of how your technology has helped improve vessel operation and maintenance? It's still early days and we are working closely with our customer and the marine paint manufacturers to gain final approval to use this process; however, we are confident that we will have generated a sufficient body of evidence to achieve this later in the year. Based on our trials so far, we have identified a number of use cases where laser ablation will offer a far safer, cleaner and faster process to other approaches such as needle gunning, bristle blasting and chemical paint cleaning. During the trials, we used the laser on some heavily corroded valve bodies and achieved very good results, getting back to a clean surface in a fraction of the time normally taken to hand clean. \\

BOOK YOUR  
CONFERENCE  
DELEGATE PASS  
ONLINE  
TODAY!



# MARINE MAINTENANCE WORLD EXPO AND CONFERENCE 2017

**Featuring more than 40 of the world's leading experts in marine maintenance, presenting brand-new technologies and breakthrough techniques!**

This year's conference features the most advanced technology that will help reduce downtime and machinery failure, increase safety, and drive down the cost of maintenance and global ship operations. Completely new topics and brand-new papers not heard anywhere else will be discussed by some of the most influential and innovative industry experts.

This is a truly global event: in previous years, speakers and conference delegates from over 60 countries worldwide participated. In 2016, the Marine Maintenance World Expo Conference was attended by almost 150 shipowners, fleet operators, maintenance and repair engineers, marine superintendents and ship repair yards, from all over the world.



**Day 1 Tuesday, June 6****9:10am-1:00pm – Intelligent ship technology, IoT, and big data analytics for smarter fleet maintenance****Moderator**

Tania Berry, senior specialist (electrotechnical) – Marine Technical Policy Group, Lloyd's Register, UK

**9:10am - Eliminate unplanned downtime: IoT + artificial intelligence for ships**  
Simon Jagers, founder, Semiotic Labs BV, Netherlands

Unplanned downtime of induction motor driven systems is costly. With 7% of induction motors failing on a yearly basis (IEEE, several reports), shipping industry costs are in the billions of dollars when it comes to downtime of radar devices, propulsion systems, HVAC systems and other electric motor-powered critical systems. At Semiotic Labs, we have developed a proprietary sensor and algorithms that predict when and why motor-driven applications fail, up to 12 months in advance. We are currently implementing the solution on several ships in a large-scale POC.

**9:35am - Big data analytics and IIoT for marine maintenance**

Dr Hao Wang, associate professor, Norwegian University of Science and Technology, Norway

Vessel builders are installing sensors for different components, which provide more accurate and timely data on the status of marine systems. This development has been strengthened by the quick development of the new IIoT paradigm. Analytics results of the monitoring data support diagnosis of vessels, prediction for maintenance needs, and allocation of maintenance facilities and resources, especially for vessels operating in different international locations. Big Data Lab at NTNU, in collaboration with local industries, is developing a new visual analytics framework, covering data processing, decision support and visualization. This talk will present the progress of the framework.

**10:00am - Extracting real value from IoT analytics at the edge**

Steve Driver, non-executive director, SRO Solutions Ltd, UK

This presentation will demonstrate how asset-intensive organizations can better leverage connected devices by merging real-time asset information with other critical asset information, enabling better optimization of operations and maintenance. It will explain the value of IoT technologies in the industry and how, with robust and scalable data replication, asset management software has advanced far



**BOOK YOUR SEAT AT THE 2017 CONFERENCE ONLINE TODAY!**

[www.marinemaintenanceworldexpo.com](http://www.marinemaintenanceworldexpo.com)

beyond more traditional CMMS. With some recent case study examples, the presentation will also describe how such systems are now being used to deliver high asset availability and real-time predictive maintenance by extracting value from the ever-growing list of IoT-enabled applications and devices.

**10:30-11:00am - Break****11:00am - Ship asset management: best practice in a data-driven age**

Daniel C Shorten, managing director, Optimain Ltd, UK

One of the directions in which modern maintenance practices in marine is moving is the increasing demand for input from expert stakeholders beyond the boundaries of the shipping company. As more detailed data about assets is created, there is a growing need to understand the increasingly vast data and information flow. To effectively manage a ship's assets, you will need to aggregate the internal knowledge created by the operational teams, the design and operational knowledge of the original equipment manufacturers, and also the expert skills of one or more independents such as the lube oil supplier, the vibration analysis provider, the ultrasonic and thermal imaging analysts. The best-practice control processes to emerge will increasingly require external experts who can effectively blend all that expertise, filter out less valuable data and work within an enterprise of competence to inform the fleet management about performance and further opportunities for optimization; then go on to buffer this data to provide useful actionable advice for superintendents and eventually the crew to enact.

**11:25am - Predicting condition-based ship operations and maintenance**

Dr Iraklis Lazakis, senior lecturer, University of Strathclyde, UK

The shipping industry is lately faced with a number of issues leading to unnecessary delays, insurance claims and potential concerns

related to safety and environmental protection. These can be tackled through novel approaches, also considering the day-to-day operational profile of ships sailing worldwide through predictive ship machinery inspection and reliability performance. This presentation showcases the development of the Machinery Reliability Analysis tool considering component failure and degradation utilizing raw recorded data. The tool involves the generation of Markov Chains integrated with Bayesian Belief Networks. Ship system components and interdependencies are considered, providing condition-based predictions for ship machinery/equipment.

**11:50am - Health and energy management: enhancing value through total optimization**

Marco Cristoforo Camporeale, general manager, health management solutions, Rolls-Royce Marine, Norway

Rolls-Royce will demonstrate how its health and energy management solutions enhance performance reliability, lifecycle efficiency, safety and cost predictability by harnessing the power of big data. Rolls-Royce is able to provide predictive and preventative maintenance solutions, thereby improving asset availability and keeping customers' vessels on schedule. Rolls-Royce is also developing the next generation of diagnostics and optimization technology based on machine learning, further exploiting big data. Rolls-Royce is leveraging these technologies and partnering with the customer in a new operating model designed to share operational risks and reduce the lifecycle cost of ownership.

**12:15pm - Panel discussion: Enabling a data-smart future for marine maintenance****Moderator**

Tania Berry, senior specialist (electrotechnical) – Marine Technical Policy Group, Lloyd's Register, UK

**Panelists**

Daniel C Shorten, managing director, Optimain Ltd, UK

Dr Hao Wang, associate professor, Norwegian University of Science and Technology, Norway

Simon Jagers, founder, Semiotic Labs BV, Netherlands

Dr Iraklis Lazakis, senior lecturer, University of Strathclyde, UK

Steve Driver, non-executive director, SRO Solutions Ltd, UK

Marco Cristoforo Camporeale, general manager, health management solutions, Rolls-Royce Marine, Norway

**1:00-2:20pm - Lunch**

∴ MARINE MAINTENANCE WORLD EXPO CONFERENCE 2017  
**June 6-8, Amsterdam, the Netherlands**



**2:20-5:30pm – Innovative inspection approaches**

**Moderator**

Daniel C Shorten, managing director, Optimain Ltd, UK

**2:20pm - How smart technologies now enable continuous maintenance**

David Knukkel, CEO, Netherlands

In addition to traditional maintenance strategies like corrective and preventive maintenance based on time, hour or condition, new technology facilitates a new strategy, known as continuous maintenance. Much technology is already available in the market, but fragmented and not specified for the specific application. The challenges and possible solutions to make it happen are very interesting.

**2:45pm - Using drones to inspect vessels' confined spaces**

Patrick Thevoz, co-founder and CEO, Flyability, Switzerland

Throughout 2016, Flyability and its partners have performed pilot projects where Elios, a collision-tolerant flying robot designed for industrial inspection, has been used as a means of inspecting ballast tanks, engine rooms and fuel tanks in multiple vessels. In this presentation, you will learn through multiple case studies how using drones to perform visual inspection indoors, in complex and confined spaces, increases operator safety, reduces downtime and cuts inspection cost.

**3:10pm - Innovative maintenance practice: using 360° cameras and virtual tours**

Edgar Steinebach, innovation specialist, Seaway Heavy Lifting, Netherlands

Current developments in the consumer market have made it very easy and affordable to create a virtual tour of any site where maintenance or other work is required. At Seaway Heavy Lifting we have adopted this technology to make site visits more efficient and to reduce the chance that an essential area is not photographed. Furthermore, the structure of a virtual tour gives the photographs a natural order and makes it instantly clear where a picture is taken on a site. This makes sifting through hundreds of uncataloged pictures a thing of the past.

**3:35pm - Engine maintenance decisions based on borescope inspections: benefits and barriers**

Steven Roos, surveyor marine engines and gearboxes, RDA Shiptech, Netherlands

Borescopic inspection of critical engine components has been a key aspect of engine condition monitoring in the aviation industry for decades, thereby contributing to increased passenger safety and slashed maintenance costs. Small-scale projects on board ships have shown that multimillion-dollar savings are feasible when

borescopic inspections are strategically applied in condition-based maintenance concepts of marine diesel engines. This presentation elaborates on the cornerstones of borescope inspection success in the aviation industry: inspectors, equipment, instructions and procedures. Also, the prerequisites for large-scale implementation and capitalization of savings potential in the maritime industry will be discussed.

4:00-4:30pm - Break

**4:30pm - Transform inspection and maintenance of marine assets with virtual presence**

Dr Michael Murphy, vice president international operations, Librestream Technologies Inc, Canada

Immediate access to experts and content is critical for operational success, and Librestream's Onsite platform brings your experts virtually where and when you need them for fast problem resolution. Customers using the platform can share content, and provide visual support for maintenance and preventative inspections. The platform supports the low-bandwidth situations, including satellite, which are often found in the marine industry. Maritime organizations are now using this platform for remote diagnosis of shipboard issues with the help of onshore experts, and this virtual inspection and diagnostic capability reduces the time for problem resolution from days or even weeks, to now just minutes.

**4:55pm - Why preventive/proactive maintenance**

Kees Veltman, director/owner, Solinas, Netherlands

The presentation will discuss the journey to world-class maintenance for making more money. This will include: eliminating the cause of failures; modern maintenance technologies; why root cause maintenance = proactive maintenance; why it is better to hire women than men in proactive maintenance; look always to the optimum reference state; the power of an educated workforce.

5:20pm - Q&A

**Day 2 Wednesday, June 7**

**9:10am-1:05pm – Data-driven maintenance**

**Moderator**

Daniel C Shorten, managing director, Optimain Ltd, UK

**9:10am - Crossing borders to innovate: Smart Maintenance of Ships (SMASH)**

Michael van Alderwegen, project manager, Maritime Campus Netherlands, Netherlands

About 90% of all innovations start with people from different disciplines accidentally meeting each other. With Smart Maintenance of Ships (SMASH) we took chance out of this equation. An asset owner formulates in what area predictive maintenance is highly valued – whether it's a thruster, an electric engine, or the complete propulsion system. An independent or state-funded development agency invites, both large and small, but all passionate and high-end commercial companies. Together we explore options, we formulate and address the research question and then innovate together. If possible, we include academy students to do research and vocational students to support installation, crossing company, organization and discipline borders wherever we can. SMASH is an initiative and collaboration of Innovation Quarter (IQ), Worldclass Maintenance (WCM), and Maritime Campus Netherlands (MCN), representing the northwest, southwest and south development regions of the Netherlands. Our project managers facilitate innovation and support national or European funding necessary to deliver results.

**9:35am - Moving from planned to condition-based maintenance**

David Chaderton, lead technical specialist, GE Energy Connections, UK

The presentation considers how the principles of condition-based monitoring and remote diagnostics can be extended to naval applications, considering the challenges of data security and organizational culture. The marine sector is under considerable pressure to optimize operations and reduce operational costs. This is leading to the development and implementation of remote monitoring, asset support and predictive analytics solutions. There are new sets of technologies that are starting to impact the sector, potentially providing key benefits. This approach is leading to centralized condition-based monitoring, enabling commercial operators to make more informed decisions based on data, and helping to improve a fleet's operational efficiency. Historical data can be used to build a 'blueprint' of system equipment to predict its operational performance. In operation, a stream of data can be collected from multiple systems and networks, relating to the condition of individual components. This data can then be processed

and translated into clear information to help understand the health of the equipment. This real-time monitoring can be used to provide navies with increased situational awareness. This paper explores how analytics can be used to help in predicting the future condition of a vessel's assets. The aim is to enable operators to monitor vessels in real time, record and analyze their histories and search for anomalies. Early warnings can be raised when an asset is exhibiting an off-standard behavior, identifying potential problems before they occur. Therefore, operators and maintainers can take action weeks or even months before a potential failure. This enables them to switch from planned to condition-based maintenance, potentially reducing downtime and creating significant cost savings. This technology enables access to real-time insight, enabling onshore equipment experts, no matter where they are in the world, to remotely diagnose problems and promptly advise on next steps.

#### 10:00am - Keel to bridge – holistic asset management

Patrik Strand, portfolio manager, digitization, services, Wärtsilä Corporation, Finland

Wärtsilä Spotlight is a holistic asset management and next-generation condition monitoring concept, taking a helicopter perspective toward the entire ship or asset – integrating, enriching and combining collected data and information from all critical systems and machinery aboard the ship, keel to bridge. The data is processed using advanced machine learning algorithms, which find patterns and learn system behavior together with input from dedicated equipment experts and specialists. The results, including proactive advice and recommendations on how to improve the performance and reduce downtime, are continuously being presented in an open and transparent format and frequency suitable and desired by customers.

10:30 - 11:00am - Break

#### 11:00am - Condition-driven maintenance strategy

Kristof Bresseleers, maintenance and reliability consultant, Allied Reliability Group, Belgium

Danielle Lammens, maintenance excellence manager, Exmar Ship Management NV, Belgium

The development of a condition-driven maintenance strategy requires a thorough understanding of how your equipment functions and the failure modes that result in functional failure. Typically, the balance between preventive maintenance (PM) and condition-based maintenance is not correct in most maintenance schemes. This imbalance creates a higher cost of maintenance and lower levels of reliability than is acceptable, and certainly not what is expected of the system. The

presentation shows a pragmatic approach to developing such a condition-driven maintenance strategy by means of examples within the Exmar Ship Management fleet.

#### 11:25am - Using condition-based maintenance in the marine industry: the smarter way to do maintenance

Simon Edmondson, director, CM Services (Global) Ltd, UK

This presentation will discuss the use of condition monitoring on critical machinery and other applications in the marine industry, with a practical case study of a CBM implementation on board several ships and platforms.

#### 11:50am - Predicting the future while managing the present

Martin Briddon, engineering and business development manager, James Fisher Marine Services (Mimic), UK

Today's technology allows shipowners to use their machinery data in a different way. This presentation shows how traditional condition monitoring data can be used in a powerful manner to understand the relationship between condition and efficiency.

#### 12:15pm - Using accumulated information to predict impending power-pack failures

Glyn Arthur, vice president, Luciad NV, Belgium

Current marine power units generate vast quantities of operational information. By using techniques first developed in the aerospace industry, ship operators are now able to accurately predict points of failure within the powertrain and take action. The presentation will show how that vast quantity of data can be collected, collated and interpreted in a simple format for the marine engineer.

#### 12:40pm - Wireless condition monitoring and energy harvesting on ship equipment

Vincent Le Breton, project manager, ACOEM, France

Despite the availability of various condition-based maintenance solutions, the approach commonly considered by the marine sector is still preventive and corrective (after failure occurs). In the objective of reduction of operational costs, a remote monitoring system together with analysis and smart diagnostics represents a significant breakthrough for the entire sector. We present a real implementation of an innovative monitoring solution in a ship environment, based on the combination of traditional vibration measurements as well as wireless technology together with smart supervision software. Eventually such a system provides an accurate status of rotating assets along with a user-friendly interface.

1:05-2:20pm - Lunch

#### 2:20-3:30pm – Data-driven maintenance: the class perspective

##### Moderator

Daniel C Shorten, managing director, Optimain Ltd, UK

#### 2:20pm - Data and maintenance – the Lloyd's Register perspective

Matt Smith IMarEng, MIMarEST, lead machinery specialist investigations, fleet services, Lloyd's Register Marine and Offshore, UK

There are many ways to maintain equipment and machinery, from corrective maintenance through to reliability-centered maintenance and performance monitoring. There are also many ways in which classification societies ensure the safety and compliance of vessels under survey. The relationship between advanced maintenance condition monitoring techniques, and how these can be used to gain survey credit, has historically been complex. Continual advances in condition monitoring, communications and data processing are changing the relationship between owners and class societies. This opens up more and varied ways in which organizations can work together to reduce the maintenance and survey burden, while ensuring the safety and reliability of vessels remains at the highest possible levels. The aim of this presentation is to raise awareness of the class society approach to alternative survey methods.

#### 2:45pm - The ABS perspective on performance-based maintenance: a step beyond CBM

Dick Pronk, country manager, ABS, Netherlands

Performance-based maintenance monitors system performance patterns, seeking potential failure trends in advance so that action may be taken to prevent catastrophic failure. This maintenance strategy leverages performance data collection and the maintenance management strategy by analyzing both data

BOOK YOUR  
SEAT AT THE 2017  
CONFERENCE  
ONLINE TODAY!

[www.marinemaintenanceworldexpo.com](http://www.marinemaintenanceworldexpo.com)

∴ MARINE MAINTENANCE WORLD EXPO CONFERENCE 2017  
**June 6-8, Amsterdam, the Netherlands**

streams simultaneously. The result is system performance improvement and optimized maintenance progressing toward the goal of operational excellence. ABS as the Classification Society continuously revises its existing maintenance programs in its rules and guides to stay current with improved technologies and strategies. ABS will share its experience with participants.

**3:10pm - Condition-based maintenance – DNV GL class perspective**

Thomas Knödseder, senior engineer, DNV GL, Norway

A modern maintenance approach combines several philosophies, but predictive condition-based maintenance (CBM) is high on everyone's agenda. DNV GL offers several follow-up regimes to match managers' requirements and needs. This presentation will give an overview of currently acknowledged condition monitoring methods by DNV GL, approval steps, and outlook toward a data-smart future.

**3:35pm - ClassNK CMAXS – an advanced machinery maintenance system using sensor data**

Dr Abdul Rahim, regional manager, ClassNK, UK

ClassNK CMAXS is a cloud-based monitoring system that centrally manages many types of equipment with functions ranging from maintenance and spare-part management to equipment condition diagnoses. One key feature is a system that can diagnose abnormal states to maintain machinery in optimal operational shape, using enhanced condition diagnosis technology and an innovative sensor data analysis algorithm. By collecting data from several sensors rather than just one, correlations can be identified and abnormal relations detected. The system can provide highly accurate condition analysis of not only data collected by the main engine sensors, but also navigation data, such as weather and sea conditions, as well as early detection of abnormalities using a sophisticated algorithm. The application of the technology allows owners and operators to mitigate the risk of machinery failure, and no longer have to compromise safety or productivity due to unexpected circumstances. Many shipping companies have already chosen to install ClassNK CMAXS technology on their vessels, and this paper will show the benefits users can expect from this type of technology based on results from ships in operation.

**4:00-4:30pm – Break**



**4:30pm - Panel discussion – The class society view of data-driven maintenance**

**Moderator**

Daniel C Shorten, managing director, Optimain Ltd, UK

**Panelists**

Dr Abdul Rahim, regional manager, ClassNK, UK

Thomas Knödseder, senior engineer, DNV GL, Norway

Dick Pronk, country manager, ABS, Netherlands

Matt Smith IMarEng, MIMarEST, lead machinery specialist investigations, fleet services, Lloyd's Register Marine and Offshore, UK

**Day 3 Thursday, June 8**

**9:15am-12:30pm – Innovative corrosion detection and repair**

**Moderator**

Matt Smith IMarEng, MIMarEST, lead machinery specialist investigations, fleet services, Lloyd's Register Marine and Offshore, UK

**9:15am - Corrosion monitoring of maritime assets based on passive electrochemistry**

Dr Axel Homborg, associate professor, Netherlands Defence Academy, Netherlands

Monitoring corrosion of assets in a maritime environment is in many cases complicated. However, the consequences of corrosion problems occurring unexpectedly in terms of costs, downtime and safety are in many cases unacceptable. This presentation focuses on a passive, non-intrusive monitoring solution that detects and characterizes electrochemical signals generated by corrosion. This provides essential information about the intensity and type of corrosion, which is valuable to the maintainer.

**9:40am - Using pulsed laser to remove paint/corrosion from maritime platforms**  
 Steve Pascoe, Babcock engineering services innovation lead, Babcock International Group, UK

Laser ablation is the process through which a pulsed laser beam sublimates a coating material from its underlying substrate. Within the naval marine environment, paint removal remains a labor-intensive task utilizing several different methods that many deem outdated. These methods range from shot blasting to the use of a needle gun. Laser ablation represents the future for both paint removal and general-purpose cleaning of contaminants. After paint is ablated away, it retains an optimum level of paint adhesion allowing recoating. As a general-purpose cleaner of components, laser ablation can save countless man-hours compared with traditional methods.

**10:05am - Corrosion of cargo and ballast tanks in oil tankers**

Abdulaziz Almubarak, professor, College of Technological Studies, Kuwait

Oil tankers suffer from severe corrosion inside the ballast tank and the cargo tank, including general corrosion, microbial-induced corrosion (MIC), pitting corrosion and stress corrosion cracking. Pitting is common in the bottom of the cargo tanks. The upper-deck plate of cargo oil tanks is exposed to corrosive environments including inert gas and moisture. Coating is composed of binder, pigment and solvent. Binder and pigment form the final dry paint film, and solvents are necessary to facilitate application and initial film formation. Monitoring and annual service for oil tankers allow the tankers to live longer.

**10:30am - Risk assessment and investigation of microbially influenced corrosion on ships**

Graham Hill, managing director, ECHA Microbiology Ltd, UK

The marine environment can provide optimal conditions for proliferation of microbes that cause microbially influenced corrosion (MIC). MIC leads to rapid development of pitting in ballast tanks, fuel and oil tanks, cargo tanks, stern tube systems and bilges, with consequent serious implications for vessel operations, safety and class compliance. This presentation will explore the factors that lead to the onset of MIC and discuss some case histories. It will propose models for risk assessment, describe the typical indicators of MIC, and outline approaches to investigation and remediation.

**11:00-11:30am - Break**

**11:30am - Application of laser weld overlay for ship components**

Dr James Huang, subsection head DNPS 2-4, DGMEPM, National Defence, Canada

**Dr James Chen, DNPS 2-4, DGMEPM, National Defence, Canada**

The marine service environment causes considerable corrosion problems in naval vessels. For certain high-value items, repair versus replacement could be a viable option. The choice of repair solution depends on suitability of the technology, ability to produce sound repairs, and economic factors. This presentation introduces a laser weld overlay technology and its application for heavy spline shaft corrosion repair, with the aim of restoring the wasted spline profile. The feasibility, repair procedure development, validation and actual application are described. The cost factor of the repair process is also discussed.

**11:55am - Reducing dock time with innovative corrosion repair**

**Henning Olsen, head of sales, Pinovo, Norway**

Cost focus should not simply be about reducing the prices of current products and services. Perhaps more important is innovation; finding new ways of performing ship maintenance that are more efficient than current practices. Repairing corrosion damage using ATEX-certified vacuum blasting equipment allows chemical tankers, oil tankers, LNG carriers and bulk carriers alike to make permanent repairs while at sea or in port, thereby reducing the time in dock for classification, and increasing the ship's revenue potential. Taking a long-term view, continuous maintenance may also extend the lifespan of the ship, thereby increasing its second-hand market value.

**12:20pm - Q&A**

**12:30-2:00pm - Lunch**

**2:00-3:00pm – Maintenance of safety systems**

**Moderator**

**Daniel C Shorten, managing director, Optimain Ltd, UK**

**2:00pm - Maritime nations and how UK manufacturing expertise is improving safety**

**Dr Carl Hunter, CEO and MD, Coltraco Ultrasonics, UK**

The presentation will explore the importance of the maritime sector, looking at the UK's place in the context of leading maritime nations. It will introduce ISO 14520 standards for gaseous extinguishing systems and outline the key issues pertaining to fire safety on board vessels at sea, where there is no fire brigade, heightening the importance of improving fire safety maintenance on board through crew learning how to safely inspect, and through continuous monitoring systems. These systems test the liquefied gaseous extinguishing systems and the integrity of the room in which they are situated, for a holistic approach to solving the problem of the ungoverned space at sea.

**2:25pm - Causes and trends in maintenance-related lifeboat accidents**

**Graham Wilson, senior lecturer in accident investigation, Cranfield University, UK**

Various studies have reported the continuing trend for accidents involving the launching and recovery of lifeboats, despite the efforts of the maritime industry to tackle this problem. These accidents typically occur during drills and maintenance activities, tragically often resulting in loss of life or serious injury. Previous studies have reported that ineffective maintenance was

a causal factor in many such accidents. This paper sets out to conduct a further detailed review of recent lifeboat accident investigations to identify contributory maintenance factors and trends relating to such accidents, and possible actions that can be taken to address these issues.

**Q&A**

**3:30-4:00pm – Maintenance of vessel structures**

**Moderator**

**Daniel C Shorten, managing director, Optimain Ltd, UK**

**3:30pm - SHIPHULLSHM: structural health monitoring through acoustic emission on operative ship**

**Alberto Monici, technical director, ETS Sistemi Industriali Srl, Italy**

The European ship repair and maintenance industry is suffering from the impossibility to accurately quantify the extent of repair work required before the ship is in dock. Through our involvement in the EU-funded H2020 project SHIPHULLSHM (696961-1) and thanks to the fruitful collaboration with the Brunel Innovation Centre at Brunel University of London, we have analyzed possible application of this method to implement continuous monitoring of ships' hulls to localize incipient failures, thus greatly increasing the efficiency of the ship repair process and operations carried out by repair providers. The system is able to analyze and identify initiated damage and incipient crack propagation in real time.

\*This program may be subject to change

## Speaker spotlight



**Graham Wilson, senior lecturer in accident investigation – Cranfield University, UK**

Thursday, June 8, 2017

**Tell me what you will be discussing at this year's Marine Maintenance World Expo and Conference.**

Various studies have reported the trend for accidents during the launching and recovery of lifeboats, typically occurring during drills and maintenance activities and tragically often resulting in loss of life or serious injury. Two fatal accidents on cruise vessels during 2016, involving a lifeboat and fast rescue craft, confirm that such accidents continue to be of concern, despite the efforts of the maritime industry to tackle this problem.

Previous studies have reported that ineffective maintenance was a causal factor in many such accidents. My presentation sets out to conduct a further detailed review of available accident data from recent lifeboat

accident investigations to identify contributory maintenance factors and trends relating to such accidents, and possible actions that can be taken to address these issues.

**How does the marine sector differ from the aerospace sector in terms of its safety culture monitoring?**

The tools and methodologies used to monitor safety culture across transportation are generally very similar. Where I think the maritime and aviation sectors tend to differ is in the level of maturity of employing these tools and following up with effective monitoring and action plans. Many areas of shipping have taken great strides in measuring and monitoring safety culture. My experience as an accident investigator suggests there are definitely areas where there is still catch-up compared with the aerospace world. Shipping faces unique challenges versus aviation. A ship may have multinational and multicultural crews operating complex platforms in hazardous environments for extended periods. This really makes it more important to embed a robust safety culture throughout a shipping company. \\

**BOOK YOUR  
CONFERENCE  
DELEGATE PASS  
ONLINE  
TODAY!**

# electric & hybrid marine

WORLD EXPO 2017

DISCOVER THE VERY LATEST  
**ELECTRIC AND HYBRID MARINE**



**6 - 8 JUNE 2017 AMSTERDAM,**

**THE WORLD'S LARGEST MARINE PROPULSION**

The international exhibition and conference dedicated to electric and hybrid marine propulsion systems, technologies, and components.

Taking place at the  
same time...

Autonomous Ship  
TECHNOLOGY  
Symposium 2017

NEW FOR 2017!  
MARITIME & NAVAL  
TEST & DEVELOPMENT  
SYMPOSIUM

MARINE MAINTENANCE  
WORLD EXPO AND  
CONFERENCE 2017

REGISTER FOR YOUR FREE EXHIBITION ENTRY CODE NOW >>>

FREE-  
TO-ATTEND  
EXHIBITION!  
**130+ EXHIBITORS!**  
PLUS Over 50 conference speakers\*

# AND NEXT-GENERATION PROPULSION TECHNOLOGY!



## THE NETHERLANDS

**BIGGEST  
SHOW YET!**  
**MORE NEW  
TECHNOLOGIES  
THAN EVER!**

# PROPULSION EXHIBITION AND CONFERENCE!

EXHIBITION ENTRY IS FREE  
**REGISTER NOW!**

\*Conference rates apply – see website for details

[www.ElectricandHybridMarineWorldExpo.com](http://www.ElectricandHybridMarineWorldExpo.com)

∴ ELECTRIC & HYBRID MARINE WORLD EXPO CONFERENCE 2017  
**June 6-8, Amsterdam, Netherlands**

**electric  
 & hybrid marine**  
 WORLD EXPO 2017  
**CONFERENCE**

**50+  
 SPEAKERS**

**BOOK YOUR  
 SEAT AT THE 2017  
 CONFERENCE  
 ONLINE TODAY!**

[www.electricandhybridmarine.com](http://www.electricandhybridmarine.com)  
[worldconference.com](http://worldconference.com)

The must-attend conference for anyone needing or developing the latest and next-generation electric and hybrid propulsion for the marine industry.

**NEW AND EXCLUSIVE PRESENTATIONS! • ALL-NEW SPEAKER LINE-UP! • BRAND-NEW SESSIONS!**

Electric & Hybrid Marine World Expo Conference is the world's most important international maritime conference focused on electric and hybrid technologies, which have the potential to dramatically cut fuel costs and reduce harmful emissions produced by the global marine industry. Over 50 expert speakers from around the world will discuss next-generation technology, IMO regulations, increased electrification of marine systems, as well as sharing future concepts, and results and findings from current and ongoing sea trials.

**DAY 1 //  
 TUESDAY, JUNE 6**

**9:00-10:30am – Keynote session**

Moderator – Nick Lambert, director, NL Associates, UK

**9:00am – The Elemed action: electrification as the key to sea mobility**

Panayiotis Mitrou, technology and innovation manager, marine and offshore, Lloyd's Register, Greece

**9:25am – Advanced hybrid systems and new integration challenges**

Oliver Simmonds, lead engineer, GE Power Conversion, UK

**9:50am – Flywheel energy stores from directed energy weapons to grid management**

Sean Worrall, business development manager, GKN Hybrid Power, UK  
 Tim Rumney, systems program manager, GKN Hybrid Power, UK

10:15am – Q&A

10:30-11:00am – Break

**11:00-12:40am – Designing and developing hybrid systems**

Moderator – Nick Lambert, director, NL Associates, UK

**11:00am – A virtual power box approach to a hybrid system**

Peter Rogers, director, Wärtsilä, Germany

**11:25am – Challenges and solutions for electrification/hybridization in large-engine applications**

Wilhelm Mueller, vice president large engines, engineering and technology powertrain systems, AVL List GmbH, Austria

**11:50am – Optimization of electric drive systems for electric and hybrid vessels**

Helge Vandel Jensen, business development manager, Danfoss Drives AS, Denmark

**12:15pm – Electrically powered ferry propulsion power estimation in underpowered operational conditions**

Marek Narewski, technical specialist, Polish Register of Shipping, Poland  
 Prof. Czeslaw Dymarski, chair of marine mechatronics, head of department, Gdansk University of Technology, Poland

12:40-1:40pm – Lunch

**1:40-6:00pm – Case studies and real-world results**

Moderator – Nick Lambert, director, NL Associates, UK

**1:40pm – Asia's first hybrid ferry**

Chih Hung Lin, engineer, Ship and Ocean Industries R&D Center, Taiwan  
 Tim Tiek, CEO, Super B, Netherlands  
 Kimmo Rauma, CEO, Vizedo, Finland

**2:05pm – Fast Ferries: the new case for energy storage**

Brent Perry, CEO, PBES, Canada  
 Erik Lanssen, president and CEO, Selfa Arctic AS avd Trondheim, Norway

**2:30pm – Green commuting on water: BB Green changes the game**

Hans Thornell, CEO, Green City Ferries, Sweden

Ulf Tudem, general manager, Effect Ships International AS, Norway

**2:55pm – Hydrogen hybrids in domestic ferries: a Norwegian reality**

Einar Kjerstad, market and sales manager shipbuilding, Fiskerstrand Verft AS, Norway

3:20-3:50pm – Break

**3:50pm – Safety analysis of 4.3MWh Li-ion battery in E-Ferry**

Antti Väyrynen, vice president of electrified transportation, Leclanché SA, Switzerland

**4:15pm – Experience from testing a maritime Li-ion battery system in operation**

Øystein Alnes, principal engineer, DNV GL AS, Norway

Jason Stefanatos, senior research engineer, DNV GL, Maritime R&D and Advisory, Greece

**4:40pm – Implementation of electric fishing boats in Canada in 2017**

Francois Bosse, VP, administration, Ocean Marine, Canada

**5:05pm – Parallel full-hybrid vessel propulsion and ZEM hotel mode**

Dr Andrea Frabetti, CEO, Diesel Center, Italy

**5:30pm – Hybrid heavy lifting vessel**

Kasper van der Heiden, R&D manager, Jumbo Shipping & Offshore, Netherlands

**DAY 2 //  
 WEDNESDAY, JUNE 7**

**9:00am-1:05pm – Enabling technologies for electric and hybrid marine**

Moderator – Dr Christopher Hill, senior research fellow, University of Nottingham, UK

**9:00am – Technical considerations for DC grid systems on ships**

Kyunghwa Kim, researcher, Korean Register of Shipping, Korea

**9:25am – Ocean energy to support electrification of vessels**

Ravindran Pallaniappan, program manager, Global Research & Innovation Centre, Nippon Kaiji Kyokai Singapore Pte Ltd (ClassNK), Singapore

**9:50am – The good, the bad and the unreliable: power quality economy**

Benjamin Sternkopf, energy storage engineer, Stable Shore Power, Germany

10:15am - Q&A

10:30-11:00am - Break

**11:00am – Using AIS to dimension shore power infrastructure – the ReCharge project**

Hans Anton Tvette, senior researcher, DNV GL, Norway

**11:25am – Applying automotive technologies and techniques to marine applications**

Angus Lyon, director, Rockfort Engineering Ltd, UK

11:50am – Q&A

12:15pm-1:45pm – Lunch

**12:45-1:30pm – Lunchtime workshop on optimal battery sizing for durability**

Scientific view on optimal battery dimensioning and its impact on durability

Adrian Heuer, Electrical Energy Systems EES, Fraunhofer-Institut für Solare Energiesysteme ISE, Germany

Alexander Schies, project manager, Fraunhofer Institute for Solar Energy Systems ISE, Germany

**1:45-5:30pm – Energy Storage**

Moderator - Dr Christopher Hill, senior research fellow, University of Nottingham, UK

**1:45pm – Peak shaving and energy storage on ships**

Magnus Eriksson, CTO, Echandia Marine, Sweden

**2:10pm – Designing safer and more reliable lithium-ion-based energy storage systems**

David Lokhorst, vice president engineering, Corvus Energy, Canada

**2:35pm – Total cost of ownership for marine battery systems**

Didier Jouffroy, marine product manager, Saft, France

**3:00pm – Fuel cells in shipping: status, experiences and the way forward**

Tomas Heber Tronstad, project manager, DNVGL, Norway

Ricardo Batista, project officer, European Maritime Safety Agency (EMSA), Portugal

3:25-3:50pm – Break

**3:50pm – SchIBZ – diesel-powered fuel cells for ships**

Keno Leites, project manager, ThyssenKrupp Marine Systems GmbH, Germany

**4:15pm – Toward improved vessel station-keeping performance with batteries**

Dr Kristine Bruun Ludvigsen, senior engineer, DNV GL, Norway

**4:40pm – Fleet status and lifecycle assessment for maritime battery systems**

Sondre Henningsgård, managing director, Maritime Battery Forum, Norway

**5:05pm – Influences on aging of marine battery systems: a field report**

Felix von Borck, executive managing director, Akasol GmbH, Germany

**DAY 3 //  
THURSDAY, JUNE 8**

**8:50-11:00am – Efficient propulsion and drive innovations**

Moderator - Dr Christopher Hill, senior research fellow, University of Nottingham, UK

**8:50am – Development of electric propulsion and integrated electrical systems for vessels**

Dr Tao Yang, assistant professor, University of Nottingham, UK

**9:15am – Multidomain system simulation for optimizing hybrid and electric applications**

Robert Strasser, lead engineer, AVL List GmbH, Austria

**9:40am – All-electric evolution: revolutionizing ship function and design**

Oscar Grooten, business development director, Visedo Oy, Finland

**10:05am – Efficiency improvements in future hybrid cruise ferries**

Andrey Lana, doctoral researcher, Lappeenranta University of Technology (LUT), Finland

**10:30am – Energy-efficient multitechnology drive solutions**

Sander Boeijen, application specialist, Bosch Rexroth BV, Netherlands

Quang Huy Nguyen, research engineer, Robert Bosch GmbH, Germany

11:00-11:30am – Break

**11:30am-12:45pm – Permanent magnet technologies for electric and hybrid marine**

Moderator: James Fanshawe, chairman, UK MASRWG, UK

**11:30am – Marine applications of high-speed permanent magnet synchronous machines**

George Santamaria, senior engineer, General Atomics, USA

**11:55am – Axial flux, PMG-based innovative propulsion system**

Prof. Andrea Aparo von Flüe, senior vice president R&D, Lucchi R Elettromeccanica, Italy

**12:20pm – Permanent magnet machines in direct-drive shaft generator applications**

Mika Koli, business development manager, The Switch, Finland

12:45-2:15pm – Lunch

**2:15-5:00pm – Innovative hybrid solutions**

Moderator – James Fanshawe, chairman, UK MASRWG, UK

**2:15pm – An innovative hybrid redundant propulsion system**

Dr Matthias Walkowiak, head of research and development, Renk AG, Germany

**2:40pm – Hybrid energy for medium-sized vessels: design considerations and operational management**

Walter van der Pennen, portfolio manager hybrid energy, RH Marine, Netherlands

**3:05pm – Zero conversion loss frequency controlled drive for Schottel propellers**

Andreas Witschel, sales director cruise, yachts and ferries, Schottel GmbH, Germany

Íñigo Atutxa, technical director, Ingteam Power Technology – IMD, Spain

3:30-4:00pm – Break

**4:00pm – Integration of a hydrogen system on an existing solar vessel**

Uwe Hannesen, technical director, Swiss Hydrogen, Switzerland

**4:25pm – Win-win wind situation – 21<sup>st</sup> century wind propulsion technology**

Gavin Allwright, secretary, International Windship Association, UK

\*This program may be subject to change

# Autonomous Ship TECHNOLOGY Symposium 2017

**6 - 8 JUNE 2017**  
AMSTERDAM, THE NETHERLANDS

## *The path towards unmanned shipping...*

The international conference dedicated to discussing the challenges and opportunities of increased automation and autonomy in the maritime sector

The Autonomous Ship Technology Symposium will bring together ship designers, fleet owners, naval architects, classification societies, equipment manufacturers and maritime research organisations to discuss and debate the technological, regulatory and legal developments necessary to make autonomous and unmanned ships a reality.

Leading experts from around the world will present their views and current findings, leading to a unique opportunity to exchange ideas and network with this pioneering community of maritime engineers.

Brought to you by the publisher of:

**MARINE MAINTENANCE** **electric**  
TECHNOLOGY INTERNATIONAL & hybrid  
marine technology international

Taking place at  
the same time...

**MARINE MAINTENANCE**  
WORLD EXPO AND  
CONFERENCE 2017

**electric**  
& hybrid marine  
WORLD EXPO 2017

**NEW FOR 2017!**  
**MARITIME & NAVAL**  
**TEST & DEVELOPMENT**  
SYMPOSIUM



[www.autonomousshipsymposium.com](http://www.autonomousshipsymposium.com)

**THE CONFERENCE  
OF THE YEAR!**



©Rolls-Royce

©Rolls-Royce

**GO ONLINE  
NOW TO BOOK  
YOUR PASS!**

[www.autonomousshipsymposium.com](http://www.autonomousshipsymposium.com)



### Topics under discussion

- Autonomous navigation technology
- Automated onboard systems
- E-navigation
- Automation software
- Maritime remote control technology
- Potential economic benefits
- Legal implications
- Environmental impact
- Maritime regulations
- Simulation
- Testing and validation
- Piracy
- Cybersecurity
- Impact on maritime workforce
- HMI
- Maritime insurance
- Case studies and research projects
- Remote satellite communications
- Reliability testing of software and hardware systems

For more information about the Autonomous Ship Technology Symposium 2017, please contact **Andrew Boakes, conference director:** [andrew.boakes@ukimediaevents.com](mailto:andrew.boakes@ukimediaevents.com)

[www.autonomousshipsymposium.com](http://www.autonomousshipsymposium.com)

BOOK YOUR SEAT AT THE 2017 SYMPOSIUM ONLINE TODAY!  
www.autonomous-shipsymposium.com

# Autonomous Ship TECHNOLOGY Symposium 2017

## The path toward unmanned shipping...

The world's first international conference dedicated to discussing the challenges and opportunities of increased automation and autonomy in the maritime sector

The Autonomous Ship Technology Symposium will bring together ship designers, fleet owners, naval architects, classification societies, equipment manufacturers and maritime research organizations to discuss and debate the technological, regulatory and legal developments necessary to make autonomous and unmanned ships a reality.

Leading experts from around the world will present their views and current findings, leading to a unique opportunity to exchange ideas and network with this pioneering community of maritime engineers.

1:30-4:20pm: **Liability and legal issues**

**Moderator**  
James Fanshawe, chairman, UK MASRWG, UK

1:30pm: **Strict or negligence-based liability for autonomous ships?**  
Erik Røsæg, professor, Scandinavian Institute of Maritime Law, Norway

1:55pm: **Legal issues with regard to unmanned systems and GNSS**  
Helen Tung, law consultant, University of Greenwich, Australia

2:20pm: **Unmanned ships – legal and regulatory challenges**  
Nick Burgess, partner, BDM Law LLP, UK

2:45pm: **Q&A**

3:00-3:30pm: **Break**

3:30pm: **Case studies and legal issues of autonomous shipping in Japan**  
Ayako Umeda, patent attorney, Tokyo University of Marine Science and Technology, Japan

3:55pm: **Unmanned ships – legal liabilities and considerations for manufacturers/operators**  
Jonathan Goulding, associate and mariner, Holman Fenwick Willan, UK

4:20-5:30pm: **Panel discussion**  
Identifying the challenges and how to overcome them. The technology and how it needs to advance, how and why operators need to adopt, plus an overview of the path toward autonomous vessels.

Markus Laurinen, R&D project manager – remote and autonomous operations, Rolls-Royce Marine, Finland

P Michael A Rodey, innovation strategy manager, Maersk, Denmark

Dr Kalevi Tervo, global program manager, ABB Marine, Finland

Gijsbert de Jong, director, offshore service vessels and tugs, Bureau Veritas, Netherlands

Hans-Christoph Burmeister, group manager – sea traffic and nautical solutions, Fraunhofer Center for Maritime Logistics and Services CML, Germany

Gert-Jan Panken, vice president of maritime applications, Inmarsat, Netherlands

**Moderator**  
James Fanshawe, chairman, MASRWG, UK

### Day 1: Tuesday, June 6

9:00am-12:30pm: **Keynote presentations**

**Moderator**  
James Fanshawe, chairman, MASRWG, UK

9:00am: **Autonomous shipping – not on its own**

Ringo Lakeman, senior policy advisor, Ministry of Infrastructure and the Environment, Netherlands

9:25am: **Redefining the shipping business with intelligent solutions**

Oskar Levander, VP innovation, Rolls-Royce, Finland

9:50am: **The DARPA and Leidos ACTUV Sea Hunter and maritime autonomy**

Dr Timothy Barton, maritime chief engineer, Leidos, USA

10:15am: **Q&A**

10:30-11:00am: **Break**

11:00am: **DBSy – addressing cyber challenges to autonomous ship technology**

Paul Irwin, principal consultant, QinetiQ, UK

11:25am: **ABB – holistic view on autonomous shipping**

Dr Kalevi Tervo, global program manager, ABB Marine, Finland

11:50am: **Autonomous Waterborne Applications Initiative – intermediate results and way forward**

Markus Laurinen, R&D project manager – remote and autonomous operations, Rolls-Royce Marine, Finland

12:15pm: **Q&A**

12:30-1:30pm: **Lunch**

## Day 2: Wednesday, June 7

### 9:00am-12:55pm: Navigation and Collision Avoidance

#### Moderator

Nick Lambert, director, NL Associates Ltd, UK

#### 9:00am: Reactive collision avoidance for unmanned surface craft

Dr Henry Robinson, technical director, H Scientific Ltd, UK

#### 9:25am: The value of dynamic positioning systems for autonomous ships

Mark Carter, business manager, Sonardyne International, UK

#### 9:50am: Rule-based automation of collision avoidance according to COLREGs

Alexander Ozersky, solutions manager, Transas Ltd, Russia

#### 10:15am: Q&A

10:30-11:00am: Break

#### 11:00am: A high-integrity decision-making system for autonomous operations

Nick Tudor, business director, D-RisQ Ltd, UK

#### 11:25am: COLREGs-compliant collision avoidance for autonomous systems

David Motson, system design authority, Atlas Elektronik UK, UK

#### 11:50am: Advanced sensing environment for obstacle avoidance on board unmanned surface vehicles

Denis Gagneux, department manager, Sirehna – DCNS Research, France

#### 12:15pm: Autonomous COLREG-compliant navigation: What next?

Dr Howard Tripp, autonomous systems R&D lead, ASV Global, UK

#### 12:40pm: Q&A

12:55-1:55pm: Lunch

### 1:55-5:45pm: Best practices

#### 1:55pm: A classification perspective on autonomous ships

Gijsbert de Jong, director of offshore service vessels and tugs, Bureau Veritas, Netherlands

#### 2:20pm: Unmanned surface vehicles for cost-saving maritime data acquisition

Vegard Evjen Hovstein, CEO, Maritime Robotics AS, Norway

#### 2:45pm: Autonomous ship developments in the NFAS

Ørnulf Jan Rødseth, general manager, Norwegian Forum for Autonomous Ships/SINTEF Ocean, Norway

#### 3:10pm: The mariner in the era of autonomous ships

John Cross, professor, Marine Institute of Memorial University, Canada

#### 3:35pm: Q&A

3:50-4:20pm: Break

#### 4:20pm: The road map for autonomous shipping

Päivi Haikkola, ecosystem leader, DIMECC, Finland

#### 4:45pm: The Norwegian Maritime Authority's responsibilities toward new innovation

Svein David Medhaug, project manager, The Norwegian Maritime Authority, Norway

#### 5:10pm: Improving remote operator situational awareness in over-the-horizon operations

Christopher Bissec, unmanned system engineer, ASV Global, UK

#### 5:35pm: Q&A – Conference close day 2

## Day 3: Thursday, June 8

### 9:00am-12:30pm: Test and Development of Autonomous Technology

#### Moderator

John Haynes, managing director, Shock Mitigation Ltd, UK

#### 9:00am: Interaction between autonomous ships and small manned craft

Dr Thomas Porathe, professor, NTNU, Norwegian University of Science and Technology, Norway

#### 9:25am: Hrönn: an unmanned, light-duty, offshore utility ship

Brett Phaneuf, managing director, Automated Ships Ltd, UK

#### 9:50am: Naval architecture considerations for the design of USVs

Iñigo Echenique, manager, chief researcher, Seadrone, Spain

#### 10:15am: Q&A

10:30-11:00am: Break

#### 11:00am: An open-source framework for testing and verification

Linus Aldebjer, product manager, SSPA Sweden AB, Sweden

#### 11:25am: Fundamental research approach to autonomous ship development in the Netherlands

Klaas Visser, assistant professor Marine Engineering, Rear Admiral (retired), Delft University of Technology, Netherlands

#### 11:50am: Autonomous USVs for cooperative harbor defense

Carl Conti, technical director, Spatial Integrated Systems Inc, USA

#### 12:15pm: Q&A

12:30-1:30pm: Lunch

### 1:30-5:00pm: Cybersecurity Challenges for Autonomous Ships

#### 1:30pm: Trusted information securely brought back to shore

Gert-Jan Panken, vice president of maritime applications, Inmarsat, Netherlands

#### 1:55pm: The 'cyber-enabled ship' – what it means for operators and regulators

Tania Berry, senior electrotechnical specialist, Lloyd's Register, UK

#### 2:20pm: Maritime autonomous systems will demand more from communications solutions

Nicholas Sheppard, communications solution architect, Thales UK Ltd, UK

#### 2:45pm: Q&A

3:00-3:30pm: Break

#### 3:30pm: Cyber-risk assessment: Case study for a remotely controlled vessel

Patrick Rossi, maritime cybersecurity service manager, DNV GL, Germany

#### 3:55pm: Connectivity challenges for autonomous ships

Dr Marko Hoyhtya, senior scientist, project manager, VTT Technical Research Centre of Finland, Finland

#### 4:20pm: Sealing vessels' electronic control units, according to factory settings

David Barzilai, chairman and co-founder, Karamba Security, Israel

#### 4:45pm: Q&A – Conference summary and close final day

\*This program may be subject to change

# MARITIME & NAVAL TEST & DEVELOPMENT SYMPOSIUM

BOOK YOUR  
SEAT AT THE  
2017 SYMPOSIUM  
ONLINE TODAY!

[www.marinetesting.com](http://www.marinetesting.com)

Maritime & Naval Test & Development Symposium is the world's only conference dedicated to discussing the latest and next-generation validation tools and techniques designed to help guarantee the durability, performance and seaworthiness of new vessels of all sizes, including their onboard systems and new components.

This unique conference will also discuss innovative testing and simulation tools that can reduce product development cycles, plus techniques to reduce product failure and ensure optimum operational efficiency, reliability and safety.

Leading test and certification experts from around the world will present exclusive papers and participate in lively debate about how component and complete vessel performance can be improved through the application of advanced subjective validation technologies. Laboratory testing and CAE application can revolutionize the way tomorrow's vessels go from concept to reality.

## Day 1 // Tuesday, June 6

9:30am-12:30pm – Opening session

9:30am - **CFD applications at Damen shipyards**

Marco Bovio, senior research hydromechanics engineer, Damen Shipyards, Netherlands

9:55am - **Ice impact to an azimuth thruster in laboratory conditions**

Ilkka Perälä, research scientist, VTT Technical Research Centre of Finland Ltd, Finland

10:20-11:00am – Break

11:00am - **Hydrodynamic testing of antifoulings, predicting their effects on ship performance**

Prof. Mehmet Atlar, professor of naval hydrodynamics and director of research, University of Strathclyde, UK

11:25am - **Ship model facilities for shallow and confined water in Flanders**

Prof. Marc Vantorre, senior full professor, Ghent University, Belgium

11:50am - **Q&A**

12:30-2:00pm – Lunch

2:00-5:30pm – Test and Development Tools for Simulating and Predicting Vessel Performance

2:00pm - **Creating the world's first realistic fast small ship simulator**

Maarten van Donselaar, CEO, Cruden, Netherlands

2:25pm - **Modular test environment for autonomous navigation systems**

Dr Christian Schyr, project manager, AVL Deutschland GmbH, Germany

2:50-3:30pm – Break

3:30pm - **Applicability of CFD for estimation of ship helicopter operational limitations**

Peter Booij, helicopter-ship interface specialist, Netherlands Aerospace Centre NLR, Netherlands

3:55pm - **SRtP performance investigation by experiment and computation approaches**

Yang Ni, engineer, China Ship Scientific Research Center, China

4:20pm - **Q&A**

## Day 2 // Wednesday, June 7

9:15am-12:30pm – Vessel Performance, Hydrodynamic Testing, and Simulation for Predicting Behavior of Marine Structures

9:15am - **Understanding vessel performance using free-running hydrodynamic scale models**

Stephen Phillips, managing director, Seaspeed Marine Consulting Ltd, UK

9:40am - **Hydrodynamic test and evaluation in the digital era**

Andrew Peters, group leader, hydromechanics and hyperbarics, QinetiQ, UK

10:05am - **Collaboration in hydrodynamic testing**

Maarten Flikkema, senior project manager, MARIN, Netherlands

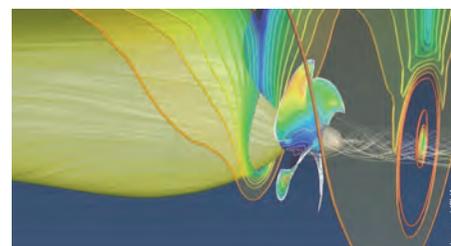
10:30-11:00am – Break

11:00am - **Using interactive visualizations to explore ship design data**

Dr John Callega, naval architect, University College London, UK

11:25am - **Ship flow simulation using OpenFOAM software**

Kiril Todorov, engineer shipbuilding and ship repair, Bulgarian Ship Hydrodynamics Centre, Bulgaria



11:50am - **Cavitation test of a controllable-pitch propeller air-ejection system**

Göran Grunditz, manager, Rolls-Royce Hydrodynamic Research Centre, Rolls-Royce AB, Sweden

12:15pm - **Q&A**

12:30-2:00pm - **Lunch**

2:00-5:30pm - **Marine Test & Development using HIL**

2:00pm - **PHIL testing of naval electrical systems at the PNDC**  
 Dr Federico Coffele, R&D manager, PNDC (University of Strathclyde), UK

2:25pm - **Integrated 5MW HIL testbed for naval power systems**  
 Dr Mischa Steurer, research faculty, Florida State University, USA

2:50-3:30pm - **Break**

3:30pm - **Integrating maritime power system design and testing using controller hardware-in-the-loop (CHIL)**  
 Dr Nikola Fischer Celanovic, CEO and co-founder, Typhoon HIL Inc., USA

3:55pm - **HIL testing of software in integrated control systems**  
 Rune Green, head of section, DNV GL - Maritime Advisory MCA, Norway

4:20pm - **Q&A**

**Day 3 // Thursday, June 8**

9:30am-12:30pm - **Large-scale Ship and Naval Propulsion Testing**

9:30am - **Developments in full-scale shore-based testing**

Oliver Simmonds, lead engineer, naval, GE Power Conversion

9:55am - **HIL validation of functions for minimization of fuel oil consumption**

Dr Michael Lundh, senior principal scientist, ABB, Sweden

10:20-11:00am - **Break**

11:00am - **Large-scale testing of propulsion systems**

Christian Bechtel, head of test department, Renk Aktiengesellschaft, Germany

11:25am - **Hardware-in-the-loop testing of ship propulsion system**

Sandor Ivancsics, research engineer, Damen Shipyards, Netherlands

11:50am - **Q&A**

12:20-2:00pm - **Lunch**

2:00-5:30pm - **Best Practices for Testing and Validating Ship Performance and Onboard Systems**

2:00pm - **Non-destructive stress measurement in steel constructions**

Prof. Valeriy Vengrinovich, head of department, Institute of Applied Physics of the National Academy of Sciences of Belarus, Belarus

2:25pm - **Poly-phase motor power analysis**

Christoph Wiedner, power manager, Dewetron GmbH, Germany

2:50pm - **Test data standardization - establishing measurement data management systems**

Ralf Nörenberg, CEO, HighQSoft GmbH, Germany

3:15-3:45pm - **Break**

3:45pm - **Development of a hybrid model basin system based on EFD/CFD integration**

Koyu Kimura, head of R&D division, Akishima Laboratory, Japan

4:10pm - **Testing intelligent ships in model scale**

Veikko Immonen, development engineer, Aker Arctic Technology Inc., Finland

\*This program may be subject to change

# Antifouling the ultrasonic way

**Much effort and expense goes into controlling or eliminating marine growth. Goetz Grosse, head of projects for Hasytec, discusses an easier, cost-effective way with ultrasonics**

**Michael Jones, Marine Maintenance Technology International**

**What's the product that you're providing to the maritime industry?**

Our key product for the maritime industry is a highly effective and efficient ultrasonic marine growth prevention (MGP) system against biofilm, fouling and marine growth. With this new technology we focus on the three main segments – hulls, seawater and engine cooling and propulsion systems.

**What is biofilm?**

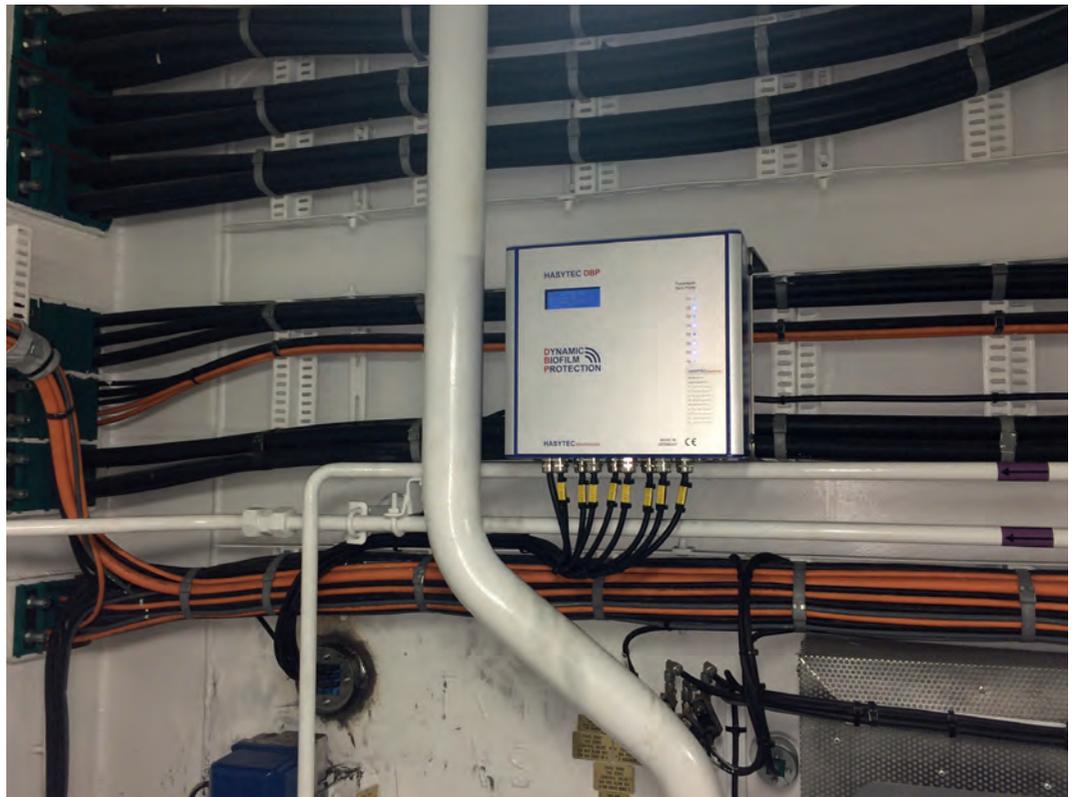
Simply stated, biofilms are a collection of microorganisms surrounded by the 'mucus' they secrete and adhering to an inert or living surface. Biofilms are well known from normal life: plaque on the teeth, slippery mud on river stones, and the gel-like film on the inside of a vase that flowers have stood in for a week. Biofilms exist wherever surfaces are in contact with water or other liquids.

More than 99% of all bacteria live in biofilm communities. Some of these are advantageous. Wastewater treatment plants, for example, rely on them to remove impurities from water. But biofilms can also cause problems; they corrode pipes, clog water filters and harbor bacteria that contaminate drinking water. And they serve as the basis of food for marine fouling!

With seawater systems, algae, barnacles, mussels, crustaceans and mollusks use the bacteria and their metabolites as a nutritional base. The lack of surface tension and the sticky polymer networks of the biofilm allow the colonization of these surfaces and cause the well-known problems.

**How does your unit work and how does it help shipowners/operators?**

Our technology is based on the use of ultrasound signals in the range 20-80kHz. Sound propagation in non-elastic media like seawater is carried out by a continuous dual-phase wave transition in a sequence of rarefaction (negative pressure) and compression (positive pressure) as long as



the amplitude is relatively low. Changing these sound signals in radiation intensity, frequency and amplitude, achieved here by our software-based control of the signals, produces increased acoustic pressure, which is extremely effective against adhesions, microorganisms and fouling.

Due to the mechanical effect of the ultrasound, adhesions, as well as existing fouling, are dissolved and removed by the destruction of vacuoles and cell tissue, which inhibits the settlement of barnacles. At the same time, algae are killed by destroying their cell organelles, as well as up to 10-day-old larvae and unicellular organisms.

The vibrations generated by the ultrasound also form an anti-adhesion (against organic and inorganic deposits) and an anti-settling (against slime-forming micro-organisms) environment. As a result, the deposition of organic material and the initial colonization by micro-organisms are prevented, so the surfaces remain clean. The adhesion, formation and growth of algae, mussels and barnacles is thus permanently disturbed and prevented and surfaces are kept clean.

The uniqueness of the Hasytec Dynamic Biofilm Protection (DBP) is the combination of the low-power consuming transducers



TOP: A Hasytec DBP transducer mounted on a horizontal surface

LEFT: A transducer on a vertical surface

ABOVE AND FAR LEFT: Controllers can be used in multiple units to provide complete coverage as required by the ship's configuration

and the intelligent software, which results in the transducers being highly focused and controlled. Hasytec DBP runs a very precisely tuned program of several frequencies and power consumptions.

The transducers need to be glued with special industrial glue onto requested applications. The metal transports the ultrasonic signals into the liquid (mostly water) and therefore it will diffuse completely through the medium. As described above, these diffused ultrasonic waves will prevent the build-up of biofilm and even remove it in early stages. Consequently Hasytec DBP prevents fouling, marine growth, bacteria, clogging and blockage.

**What are the effects and results from using ultrasonic tech?**

The use of ultrasonic technology yields many advantages and results. Among them, cooling systems retain their full

performance with an extended service life and reduced maintenance costs because dry dock and shipyard stays are no longer necessary for cleaning these units. Fuel consumption is reduced because the drive systems and hulls stay clean, reducing wear and corrosion. The system can also protect seawater-cooled machines, pipelines and tanks (ballast water, for example).

A major advantage is that there is no use of poisons and chemicals, which is particularly beneficial in light of stricter environmental protection in the future.

Hasytec BCP is also a maintenance-free, low-energy and environmentally friendly technology, in contrast to conventional antifouling methods.

**How many transducers can be powered by one unit?**

Our system can contain and power up to eight synchronized transducers, which is

a unique feature and a huge advantage for covering larger installations and surfaces.

**Where can transducers be installed?**

We can treat all hull surfaces from inside the vessel. Our transducers can be installed in dry (void spaces, coffer dams) and wet environments (ballast water tanks).

In seawater and engine cooling systems we can treat the whole range of applications including sea chests, seawater pipes, cross-over sections and filters, box coolers, plate-type heat exchangers like LT-coolers, fresh water generators, and fresh water and other tank types.

Tunnel thruster systems such as bow or stern thrusters, as well as conventional shaft propulsion systems, have been successfully equipped with our systems.

**Can multiple systems be installed on one ship?**

Yes, due to our high manufacturing standard and the modular design, our customers can have several of our DBP systems installed on their vessels to cover various applications and demands.

**What are the installation requirements? How much power does the system need?**

Installation of Hasytec DBP is very easy. There's no need for the vessel to go into dry dock and installation can be undertaken at any time. Only hull protection installations require dry dock conditions to reach the ballast water tanks, if applicable. The system needs a constant power supply that has to be provided 24/7. It consumes 20W per ultrasonic transducer.

Only minor preparation work needs to be conducted by the customer, such as preparing frames for the control boxes, providing a sufficient power supply and, if needed, making the cable penetrations through bulkheads.

Due to the fact that Hasytec DBP is a preventive system, it's necessary to start with a clean surface.

**How does one get started with installing the system? What conditions need to be met?**

That is as easy as it can get. With the customer, we will plan and deliver the complete installation and commissioning on-site, wherever the customer or their vessel is located. \\

**Free reader inquiry service**

Hasytec

To learn more about this advertiser, visit [www.ukimediaevents.com/info/mmm](http://www.ukimediaevents.com/info/mmm) NOW! Reader inquiry no. 101

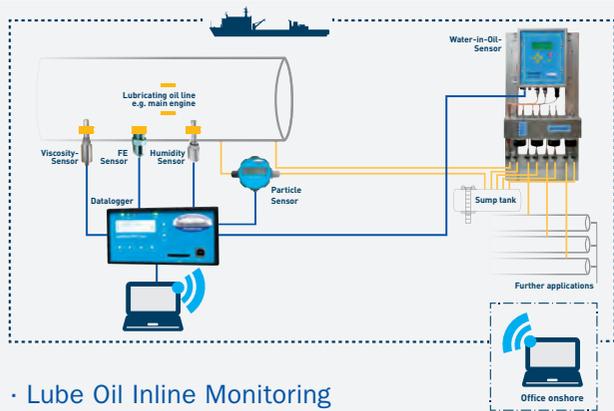
## MODULAR MONITORING SYSTEM

> LUBE OIL

# OIL MANAGEMENT

## ONBOARD TESTING WITH DIGITAL 4.0 DEVICES

> INNOVATIVE SOLUTIONS



• Lube Oil Inline Monitoring

### > TWIN CHECK 4.0

Water-in-oil and alkalinity reserve (BN, TBN)



### > IRON CHECK E

Iron concentration in cylinder drain oil



Digitalization leads to new age testing of crucial oil parameters on board a ship:

1. Automation of measurements
2. Digital evaluation with precision
3. Direct availability of test results

Martechnic GmbH

Adlerhorst 4 · D-22459 Hamburg · Phone: +49(40) 853 128-0 · Fax: +49(40) 853 128-16  
e-mail: info@martechnic.com · www.martechnic.com



# Next generation abrasive blasting

- Up to 80% cost reduction
- No spill, no damage to other equipment
- Surface ready to be coated immediately after blasting
- ATEX certified

 pinovo

www.pinovo.com

# Maneuverable, powerful coatings removal

**A new chain drum machine for coatings removal just announced by Rustibus offers easier maintenance and operation closer to walls**

Glenn Vanbrabant and Andrew Harris, Rustibus

**H**ard-hitting, heavy-duty machines – ‘the ones with chain links’ – is what Rustibus makes. Mechanical de-scaling has been our forte since 1978, but to keep serving our clients the best way possible, we need to stay one step ahead, so Rustibus’s research and development is continual.

To improve a system that is already good as it is, is not easy – especially when new challenges arise almost constantly. To be proactive without acting on whims, Rustibus takes client feedback, mixes it with the work of the R&D department, and generates many new ideas. Not all solutions can become reality overnight, but Rustibus knows that its product range needs to reflect what the customer needs, so we have created an even more versatile machine for our range – the Rustibus 1600.

This machine enhances our product range by adding a more compact and powerful machine with increased effectiveness and improved accessibility. It is a result of combining the known best qualities from our other machines with the constructive comments and personal experiences of the crew members that are using them.

The Rustibus 2000 (R2000) is our flagship model and the most powerful unit with the greatest capacity and durability. For large areas the R2000 will remain king, but because in the unit the drum sits in the middle and the wheels stick out to either side, it could never get as close to a vertical surface as desired. In addition, changing the disposable chain drum set on the R2000 still requires removing the cover, belts, pulleys and bearings.

To make that job an easier experience, the new Rustibus 1600 has an arrangement similar to that on the R1200 and R400. The Rustibus 1200, our current best seller, has its pros and cons.

For example, with the motor on the side it is quite wide, making it a little trickier to maneuver in tight corridors.



**LEFT:** Removing rust and old coatings from a cargo hold where the ability to operate close to the vertical edges is important

**BELOW LEFT:** The new Rustibus 1600 will be able to be used close to walls and vertical surfaces, as can the more powerful R2000 (shown). Both have easy to change chain-set drums



The motor of the R1600 is on top of the machine and its axle is free to rotate, which makes the machine as narrow as possible, enables better maneuvering, and provides increased user friendliness when changing the drum. Thanks to its narrow profile and the new slim-line handle, which is specially designed not to project outside the total width of the machine (measured across the front), the R1600 can now get as close to walls as possible.

The Rustibus 1600 will also feature our newest disposable chain drum configuration with a special drive system that rotates the drum in the housing. The new chain drum will still deliver the same results as only genuine Rustibus equipment can, and still consists of three cassettes – but in a machine that now has a new form, drive system and drum design.

This newest model is only 25% less powerful than the R2000, but nearly double the power of the R1200. As the R1600 is positioned between these two current models, it will offer a better alternative to someone looking for something more than the R1200 but not as powerful as the R2000.

Our product range and the very straight forward information we provide will enable the consumer to make a well calculated choice when buying a machine. Rustibus continues to consult with customers, listen to their needs and give them the information and advice needed to choose the correct model for the job. \\

## Free reader inquiry service

Rustibus

To learn more about this advertiser, visit [www.ukimediaevents.com/info/mmm](http://www.ukimediaevents.com/info/mmm) NOW!  
Reader inquiry no. 102



# Networking skills

**Harnessing IBM Maximo and SRO's infrastructure to extend your network to the edge of your operations can pay dividends in terms of reduced maintenance costs**

**Steve Driver, SRO Solutions**

Running expensive floating and marine assets effectively demands real-time operational data, and this is difficult when at sea or in remote locations with intermittent or low-bandwidth data connectivity. Asset management, be it for entire assets or individual components, has come a long way from when it was commonplace to strip down, say, a pump, simply to check it was okay. We've now moved on and exist in an age where engineers at sea, superintendents onshore and data analysts demand much more instructive visibility of their assets' health. Organizations expect their asset infrastructures' operational data and availability to be timely, entirely visible and manageable through a fully connected web of data.

Forward-thinking maritime organizations need that level of connectedness across their entire fleet. Data – and the way this information is delivered – is vital to running an efficient, economical and safe fleet of assets. It's here that SRO Solutions is leading the way in regard to asset management and data replication.

## The nuts and bolts

Asset management systems refer to solutions that monitor and feedback on the integrity of assets in the field and the maintenance being carried out – be those on a ship, an oil rig or any other location across an organization. These systems have evolved as technology has allowed them to process more granular information from a wider variety of datapoints, but they are still limited in one regard: how this data can be shared across the network to provide true, tangible value.

Networks – fixed or wireless – were not built with connectivity at sea in mind. Although great strides have been made in terms of allowing distributed enterprises to communicate, issues consistently arise regarding latency, network availability, service level and access to data across the enterprise. This is where data replication comes to the fore.

Database replication is the frequent electronic synchronization of data from one database to another, allowing all users access to the same level of information. The result is that users can access data relevant to their tasks without interfering with the

work of others – regardless of where they are within the network. It is in this area that SRO's Data Replicator (SDR), based on its patented DataXtendRE (DXRE) technology, works alongside IBM's asset management system Maximo to provide connectivity to distributed assets.

## Working in harmony

By combining industry-leading asset management systems with data replication, geographically diverse companies can strive for a real-time, accurate and granular overview of their assets – regardless of the type or location of their vessel, rig, office, store or project. Many applications on board vessels are designed with the sole purpose of presenting data to the crew and local network users to aid the running of the vessel. However, by getting these systems to swiftly share data with other key personnel ashore enables organizations to move from planned maintenance to predictive and proactive maintenance – a far more economical model. It's getting the correct system and data synchronization in place that is the difficult aspect.

and gas, utilities, power generators and manufacturing sectors.

Every sector will always have its own specific requirements and, of course, SRO's solutions are still class-approved, but are built to serve and learn from a variety of sectors, giving them unprecedented flexibility and applicability.

#### Stuck in the middle with you

Data is everywhere. Although many systems claim to synchronize, this is often inefficient and costly, leading to a lack of confidence with the data and a natural tendency for each remote location to operate autonomously. This problem is compounded as OEMs often embed technology in their equipment, generating more data, but often without anything being done with it. In 2015 the, McKinsey consultants reported as little as 1% of data from a typical offshore vessel with 30,000 sensors is actually used for decision making. Partly because the data is not used locally, but mainly it is not being shared with onshore analysts.

Combining an asset management system in IBM Maximo, with cross-industry best-practice, classification guidance and its most technically robust, session based, patented replication, SRO is changing asset management systems. Not only is asset data replicated confidently, but also there is better distribution of OEM information produced by machinery sensors and equipment.

#### Web-based and cloud-enabled

Traditionally, due to poor connectivity, web-based technology at sea has been ignored. Client-server applications became the norm, with every PC installed with required software and operated independently. IBM Maximo's web-based, cloud-enabled architecture requires a single installation per site and all interaction is via a web browser. This massively reduces the IT overhead and updating the software is much more efficient. Installation on a laptop for mobile maritime workers – superintendents, service engineers, etc. – is now possible. With SRO's cloud-based SDR across the entire network, individuals can use Maximo wherever they are and later when in a internet location they connect and replicate the data – an almost seamless process. For many, SDR is the hidden hero, ensuring all data sets are accurate in as close to real-time as possible with minimal data administration or user intervention.

SDR – and its underpinning DXRE technology – also means that data is being replicated and sent across Maximo systems autonomously, and over far lower satellite bandwidth than was previously possible with less sophisticated technology.

#### Moving forward

Monitoring assets in the maritime and shipping industries is as subject to Moore's law as any. Data is growing exponentially due to the Internet of Things – as devices are able to collect and transmit it. Estimates say 212 billion 'things' will be connected by 2020. For ships, this has a profound effect. Many vessels are now connected to networks of data – from engines, navigation systems, individual bearings, oil filters – all are either reported and sending data or being monitored.

As data volumes increase two issues arise. First, many remote networks are not capable of handling and transporting large data volumes without errors and faults. Second, a solution is needed that can condense data into an easily understood form to alert users to the most urgent points. Drowning in data is a very real issue.

The DXRE technology, underpinning IBM Maximo, allows asynchronous two-way transfers of data, delivering valuable information. In a traditional replication process, exchanging as few as 15 data sets can cause serious issues with throughput, integrity and collision management. But the DXRE technology seamlessly handles data collisions, works in the background and requires up to 70% less administration overhead, and is easily scaled to many data sets. SRO's largest client currently replicates 70 ships' data sets twice per day, every day. Couple this with the ability to set acceptable level parameters for different data sets, and users of Maximo can cut straight to the data they need across an impressively large and geographically remote fleet of assets.

#### Premium service – wherever you are

Wherever they are in the world, asset management and data replication combined have the power to overhaul how distributed assets are managed across a network.

SRO's seamless, accurate and robust data replication technology offers real-time data availability and an ability to operate fully featured asset management systems to give insight previously unattainable.

SDR's sophisticated data replication and its underpinning DXRE technology avoids these problems and delivers the ability to manage assets' health, irrespective of geographical remoteness or connectivity. SRO Solutions feels that it provides the calm operating environment needed for marine companies to thrive. \\

#### Free reader inquiry service

SRO Solutions

To learn more about this advertiser, visit [www.ukimediaevents.com/info/mmm](http://www.ukimediaevents.com/info/mmm) NOW!  
Reader inquiry no. 103

ABOVE: SRO Solutions provides asset management through robust connectivity and robust data replication no matter where in the world the asset is located

#### Specialization vs cross-fertilization

One of the first questions often asked in regard to asset management and data replication is how specialized the systems are for maritime businesses. And for a long time, the answer has always been that they were entirely specialized for the industry.

The maritime industry is steeped in traditional ways of working, so when computer systems arrived in the late 1980s, these adhered to the status quo. The systems were rigid and inflexible, drawing on the language and past-practice of maritime work. This was fine until any change, innovative idea, or new legislation arrived. Then the systems couldn't be adapted or customized, leading to a reduced quality of service and, in some cases, paper-based processes being reinstated in parallel.

However, from SRO's early days, it has had a different approach – which it maintains. Rather than build systems from purely a marine outlook, SRO looked into cross-fertilizing with the best practice from similar industries. By referring to IBM Maximo's wide spread of clients, SRO has learned processes and best practice from oil

# Harsh and hazardous environment NDT

The SpoolScanner and probe (left-most yellow object) mounted on the ROV being lowered into 0°C water to work at 100m depths

**Some oil and gas operations require customized solutions to carry out NDT – a field in which TSC Inspections specializes. In an exclusive interview, the company's Corinna Cuciureanu and Dave Parramore reveal the details**

**Mike Jones, Marine Maintenance Technology International**

## What is TSC Inspection's business specialty?

TSC Inspection's specialty is rooted in the fact that we are the owners and sole providers of alternating current field measurement (ACFM) technology and we offer the complete range of services to our clients. From our head office in Buckinghamshire, UK, TSC designs, develops and manufactures ACFM inspection technology and products and also provides inspection services, product sales and rentals, subsea engineered solutions and technical support. We also supply local inspection services and equipment rentals via our facilities in Aberdeen and Singapore.

## What kinds of industries are the customers of TSC Inspections?

Since the first trials of ACFM in the North Sea in the early 1990s, the technology has been adopted around the world and across various industry sectors as an alternative to conventional weld inspection methods.

Because of its oil and gas origins, these industries were quick to adopt ACFM across a range of inspection applications including topside weld inspection, subsea and splash zones, FPSO hulls, mooring chain inspection, drilling and downhole tools, and refineries. However, TSC now has customers in the defense, marine, nuclear, infrastructure and transport sectors.

## What is ACFM and what benefits can be gained from it compared with magnetic particle inspection (MPI) or eddy current?

The ACFM technique introduces an alternating current into the surface of the component to detect defects. The presence of a crack disturbs the electromagnetic field and the return signal is converted to data in real time, so the operator is instantly alerted to the presence of a defect.

The immediate defect sizing and the accuracy of ACFM as an inspection technique is one of the major advantages

over other NDT methods, including MPI and eddy current. ACFM inspection results deliver not only the measurement of the width of a surface breaking crack, but also its depth. As signal strength is proportional to defect depth, there is no chance of missing a major defect, while insignificant surface scratches can be ignored. The reliability of ACFM inspection data is well recognized and accepted by industry specifiers and classifications societies such as ABS, BV and Lloyd's Register.

Independent testing has shown that ACFM not only matches the performance of rival techniques for inspecting underwater structural welds, but also offers much lower instances of missed and spurious signals. ACFM uses a very simple scanning pattern and no interpretation is required from the operator deploying the probe, such as a diver or rope-access technician. The technique is widely recognized as having an excellent probability of detection when deployed by a diver, crawler or scanner, being well

suited to remote subsea deployment and the challenges involved in inspecting complex subsea structures and geometries.

ACFM has no direct electrical contact with the surface to be inspected, is insensitive to temperature and has a depth rating of up to 2,000m. This allows ACFM to be used in a wide range of environments and applications, adding to the flexibility of zones of deployment.

#### How is ACFM deployed? What sorts of vehicles or devices are possible?

ACFM can be deployed topside and subsea by one operator or diver, but due to the increasing challenges faced by our customers in the execution of their inspection/IRM programs, TSC's Engineered Solutions department is able to design and deliver remote ACFM solutions using scanners and crawlers, deployed by remote operated vehicles (ROVs).

#### How do TSC's new crack detection solutions – PACE and SENSU – fit into its NDT solutions?

As new industrial sectors have discovered the time and cost-saving benefits of using ACFM, the demand for a more flexible and lightweight instrument that can easily be used by a single operator has increased. TSC responded to this demand through user consultation and field testing, and in spring 2017 released the revolutionary portable ACFM instrument Pace, together with an ergonomically designed handheld probe range called Sensu. This product evolution introduces a new level of portability and performance to the ACFM product range, so the technology can now go anywhere and is ideal for rope-access operators and solo inspectors who need to rely on an accurate solution for weld inspections out in the field.

#### Over what kind of thickness range can ACFM be used?

ACFM is suitable for detecting and sizing surface breaking cracks in any thickness of material. The minimum detection threshold is set by the application but is typically 1mm deep for topside applications and 2mm deep for subsea applications. ACFM's signal strength maintains sensitivity when inspecting larger cracks, so the extent of crack progression through the material's wall thickness can be measured accurately.

#### Can ACFM work with coatings in place, for example?

Clients also benefit by not having to clean inspection zones to bare metal. Rust and any protective coatings can remain, saving time by removing the need for cleaning and preparation. ACFM also has a high



ABOVE: A TSC U31 ACFM and array probe in the snow offshore of Sakhalin Island

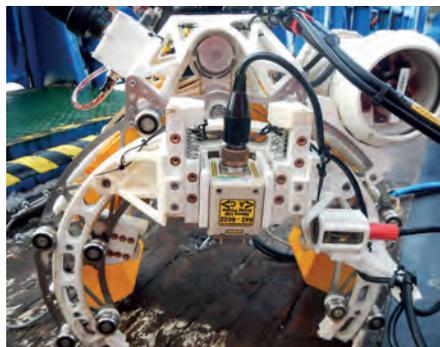
tolerance for lift-off, which allows for fluctuations in pass speed, marine growth and environmental changes.

#### How small a defect can be detected?

ACFM can detect and size surface breaking defects as small as 15mm long by 1mm deep in welded connections, even when inspected through coatings.

#### Can you describe an important case study application of TSC's technology and services?

At the height of the recent northern hemisphere winter, TSC's Engineered Solutions department were approached by a client with an urgent requirement for the ACFM inspection of selected subsea spools at a gas field in the North Pacific Ocean, working in a harsh climate at very low operating temperatures. Inspections depths would be 100m below the surface with air temperatures down to -11°C, plus wind chill,



ABOVE: SpoolScanner and probe designed for use with a specific ROV

while the average sea temperature hovered at around 0°C.

The target spools were of various sizes and the welds were protected with a 2.5mm thick polypropylene coating. Some sections also had at least 2.5mm of epoxy coating. In response TSC needed to design and build an ACFM scanning tool to meet the environment's conditions and to work with a specified 15kW ROV with a payload of 20kg.

#### What kind of engineering support did TSC provide?

To deliver a circumferential scan in two minutes, a bespoke lightweight scanner solution, with neutral buoyancy, was developed and built in house. The SpoolScanner was designed to deploy an ACFM Array Probe (Model 542) on a compliant mount, which has a scan width of 50mm. The U31R probe, which is designed to work at depths of 2,000m, and the scanner were carried and deployed by the ROV.

#### Were TSC experts sent to the location to operate the equipment?

As part of the solution TSC also sent two in-house ACFM operators to work with the local teams and ROV crew, on 12-hour ACFM inspection shifts.

#### Do some customers get training to do their own inspections?

Yes. When customers purchase ACFM equipment for the first time TSC can provide ACFM Level 1 and Level 2 operator training courses and examinations in house, to recommended practice SNT-TC-1A (2016). These are delivered over a four-day training program with written and practical examinations on day five. Personnel Certification in Non-Destructive Testing (PCN) and Certification Scheme for Welding and Inspection Personnel (CSWIP) courses are also available through other training providers. Customers are then qualified and able to conduct their ACFM own inspections.

With larger subsea or engineered solutions-driven ACFM inspection campaigns it is usually the case that TSC personnel will closely support the inspection campaign or work directly with the client's teams on-site. This enables a very fast turnaround and with the fully qualified Level 3 ACFM expertise supporting our clients, a competent and seamless campaign is ensured. TSC is able to customize the level of support to fit best with the client and the scope of the work. \\

#### Free reader inquiry service

TSC Inspections

To learn more about this advertiser, visit [www.ukimediaevents.com/info/mmm](http://www.ukimediaevents.com/info/mmm) NOW!

∴ VAPOR BLASTING

Fast and low-maintenance prep

# Surface preparation's future

**Existing wet blasting methods are very messy. A different approach – vapor blasting – is faster, friendlier for the environment and solves many problems in hull preparation**

**Stephan Rindfleisch, Graco BVBA**

**F**orty kilometers south of Canada's western maritime border with the USA, ferries pull into the Port of Bellingham, Washington, the southernmost terminus of the Alaska Marine Highway System. Jutting into the bay a stone's throw from the ferry terminal is the 250m pier of Fairhaven Shipyard.

Owned and operated by Puglia Engineering, Fairhaven Shipyard is a medium-sized facility consisting of a semi-submersible dry-dock barge, a dry dock, a marine railway and five cranes. Its main client is the US government. It does full blast and paint for vessels serving the Alaskan and Washington state ferry

systems, US Coast Guard, Navy and Army. A smaller portion of the business comes from commercial customers whose vessels need hull cleaning and repaint but can't afford a full blast.

Fairhaven does a tremendous amount of abrasive blasting – at least 90% of the ships serviced need surface preparation and paint. In the last 10 months alone 49 vessels were blasted.

Until 2012, when wet blasting, Fairhaven used slurry blasting for the ship hulls. This system uses water rings on sandblasting rigs, but the system was far from perfect.

"With slurry blasting you use a lot of water and produce a lot of grit," says Benny

Briones, paint lead for Puglia Engineering at Fairhaven. "You spend a lot of time washing, trying to get the surface clean. In the end, it's a big muddy mess.

"A big disadvantage with slurry blasting is that the blaster controls the water flow at the nozzle. When the mud starts flying everywhere, the blaster will dial the water down for better visibility, but that defeats the purpose because you won't get the dust suppression. Plus you have the weight of the hose at the nozzle, which contributes to operator fatigue.

"Because we're on the ocean, with slurry blasting you have to contain everything. We also have to catch all the water and treat it,



**FAR LEFT:** Vapor blasting with EcoQuip 2 equipment on a ferry hull

**CENTER:** Graco's EcoQuip 2 system for vapor blasting

**RIGHT:** Low-dust operation results in easy-to-see surfaces to speed up work

**BELOW LEFT:** Operators can handle the nozzle easily while having a clear field-of-view of the work surface

so slurry blasting is not only messy but also creates a lot of work," says Briones.

According to purchasing manager Joel Underwood, all the labor involved in containing and cleaning up the site was costing Puglia's customers a lot of money. "We were trying to find something that would bring more customers into the yard and make it more efficient so that they could afford a full blast."

Searching for solutions on the internet, Puglia stumbled onto wet abrasive blasting technology and decided to rent a system. They could see the potential for the operations, but they were not yet convinced. "The unit we rented had some problems,"

says Briones. "There was not enough pressure. It was a single-tank unit with a small hopper, with a tank that was only rated for 5.5-6 bar, and it could only run 30m of hose. It just wasn't built heavily enough for the job."

The search continued until they found the website for Graco's EcoQuip product line. "There we saw guys using it on the street, with no containment, with cars driving by. We are very carefully overseen here – it's not uncommon to have the US Occupational Safety and Health Administration visit us – so to see that unit operating in the open on a street in California was amazing."

Underwood put in a call, asked a lot of questions and got a lot of answers. They agreed to take two high-capacity double-tank vapor abrasive blasting units, with the understanding that if the machines didn't live up to their billing, they would be returning them.

"Wade Hannon showed up at the yard with the machines and put the units together. He instructed us on how to dial in the sand and water, and adjust the pressure. Right

then we fired it up under a 90m barge and tested it," says Joel. "It did the job with less abrasive, less dust, less water and without creating a huge, swampy, gritty mud puddle."

They were sold. "With the EcoQuip vapor abrasive blaster, the water is controlled at the unit," says Briones. "It's easier to monitor the water and the mixture – everything is controlled by the pot tender."

"With slurry blasting, the operator needs full body armor. But with the vapor abrasive unit, you have one guy at the unit, with the operator spot-blasting on a man-lift with just a face shield and respirator and no containment. Or we might throw up a tarp to shield a welder. But in a normal blast environment you don't get near the boat."

"It's a completely revolutionary blast system," said Underwood. "We have cut our clean-up cost and time by 25-30% and we can have welders and other crafts working next to the vapor blasters in a completely safe environment."

Is Fairhaven getting a good return on their investment?

"Yes," says Underwood. "Definitely." \\

**Free reader inquiry service**

Graco

To learn more about this advertiser, visit [www.ukimediaevents.com/info/mmm](http://www.ukimediaevents.com/info/mmm) NOW! Reader inquiry no. 105

# Improved wet blasting

An amine-based water treatment during wet abrasive blasting and high-pressure water blasting is a solution to the problem of flash rusting

For maintenance crews on offshore drilling rigs, corrosion represents a persistent and costly problem. Protective coating systems have long been the primary means of defending against corrosion for steel structures in offshore, saltwater environments. However, environmental conditions, including ultraviolet degradation and the corrosive effects of seawater, ultimately undermine their effectiveness, leading to premature coating failure and corrosion. Often these coating systems need to be repaired or completely redone within two years – and that is if everything goes according to plan during the initial application.

## Dry abrasive blast limits

The standard method of preparing a steel surface for a new coating has been dry abrasive blasting. However, this method is fraught with issues both onshore and off. Steel stripped by dry abrasive blasting should be coated immediately before flash rust develops. Any potential interruption to the coating process, including unexpected climate or worksite developments, can completely sideline a project, causing newly blasted surfaces to corrode prematurely. This forces crews to waste valuable time reblasting and recoating the next day. The abrasive itself also presents a costly headache when handling, transporting, recovering and disposing of the medium is factored in.

In addition to the risks, dry abrasive blasting is inefficient, leaving behind an invisible layer of corrosion by-products, including harmful salts. These by-products undermine new coatings and serve as a starting point for premature corrosion and coating failure.

## A solution discovered

One of the largest names in offshore drilling felt it was extremely important to develop a viable alternative to conventional surface preparation options that would keep surface salt/ion contamination levels below the company's standard. It has been known for years that truly clean surfaces are the only way to protect surfaces from corrosion prior to coating.



Holdtight 102 used with ultra-high-pressure blasting keeps offshore rig surfaces free of flash rust for 73 hours

Wet abrasive blasting has always effectively removed damaged coatings and washed off residual salts and fractured abrasive blast media prior to painting, but inevitably leads to flash rust. However, HoldTight 102, a volatile, amine-based surfactant, gave the company's research team a viable solution. Water treated with the product is 'wetter', allowing it to clean the surface and remove ionic contamination with greater efficiency. Since it targets all surface contaminants, it can prevent flash rust on steel for 48 to 72 hours or longer.

The company found that HoldTight 102 in conjunction with ultra-high-pressure blasting kept its offshore surfaces free of flash rust for 73 hours and reduced surface contamination well below the company's maximum allowable level and much better than contamination levels after dry abrasive blasting. Even after being recontaminated with synthetic seawater, the surface blasted

with the water/HoldTight combination remained suitable for coating for 49 hours in ambient conditions of 50-85% humidity.

## Cleaner prepared surfaces

With more wet blasting crews swearing by the product, the industry is recognizing the importance of truly clean surfaces. Tight space requirements on offshore rigs and a need for efficient procedures mean it's the ideal choice for both wet abrasive blasting and high-pressure water-only coating removal. Whether measuring ion-specific contamination, total contamination or conductivity, HoldTight 102 will achieve the desired result. \\

## Free reader inquiry service

HoldTight Solutions

To learn more about this advertiser, visit [www.ukimediaevents.com/info/mmm](http://www.ukimediaevents.com/info/mmm) NOW! Reader inquiry no. 106

# Reliable onboard condition monitoring

**Martin Briddon, MBE, is business development manager of James Fisher Mimic, a specialist in reliability engineering and condition monitoring. He talks to MMTI about use of the company's software in the marine industry**

**Michael Jones, Marine Maintenance Technology International**

## How did Mimic start?

Mimic is a condition monitoring software system, originally developed from a PhD thesis at Manchester University in 1990. Encouraged by the UK Ministry of Defence, the developer left the university in 1990 and set up Wolfson Maintenance Engineering, which sold the Mimic condition monitoring systems to the Royal Navy. In 2003, Wolfson Maintenance Engineering's defense contracts were sold to James Fisher and Sons Plc and we became James Fisher Mimic.

## Who are some of your customers?

We provide Mimic condition monitoring solutions focused on the maritime sector with systems installed on both commercial and military vessels. The UK's Royal Navy and Royal Fleet Auxiliary continue to be primary customers with Mimic systems operating on all surface and subsurface platforms. Since 2005, we've built a commercial portfolio of companies and have a growing list of clients, including many cruise ship companies, tankers and bulk carriers.

## Please can you describe Mimic.

It is software system that contains tools and databases allowing ship operators to conduct maintenance on a condition-based approach, rather than in a traditional time-or-calendar-based way. Operators use Mimic to collect the data and information from equipment, and turns this into information enabling accurate decision making. This in turn allows the chief engineer to decide on what actions to take and when to maintain the machine. Condition-based maintenance is a recognized strategy throughout the world – class approved – and it operates on many ships. CBM, delivered via Mimic, enables owners to maximize the life of assets while avoiding early failures, and so they're able to predict the continuing healthy condition of their machinery.



## Lots of companies collect vibration data. How is Mimic different?

Condition monitoring – some tend to think of it as just vibration analysis – calls for the collection of data signatures from assets, and then requires analysis of that data and determines the status of the asset's condition. Mimic provides a support system to enable modern technology to be utilized to conduct those requirements. Unlike many similar systems, Mimic uses the capabilities of the database to promote performance monitoring. Even at a basic level – pressure, temperatures, speeds, loads – can add context to the vibration analysis data. But if these values are used in the correct way and at very little expense, vessel operators can start doing condition monitoring based on the performance of their assets without adding additional sensors.

And we're also using the performance data now to create power curves, such as for an engine, propeller, pumps and many other types of equipment. Mimic can be used to consider the efficiency of the asset as condition-based maintenance trigger by comparing performance values with manufacturers and/or baseline power curves. Mimic can use performance status along with vibration signature and fluid conditions to inform maintenance decisions and to aid defect root cause analysis; we feel that Mimic is unique in this regard.

## What kind of user interface does Mimic have and how does this help?

We have traffic-light systems on both the performance and the vibration analysis to provide a threshold value and to inform the crew of the current conditions. When green, continue to operate; if yellow or red shows, use Mimic as a first level of diagnosis system to determine the root cause of an impending defect.

## The lifeblood of machines is oil.

**How are the analysis reports integrated?**  
Another important part of condition monitoring is oil analysis, and these or any other fluid analysis tests conducted on board can also be integrated into Mimic. We work with oil laboratories to format the email so our system can automatically add the data.

## Can Mimic help with shoreside staff monitoring vessel operations?

All data captured on board can be replicated, via satellite links, to a shoreside system. Companies nowadays directly manage more of the ship than previously. \\

## Free reader inquiry service

James Fisher Mimic

To learn more about this advertiser, visit [www.ukimediaevents.com/info/mmm](http://www.ukimediaevents.com/info/mmm) NOW!  
Reader inquiry no. 107



## Onboard and onshore fleet asset management systems can support a ship's entire life

Caterina Cerrini and Barbara Terrosi, IB

The marine industry is where IB took its first steps to create software solutions for maintenance and purchasing processes. Since then, lots of market parameters have changed: rules and regulation have become stricter, safety and environmental impacts are now extremely relevant, and operator requirements have grown as a consequence.

IB provides a spectrum of software solutions aiming at supplying the client's organization with a complete offering in terms of product, highly specialized consultancy and implementation services. This is why a software producer now has to be a strategic partner working side by side with its clients, optimizing the operational, technical and decision-making processes and supporting them in their daily needs.

InfoSHIP is the software reference point in the marine market covering all technical fleet management needs and satisfying a wide range of privileged interlocutors such as technical and marine operators, energy managers, purchasing department, and risk and compliance managers. The solution works using a data transmission engine between ship and shore installations, ensuring data alignment and automatic synchronization. It covers all operational issues, from maintenance to purchasing and cost control. A set of dashboards are available for every specific analysis as well

as a classification of ship events and their workflow management.

Moreover, to respond to the challenges of the current marine market, in recent years the company has been developing the new generation of InfoSHIP, named InfoSHIP EVO, by adopting new designing tools and by rethinking the product from a functional perspective. The new web-based software will still provide the large and consolidated subset of traditional functions, with the addition of new models and functionalities. It will support the daily activities of the operators and at the same time improve operability and simplify data collection. It will facilitate the management of new processes while improving data analysis and statistics.

EVO can support companies in a real step-change in marine operations, bringing ship owners to a different level of control of their vessels, switching from traditional ship management to asset and fleet management. All this has been done while keeping in mind end users, who ask for simplicity, with clear and easy-to-use interfaces, and also by using mobile application devices and smart tags (barcodes, QR codes, RFIDs and beacons) designed for specific process flows.

Another IB solution able to assist board management in a strategic issue like the emissions decrease and the implementation of environmentally friendly best practices,

is InfoSHIP EGO (Energy Governance), powerful, reliable and accurate software for real-time energy performance monitoring. Fulvio Solari, Marine Division sales director at IB, says, "Many operators are investing in ship fuel efficiency through services and products, confirming that energy efficiency is a key differentiator. By collecting data every five minutes and by analyzing onboard KPI data, shipowners and managers can continually grow vessel and fleet intelligence to achieve fuel savings and remain competitive".

EGO, now on board on over 150 vessels, is an effective way to be compliant with SEEMP and upcoming monitoring, reporting and verification (MRV) regulation.

"Helping our clients build excellence in their operations and processes is one of our main goals," concludes Solari. "Our solutions are designed and distributed together with RINA Services, the Italian classification and certification society. We both have to continually improve our offerings to be able to supply technological and functional upgrades in asset management within an economical and sustainable scenario." \\

### Free reader inquiry service

IB

To learn more about this advertiser, visit [www.ukimediaevents.com/info/mmm](http://www.ukimediaevents.com/info/mmm) NOW!  
Reader inquiry no. 108

# Sound advice

**Valves play an important role in the industrial environment ashore, as well as on board ships and offshore installations. Assessing their condition and faults can be carried out effectively with ultrasound testing**

Walter Vervloesem, SDT International

**B**locked, leaking or cavitating shipboard valves not only cause serious system problems, but in many cases, shipboard valves that are blocked, passing or cavitating have a high accident, injury and claim potential and can be a vehicle for commercial and operational disasters.

Valves, whether pneumatic, hydraulic or manually controlled, allow regulation of flow and are of crucial importance on board a ship. Ultrasounds are there to help in detecting failures and problems in a quick and easy way.

Failures can range from being blocked or leaking to complicated situations related to flow regulation. If a valve is lost, you lose control over the system.

Unless considered critical, valves are often thought of as secondary systems and when an attitude of 'run to failure' prevails, maintenance is often limited to time-based replacement programs.

A benefit of having ultrasonic diagnostic equipment available on board a vessel is being able to easily conduct valve condition monitoring anytime.

## Why ultrasound?

Ultrasound is very good at detecting failures from impact, friction and turbulent flow, which makes it useful for valve condition monitoring. Small leaks, especially under pressure, will generate turbulent flow that can easily be picked up by ultrasound.

To detect ultrasound, operators need sensors to work in a 'contact' mode (for quickly listening to the sounds) or magnetic mode, when more accurate, repeatable readings are required.

When assessing valve condition measurements, it is important to remember that these should be taken in the same measurement location, with the same sensor, and that the piping systems are the same. Special care should be taken if a change of flow direction can take place in the system.

With advanced or sophisticated diagnostic modes, specialized software records and analyzes the signals. Thresholds and alarms can also be set up to ease the monitoring process.



LEFT: Conducting an ultrasonic condition test of a valve can be cost effective and easily performed when the testing equipment is kept on board ready to use

## Other failure modes

There are three key elements to the valve: the actuator, the gasket and the valve body. Apart from passing, valves may also suffer from other problems such as moving too slowly (plunger friction or stickiness), flutter and noisy valves, diaphragm leaks and gasket problems.

The actuator is usually pneumatically operated, and both internal leaks (on the diaphragm) and external air leaks can easily be found. The gasket can leak, there can be mechanical problems on the plunger such as friction or sticking, and there can be problems internally on the valve body itself. All these problems can generally be detected/checked by using ultrasound in the airborne or contact mode.

Cavitating valves make an enormous noise ultrasonically, similar to cavitation in a pump, which is very easy to spot. A flashing valve sound is similar to cavitation, but the hydrostatic pressure downstream will

not recover and disappears with distance, indicating serious damage.

## Case in point

On one FPSO, the chief engineer was facing problems with some of the vacuum valves and was on the point of ripping out an entire section at a cost of US\$125,000. A test with ultrasound found a passing vacuum valve within 30 minutes, which confirmed no need for lengthy overhauls and replacement. Correcting the passing valve solved the problem, which was the result of a poor overhaul some years before.

While valve inspections are generally difficult and time consuming, an ultrasound check takes only about a minute. \\

## Free reader inquiry service

SDT International

To learn more about this advertiser, visit [www.ukimediaevents.com/info/mmm](http://www.ukimediaevents.com/info/mmm) NOW!  
Reader inquiry no. 109

# LEARN MORE ABOUT OUR ADVERTISERS **NOW!**



**FREE SERVICE!**

Visit [www.ukimediaevents.com/info/mmm](http://www.ukimediaevents.com/info/mmm) to request exclusive and rapid information about the latest technologies and services featured in this issue

**MARINE MAINTENANCE**  
TECHNOLOGY INTERNATIONAL

[www.ukimediaevents.com/info/mmm](http://www.ukimediaevents.com/info/mmm)

# Versatile, no dust or spillage blasting

Controlling dust during a range of coating removal techniques requires a unique approach to difficult situations, as Henning Olsen, head of sales for Pinovo, explains

Please can you describe your system of dustless coating removal and its advantages.

The Pinovo system is a unique, ATEX-certified system for surface preparation with no spillages, dust or clean up, giving up to 80% cost reduction – and a permanent repair of the highest quality. It's used on a wide range of assets, including ships and oil platforms among others. It minimizes downtime and increases the longevity of a wide range of asset types.

It's recommended by the world's largest paint manufacturers, such as Jotun and International, because it creates an excellent surface for new coatings.

What are the benefits of the explosion-proof (ATEX) certification?

The system is certified to be used in Gas Zone 1 according to the ATEX directive (i.e. where an explosive gas mixture is likely to occur during normal operation), so you do not need a gas-free certificate. This means that maintenance can be performed at any time, even on board tankers.

How is the recycling of the blast media achieved?

Used blast media is returned to the vacuum blasting unit along with any rust and paint. There a cyclone separates reusable aluminum oxide grit from the waste and returns it to the grit container to be reused up to 20 times. This reduces grit consumption by up to 95%.

What about the clean-up afterward? Is it eliminated, or just simplified?

It's completely removed. There's no spillage into the surroundings. The Pinovo system can be used without any sheeting next to very sensitive and expensive equipment on ships, oil platforms and refineries, for example. It enables high-quality permanent repairs with low noise and no spill, which means corrosion removal can even be performed while in port.

RIGHT: The PiConnect can be fitted with various adaptors to fit the geometries needing blasting

INSET: The PiCoPipe adaptor encloses pipes for clean blasting



The PiHab enclosure can be set up over awkward areas

What surface preparation standards can be achieved when using the Pinovo system?

It provides SA 2.5, and even a perfect SA3 if required, with a roughness of 40-120µm. When doing spot repairs, you get feathered edges, meaning the new coatings will stick much better, providing a permanent high-quality repair.

Which of the pipe cleaning tools is most popular?

It's a draw between the PiCoPipe, a favorite among rope-access technicians, and

the PiHab, a mini-habitat that combines the efficiency of open blasting with the advantages of dustless blasting.

What about maneuverability in confined spaces?

We have recently launched a new vacuum blasting unit specifically for the shipping sector. The PiSys Flex is modular and fits through 60cm manholes, providing access to the whole ship.

What kinds of tasks on a ship would they be useful for?

The system can be used extensively because of a wide range of adaptors. PiHab allows dustless open blasting within a special bag and can be used next to sensitive equipment. The Norwegian Navy uses our systems, inside submarine engine rooms - a testament to reliability and quality. \\

#### Free reader inquiry service

Pinovo

To learn more about this advertiser, visit [www.ukimediaevents.com/info/mmm](http://www.ukimediaevents.com/info/mmm) NOW!  
Reader inquiry no. 110



**Without using water, a novel approach using abrasives embedded in urethane sponges has proven to be comparable in price and results to conventional methods with a considerable decrease in dust levels**

**H**igh-quality surface preparation is absolutely essential to ensure successful coating applications, and never more so than in marine situations that present particularly challenging conditions and where chloride removal can be a significant factor.

For many applications, conventional abrasive blasting produces the required results. It is a familiar technique using tried-and-tested equipment and materials. But it has undoubted drawbacks in some situations, which can reduce productivity, increase costs and adversely affect operations in the surrounding area. Most of these factors will be familiar to businesses in the maritime sector:

Operators have to wear full personal protection equipment (PPE) to avoid injury. This is uncomfortable and inconvenient, which tires them and reduces their productive work time.

Unless the area being worked on can be sealed off to contain the dust created, other work nearby has to stop and machinery also has to be switched off and protected.

This situation can last for some time until the dust has settled, at which point it will also be possible to inspect the surface, but not before. The need to control dust is even stronger if hazardous materials are involved.

Cleaning up and disposing of waste material are also important factors with associated costs. Conventional abrasive is heavy, so handling can be awkward and freight costs considerable.

#### **A new approach**

Hodge Clemco is one of Europe's leading manufacturers and suppliers of abrasive blasting equipment, materials and services. Founded in 1959, it is part of the 100-year-old Samuel Hodge Group, a diverse engineering group active for many decades in the marine industry. Recognizing the negative aspects of conventional blast cleaning in many situations, particularly the enclosed work spaces often found in ships, oil/gas platforms, power generation plant, etc, the company started an intensive two-year research and development program in 2011 that led to the introduction of EnviraSponge.

The aim of this effort was to develop a system that virtually eliminated dust without the use of water, was effective, could be recycled and, when all factors were taken into account, was comparable in price to alternative methods.

The key feature of EnviraSponge is the urethane sponge that encapsulates the abrasive and which flattens on impact with the target surface, absorbing the dust created by the internal abrasive on impact. The abrasive inherently limits rebound because it absorbs and transfers collision energy caused by the media's impact on the substrate. Also, the particles are less dense and have a greater surface area, so the ricochet is more controlled and less hazardous. This technology is particularly suitable for confined spaces that are awkward to work in and may also be difficult to supply with ventilation and/or extraction systems. In addition, for certain applications PPE requirements can be reduced compared with conventional shot-blasting work. Operators find the reduced PPE more comfortable and easier to work in, which



LEFT: EnviraSponge abrasive is available in a wide choice of grades to suit many different applications

ABOVE: Sponge blasting on a shipping container to demonstrate the low-dust produced

RIGHT: Media generators from EnviraSponge sized from 100 to 500 liters



in turn reduces operator fatigue and can increase productivity.

When EnviraSponge is used, the surface preparation work can very often be done without dust extraction systems and with reduced containment equipment such as sheeting, even if other work is ongoing and equipment is operating nearby. The lack of dust also means that the progress of the work can be seen clearly while it continues, without waiting for the atmosphere to clear, and staff can continuously keep the area clean while work continues. Disposal costs are also greatly reduced.

### Reusable media

In any surface preparation project, the ability to reuse blast media can considerably reduce total costs, when all factors are taken into consideration, including the abrasive itself and disposal operations. As part of its EnviraSponge technology, Hodge Clemco has developed a specialist mobile re-grader that separates good reusable media from dust, contaminants, oversize particles and other potentially harmful waste that might

### Internal tank blasting

A major Malaysian shipyard appointed to undertake the maintenance, repair and overhaul of internal tanks on an oil/gas carrier has successfully used EnviraSponge ESA30 for surface preparation to meet the strict specifications required by the ship's owners. The aluminum oxide abrasive achieved the minimum SA2.5 surface cleanliness and uniform profile of no less than 25µm on ballast tank weld seams and all construction joints.

The ESA30 media was chosen following a careful evaluation process instead of the previous method involving surface grinders, which created uneven surfaces and variable roughness, some of which fell below specification. The EnviraSponge procedure met the SA2.5 cleanliness specification and created a required uniform 60-75µm profile.

Despite the confined spaces the operators worked in and the limited effectiveness of conventional dust extraction systems, the dust-encapsulating performance of the media enabled the operators to work with good visibility and maintain high production rates. They also found it easy to feather in areas of existing coatings thanks to the good visibility and controllability of the equipment.

By using this system instead of slurry/wet blasting to reduce dust, they avoided the problems caused by run-off. The shipyard also found the low rebound energy of the material an advantage, as the reduced ricochet stopped adjacent coated surfaces being damaged and made the media easy to contain and collect. As a result of these factors and the fact that other trades could work simultaneously while the surface preparation work continued, the shipyard could considerably reduce the contract time.

Grades ESA60, ESA80 and ESA90 are recommended for removing light coatings from steel and aluminum substrates and for profiling previously painted surfaces. Average profile on steel is 30-60µm.

In addition to these standard grades, Hodge Clemco manufactures bespoke materials for special applications.

### Sponge blast equipment

As part of the EnviraSponge program, the company has developed three specialized media generators with hopper capacities from 100 to 500 liters, providing blast times from 10 to approximately 100 minutes depending on the application. Output pressure can be adjusted from 14psi to 115psi (1 to 8 bar). The machines are on wheels so they can be moved into position.

A specially designed vertical screw and agitation system optimizes the flow of media from the pressure vessel into the air blast stream to ensure consistent, reliable performance. The screw can reverse to easily clear a blockage. A compact control panel monitors essential functions and allows precise adjustment of blast and flow pressures. Specialized Power Plus nozzles increase production efficiency by up to 35% compared with standard versions. The machines are also fitted with heavy-duty wheels and specially designed handles to increase maneuverability. \\

### Free reader inquiry service

EnviraSponge

To learn more about this advertiser, visit [www.ukimediaevents.com/info/mmm](http://www.ukimediaevents.com/info/mmm) NOW! Reader inquiry no. 111

otherwise become airborne dust. This equipment, which is available in pneumatic or electric versions, allows the media to be reused between 6 and 10 times, providing considerable cost savings.

### Abrasive grades to match jobs

EnviraSponge abrasive is available in a wide choice of grades to suit many different applications. On steel and most other metallic substructures, the process removes rust, paint and mill scale to leave an SA2.5 or SA3 quality surface finish. Depending on the surface hardness, air blast pressure and grade selected, a surface roughness or profile up to 125µm can easily be achieved.

Grades ESA16 and ESA30 are both aluminum oxide grades typically producing average profiles on steel of 80-100µm (ESA16) and 60-80µm (ESA30).

Grade ESG17 has chilled iron abrasive for use on heavily pitted surfaces and for removing elastomeric or extremely thick coatings. Average profile achieved is 100-125µm, but this grade is not recommended for wet environments.

# ABCON stops your oil leak



Trouble with leak in  
- Stern tubes  
- Thrusters  
- Pitch propellers  
- Stabilisers

The best solution:  
ABCON Stop Leak  
additives stop the  
leaks within hours

Keeps the vessel  
sailing until planned  
dry docking

ABCON Stop Leak  
additives supplied to  
BBC-Burger since 2010

MARINE MAINTENANCE  
WORLD EXPO AND  
CONFERENCE 2017

We sell our products to the merchant fleet all over the world / Please visit [abcon.eu](http://abcon.eu)

FREE SERVICE!

## LEARN MORE ABOUT OUR ADVERTISERS **NOW!**

Visit [www.ukimediaevents.com/info/mmm](http://www.ukimediaevents.com/info/mmm) to request  
exclusive and rapid information about the latest technologies  
and services featured in this issue

**MARINE MAINTENANCE**  
TECHNOLOGY INTERNATIONAL

[www.ukimediaevents.com/info/mmm](http://www.ukimediaevents.com/info/mmm)



**Businesses and new concepts that will drive the shipping industry in the future are going to be on show at Nor-Shipping in Oslo, the sector's premier event**

To retain its importance in world trade, shipping must keep pace with developments in digitization and new innovations. Nor-Shipping 2017, which takes place from May 30 to June 2 at a series of venues across Oslo and Lillestrøm in Norway, is dedicated to showcasing businesses and concepts that will drive the shipping industry to a new age of sustainable success.

The main theme of this year's exhibition and activity program is 'Catalyst for Change'. Within that is a broad spectrum of initiatives, from forums and events linked to key maritime hot spots (Brazil, Africa and Asia), to the industry's first Global Young Owners Forum, a special focus on encouraging increased diversity in shipping, and crowdsourcing and awards activity where enhanced sustainability, innovation and

# Nor-Shipping: Leading from the front

energy efficiency are firmly in the spotlight. An entire hall will be dedicated to the concept of Disruptive Sustainability, which is also something delegates will not experience anywhere else within the shipping calendar.

What technologies can revolutionize shipping businesses, assets and the delivery of services? How can new thinking transform established models? Can we break free from business cycles?

These are important questions that Nor-Shipping's Hall A is focused exclusively on investigating. Using the platform of Disruptive Sustainability to interact with thought leaders from both within and outside the industry – they will bring ideas and technology, share learning, and enable new ways of working with new partners. Other halls will be dedicated to IT and navigation, safety and rescue, shipbuilding

and repair, maritime services and logistics, and propulsion and machinery, which means Nor-Shipping will have the complete exhibition for all future-focused shipping event for stakeholders.

Success in the shipping sector is about knowing the right people, understanding their needs, and providing the products and services to answer that demand. Nor-Shipping provides the platform for face-to-face interaction – for building relationships with key decision makers, whether that be at the exhibition stands or at the social venues provided. \\

## Free reader inquiry service

Nor-Shipping

To learn more about this advertiser, visit [www.ukimediaevents.com/info/mmm](http://www.ukimediaevents.com/info/mmm) NOW!  
Reader inquiry no. 112



Key facts from this issue

PAGE  
**4**

**200 million**

Estimated total operating hours for the 10,000+ MAN TCR turbochargers installed worldwide

**“Ensuring the availability and reliability of a large, globally operating fleet requires a wide service network” (Wärtsilä)**

PAGE  
**10**

**80%**

**Failures in which human intervention is a key factor**



Planning, operational tasks, and decision making will be carried out by involving more people and information

PAGE  
**26**



**1,700°C**

Heat protection for aircraft carrier decks provided by a new coating with a combination of aluminum and titanium

**Glow-in-the-dark coatings will provide floor lines to follow in the event of electric light failure**

PAGE  
**32**

**20-200kHz**

Frequency range used in acoustic testing (AE)



**“Other techniques wouldn’t particularly tell you if the cracks are growing, as AE would”**

PAGE  
**20**

**125µm**

Surface roughness/profile achievable with sponge blasting using the right air pressures and types of sponge abrasive



**“Vapor blasting is said by its proponents to be well suited to marine and offshore applications”**

INDEX TO ADVERTISERS

ABCON AS .....	86
Autonomous Ship Technology Symposium 2017 .....	62
Electric & Hybrid Marine World EXPO 2017 .....	58
Envirosponge .....	Inside Front Cover
Flyability SA .....	50
Graco BVBA .....	25
HASYTEC GmbH .....	3
HoldTight Solutions Inc .....	9

James Fisher Marine Services T/A	
James Fisher Mimic .....	9
LOG@SEA .....	31
Marine Maintenance Reader	
Inquiry Service .....	36, 82, 86
Marine Maintenance World Expo	
and Conference 2017 .....	15, 17, 18
Martechnic GmbH .....	70

MTU Friedrichshafen GmbH .....	47
Nor-Shipping .....	Inside Back Cover
PINOVO AS .....	70
Rustibus NV .....	31
SDT International sa-nv .....	36
SRO Solutions Ltd .....	39
The Future of Transportation World Conference 2017 .....	40
TSC Inspection Systems .....	Outside Back Cover

THE LEADING MARITIME EVENT WEEK

MEET THE WORLD AT NOR-SHIPPING



NATIONAL PAVILLIONS



**NOR** OSLO MAY 30-JUNE 2  
**SHIPPING 2017**

Main sponsor:



Leading sponsors:



Organizer:



Partner:





Revolutionary new portable ACFM® instrument

**NEW  
PRODUCT**

# PACE™

- Reliable, repeatable ACFM® crack detection.
- Accurate defect sizing, length and depth.
- Inspection through coatings.
- No cleaning required.
- Long life battery (8+hrs).
- No in-situ calibration.
- Integrated, portable, robust unit (IP65).
- Large, toughened, high contrast LCD screen.
- Built-in camera, for inspection site images.
- 4 secure corner harness points.
- Glove accessible features.
- Interface design enables single-handed operation during inspection.
- New ergonomic probe range **SENSU™**.
- Straight and Right-angled ceramic nose.
- Hot swappable probes.

**"Discover your PACE™"**  
email: [info@tscis.com](mailto:info@tscis.com)

## TSC deliver expertise in ACFM® NDT Technology & Inspection Services.



### Infrastructure

Through Coating NDT  
Bridges & Cranes  
Storage Spheres & Tanks  
Pipeline Damage Assessment



### Marine & Subsea

Weld Inspection: Diver & ROV Deployed  
Vessel, Hull & Mooring Chain Inspection  
UWILD Campaigns  
Subsea Inspections at 1000+m depth



### Offshore

Topside Weld Inspection  
Subsea & Splash Zones  
Drilling & Downhole Tools  
Caisson & Jacket Structures



### Recent ACFM Projects

Wind Turbine Tower Inspection  
Offshore & Subsea Inspection Services  
Complex Weld Geometries  
Bespoke Subsea Scanner & Probe Design



Milton Keynes +44 1908 317444  
Aberdeen +44 1224 725136  
Singapore +65 6543 9728

[www.tscis.com](http://www.tscis.com)

[info@tscis.com](mailto:info@tscis.com)