THE NAVAL ARCHITECT

A publication of The Royal Institution of Naval Architects | www.rina.org.uk/tna

SIMPLE
Low power consumption.
Minimum risk of mechanical failure.

SURE
Definitive way of treatment ;
Filtration + Chemical.
Efficient sterilization, regardless of water quality.

SAFE
No toxic gases are generated.
No need for concern about effect on coatings.

JFE Engineering Corporation
www.jfe-eng.co.jp/en/
2-1, Suehiro-cho, Tsurumi-ku, Yokohama, Kanagawa
2308611 Japan TEL +81(0)45 505 6538
prj-ballastnews@jfe-eng.co.jp

China / Cruise ship technology / BWTS / Finland / Propellers & thrusters / Accommodation & interiors /

February 2016

becker marine systems

environmentally friendly • becker products

Innovative engineering for environmentally friendly products.

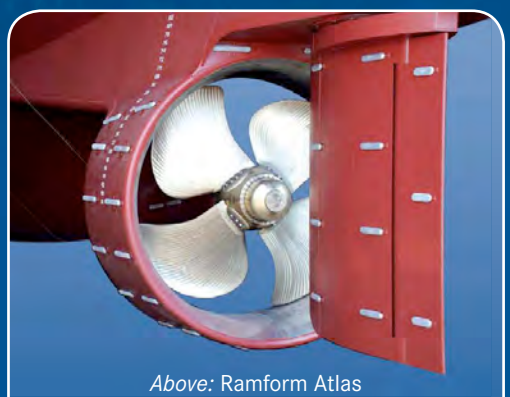
Becker Marine Systems faces its responsibility for sustainable and environmentally friendly development by continuously reducing the ecological footprint of Becker products.

To achieve this ambitious goal, Becker is pursuing a three-part approach – by avoiding hazardous and environmentally harmful materials, increasing efficiency and developing sustainable processes. This is done in cooperation with its sub-suppliers, which are verified by independent testing organisations.

© PGS

tough

Our proven rudder systems are the perfect choice for all types of ships. A tough working environment requires a sturdy, well-customised design combined with superb manoeuvring capabilities. Seasoned captains rely on Becker rudders for their reliability, safety and exceptional manoeuvrability.



Above: Ramform Atlas
3D Sea Bottom Exploration
24 streamer cables • built 2014
3 x Becker Flap Rudders with closed linkage

WWW.BECKER-MARINE-SYSTEMS.COM

SHIPPING 2016

Visit us at **CMA Shipping**, Hilton Hotel, Stamford, Connecticut, USA, booth #L4, 21st–23rd March 2016

Editor Nick Savvides
Editorial Assistant Robert Grisbrook
Design/Production Manager Sandy Defraine
Group Sales Director John Payten
Assistant Advertising Manager Valder Gates
Advertisement Production Manager Stephen Bell
Subscriptions & Publications Manager Jim-Ray Semanhyia
Publisher Mark J Staunton-Lambert

Published by:
The Royal Institution of Naval Architects
Editorial & Advertisement Office:
8-9 Northumberland Street
London, WC2N 5DA, UK
Telephone: +44 (0) 20 7235 4622
Telefax: +44 (0) 20 7245 6959
E-mail editorial editorial@rina.org.uk
E-mail advertising advertising@rina.org.uk
E-mail production production@rina.org.uk
E-mail subscriptions subscriptions@rina.org.uk

Printed in Wales by Stephens & George Magazines.

The Institution is not, as a body, responsible for opinions expressed in *The Naval Architect* unless it is expressly stated that these are the Council's views.

Registered charity No. 211161
© 2016 The Royal Institution of Naval Architects. This publication is copyright under the Berne Convention and the International Copyright Convention. All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted without the prior permission of the copyright owner. Permission is not, however, required to copy abstracts of papers or of articles on condition that a full reference to the source is shown. Multiple copying of the contents without permission is always illegal.

A 2016 subscription to *The Naval Architect* costs:

NAVAL ARCHITECT (10 issues per year)

12 months	**Print only†**	**Digital Only***	**Print + Digital**
UK	£182	£182	£232
Rest of Europe	£190	£182	£240
Rest of World	£204	£182	£254

†Incudes p+p
*Inclusive of VAT

The Naval Architect Group (English & Chinese Editions)
Average Net Circulation 15,812 (total)
1 January to 31 December 2014
ISSN 0306 0209

We take pride in the relations we build with our customers, and we take pride in the products we deliver. This gives us the confidence to state that we are always to be trusted.

www.jetsgroup.com

JETS™
Sanitary Systems - Made to Please

Jets Vacuum AS, Myravegen 1, N-6060 Hareid, Norway – Tel.: +47 70 03 91 00 – E-mail: post@jets.no

AVITALIS™ BWTS

The clean solution with PERACLEAN® Ocean

The ballast water treatment system with PERACLEAN® Ocean by Evonik. PERACLEAN® Ocean is the biocide for ballast water treatment developed and produced by Evonik. With decades of experience and production facilities on all continents, Evonik offers the necessary expertise in safety and security of supply.

Besides other reasons, the BWTS of Evonik is particularly suited for large bulkers and tankers because of its very low power demand.

Evonik has been granted Final Approval for its BWTS at MEPC 66 and is now conducting shipboard tests to apply for the German Type Approval in 2016.

Evonik Industries AG
Active Oxygens
Rodenbacher Chaussee 4
63457 Hanau
Germany
PHONE +49 6181 59-5326
FAX +49 6181 59-75326
peraclean-ocean@evonik.com
www.evonik.com/peraclean-ocean

Evonik. Power to create.

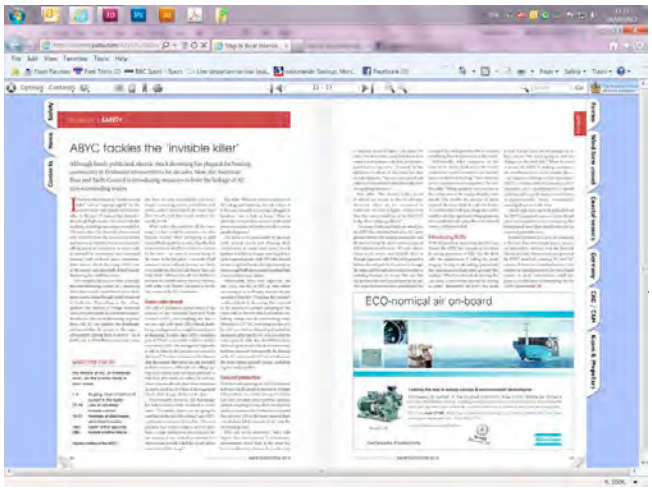
EVONIK INDUSTRIES

32-74 Features

Digital Editions

The Naval Architect is published in print and digital editions. The current and archived digital editions (from January 2004) may be read on PC, iPad or other touchpad.

Visit http: www//rina.org.uk/Naval-architect-digital.html to read the digital editions, or download the free RINA Publications App.



The 14th edition of

Asia Pacific MARITIME

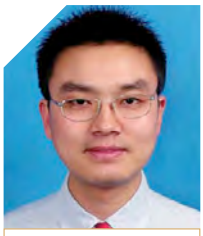
Shipbuilding & Marine • Workboat • Offshore

16 - 18 March 2016
Hall A, B, C, D, E & F
Marina Bay Sands, Singapore

Join us at Asia's premier marine, workboat & offshore exhibition and conference

- **13** editions of proven track record
- **6 exhibition halls** and **21,000sqm** of exhibition space
- **14,239** visitors from Asia
- **1,518** participating companies from 60 countries
- **18** official pavilions
- **High-powered** conferences and seminars
- **Free access** to APM 2016 exhibition

Featuring some of Asia's most influential thought leaders in the marine, workboat and offshore industry



Gan Shaowei
National LNG Project Leader, LNG leading Expert & Director Company, China Classification Society, China

Joachim Skorge
Regional Head & Managing Director, DNB Bank ASA, Singapore

Jason Waldie
Associate Director, Douglas Westwood, Singapore

Mike Meade
Chief Executive Officer and Founder, M3 Marine Group, Singapore

Khalid Hashim
Managing Director, Precious Shipping Public Company Limited, Thailand

Eddy Logam
Chief Executive Officer & Chairman, PT. Steadfast Marine and Indonesian Shipbuilding & Offshore Association (IPERINDO), Indonesia

APM 2016 conference† is FREE for all ship, boat & vessel owners, managers and buyers.

†Exclude conferences organised by:
Asia Insurance Review, Digital Ship, InterMET Asia and PetroEdge
Subject to accreditation

Register before 11 March 2016 and enjoy early bird rate at $300*.

**All rates are subject to 7% GST for all Singapore registered companies.*

Online Registration Now Open!
Register now!
www.apmaritime.com/registration

Contact us
T: +65 6780 4586
E: apm@reedexpo.com.sg
W: www.apmaritime.com

Organised by Reed Exhibitions®

Endorsed by aif Approved International Fair

Supported by MPA Singapore, Singapore Exhibition & Convention Bureau

Official Logistics Partner Agility Fairs & Events

Held in YourSingapore

China - quality assured

Joint venture companies in China have helped to improve the quality of ships, cranes and other engineered equipment produced there incorporating Western knowhow

Western companies have been entering into joint ventures for many years, looking to improve their prospects in, for example, China, by taking on local partners. Such joint ventures have been welcomed by China. But have they always been successful from the outset, and once the Chinese have acquired the technology and the expertise will they have use for their joint venture partners? Valid questions for any company considering or involved in joint ventures, particularly in the present economic climate.

For many multinational companies, manufacturing in China at first appeared to be a straight forward transfer of knowledge and equipment. They would simply move production to China and let Chinese workers build to international standards. However, some companies' experiences have shown this is not so straightforward.

Norway's TTS Group had acquired the well-known crane building brand NMF when its parent company, the German shipyard Seitas, went bankrupt in 2012. Building cranes in Germany, however, added significant costs to the process when the cranes needed to be transported to Asia to be fitted to ships. The costs for manufacturing cranes in Germany and then moving them to China are estimated to be around €150,000 (US$164,000) for each unit.

It therefore made economic sense to move crane production closer to the region where the host ships were being built, substantially cutting costs for TTS Group and its customers.

NMF, in its pre-TTS days, had experienced a painful lesson in technology transfer. In describing its first attempt to build a heavy lift crane in China, TTS NMF general manager of operations, Andreas Harms said Chinese workers were unable to produce the cranes to the quality required.

"Parts were missing, the cranes did not work, and as a result the unfinished units had to be shipped to Hamburg where German workers completed the cranes before transporting them back to China to be fitted to the newbuild ships.

"It caused us a loss of reputation and the financial costs were in excess of €500,000 (US$547,000)," he added.

Today, TTS NMF is producing high quality cranes in a number of locations in China and one of the tools that they have adopted to help in the improvement of the quality of the manufacture is the China Sourcing Tool (CST). Harms wrote the software, logging every piece of each crane and all the processes required to complete the heavy lift unit. Each part was photographed and a technician needed to complete each task was suggested.

The CST is an ingenious tool for transferring knowledge and training staff. It is provided to TTS NMF staff in three languages, German, English and Chinese, and is, no doubt, a symbol of TTS Group's successful operations in what has proved a very difficult market for many Western companies, particularly at this time when the crash in oil prices followed the global slowdown, which itself was preceded by the banking crisis in 2008.

TTS NMF believes CST has given the company a competitive advantage, crucial in the difficult market. But even with this outstanding success the burning questions being asked in private by some executives is what happens to these joint venture companies in the future?

Chinese companies and workers are learning fast and the quality of working is improving as a result. The process that the Chinese are going through at the moment is similar to the South Korean experience some 20 years ago. However, when the global economic outlook improves substantially, as it will inevitably at some point, China will be well placed to take advantage of the upswing. With trained staff, state-of-the-art machinery, improving wages, better conditions for workers leading to improved quality and competitiveness, China may well consider that it has no further use for joint ventures.

If that is the case, where does it leave the joint venture companies that have become an integral part of China's development over the last 20 or so years? If China decides that it does not need joint venture partners to provide the knowledge and expertise which it now has, what will be the future for European equipment suppliers?

These questions come under the guise of what former US secretary of state for defense Donald Rumsfeld might call known unknowns. And until it happens they will remain unknown. *NA*

Naval architects

SDARI set to expand

Shanghai Merchant Ship Design & Research Institute (SDARI) has paid RMB160 million (US$24.33 million) for a 10,000m^2 building next door to its Shanghai headquarters.

The unfinished building was sold at a court auction and will be re-modelled by SDARI to develop a research centre for the group with a further RMB80-100 million (US$12.16-15.02 million) investment from the company.

SDARI president Hu Jin-Tao at the company's Shanghai offices explains that the naval architect firm is keen to expand, both its operations in China and through acquisition in Europe

The new building is a significant increase in size for SDARI with its headquarters employing 600 staff in a 6,660m^2 space. The company is looking to expand its military design operations and its cruise vessel design options while also trying to get a better foothold in the container shipping sector.

Hu Jin-Tao, SDARI president said: "We have ambitions to grow, we are expanding into military work and we plan to integrate marine systems and our equipment research and test workshop."

SDARI is also in discussions to acquire a European naval architecture business following the failure of its bid to buy Deltamarin when AVIC International acquired 79.57% of the Finnish designer's shares in early 2013.

Regulation

BWMC trigger poised

Following the ratification of the IMO's Ballast Water Management (BWM) Convention by Ghana, Morocco and Indonesia in November 2015 the recalculation by the IMO of the tonnage qualification shows that the convention will not be enforced this year.

According to IMO rules, more than 30 countries that have 35% of the world's tonnage under their flag must ratify the BWMC for the convention to come into force one year later.

Calculations show that the ratifications fail to take the percentage of tonnage over the 35% mark, bringing the tonnage level to 34.56%, just 0.44% below the threshold.

The IMO released a statement confirming the position last month: "Following the spate of ratifications in November 2015 of the Ballast Water Management (BWM) Convention, IMO and partner IHS Maritime & Trade have been engaged in a process to verify tonnage figures to ascertain whether or not the convention's final entry-into-force requirement has been met.

Although that process is not yet complete, and will continue for up to three more weeks, IMO is in a position to confirm that the November ratifications did not trigger the convention's entry into force.

IMO figures show that 47 countries have now ratified the BWMC, which is significantly more than the 30 states required, and new IMO Secretary-General Kitack Lim said: "The recent ratifications have brought the BWM Convention so very close to entry into force. While we cannot predict exactly when that will happen, I would urge countries that have not done so to ratify the BWM Convention as soon as possible so that we can establish a certain date for entry into force, and also so that it is widely accepted when it does. In particular, those countries with large merchant fleets that have not done so, are requested to accelerate their processes to ratify the Convention."

LNG Power

Shell barges fitted with LNG systems

Plouvier Transport of Belgium has ordered 15 110m barges from Poland's VEKA Shipyard CENTROMOST where the hulls will be constructed; the outfitting of the vessels will take place at Veka's Werkendam yard.

The barges will be delivered in late 2016 through to 2018 and will be chartered by Shell Trading, Rotterdam. They will operate on LNG using Wärtsilä's LNGPac fuel gas handling system following a contract signed in December.

Wärtsilä said that its: "strong focus on promoting environmentally sustainable solutions for inland waterway vessels, together with its extensive experience in developing capabilities for the use of LNG fuel, was considered a key factor in the award of this contract. In optimising the efficiency parameters for these 15 vessels, Wärtsilä was able to draw on its experience from the two latest dual-fuel powered inland waterway vessels with Wärtsilä DF engines.

As maritime needs grow, ClassNK has solutions.

As the world's economy grows and changes, the maritime industry is faced with ever greater challenges. With roughly 20% of the world's merchant fleet under class, we understand the requirements for the future of safe shipping, and we're working to develop new tools and technologies to meet the changing needs of the maritime industry. Learn more about our efforts to advance maritime safety and protect the marine environment at www.classnk.com

Global Authority in Maritime Standards

ClassNK

www.classnk.com

Shell's latest inland barges will set the benchmark for clean inland shipping according to Shell

The company also recently introduced a combined engine and thruster package that is ideal for the specific demands of river and inland waterway operation."

The barges will operate in the Amsterdam, Rotterdam, Antwerp and Rhinetrack (Germany/Switzerland) regions and the barges have a tank capacity of up to 3,785m^3 in 10 tanks and are designed to transport refined petroleum products, said Shell.

Dr Grahaeme Henderson, vice president of Shell Shipping & Maritime said: "These innovative new vessels will enable a step-change in the safety and environmental performance of our barge fleet. Chartering these cutting-edge vessels from owners who share our vision helps drive innovation in the barge sector, and we are proud to be leading in the development of LNG as a cleaner fuel for shipping."

Cruise

Carnival orders four ships

US cruise operator Carnival Corporation and Italian shipyard Fincantieri signed a memorandum of agreement last month to build four new cruise ships at the Italian yards of Monfalcone and Marghera with deliveries of the ships expected in 2019 and 2020.

Two ships will be built for the Costa Asia brand, one for P&O Cruises Australia and one for Princess Cruises with the contract worth €2.5 billion (US$2.71 billion).

In a joint statement the companies said: "Each unit will be designed and developed specifically for the brand and for its reference guests. The 135,500tonne Costa Asia and P&O Cruises ships will carry 4,200 passengers. Princess Cruises' new 143,700tonne ship will carry 3,560 passengers and will be its fourth "Royal Princess" class vessel, after *Royal, Regal* and *Majestic*, currently under construction in Fincantieri's shipyards and scheduled for delivery in 2017."

Giuseppe Bono, Fincantieri CEO, said: "The signing of this agreement happens during a real and beyond all expectations boom of the cruise sector. This announcement confirms, once again, the effectiveness of our strategy: with these projects, based on those of the prototype units acquired in extremely challenging conditions, we ensure our group not only continuity and development, but also a new-found profitability in this segment."

This latest deal follows a memorandum of agreement signed by the two companies in March last year for five cruise ships, to be built over the period 2019-2022.

Fincantieri has built 59 ships for the US cruise operator since 1990 with a further 10 ships on the yard's orderbooks. Carnival Corporation has ordered ships valued at more than US$25 billion, making it one of Italy's largest foreign investors.

Markets

Volatile market continues in New Year

Accountancy firm Moore Stephens believes that both the bulk carrier and container shipping sectors will need to reduce the number of newbuildings that they order and scrap a significant number of ships in order to rebalance the market sectors.

Richard Greiner a partner at Moore Stephens shipping said: "The Baltic Dry Index, a measure of shipping rates for everything from pins to elephants, dropped to an all-time low in December last year, and has fallen still further this month. Most people blamed this on China for not consuming as much of anything as it did previously. Nevertheless, the dry bulk sector will probably have to reduce the newbuilding orderbook and increase ship recycling in 2016 in order to restore the balance."

Greiner said that CMA CGM's bid to buy NOL, currently awaiting regulatory approval, "is an indication of further consolidation and it would be no surprise to see more still in 2016."

However, the outlook for the tanker market is brighter with the low price of oil meaning that the tanker market "enjoyed a stronger year in 2015". That same low oil price has posed problems for the offshore sector and with the oil price expected to remain low in the short to mid-term the outlook is not expected to change this year.

"Shipping will remain volatile and uncertain throughout 2016. Operating costs will go up, as will the cost of regulation - for example, implementation of the Ballast Water Management Convention. The threat from cyber security will rise. Interest in refinancing, as a means of getting cash out of the business, is likely to increase, as are calls for accelerated ship recycling and a cap on newbuildings. The effect of geopolitical developments should not be under-estimated, while speculation about the UK's planned Brexit referendum in 2017 will add spice to the pot," said Greiner. *NA*

Green MAN B&W G-Engine

New ultra-long-stroke optimises the efficiency

MAN B&W G-Engines G95ME G80ME G70ME G60ME G50ME G45ME G40ME

The world's most versatile engine programme has been further extended with the new ultra-long-stroke MAN B&W G-type. Longer stroke and lower engine speed increase the engine efficiency – and provide the option of selecting a larger and more efficient propeller for tomorrow's energy-optimised aft ship designs. Fuel consumption and CO_2 emissions are reduced by up to 7%. Take a green step into the future!
Find out more at www.mandieselturbo.com

Engineering the Future – since 1758.

MAN Diesel & Turbo

BWMC, the fight goes on

Shipping's ballast water management saga looks set to continue as in spite of the fact that 47 countries have now ratified the convention it still lacks the 35% of world tonnage to enter into force, even with recent ratifications, *writes Sandra Speares*.

The problem is that countries with the largest registered tonnage, like Panama, remain concerned about how the convention will work in practice, not least because of the requirements needed to take ships into US waters.

IMO Secretary-General Kitack Lim said recent ratifications have brought the convention close to entry into force and he urged those countries that have not ratified the convention to do so as soon as possible so that a date for entry into force can be set for certain.

However, there have been suggestions that the cart is being put before the horse, as amendments to the convention are already on the agenda for the next meeting of the Marine Environment Protection Committee in April.

Shipowners have raised concerns not only about the type approval process for ballast water treatment equipment, which might leave early implementers of the new rules in an ambiguous position, but also the position regarding requirements for ships entering US waters is under scrutiny.

The International Chamber of Shipping (ICS) raised industry concerns on the issue in November when the convention looked set to be ratified, saying it believed it was "now incumbent upon IMO to finalise the revision of the G8 Type Approval Guidelines as soon as possible, in order to ensure that shipowners can have absolute confidence that the expensive equipment they will soon have to install will be effective in treating ballast water conditions normally encountered during worldwide operations and be regarded as fully compliant during Port State Control inspections."

It raised concerns about the "extreme difficulties" in the US where a more stringent approval regime is in place. Because of the delay in obtaining approval for systems, ships that need to comply with the US rules have either been given extensions to the dates for fitting treatment systems or been allowed to fit an Alternate Management System (AMS). This can be applied for a five year period after which a US Coast Guard approved system will need to be installed.

There is no guarantee that an AMS will be subsequently granted full approval, and shipowners who may have installed an AMS in good faith, at a cost variously estimated at between US$1-5 million per ship, might then have to replace the system completely after only five years. This is a particular concern for operators that have installed ultra-violet (UV) systems, said the ICS.

Suppliers of ballast water treatment systems have in many cases received IMO approval for their products and some of these are also on the AMS list, but issues still need to be thrashed out. For example, in a statement in December the USCG declined the use of the Most Probable Number (MPN) method for evaluating the biological efficacy of UV-based treatment technologies for ballast water. As a consequence, classification society DNV GL said it foresaw a delay to USCG first type approval of any BWM system.

> "The MPN method's use is ubiquitous, including the protection of human health in drinking water applications, and is supported by the world's foremost scientific experts"

Ballast water treatment technology provider Trojan Marinex said it had requested the approval of the MPN method – a method used in determining the biological efficacy of a UV-based ballast water management system. In the announcement, it was stated that the MPN method is not equivalent to the Environmental Technology Verification (ETV) Protocol vital stain method.

"We strongly believe that this preliminary decision by the USCG should be reversed. Our application for the approval of the MPN method presents solid scientific facts that prove the method is consistent with US Law, accurate, and just as protective of the environment, if not even more so, than the vital stain method. The MPN method's use is ubiquitous, including the protection of human health in drinking water applications, and is supported by the world's foremost scientific experts.

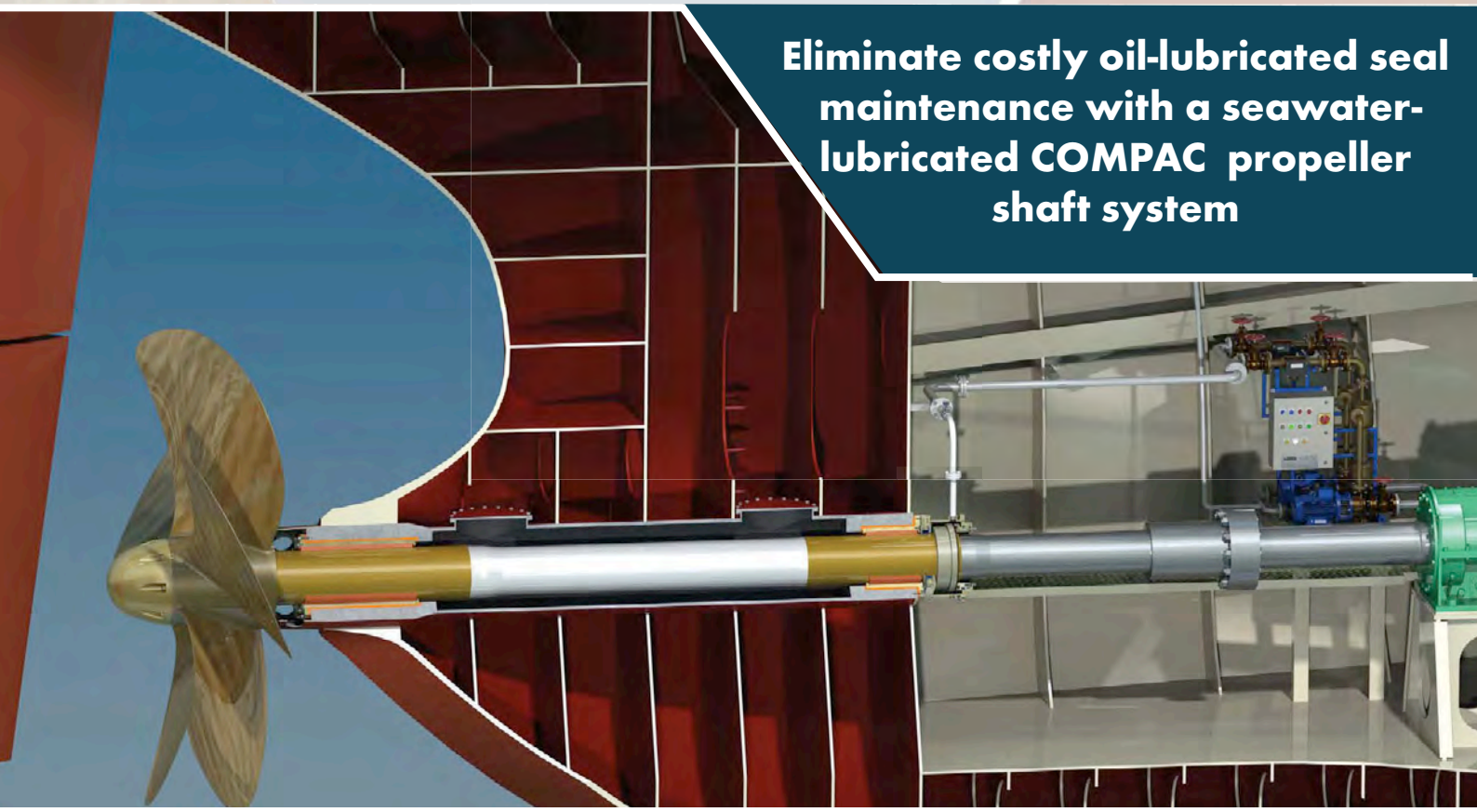
"We are proceeding with an appeal, and considering all other options. We remain focused on our pursuit of USCG Type Approval, and providing customers with robust ballast water treatment systems."

While ratification of the convention appears to be imminent, the type approval saga seems set to continue, both within and outside the IMO. *NA*

GET A TIGHTER GRIP ON MAINTENANCE COSTS

COMPAC FOR LIFE

- Reduce operational costs
- Eliminate aft seal problems
- Eliminate emergency docking
- Fewer components
- Zero environmental impact
- Polar Code compliant
- Meets US VGP requirements
- Over 2000 ship references



Eliminate costly oil-lubricated seal maintenance with a seawater-lubricated COMPAC propeller shaft system

THORDON

THORDON BEARINGS INC.

To contact your local distributor, please visit www.thordonbearings.com

Bridge & communications

e(asy)-navigation

Norwegian ferry, *MS Stavangerfjord*, will be the first vessel to undergo a full-scale trial of e-navigation in Norwegian waters in conjunction with NAVTOR, a provider of e-navigation technology and services.

The Norwegian Coastal Administration (NCA) initiated the trial to test the feasibility of digitally sharing routing information between the ferry and the NCA with the goal of improving the process of data sharing.

"For the vessel it offers increased efficiency and a real simplicity of service, while the NCA gets the information it needs to effectively monitor and control traffic," says Bjørn Åge Hjøllo, project development manager at NAVTOR.

Until recently, ships used maritime VHF radios to verbally communicate routing information before arrivals and departures with the relevant authority, which would then, in turn, update vessel navigators on traffic and factors affecting their speed to port.

NavStation, the "world's first 'digital chart table'", uses software that collects all relevant navigational information within a single interface, and allows for the accurate and instantaneous transfer of data between the ship's digital chart and a shipping control centre's identical digital chart.

"Through the use of NavStation, both *Stavangerfjord* and the NCA's shipping centre in Kvitsøy, Rogaland, have access to identical digital chart information. The vessel sends its sailing data automatically, eliminating any risk of communication misunderstandings, and the centre receives this accurate data instantaneously, allowing it to approve or if necessary adjust the route," says Hjøllo.

www.navtor.com

Energy storage

Ferry-powering the wireless way

The world's first marine wireless charging and automatic mooring concept will be jointly developed by Wärtsilä and Cavotec for use in Wärtsilä's ship designs. The new collaborative agreement will see Wärtsilä handle the power system while Cavotec will deliver the automated mooring technology for the green-minded concept.

"The environmental challenge has been the starting point for Wärtsilä's work in developing battery/hybrid technology for marine vessels. By making wireless charging of ship batteries possible, the electrification of coastal shipping is enhanced, resulting in major reductions in harmful exhaust emissions," says Wärtsilä.

The company's wireless system utilises inductive power transfer technology that is capable of powering 1MW of electrical energy – 300 times more than that of current chargers used by electric cars, according to the company – and promises to make connections and disconnections from the vessel and shore safer with the removal of cable connections. The system should also reduce maintenance because the wear to physical connection lines is eliminated, as is damage to electrical outlets caused by seawater, snow and ice.

The Wärtsilä/Cavotec charging station powering Wärtsilä's new ferry concept

HEMPEL

Hempadur Quattro XO

As a universal anticorrosion primer range, Hempadur Quattro XO are tough, longlasting coatings that are equally effective on all main areas of a ship as they are on the steel areas of a power plant or an offshore structure.

quattroxo.hempel.com

Cavotec, a provider of automated mooring systems and shore power and reel systems, will deliver a vacuum-based automated mooring system that remotely controls vacuum pads recessed into, or mounted on the quayside. Conventional mooring lines are removed by the system, and the mooring and release of vessels is able to happen in seconds, according to Cavotec.

Wärtsilä has recently launched a ferry concept featuring its wireless charging system in line with the Norwegian Government's new environmental regulations for ferries.

www.wartsila.com

Auxiliary systems

Operating for requirement

Pump solution manufacturer DESMI reasserts the need to match energy consumption with a vessel's changing requirements when attempting to improve the efficiency of auxiliary systems.

The Danish-based company points out that auxiliary systems in engine rooms and pump components are designed to function in a worst-case scenario, but can be made to run at variable operating levels that respond to the vessel's load at any particular time.

DESMI'S segment director for Marine & Offshore, Michael Lassen, says: "A lot of onboard machinery constantly operates as though the vessel is under 100% load and having to cope with air temperatures of up to 50° Celsius and sea water temperatures up to 32° Celsius. But those conditions reflect perhaps only 1% of a ship's operating lifetime. The rest of the time, you might say, it's like running the heating in your house at full blast with the windows wide open."

www.desmi.com

CAD/CAM

New strength assessment software

A new software system from ClassNK will provide structural design support to container carriers as they try to meet the class society's latest rule amendments following findings from ClassNK's investigation into a large container carrier casualty.

PrimeShip-HULL for Container Carriers, a "total design support tool" according to ClassNK, has been designed alongside the new rule amendments to increase the efficiency and quality of container carrier structural design, and is based on a similar tool that supports the safe design of bulk carriers and oil tankers compliant with the IACS Common Structural Rules for Bulk Carriers and Oil Tankers.

The tool features rule calculation software that can perform longitudinal strength assessments on cross sections and bench structures specific to container carriers; direct strength calculation software; the ability to propose reinforcement plans based on sensitivity analysis; and can take into account the effects of whipping, sea pressure and container loads as part of ClassNK's independent longitudinal strength requirements.

www.classnk.com

Paints & coatings

Tank coating upgrade

A new pure epoxy tank coating will replace Hempel's previous offering Hempadur 15400 and aims to meet customers' needs for greater protection and added flexibility.

Hempadur 15460 has been designed as a coating for chemical vessel tanks and is formulated using an amine adduct cured epoxy technology. Hempel says it contains no toxic products, can be used to coat all liquid cargo tanks and is also suitable for grey and black water tanks, mud and brine tanks, refrigerated seawater fish tanks and other vessel tanks.

Hempel also says that the coating features a two coat system that reduces the time and cost of application; higher volume solids with reduced solvent emissions; low cargo absorption and retention; and a high cross-linking density that improves chemical resistance, including resistance to crude oil in temperatures of up to 80°C, according to the company.

Michael Aamodt, Hempel's global product manager says: "This new tank coating is FDA compliant for the carriage of liquid foodstuffs and has been developed specifically to resist all oil product cargoes including clean petroleum products (CPP), dirty petroleum products (DPP), crude oil, benzene, ketones, fats, and caustics."

www.hempel.com

CAD/CAM

Siemens to acquire CD-adapco

Siemens have entered into a stock purchase agreement to acquire CD-adapco for US$970 million.

The simulation company, CD-adapco, will strengthen Siemens' industry software portfolio according to Siemens, bringing its experience as a

DUPONT™ MARINE SCRUBBER

SOx REMOVAL TECHNOLOGY FOR SHIP ENGINES AND BOILERS

DuPont
Clean Technologies
marinescrubber.dupont.com

FUTURE-PROOF YOUR FLEET

Comply ***NOW*** with IMO Annex VI sulphur emissions regulations and be ready for 2020

- Slim, small footprint design
- Multi-stream and single-stream options
- Low pressure drop scrubber – no fans required

For more information, contact us at marinescrubber@dupont.com.

Copyright © 2016. E.I. du Pont de Nemours and Company. All rights reserved. The DuPont Oval Logo, DuPont™ and all products denoted with a ® or TM are trademarks or registered trademarks of E. I. du Pont de Nemours and Company or its affiliates.

provider to 14 of the 15 largest carmakers, the top ten suppliers to the aerospace industry and to nine of the ten largest manufacturers in the energy and marine sectors.

Klaus Helmrich, member of the managing board of Siemens, says: "As part of its Vision 2020, Siemens is acquiring CD-adapco and sharpening its focus on growth in digital business and expanding its portfolio in the area of industry software."

CD-adapco will be integrated with Siemens' existing Product Lifecycle Management (PLM) software business, a part of its Digital Factory (DF) division.

"By adding advanced engineering simulation tools such as CFD to our portfolio and experienced experts in the field to our organisation, we're greatly enhancing our core competencies for model-based simulation that creates a very precise digital twin of the product," says Anton Huber, CEO of the DF division.

www.siemens.com

Deck equipment

Growing the cargo business

Cargotec is to acquire INTERSCHALT maritime systems in a bid to lead intelligent cargo handling in the maritime industry, while its subsidiary MacGregor has won an order to deliver 12 heavy lift cranes with a 450tonne capacity.

"The acquisition of INTERSCHALT is part of our strategy of growing our software business in new areas and creating more value for existing and new customers. The acquisition will add customers, talent, additional knowledge, capabilities and software products to support the future growth of XVELA as the leading collaboration platform serving the needs of ocean carriers, terminals and their shipping partner," says Olli Isotalo, president of Kalmar, part of Cargotec.

Cargotec is planning to integrate INTERSCHALT's software solutions with its Kalmar business and its service provision with MacGregor.

Meanwhile, MacGregor's new crane contract will provide equipment for six Ecolift F900 vessels being built at Hudong and Huangpu Wenchong shipyards, China. It includes delivering deck machinery from the company's Hatlapa range and Porsgrunn steering gears.

Crane deliveries will commence at the end of 2016. The Ecolift vessels will be delivered from the summer of 2017 through 2018.

www.macgregor.com

Bridge & communications

A clearer picture

FURUNO will launch the new FAR-15x8 radar series to improve operability and remove the need for "troublesome radar adjustment work", according to the company.

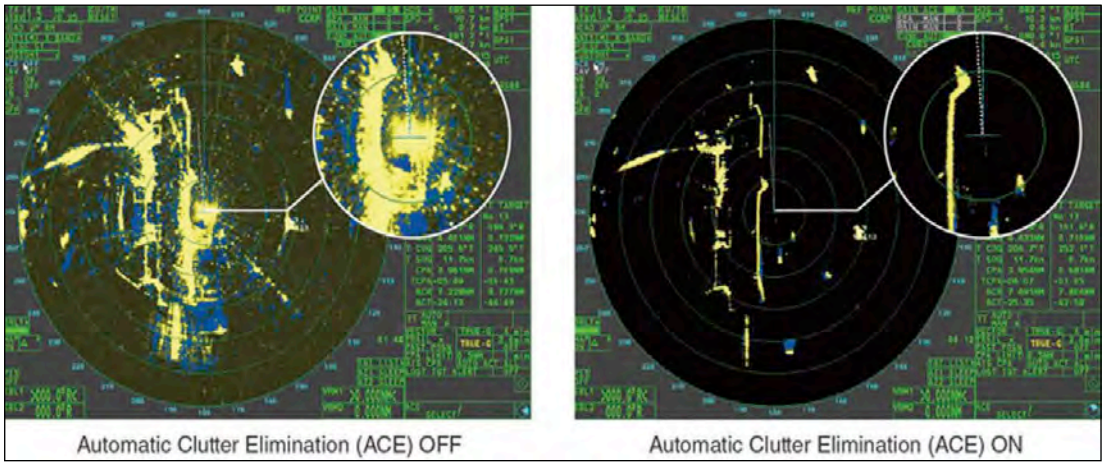
The FAR-15x8 radar series meets the latest IMO performance standard for all Cat.2 radar and Cat. 3 radar, but has been developed alongside the non-IMO suitable FAR-15x3 for workboats and fishing vessels.

The radar features an Automatic Clutter Elimination (ACE) function based on FURUNO's signal processing technology that automatically adjusts gain control, sea surface clutter and rain clutter control.

In addition, the company says the radar possesses Fast Target Tracking that quickly gives speed and course vector displays after selecting a target, as well as enhanced usability from a touchpad on the standard control unit.

www.furuno.com

FURUNO'S Automatic Clutter Elimination (ACE) function provides a clearer picture for operators



CSBC CORPORATION, TAIWAN

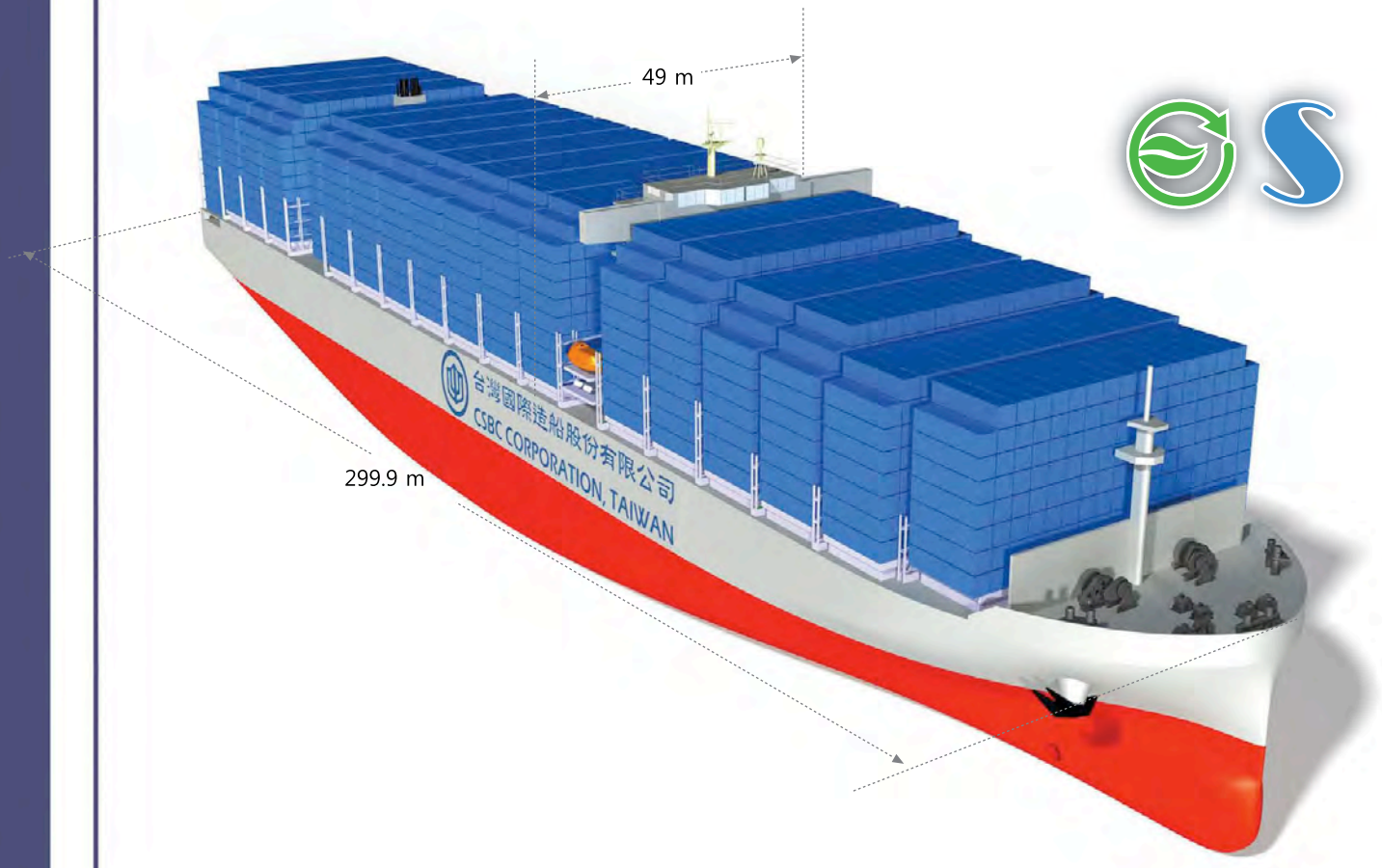
New 10,300 TEU container vessels with innovative sea sword bow

Competitive performance under trim and draft variation, more favorable than the traditional bulbous bow

Seaway Optimum Design & Operation

Website:http://www.**csbcnet**.com.tw

1. State-of-the-art hydrodynamics in ship design
2. 2025 EEDI compliance
3. Easy manoeuvring
4. Cargo loading optimum (14 t / TEU homo. abt. 7,550 TEUs)
5. Reefer container maximum (abt. 1,100 receptacles)
6. Low ballast water use
7. Shallow draft consideration
8. Adaptable multi-route sailing
9. Reliable building quality & abundant experience



台灣國際造船股份有限公司 CSBC CORPORATION, TAIWAN

3 Jhonggang rd., Siaogang District,Kaohsiung, 81234, Taiwan, R.O.C.

Tel:+886-7-801-0111 Fax:+886-7-801-8830 Email:sales@csbcnet.com.tw

Nautilus sets out its deep sea mining stall

In an innovation that is set to revolutionise the mining industry Nautilus Minerals is developing a deep sea mineral mining vessel that will exploit mineral deposits at depths of up to 2,500 metres. The Production Support and Storage Vessel is currently under construction and is set to be delivered in the fourth quarter of 2017

TECHNICAL PARTICULARS

Production Support and Storage Vessel

Length OA	227m
Length BP	210m
Breadth	40m
Depth MLD	18.2m
Design Draught	13.2m
Scantling Draught	13.2m
Storage Capacity	approx 45,000tonnes
Speed @ 90% MCR	12knots
Complement	199 crew
Ship Crew	30
Seabed Production Crew	69
Engines	6 Rolls-Royce B33:45L9A 5400kW, 5238KWe, 720rpm
Thrusters	Rolls-Royce 3 x Azimuth thrusters UUC305 FP 3000kw (main propulsion thrusters + DP) diameter 3m, removable at sea, 2 x Azimuth Thrusters UL 355FP 3500kW retractable – 3500mm Diameter, removable at sea. 2 x Tunnel Thrusters TT3300 2000kW diameter 3.3m
Generators, switchboards and transformers	VFD's – Siemens, ABB, Rockwell, Toshiba
Cargo handling	Bedeschi
Lime handling	VAMO
Launch and Recovery Systems	Axtech
Seafloor Production Tools	SMD
Dewatering Plant	DRA Pacific
Riser and Lift system	Hong Hua and GMC Subsea Slurry and Lift Pump GE Hydril
Injection Pumps	Clyde Union
Cranes	Macgregor
Dynamic Positioning system	Kongsberg Marine

Revolutionary is perhaps an overused adjective, but in the case of the Production Support and Storage Vessel (PSSV) that is currently under construction in China the word is very appropriate. Launch of the vessel will see the start of a new industry, that of the commercial exploitation of deep sea mineral deposits.

Work on the construction of the PSSV has already started at the Mawei Shipyard in Fujian province, China, but the vessel itself is part of an entire mining system that will operate in the Solwara 1 concession off Papua New Guinea (PNG).

The PSSV is an innovative design as the vessel and its mining system are the first of their kind in the world. The ultra-deep water mining process begins at the seafloor where three large mining ROV's cut rock and turn it into slurry for pumping.

The slurry is pumped to the PSSV via a Subsea Slurry Lift Pump (SSLP) through a top tensioned riser. At the PSSV the slurry is delivered to a Dewatering Plant (DWP) and then into the vessels' holds for storage. The stored ore is reclaimed from the ship's holds and offloaded via a cargo handling system into a bulk carrier moored alongside. The bulk carrier then transhipps the ore to market.

The 227m ship will be constructed with a moonpool through which the SSLP and riser system can be deployed. The three main remotely operated machines consist of an auxiliary cutter that flattens the working site, a bulk cutter that breaks the ore, and a collector that picks up the ore and transfers it through a flexible pipe to the SSLP and then the riser, which takes the ore to the surface.

The DWP separates the ore from the seawater, with the ore being deposited to storage holds while the seawater is returned to the sea depth from which it was first taken to minimise any environmental damage. The DWP brings the moisture content of the ore down to below the TML of the product ensuring the ore can be safely shipped.

Principal project engineer at Nautilus Minerals, Daal Jaffers along with his colleague Mike Howitt, Project Manager Offshore, were responsible for the initial concept designs of the system and this was followed by a preliminary and basic design by Dilip Sarangdhar, the technical director at Seatech Solutions International; the detailed and production design was carried out by Mawei Shipbuilding Limited.

A significant number of innovative design features have been incorporated into the PSSV including an advanced power generation and dynamic positioning (DP) system. The DP notation is ABS DPS-2 EHS-F, with system configuration incorporating three engine rooms and a closed ring configuration. The high mining loads, higher than DP requirements, means that there is a special electrical design configuration to allow the sharing of loads between DP and production requirements while keeping the vessel and its assets safe. The closed ring configuration allows a reduction in installed power in the ship whilst meeting the high power demands. This arrangement saves considerable capital cost in the construction of the ship.

In addition, the vessel is designed with a heavy ballast capability that will maintain the freeboard at a constant level, which simplifies the repetitive subsea lifts and side-by-side mooring activities. This simplification translates into improved safety for these operations.

The side-by-side mooring system is a regular operation that will require vessels to moor alongside at sea for a variety of activities, which will take place a number of times a week.

THE MONEY-SAVING ALTERNATIVE TO LOW SULFUR FUEL

CR Ocean Engineering (**CROE**®) offers ship owners and operators a proven low-cost alternative to the conversion to distillate fuel.

Backed by nearly 100 years of experience, **CROE**® provides cost-effective systems customized to your specific needs and designed to help you save money and remain competitive.

Our systems can easily achieve the 0.1% Sulfur equivalency when burning high Sulfur fuel oil. The **CROE**® Exhaust Gas Cleaning System (also known as Scrubbers) offers:

- **all metallic construction**
- **ability to run dry**
- **designed for full engine temperature**
- **in-line construction for single engines or multistreaming**
- **light weight & small dimensions**
- **ability to replace silencers**
- **high efficiency**

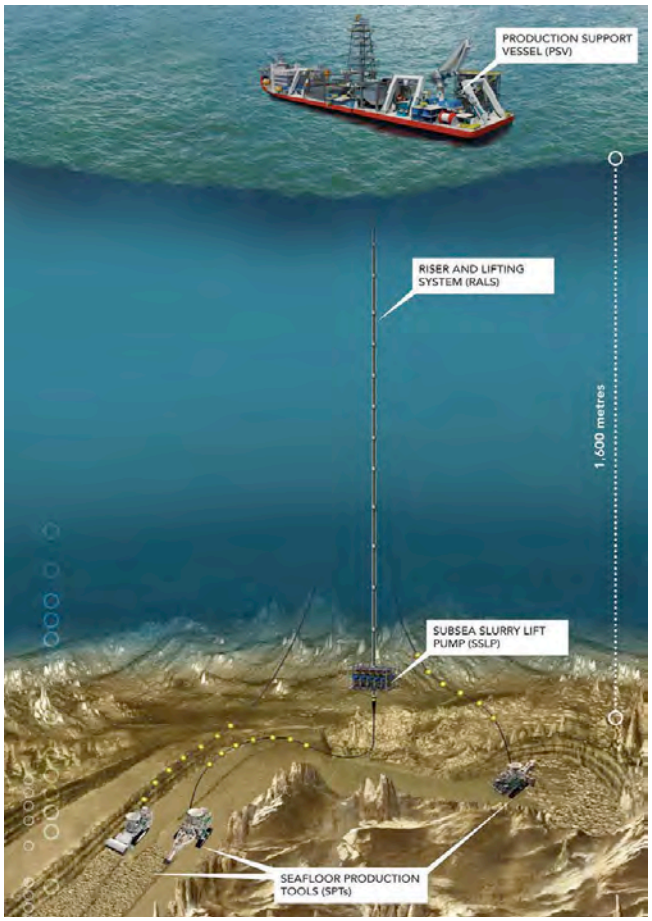
CROE® Scrubbers are very cost effective and can be delivered on a short schedule when needed.Let us guide you to the most efficient and compliant solution.

Contact: nconfuorto@croceanx.com

Tel. +1 (973) 455-0005
www.croceanx.com

CR Ocean® Engineering

CR ocean Engineering, LLC , Six Campus Drive, Parsippany, NJ 07054 USA



The production support and storage vessel deploys the mining tools at the seafloor and ore is collected and sent to the surface via the slurry lift

Jaffers said: "Simultaneous operations can occur during these times to reduce operational downtime on production. The system is operationally safe for crew to enable line handling, line replacement and line pre-tension and monitoring during the operations."

Mooring events that occur at sea are for ore offtake, bunkering, re-victualling, crew transfer, garbage removal, lime transfer, miscellaneous liquids removal and sparing.

In total the PSSV can accommodate 199 crew and meets the Special Purpose Ships (SPS) code and also the Maritime Labour Convention 2006. In addition, it has a central control room to enable seamless subsea and deck operations. All control stations are within one room for ease of communication and to improve production efficiencies.

It also features a wide range of technologies and equipment to facilitate its operation such as seafloor mineral extraction topsides support equipment, extensive equipment integration and support systems for ore production, and a survey system.

The vessel will house the subsea mining tools with support mechanisms such as launch, recovery, subsea operation and maintenance. The subsea tools are the three large ROVs being used as Seafloor Production Tools (SPTs). These are large tracked vehicles used for mineral ore production on the seafloor.

The three SPTs are:

- Bulk Cutter (BC) – the configuration is similar to a continuous miner. This is a high production rate machine that does the bulk of the production cutting
- Auxiliary Cutter (AC) – the configuration similar to a tunnelling roadheader with contra-rotating, dual cutting heads. This is an agile machine that prepares the mine site and completes production cutting. It also stockpiles its own cuttings by pumping cut ore to a central stockpile
- Collecting Machine (CM) – the configuration is similar to a crown cutter suction dredge. This collects the cut material from the seafloor stockpile, fluidises it into pumpable slurry and also acts as a charge pump for the SSLP to pump the slurry to the surface vessel for dewatering, storage and offtake.

A deck mounted derrick is used to lift and lower the SSLP and the riser. It has a similar configuration to a drill derrick without the rotating turntable. This is part of the riser retrieval and running system.

In addition, the ship is equipped with:

- A SSLP, with a configuration similar to an ultra-deep water mud pump starting to see use in dual gradient drilling. This is a dual bank diaphragm pump. Power is transferred to the diaphragms via high pressure water injected from the surface ship
- Riser handling system – uses a gantry crane, catwalk and horizontally stacked riser joints. This system handles riser joints into and out of the derrick
- Riser hang off structure sits on top of the moonpool below the derrick to hold the SSLP on deck for maintenance and also to hang the deployed riser system from the vessel.

The cargo handling system is a configuration of belt conveyors, rotating stackers, scooper reclaimers, vertical bucket elevators, and telescopic offloading arms. It handles dewatered ore from the dewatering plant and distributes it into four cargo holds. The system trims the ore to meet the requirements of the International Maritime Solid Bulk Cargoes Code (IMSBC). The cargo can then be reclaimed and offloaded into a handymax dry bulk carrier moored alongside. The cargo is trimmed during offloading by the offloading booms using throwers.

The ship is also equipped with:

- A deck wash down oil/water/mineral ore separation system – separates out oil water and ore into three separate phases where the ore is reclaimed and stored and the oil is processed and stored
- WROVs – three large work class ROVs to support subsea production activities
- Lime handling system – used to dose the ore to prevent oxidation of the ore before reaching market for processing

- 200tonne subsea crane, 100tonne ship to ship crane. 2 x 20tonne maintenance cranes
- Flexible hose storage rack – vertical storage rack for storing flexible jumpers on deck for connecting subsea to the SPTs and connects the CM to the SSLP
- Compressed air system – a very high capacity system to support pneumatic instrumentation, air blow for the filters in the DWP and on deck tooling
- Reverse Osmosis freshwater makers
- 6.6kV electrical system to support the seafloor production equipment
- Seawater cooling circuits to cool topsides equipment
- High pressure Seawater injection system in a pump room in the PSSV to power the SSLP
- Workshops, storerooms and maintenance areas to support the mining operations
- Ore cargo hold drainage system
- Lube and hydraulic oil drain down and replenish system
- Overarching process and control system for the mining systems which integrates with the ships control systems.

Designing a vessel from scratch that is the first of its type in the world threw up a number of challenges according to Jaffers, who said: "As it is a new type of vessel, many discussions occurred with class and the flag state to ensure the appropriate rules and regulations were met. Discussions were held and have continued with a number of parties from concept design through to construction, including discussions on the materials handling and ore storage and offtake systems; the heavy ballast requirements; the lifting and crane equipment for the many repetitive subsea lifts and one off lifts for production site setup; side by side mooring at sea; the survey system for the very high accuracy required at the seafloor in ultra-deep water; power management – meeting the high power demand from combined dynamic positioning (DP) and production operations whilst reducing the installed power required in the vessel. It is an enjoyable challenge to work on a complex world first project of this type."

With a background in commercial ship construction, offshore and subsea fields, Jaffers has been able to draw on this diverse experience to help deliver this world first integrated ultra deep water mining ship.

He added that a great deal of work has gone into the storage hold design and materials-handling system to enable the even loading of the holds. The loading system meets the requirements of the IMSBC Code and also meets TML requirements from the same code.

"The ore is very dense with specific gravities of up to 3.8t/m^3 and bulk densities at a little over 2t/m^3. So the material is more dense than most bulk cargoes seen in the market. The utilisation of the cargo holds is very high with the stacking of the ore extremely important to be able to utilise space. Many studies were undertaken to arrive at the preferred solution that is being installed in the vessel for the cargo handling. The cargo holds can essentially be reclaimed clean with little manual intervention. This saves manual labour for cleaning out and inspecting coatings in the holds."

The material is highly abrasive so coatings and material selection for equipment in the holds is of the utmost importance. Cargo hold strength due to high bulk densities was also considered. In addition, the large cargo hold spans with high deck loads from equipment above requires high end structural analysis with load combinations for operation and survival to be considered. The result is a self-contained loading and self-unloading system with low maintenance requirements that has a fully remote controlled operation to ensure seamless bulk cargo storage and handling, explains Jaffers.

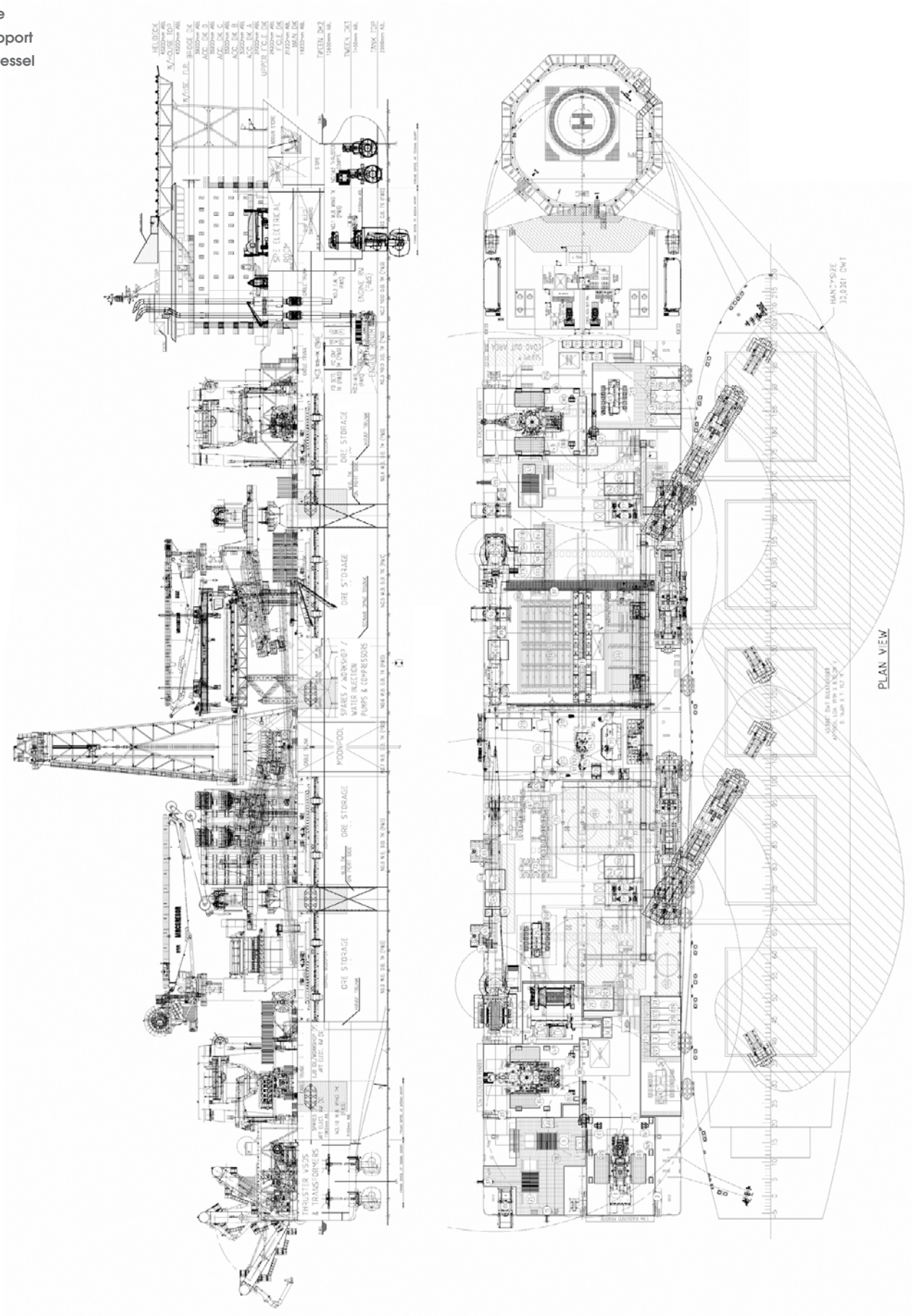
Deck stiffness on the ship is also of utmost importance with deflection across operating equipment needing to be met. The ship's deck arrangement is busy with topsides equipment arranged to improve operational performance and maximise productivity.

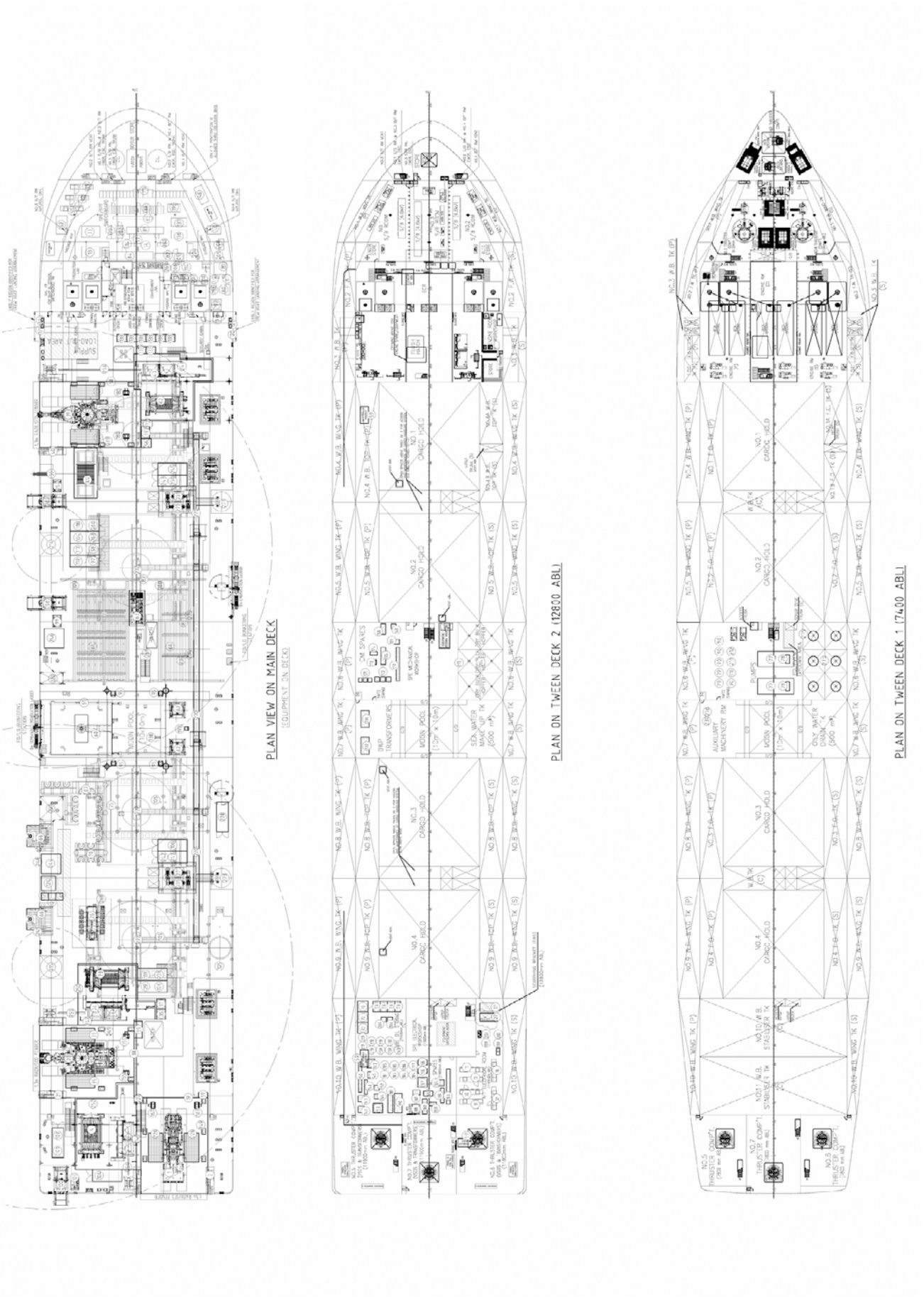
The shipbuild is complex with the fixed items of mining equipment being integrated during the build. Many items of the mining equipment are at an advanced stage of design and construction and so can be integrated into the ship at the yard. Loose items of equipment such as riser pipe, WROVs and the mining machines will be lifted on after delivery of the PSSV. Commissioning and seatrials of the ship's systems and mining systems will be completed simultaneously at the end of the build program.

The vessel will be delivered at the end of 2017 with thousands of tonnes of steel already cut and fabricated into blocks. All main items of equipment have been ordered and are at an advanced stage of construction. Many factory acceptance tests have been performed and these large items are due for delivery to the yard in

The 227m long production support and storage vessel is under construction at the Mawei shipyard in China and is expected to be delivered in 2017

GA Plan for the Production Support and Storage Vessel




PLAN VIEW ON MAIN DECK
(EQUIPMENT ON DECK)
PLAN ON TWEEN DECK 2 (12800 ABL)
PLAN ON TWEEN DECK 1 (7400 ABL)

Chinese built vessel resale values drop

According to shipbroking and vessel information provider VesselsValue ships built in Korea and Japan hold their value better than Chinese built ships. Momchil Zhelev, shipping team leader, Graham Close, shipping team leader, and Toby Mumford, valuation analyst, explain why

With an excess of 10,000 vessels delivered and the current orderbook standing at 59.5m gt, China's shipbuilding sector is one of the most dynamic and the most rapidly growing the world. However, with the seemingly never ending tumble of the dry bulk industry, the Chinese shipbuilding industry's reliance on producing these types of vessels has led to diversification of the ship types being ordered.

The quality of Chinese tonnage varies wildly from large, state owned entities to small, privately owned yards. It is a constantly changing market, with many of the smaller yards born out of shiprepair yards in the boom years which have now ceased building ships. Total tonnage delivered reached its peak in 2011 at 38.97m gt compared to only 1.77m gt in 2000. Throughout these years Chinese yards have been focused on small tankers and bulk carriers, with bulkers representing 56% of all vessels delivered during this period.

The VesselsValue algorithm values every conventional vessel over 1,000dwt (500TEU for container vessels and 100m^3 for Gas vessels) daily. These are vessel specific valuations that take into account all the features, ie, size, age, cranes, tank coatings, engine, etc. One of the major features is the yard at which vessels are built. Each Chinese shipyard is scored individually for each vessel type with the score also dependent on vessel age.

As a generalisation Chinese yards are improving. The discount for Chinese yards ranges from c.6% for a top tier builder down to 40% for the worst yards. These discounts are derived from the second hand trading sales that take place and move as quickly as the S&P market. A very clear example of the Chinese discount can be seen back in November 2014 with the sale of *ACS Diamond* (53,300dwt built 2005 at New Century – China), which sold for US$10 million on 18 November 2014. The previous week the sister ships *Jubilant Sky* and *Brilliant Sky* (52,300dwt built 2004 Oshima – Japan) sold on 6 November 2014 for US$15.5 million each. This gives an implied discount of c.40%.

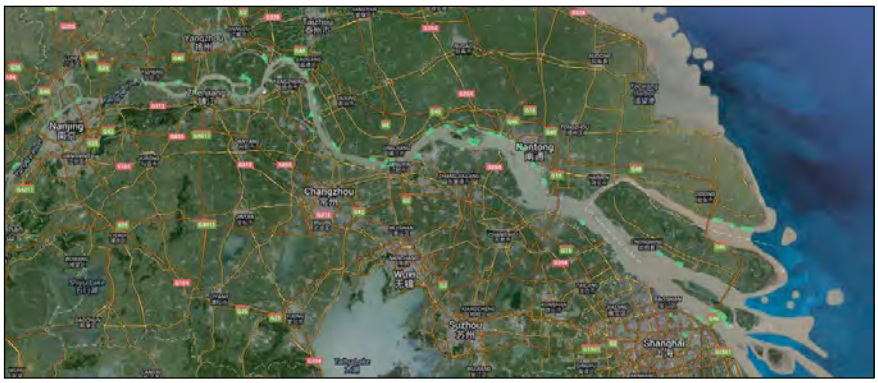
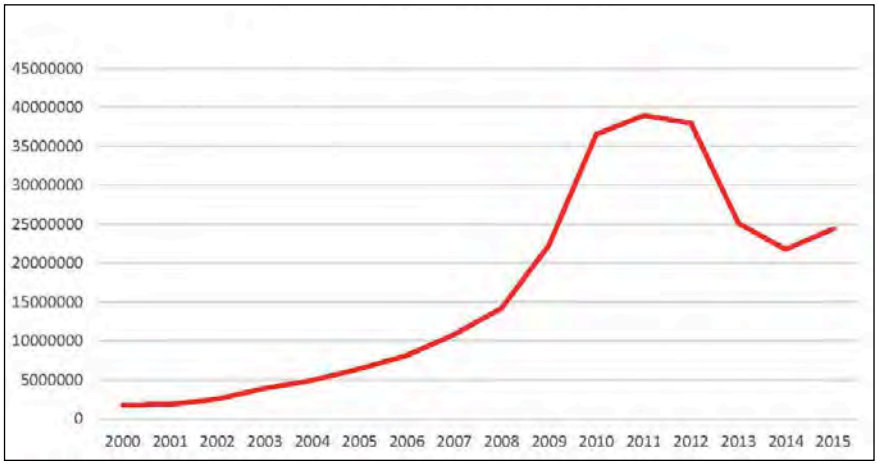


Figure 1: Screen shot from VesselsValue Mapping Service VV@: each of the green dots represents a shipbuilding yard along the Yangtze River, China

The bulk market is seeing the worst drops in value since 2008, with each sale being significantly below the last. This drop in the value has also affected the discount attached to Chinese yards. Generally when the market is bad, the Buyer has the pick of the vessels and so will generally choose a higher quality, Japanese or Korean built vessel over a perceived lower quality vessel from China. This has played out as expected in the most recent down turn with bulker discounts on average increasing by a further 5%. The lower tier yards are again the worst hit.

Although Chinese vessels are valued lower than their counterparts built in Japan or South Korea, China has delivered the highest number of vessels during 2013-2015. A grand total of 66.7m gt was delivered, versus 62.7m gt produced in South Korea and only 37.5m gt from Japan with the majority of these vessels being in the bulk market segment. China and Japan have similar patterns in terms of ship types

Figure 2: The total Chinese orderbook in million GT 2000-2015



CADMATIC

SOFTWARE SOLUTIONS

Marine Design Software

INCREASE QUALITY in Design & Production

OPTIMIZE RESOURCES with Distributed Engineering

ENHANCE UNDERSTANDING with Project Communication

CONTROL PROJECTS with Information Management

www.cadmatic.com

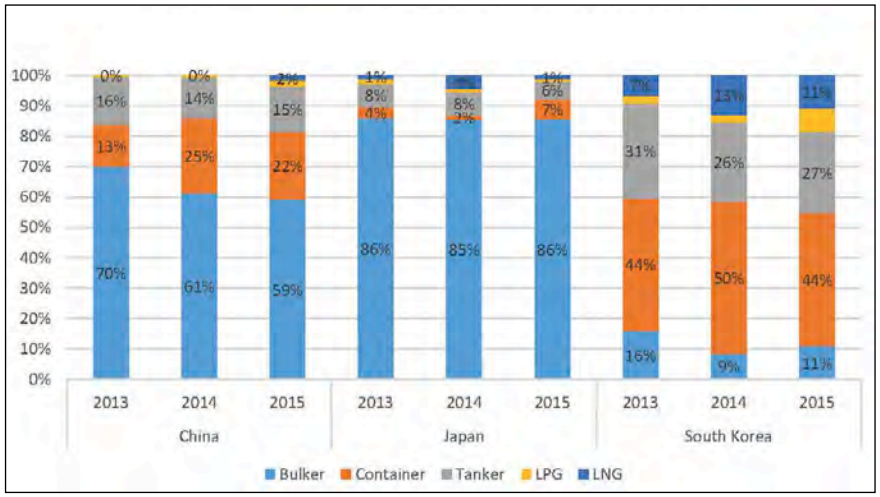


Figure 3: Percentage of orderbook by ship type for China, Japan and South Korea 2013-2015

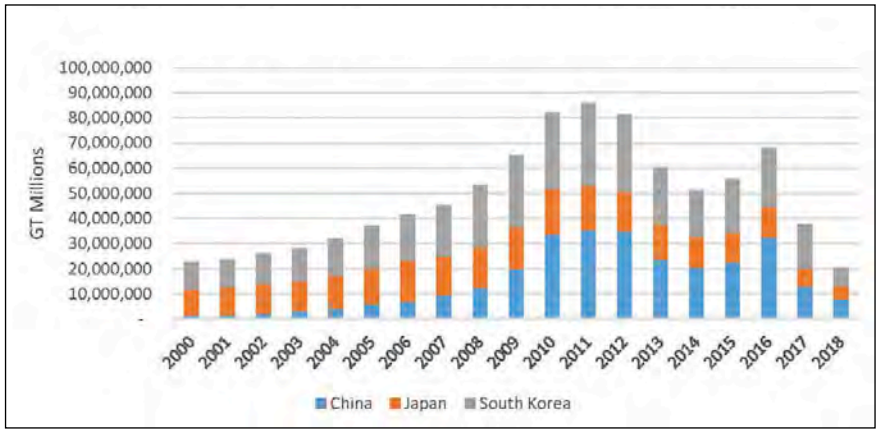


Figure 4: Chinese, S. Korean and Japanese orderbook (million GT)

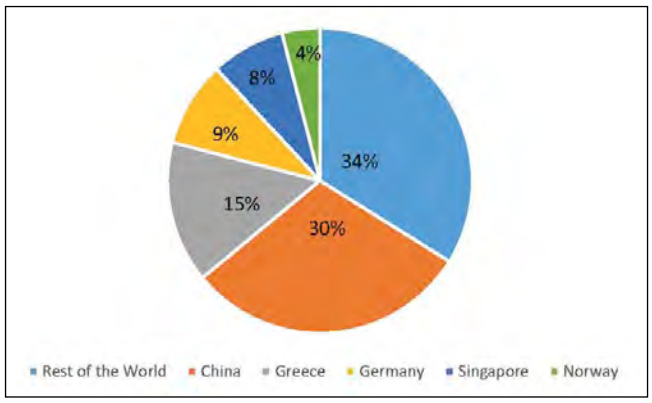


Figure 5: Chinese yards deliveries 2000-2020 by country of ownership

ordered, South Korea stands out as the only builder country that has successfully diversified its orderbook – 45% of vessels built in the last 3 years were containers, 28% tankers and only 12% were bulkers. It would appear that China is starting to follow this example, because as each year goes by the reliance on dry bulk is lessened with an increase in Gas and Container orders, see Figure 3.

2016, however, looks to be a bumper year for all three shipbuilding countries, with a total of 67.9m gt scheduled for delivery, although this is not quite reaching the highs of 2011 when the Global orderbook stood at 85.9m gt. This year of respite will be short lived and the more pressing issue facing all shipbuilding countries is the lack of orders since 2012. With only half the total tonnage to be delivered in 2017 vs 2016, with dry bulk and the offshore markets being in such a bad way, it's difficult to see how many of the smaller yards will survive.

With worrying signs that China's economy is slowing, a look at the data related to the vessels delivered in the period 2000-2015 and the current order book (2015-2020) reveals domestic orders account for only 30% of all orders placed in Chinese yards. Recent remarkable domestic orders in China include a 10 VLCCs order placed by China VLCC in December 2015 and an 11 ULCVs order by China Shipping Container Lines (CSCL) in August 2015. On the other hand, 36% of all Chinese orders have been placed by only four countries: Greece, Germany, Singapore and Norway – see Figure 5. In that respect the Chinese shipbuilding industry is more similar to Japan where domestic orders account for 47%, than to South Korea where domestic orders account for just 7%.

However, not all these orders are necessarily what they seem. During 2015 19 bulker vessels ordered at Chinese yards were converted into tankers or containers, 13 of which would have started life as capesizes. These bold actions clearly express the worry felt by many owners at the state of the bulker market when these vessels would have been delivered.

Dalian Shipbuilding Industry Corp, China's second largest shipbuilder by gt during 2000-2020, is starting to show signs of diversification. Set in the Dalian builder region, DSIC is normally focused on large scale bulkers and tankers, as well as favouring ship types such as MR and LR vessels from the smaller tanker segment. However, two ULCVs on order as well as four VLEC under construction reveals DSIC is exploring the Gas segment, moving up on the construction complexity scale.

In the 1990s Korea was looked upon as an inferior shipbuilding country to Japan, now the top tier Korean yards are seen as equals. This process took time and it was not until the late 1990s that the Korean yards started building significant numbers of ships for the international market. It then took a further 10 years for the yards to catch up with the Japanese in terms of quality. The Chinese builders are now going through a similar process, with more modern vessels increasing in quality and with charterers giving little discount on them against their Japanese contenders. Perceptions will change in time and eventually new Chinese ships being produced will be seen as peers to the Korean and Japanese ships. *NA*

SEA JAPAN 2016 will be held
with the LARGEST scale EVER!!

SEA JAPAN

INTERNATIONAL MARITIME
EXHIBITION AND CONFERENCE
13-15 APRIL 2016 TOKYO

2 Key Themes for SEA JAPAN 2016

環境保全(大気・海洋)
Environment protection
(Air and Water)

人材育成
Development of
human resources

2016年4月13日水~15日金 13-15 April 2016

東京ビッグサイト 東5・6ホール Tokyo BIG SIGHT Exhibition Center,
East Halls 5 & 6, Tokyo, Japan

www.seajapan.ne.jp

主催：UBMジャパン株式会社 Organiser : UBM Japan Co Ltd

お問合せ Inquiry

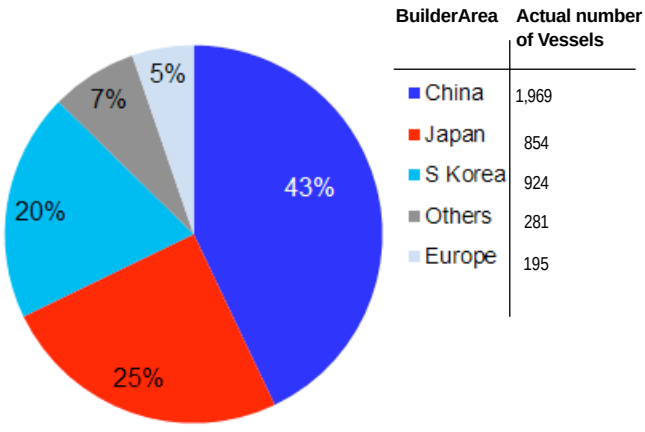
SEA JAPAN 運営事務局 UBM ジャパン株式会社内
〒101-0044 東京都千代田区鍛冶町1-8-3 神田91ビル TEL: 03-5296-1020 FAX: 03-5296-1018 E-mail: info@seajapan.ne.jp
SEA JAPAN Secretariat Office UBM Japan Co Ltd
Kanda 91 Bldg, 1-8-3 Kaji-cho, Chiyoda-ku, Tokyo, 101-0044 Japan TEL: +81-3-5296-1020 FAX: +81-3-5296-1018 E-mail: info@seajapan.ne.jp

Clarksons Research: Historic and Scheduled Delivery

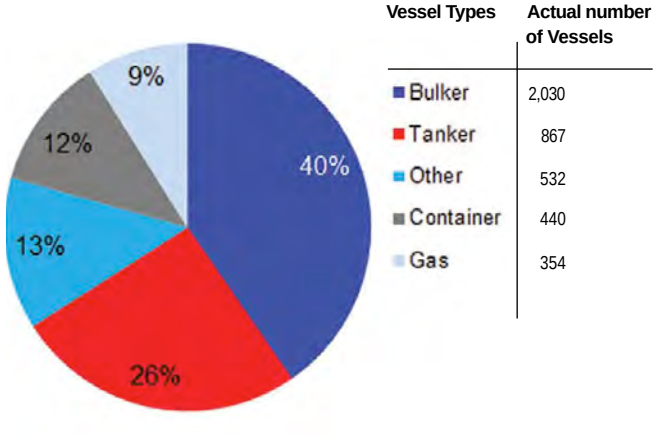
Data extract from World Fleet Register available at www.clarksons.net/wfr

Vessel Type		2005		2006		2007		2008		2009		2010	
	2nd Half	1st Half	2nd Half	1st Half	2nd Half	1st Half	2nd Half	1st Half	2nd Half	1st Half	2nd Half	1st Half	2nd Half
VLCC >= 200,000	14	15	16	5	13	15	14	18	22	33	20	30	24
Suezmax 120-200,000	11	17	8	14	12	15	10	9	5	23	22	26	12
Aframax 80-120,000	21	37	28	29	21	29	27	26	42	63	33	39	31
Panamax Tankers 60-80,000	11	23	22	24	20	27	15	17	26	26	12	15	16
Products 30-60,000	58	52	48	58	55	69	67	73	91	92	66	63	43
Products 10-30,000	4	3	5	2	10	9	10	9	6	5	5	7	7
Chem & Spec. 10-60,000	33	35	41	56	45	62	62	83	102	107	71	79	63
Tankers < 10,000	17	27	27	20	26	31	44	59	89	67	69	60	49
Capesize > 100,000	20	22	25	32	28	29	27	20	24	34	77	101	112
Panamax 80-100,000	3	5	11	22	23	22	16	15	17	27	21	61	60
Panamax 60-80,000	39	41	35	36	26	22	22	23	20	18	15	17	33
Handymax 40-60,000	43	52	48	53	40	50	50	66	59	86	100	168	168
Handysize 10-40,000	35	32	38	33	33	43	54	66	61	92	123	142	159
Combos > 10,000	0	0	0	0	0	0	0	0	0	0	0	3	2
LNG Carriers	9	7	11	12	16	16	16	25	26	22	17	15	12
LPG Carriers	5	4	3	9	14	16	20	27	33	25	18	18	18
Containers > 8,000 teu	10	14	18	34	28	20	17	25	25	22	13	30	33
Containers 3-8,000 teu	35	38	54	45	56	60	70	72	61	62	57	79	41
Containers < 3,000 teu	50	63	78	88	115	105	121	140	108	70	51	56	25
Offshore	4	5	6	4	5	3	18	14	14	13	15	25	25
Cruise Vessels	2	3	1	6	0	7	3	6	3	3	6	9	4
Ro-Ro Ferries	5	13	6	9	3	8	7	19	5	9	7	10	9
Other	63	76	81	105	126	147	136	151	150	144	154	167	181
TOTAL	**492**	**584**	**610**	**696**	**715**	**805**	**826**	**963**	**989**	**1,043**	**972**	**1,220**	**1,127**

Orderbook by builder region (number of vessels)



Orderbook by sector (number of vessels)



2011		2012		2013		2014		2015		Scheduled Orderbook		
1st Half	2nd Half	1st Half	2nd Half	1st Half	2nd Half	1st Half	2nd Half	1st Half	2nd Half	OB2016	OB2017	OB2018
35	27	27	22	21	9	14	10	9	11	66	46	22
25	18	31	16	25	6	4	4	8	3	40	56	7
28	31	29	14	13	5	4	13	21	10	69	71	31
18	8	8	6	6	4	3	1	2	1	32	28	10
45	23	25	30	49	27	48	52	57	55	120	77	12
9	8	12	2	6	2	2	7	3	1	3	8	2
52	45	41	11	11	16	13	10	39	30	125	62	29
50	49	65	34	29	24	20	16	10	11	39	12	0
128	123	148	65	63	40	56	38	46	42	185	35	18
83	97	140	95	100	68	62	36	57	40	222	66	19
38	46	54	39	34	43	44	23	19	4	22	3	0
195	198	226	146	147	117	96	97	144	121	448	135	15
160	170	212	113	110	74	89	68	101	81	259	91	35
3	0	0	0	0	0	0	0	0	0	0	0	0
5	10	1	2	4	13	14	19	17	16	51	47	33
16	14	13	7	23	16	14	14	25	39	106	72	11
46	25	50	28	51	32	60	40	59	61	91	72	53
33	26	40	19	46	29	26	24	19	6	8	21	7
32	29	33	34	29	16	22	27	26	34	98	66	25
29	25	33	17	15	19	31	30	26	11	88	53	17
4	2	6	1	6	0	3	2	5	1	11	10	8
10	7	9	7	4	6	12	4	11	5	24	9	6
177	173	189	93	98	86	72	46	61	37	169	81	26
1,221	**1,154**	**1,392**	**801**	**890**	**652**	**709**	**581**	**765**	**620**	**2276**	**1121**	**386**

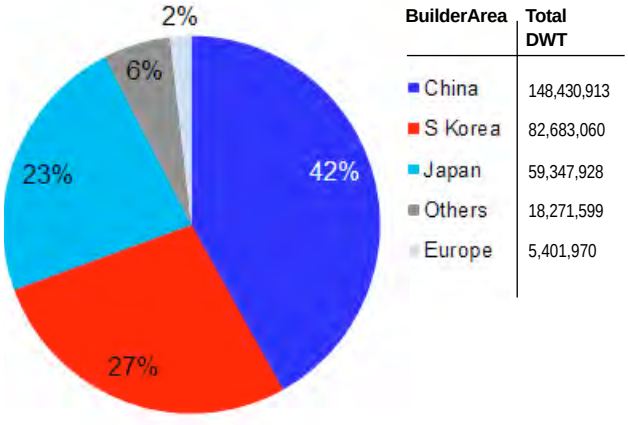
Data includes all vessels with LOA estimated at >100m

Where scheduled month of delivery is unknown an arbitary month of build has been applied for orderbook data

The orderbook by year of delivery on this page is based on reported orders and scheduled delivery dates and do not necessarily represent the expected pattern of future deliveries

All data taken as of 1st January 2016

Orderbook (DWT) by builder region



Source: Clarksons Research

War of attrition as yards struggle for survival

China's shipyards are literally battling each other for survival as newbuilding prices have reached rock bottom and orders in both the maritime and offshore industries have all but dried up. *The Naval Architect* looks at what is in store for the industry in the coming year

Bankruptcies and restructuring of debt are the order of the day as the global newbuilding slump, particularly in the bulk carrier sector, continues to bite. Few orders in the last year and the collapse in the market price for new vessels have brought some yards to their knees, notably Rongsheng and Jiangsu Eastern Heavy Industries (JEHI).

Last year's China Association of the National Shipbuilding Industry (CANSI) said that there would only be around 30 yards left in China within a few years. That is a figure disputed by some as yards are "put to sleep" according to one senior Chinese industry figure.

According to Hu Jin-Tao, president at the Shanghai Merchant Ship Design & Research Institute (SDARI), although some yards are in financial difficulties many yards have already paid off loans and have been put into lay-up waiting for the upturn in the shipbuilding market.

"Many yards have already paid their loans and they occupy a large amount of valuable land which is increasing in value, so why would they sell?" he asks. "They are trying to keep hold of their assets and may ask banks to be part owners," he added.

Many yards are suffering, however, with few orders received this year and the backlog of orders dwindling fast. Yangfan marketing manager David Wang Wenqiang said that the yard had received no orders for bulk carriers last year and that the group is looking into scientific research vessels and the offshore engineering market, though the yard had not received any orders for offshore ships in 2015 and its current orderbook would expire in 2017.

Li Jinian, the vice general manager at AVIC Weihai shipyard says it has orders and it is looking to move into a new area of shipbuilding with the yard about to sign a contract for a ro-pax vessel designed by its Finnish sister company, Deltamarin.

Li says that many yards, including Weihai, are upgrading during this period of relative calm. "The shipyard is re-tooling and re-training staff for a high-tech capability and improving the craftsmanship of workers so that there is little waste," he said.

SDARI president, Hu Jin-Tao, points to the hundreds of unsold cars parked outside of the company's offices as a symbol of the stagnating economy

"We have simplified the steps in the work and efficiency has improved greatly. We train the heads of teams first and they pass on the training to their teams. In the past the accuracy has not been as precise as it is today."

A former manager at the New Century shipyard, Li has transferred some of the management practices in an effort to cut costs. This includes demotion and fines for poor workmanship. "For example, cutting steel plate, when it is moved to the next phase of work, if it doesn't fit it is returned and the worker must pay for the cost of the error," explained Li.

Cutting costs are important in this tough market and yards are not alone in suffering as the global slow-down has hit many industries.

Hu Jin-Tao says many industries are suffering including the steel industry where prices are low, the offshore industry, where oil prices remain under US$30/barrel and the car industry, which like the shipping industry is still producing cars, but with the sales of cars falling substantially there is a need to fined storage for the unsold vehicles.

"Look outside my office window," Hu Jin-Tao points to the vista which until little more than a year ago was wasteland and is now a massive car park for unsold cars. "The car factories need storage, they build cars in Yantai, but there are no sales. The shipyards are the same as the car industry, they are trying to produce vessels, but the bulk carrier market is dead."

SDARI itself is investing in the future with the development of a research centre next door to its headquarters in Shanghai (see News page 8 SDARI set to expand) and a further RMB100 million (US$15.02 million) will be spent on improving efficiency through improvements to its IT technology.

In an effort to replace the lost business from the bulk carrier market SDARI is looking at a number of other options including the further development of its ro-ro business and a move into the container shipping market with the development of smaller vessels of between 1,100TEU up to around 4,800TEU.

SDARI concedes that its counterpart in Shanghai naval architecture, the Marine design and Research Institute of China (MARIC) has the lion's share of the large container market, but SDARI believes that it can win some market share in this sector with the feeder ship sector.

Both companies believe there will be an upsurge of orders for the smaller container ships as the feedership vessels are aging and need replacing, said Shen Weiping, vice president at MARIC.

According to MARIC the life cycle analysis that it has completed shows that the key to operating successfully will be flexibility.

MARIC senior engineer Yan Jiale says that the 18,000TEU ships have a lower slot cost if the vessel is operating with sufficient cargo which is paying a reasonable rate for

the freight costs. However, "the next stage is to have flexible routes, operated by flexible ships that are able to cope with the different routes and the different cargo mix," said Jiale.

He believes that the days of the seemingly ever-increasing container ship sizes are over as the port logistics, including the length of the terminal walls have reached their optimum sizes.

"Maersk and CMA CGM made money in 2013 because they had large vessels, but MSC had many 13,000-14,000TEU ships and they also made money," explained Jiale, and he believes that these smaller sized boxships could become the workhorses of the major trades on the Pacific and between Europe and Asia.

The struggle for survival by the shipyards in China is an epic battle that will only be resolved when there is a significant upturn in the global economy and resultant knock-on effects such as increased demand and rising freight rates boosting new vessel demand take root. *NA*

China's shipyards are struggling to agree new orders even though newbuilding prices have collapsed

Container cruises come to French Polynesia

An unusual yard builds an unusual ship. HuangHai Shipyard is responsible for the world's first container cruise ship, the *Aranui 5*, which will supply the Marquesas Islands and offer passengers a luxury cruise of the islands made famous by Paul Gauguin, Robert Louis Stevenson, Thor Heyerdahl and Jacques Brel

Trade in the Southern Pacific islands has often included cargo vessels carrying passengers, but Gaugin and Brel would have revelled in the luxury of *Aranui 5* and they certainly would not have travelled in such safety. The container cruise vessel is the first hybrid of its kind and it combines luxury and safety with practicality and space for 166TEU and a ro-ro capability.

Built in China's innovative HuangHai Shipyard in Shandong province and delivered in October last year, the new look vessel combines existing technology with practical use and is doing the rounds in the South Pacific. *Aranui 5* is capable of carrying container and ro-ro cargo with up to 295 passengers in luxury accommodation that brings container cruising to a new level.

Many container ships can already carry up to 12 passengers — more than that and the vessels would be subject to passenger regulations — but *Aranui 5* meets the SOLAS requirements including the Safe Return To Port rules, with the vessel capable of travelling up to 2,000 nautical miles at a minimum of 6knots in rough weather conditions, up to Beaufort 8.

Designed by SDARI in Shanghai and classed by Bureau Veritas the vessel is specifically designed to offer luxury accommodation to cruise passengers while supplying the island communities with commodities. *Aranui 5* is powered by two MaK Caterpillar 8M32C engines each with a 4,000kW output that drive two 3.4m controllable pitch propellers. Two shaft driven AEM SE500 S4 alternators producing 1,500kW of power and two additional diesel driven Caterpillar 6M20C / C32 alternators providing up to 590kW power each provide electrical power for both the cargo and passenger sections of the ship.

Aranui 5 has replaced *Aranui 3* which also carried a few passengers, but with few of the luxuries

Hu Jin-Tao, SDARI president, told *The Naval Architect*: "We are looking to develop cruise ship designs and we have received government funding to send ship designers onto cruise ships so that they can learn what is necessary to develop these types of luxury vessels."

Many shipyards in China are looking to develop the capability to build cruise vessels with China tipped to become a major cruise destination. SDARI itself is expected to design the first Chinese built cruise ship with Shanghai Waigaoqiao Shipbuilding widely tipped to be the builder.

Naval architects SDARI gained some experience in designing passenger vessels with the design of *Aranui 5*, but HuangHai Shipyard also built on its own experience, with the yard claiming that 70% of China's ro-ro orders have been built at its yard. The director of administrative affairs Han Ming Jie told *The Naval Architect*: "We have

The luxury modern interior of *Aranui 5* is a draw for passengers

Experience the progress.

LIEBHERR

ship.port.crane@liebherr.com
facebook.com/LiebherrMaritime
www.liebherr.com

TECHNICAL PARTICULARS

Aranui 5

Length oa: 126.08m
Length bp: 117.00m
Breadth moulded: 22.20m
Depth moulded to main deck: 7.85m
Draught design: 5.20m
Gross: 11,468gt
Displacement: 10,488gt
Lightweight: 6,467gt
Deadweight: 4,021dwt
Block co-efficient: ..... 0.75 (at design draught)
Speed, service: ..... 15kn (80%MCR, with SG 600kW x 2, 10%SM)
Water ballast (m^3): ..... 2380m^3
Main engine(s)
Design: ..... 2 x MaK Caterpillar 8M32C
Output of each engine: 4000kW
Propellers: ..... 2 x BERG Cu-Ni-Al with a diameter of 3400mm
Cargo cranes/cargo gear
Make: ..... 2 x Liebherr CBW 36(25) / 14(20) With 36.0 tonnes SWL, from 3.0m to 14.0m radius (hook operation);
Capacity: ..... 25.0 tonnes SWL, from 3.0m to 20.0m radius (hook operation)
Special lifesaving equipment
Number of each and capacity: ..... 4x90 persons
Make: ..... Jiangyinshi Beihai LSA Co. Ltd.
Type: ..... 8.5m Partly Common Life /Rescue Boat
Special lifesaving equipment
Number of each and capacity: ..... 2 x 6 persons
Make: ..... Jiangyinshi Beihai LSA Co. Ltd.
Type: ..... 4.5m F.R.P Rescue Boat
Special lifesaving equipment: ..... 6 x Jiangyinshi Beihai LSA Co. Ltd. RFD Davit Launched Liferaft with 25 persons capacity
Containers Total TEU capacity: 166
65 on deck &:101 in holds
Doors/ramps/lifts/moveable car decks
Number of each: ..... 19 Pcs
Type: ..... Hydraulic Sliding Watertight Door
Designer: ..... Wuxi Hailian Marine Fittings Co. Ltd.
Doors/ramps/lifts/moveable car decks
Number of each: ..... 4 Pcs
Type: ..... Embarkation Ramp & ER Spare Parts Ramp
Designer: ..... Shanghai Goodway Marine Engineering Co. Ltd.

Even with the beautiful Southern Pacific waters a swimming pool is essential on this cargo ship

delivered 18 ro-pax vessels with two more under construction and a further two ships on order."

The delivered vessels were mainly for Chinese and South Korean clients, explained Han, particularly after the *Sewol* accident there was a spate of new orders to replace old tonnage in the South Korean market.

HuangHai has a history of collaborating with SDARI on passenger vessels including the luxurious Bohai Bay ferry and Ming Jie confirmed: "We want to accumulate further experience in this market so that we can move into the cruise ship market."

The hybrid *Aranui 5* has helped in this respect, says Han, but the management at HuangHai has decided to develop this sector further. Interestingly the yard originally built fishing vessels and multi-purpose vessels, particulary for German shipowners.

However, in 1999 the yard shifted from being a state owned enterprise (SOE) to an independent yard. As the company reformed, with RMB45 million (US$6.84 million) capital, instead of taking on the standard company structure the president preferred to form a cooperative company with 80% of the shares being owned by HuangHai staff and the remaining 20% by a government agency.

"All the board members are elected by staff every three years, they are not designated or appointed, and the senior executives are allowed to have more than 1% of shares with the president holding the most with 3%, which is still not a controlling share," says Han.

The value of the company has since increased to RMB1.079 billion (US$164.02 million) while the workers' bonuses have also grown with the success of the yard.

"Workers' [that is all staff including management] salaries depend on the amount of work done, the length of service and the position in the company," explained Han. "Last year's bonus was the lowest ever," he said, with all the 2,500 employees affected by the sluggish newbuilding market. However, the yard structure benefits all staff and HuangHai workers will also build up a pension through the ownership of shares. An ordinary employee with 20 years service is expected to sell shares on retirement valued at RMB500,000 (US$76,000), while a middle manager with a similar length of service could retire with RMB4 million (US$608,000).

According to HuangHai, one reason for creating the cooperative was to encourage a higher standard of applicants to work at what is otherwise a relatively remote shipyard near Rongcheng in Shandong province. And once that talent is acquired Han says there must be some incentive to keep those people at the yard. "Once they're here they will not leave, but it is hard to recruit staff in the first place," Han said.

Respect for the yard is, however, growing with its reputation for high quality work, such as *Aranui 5,* and it has been rewarded with contracts even in these tough times for German owners who are particularly careful about the quality of work. There are also rumours of a Scandinavian owner negotiating to build four vessels at the yard with a further four options. The development of *Aranui 5* has enhanced the remarkable yard's reputation, allowing its joint owners to flourish in tough times. ***NA***

NAVALIA
INTERNATIONAL SHIPBUILDING EXHIBITION

2016 6th EDITION

24th, 25th and 26th May
VIGO (SPAIN)

www.navalia.es

Organised by: muestralo

Sponsors: VULKAN COUPLINGS, DNV·GL, //ABANCA

XUNTA DE GALICIA, CONCELLO DE VIGO, IGAPE, Porto de Vigo, ZFV, IFEVI

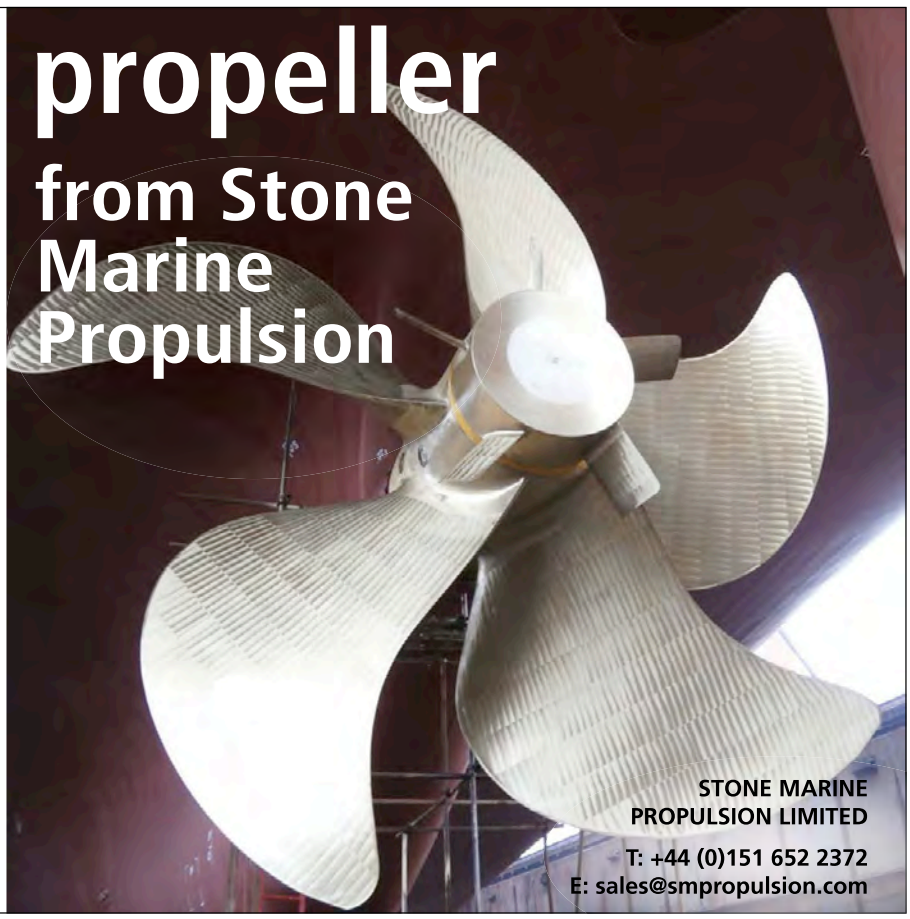
The NPT propeller from Stone Marine Propulsion

Already proven in service with some of the worlds largest shipping company's the NPT propeller:

- Lowers fuel consumption
- Reduces emissions
- Lowers noise and vibration
- Reduces cavitation and pressure pulses
- Can cost less than a conventional propeller
- Achieves additional gains when fitted with Stone Marine Cap Fins

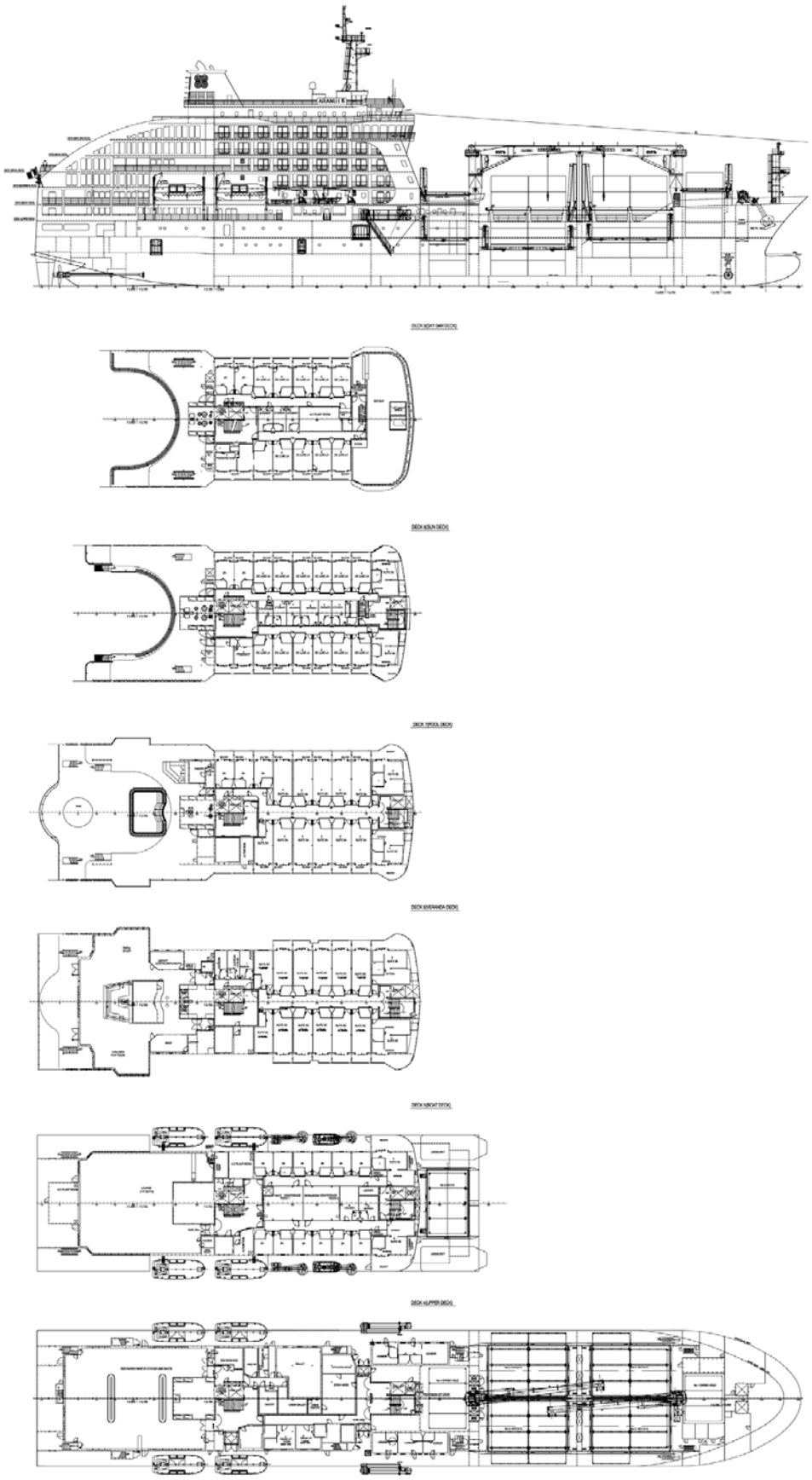
This highly efficient propeller design is suitable for all ship types including container ships, bulk carriers, tankers and gas carriers. For more information go to **www.smpropulsion.com/npt**

STONE MARINE
STONE MARINE PROPULSION



STONE MARINE PROPULSION LIMITED
T: +44 (0)151 652 2372
E: sales@smpropulsion.com

GA Plan for *Aranui 5*



DISCOVER BETTER DESIGNS. *FASTER.*

STAR Global Conference 2016 PRAGUE

7 - 9 MARCH | HILTON PRAGUE

BOOK NOW!

#SGC16

FREEDOM TO INNOVATE

The Marine industry is subject to an increasing number of regulations, related to energy efficiency and emissions control, which will influence all aspects of future ship performance. To meet these challenges, the industry needs to move away from traditional design methods and optimize ship performance at design stage. STAR-CCM+ offers the best approach, allowing full scale CFD simulation of vessels under real operating conditions, and delivering better more efficient vessel design.

info@cd-adapco.com
www.cd-adapco.com

CD-adapco

STAR-CCM+

DECK EQUIPMENT AND HANDLING SOLUTIONS

Marine Cranes

Offshore Cranes

Launch and Recovery Systems

Boats

Winches and Offshore Equipment

After Sales and Service

PALFINGER

LIFETIME EXCELLENCE

NDM NORWEGIAN DECK MACHINERY

PART OF THE PALFINGER GROUP

PALFINGER MARINE is the global leading manufacturer of highly reliable, innovative and customised deck equipment and handling solutions for the maritime industries.

WWW.PALFINGERMARINE.COM
WWW.NDM.NO

Competitive hedge

Western companies have been moving production to China for many years and TTS Group was an early mover, having first entered into a joint venture in 1998. Today the company has a number of Chinese subsidiaries and the company has developed software to help with the technological change

Joint venture (JV) companies have sprung up in many industries in China as Western multinationals have sought to take advantage of the cheap labour and other costs in what was a fast developing market.

In recent times the Chinese economy has slowed significantly and the ripple effect from the global economic crash in 2007/08 is still being felt in the maritime industry today.

As the newbuilding market has constricted, those in established JV's were in a strong position to maintain their business. Most recently, however, the tough global conditions have intensified competition and companies are looking for an edge.

The solution for the Norwegian headquartered TTS Group was to create a number of JV companies with Chinese enterprises and to train local staff to build the cranes to German standards. In Guangzhou there is TTS-SCM Marine and Offshore Machinery, in the Bohai Bay region there is the TTS BoHai Machinery (Dalian) Co and in Shanghai TTS Hua Hai Ship Equipment produces heavy lift cranes.

TTS BoHai was created in 2005 and started manufacturing hose handling cranes and other marine and offshore cranes. Chinese staff were sent to Norway for training for the Boffai company. In Guangzhou TTS SCM was established in April 2015 and the company received an immediate boost with the NOK274 million (US$30.88 million) order of six ship sets, 18 cranes in total, for COSCO, with each vessel being fitted with two 350tonne cranes and a 100tonne crane. The first set is expected to be delivered in late May this year with the final set due for delivery in 2017.

TTS Hua Hai is another 50/50 JV, as is TTS SCM, but the Shanghai based Hua Hai, a China State Shipbuilding Company (CSSC) subsidiary, manufactures marine access equipment. TTS Hua Hai was established in 1998, after negotiations between MacGregor and the Chinese broke down with the European company demanding an 80% share in the JV rather than an even split, but the latest developments are now seeing the JV's further evolution as the shipbuilding industry has evolved.

The Chinese shipbuilding industry has undergone a significant period of consolidation and restructuring. The number of shipyards operating in China has already reduced from around 1,400 two years ago to under 700 yards this year and the China Association of the National Shipbuilding Industry (CANSI) expects that figure to fall to around 30 yards in total over the coming years.

Significant consolidation by the shipyards is a game-changing affair for the equipment suppliers who must develop relationships with both the yards and ship owners in an effort to develop their business. And with the intensification of competition between deck equipment providers, such as TTS, MacGregor and the fast expanding Palfinger (which has stated that it wants to be in the top three deck equipment providers within the next three to five years), the pressure is on the companies to provide the best service possible.

Geir Storaas, chairman of TTS-SCM told *The Naval Architect*: "European owners were prepared to pay a premium for European production, but with the reduction in European shipbuilding, we need to do work of a similar quality in Asia. We have TTS as a backer and NMF as a strong brand, and there are a lot of German owners; the game has changed following the recessions…we are now telling owners that they can get German quality in China."

For TTS Group, this means producing cranes to a German design, with German quality in China with Chinese staff. And in order to achieve this goal, the German subsidiary heavy lift crane builder, TTS NMF's general manager of operations Andreas Harms, based in Hamburg, devised a system that would train the staff at the Chinese sister company to achieve similar results as their European counterparts.

"We have the requirement and technology described from Germany, but we cannot have quality problems building up to the final stage of production," stressed Harms, who emphasised the need to supervise and check at every stage of the production process. "Achieving German standards is difficult," he conceded, but pointed out that if there was high quality welding, for example, there would be no "after work", which is grinding welds flush as a result of poor welding in the first instance.

To achieve the quality required Harms spent four months writing a piece of software with the cooperation of his German staff that catalogued each stage of building a crane, showing each piece necessary, which technician was required and how to complete each task. The software is detailed down to every nut and bolt required to build a crane and the aim is to train Chinese staff so that an owner can no longer "tell the difference between German and Chinese workmanship".

The software tool, as yet unnamed, is patented by TTS Group and can be adapted to any production process; it comes complete with photographs and diagrams and in three languages, German, Chinese and English and has now been put to the test with the building of the COSCO ship sets using the programme.

"This is a demonstration of technology transfer – not just nuts and bolts – but the complete management system, said

Harms, adding, "When we get the first delivery in May we will see the effectiveness of the system".

Harms admits that "transferring a work ethic is very difficult, you must first follow procedures, step-by-step and you must not change a thing. There must be a change in the Chinese mind-set that 'it's good enough'".

The Germans have credibility where this is concerned, since they are the best managers in the world, claims Harms. "It's not just the flatness of the steel cut, but it's the efficiency in hours and minutes too, China is not there yet, but it will come."

However, Harms also admits that "The Germans are not the most elegant – they're very bureaucratic – they have 25 years of experience and they keep telling us that. They do not compromise."

This uncompromising nature caused some friction at the beginning, but relations are improving as time goes by, he says, adding that the two groups need time and to get some projects under their belts before it becomes easier. "If we can release this potential it will be fantastic for all parties."

There are many potential culture clashes, but the Germans have made a major investment in China and there is pressure to make it a success. The Germans must, therefore, put their efforts into coaching, allow their Chinese partners to operate in a Chinese way and recognise that the competition is rapidly changing into a Chinese game, which is price focused - "this is a completely different world".

Still developing, different global economic conditions pose difficulties for all operating in that market and in China in particular. TTS has found a solution that it believes will benefit its operations in China, Norway and Germany alike and the theory and initial signs look positive.

There are nagging doubts, however, for the future with downward economic pressures, and the strong growth in China, seen for a number of years, beginning to decline. A strong parent company is essential to support the technology transfer and the development of the JV companies.

A positive indicator of the state of the global economy is the cost of energy and at the time of writing West Texas Intermediate and Brent Crude had plunged further and were trading at around US$26-27/barrel, down from the mid-US$30/barrel a month earlier and around 50% of the price from a year ago, according to Oil-Price.net.

The decline in the oil price has also hit TTS Group as a whole with the offshore crane business and shipbuilding both hitting orderbooks and employment numbers.

The pay-off for those European companies with strong JV partners is that they can ride out the economic storm with more confidence. But as TTS Group has highlighted, companies must still innovate to maintain their competitive edge over their industry challengers. *NA*

www.steerprop.com

ECONOMICAL WITH HIGH PERFORMANCE

Being economical with fuel doesn't have to mean inferior performance or reduced reliability.

Available up to 25 MW, Steerprop CRP (Contra-Rotating Propellers) propulsors provide 5 - 15 % improvement in fuel efficiency.

Steerprop Push-Pull CRP technology combines unsurpassed propulsive efficiency with the reliability of robust mechanical propulsion.

Steerprop
The Azimuth Propulsion Company

EMSA finalises third passenger ship safety study

In the latest European Maritime Safety Agency study assessing the acceptable and practicable risk level of passenger ships a number of research institutions looked at issues related to damage stability in ro-pax and cruise ships

A consortium coordinated by DNV GL has recently finalised a study on the damage stability of passenger ships. This is the third study on this topic funded by the European Maritime Safety Agency (EMSA). The research work has led to recommendations for updated requirements, new software tools and new knowledge of the risks from watertight doors and grounding. The final output from the work has also been forwarded to the IMO Sub-Committee on Ship Design and Construction (SDC) for further consideration.

The probabilistic concept of damage stability was made applicable to cargo ships by the 1990 Amendments to the SOLAS Convention. The probabilistic concept implies that a factor A (Attained Subdivision Index), which is the weighted sum of the probabilities of damage occurring (p-factor) multiplied by the respective probability of survival (s-factor), shall be bigger than the target value R (Required Subdivision Index).

$$A = \sum p * s \geq R$$

Through a harmonisation process, the requirements were updated and also expanded to include passenger ships in the 2005/2006 Amendments to SOLAS, normally referred to as SOLAS 2009. The development of the new requirements was to a large extent based on the work carried out in the partly EU-funded research project HARDER.

According to the terms of reference set forth by IMO at that time, the introduction of the probabilistic concept to passenger ships should maintain the safety level and not lead to stricter standards. Since SOLAS 2009 entered into force, designers of passenger ships have gained a lot of experience which provides a better background for setting future safety targets. Several research projects have concluded that the level of the required index R could be adjusted in accordance with the ALARP principles.

Figure 1: A sample of the ships used in the EMSA III study

The EMSA II study (addressing ro-pax ships) as well as the partly EU-funded research project GOALDS included recommendations to raise the level of R. Against this background and in light of the accident involving *Costa Concordia*, EMSA developed the project description for the third EMSA study.

The EMSA III study covered the following specific tasks:

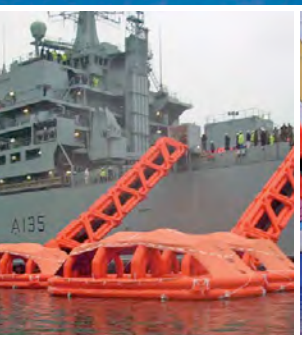
1. Collision risk and risk acceptance criteria
2. Risk from watertight doors
3. Risk from grounding
4. A combined assessment based on the above three tasks; combining the collision risk with risks from watertight doors and grounding
5. An impact assessment in accordance with EU Guidelines
6. Recalculation of the sample ro-pax ships used in the GOALDS project

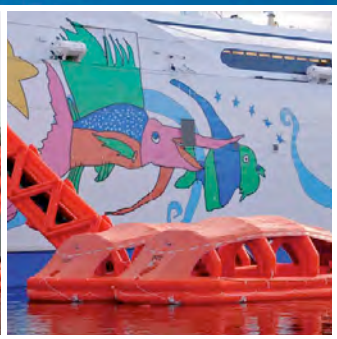
In order to be able to provide a technically sound and robust basis for recommendations, a consortium with expertise in ship design and operation, risk modelling, formal safety assessments (FSA), accident data analysis and software development was established. The major European passenger ship builders, represented by EUROYARDS (Meyer Werft, Meyer Werft Turku, STX-France and Fincantieri) and ship design consultancy company Knud E. Hansen, together with the major cruise and ferry operators (RCCL, Carnival, Stena and Color Line), established 'design teams' that have studied possible ways of improving a ship's ability to survive flooding represented by the attained index A. The sample ships provided by the shipyards/designers used in the study are shown in Figure 1.

The National Technical University of Athens (NTUA), University of Trieste (UNITS), University of Strathclyde (SSRC) and DNV GL have played key roles in the examination of accident statistics and the development of risk models, and FSA compilation Safety at Sea (SaS) has led the task concerning risk from watertight doors. NAPA was responsible for developing the software for grounding calculations and DNV GL has coordinated the studies.

The methodology applied in the studies is based on the IMO Guidelines for

THE MES YOU CAN DEPEND ON






In 1992 Liferaft Systems Australia (LSA) pioneered a simple inclined slide based dry shod Marine Evacuation System (MES) designed to be simple to use and deliver passengers and crew, fast yet safe, directly into large capacity liferafts. Today LSA MES is world renowned for reliability and installed on all types and sizes of passenger & personnel carrying vessels, including conventional ferries, high-speed craft, cruise ships, military vessels and large private yachts.

SAFE, RELIABLE, SIMPLE TO USE, COST EFFECTIVE TO OWN

CERTIFIED TO IMO, SOLAS AND EU; AND APPROVED BY USCG, TRANSPORT CANADA AND DNV.

WWW.LSAMES.COM

LSA
LIFERAFT SYSTEMS AUSTRALIA

AUSTRALIA: 5 Sunmont Street, Derwent Park Tasmania 7009 Australia
Phone: +61 3 6273 9277 Fax: +61 3 6273 9281 Email: info@LSAMES.com

EUROPE: Phone: +44 7939 468 224 Fax: +44 2891 240 138 Email: p.rea@LSAMES.com

NORTH AMERICA: Phone: +1 604 780 0016 Fax: +1 604 434 2911 Email: v.prato@LSAMES.com

c: 140828

Formal Safety Assessment (FSA) for use in the IMO rule-making process.

The IMO FSA Guidelines comprise the following elements:

1. Hazard identification
2. Risk analysis
3. Risk control options
4. Cost benefit assessment
5. Recommendations for decision making

The problems identified relate to collision and grounding accidents and the ship's ability to survive such accidents. Means for reducing the probability of such accidents occurring have not been a part of the study. The high-level risk model for collision in the form of an event tree is shown in Figure 2.

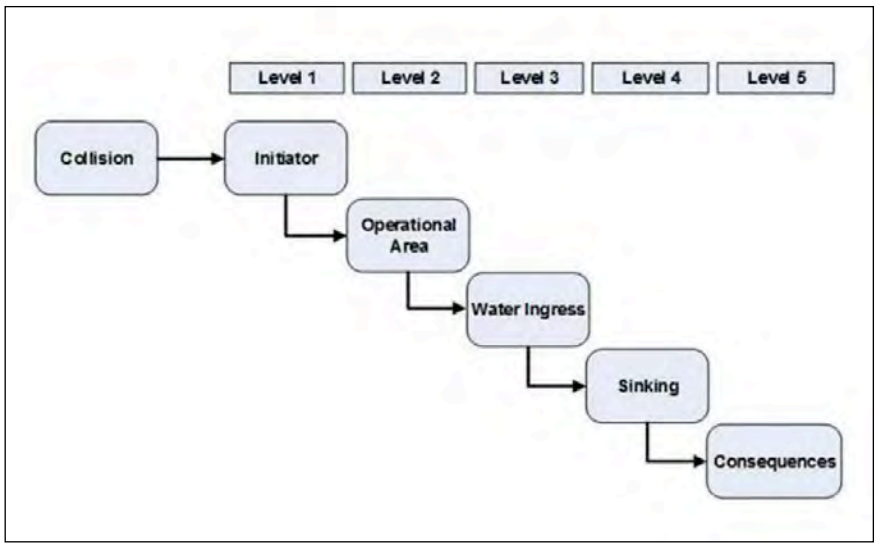


Figure 2: The high-level risk model for collision as an event tree

Each level reflects a probability which has been derived from a thorough investigation of accident records. The initial collision frequency is based on recorded accidents for ro-pax and cruise ships respectively during the period from 2000 to 2012. The relevant branches, level 1 to 3 in the event tree, have been populated based on the data found in the accident databases covering the period from 1994 to 2012.

The probability of sinking is taken as 1-A, where A is calculated according to the current SOLAS Regulation. The next level reflects whether the ship will sink slowly or quickly. This is to a large extent based on known results of model tests, although nearly all model tests have been carried out on ro-pax ships. The models reflect that a ro-pax ship is more likely to capsize rapidly than a cruise ship, which tends to sink more slowly. In scenarios where the ship sinks or capsizes rapidly, it is assumed that the fatality rates are higher. By using this risk model, the risk is expressed as the Potential Loss of Lives (PLL). It may be seen that there are several factors influencing the results and these have been investigated using sensitivity and uncertainty analyses.

The modified designs developed to increase the probability of survival corresponding to the attained index A are considered as Risk Control Options (RCOs). The additional building and operational costs imposed by the design modification are calculated for each RCO. It is generally seen that a moderate increase in the ship's breadth alone or in combination with a rise in the freeboard gives a higher attained index A. However, there are costs related to such modifications; the newbuilding price will increase and the operational costs may also increase due to added fuel consumption and maintenance costs.

Each risk control option needs to be assessed with respect to cost criteria. In FSA, the terms used are:

Gross Cost of Averting a Fatality:

$$GCAF = \frac{\Delta Cost}{\Delta Risk}$$

Net Cost of Averting a Fatality:

$$NCAF = \frac{\Delta Cost - \Delta Benefit}{\Delta Risk}$$

For all RCOs included in this study, the business cases have been assumed to remain unchanged from the initial design. For example, no benefit from increased passenger capacity or lane metres has been accounted for and the ship is assumed to maintain its operating schedule. The only benefit accounted for is the value of the ship itself and the reduced probability of the loss of the ship when the survivability represented by the attained index A is increased.

An RCO is recommended to be implemented when the Gross Cost of Averting a Fatality (GCAF) or Net Cost of Averting a Fatality (NCAF) is less than the Value of Preventing a Fatality (VPF). According to the IMO FSA Guidelines, the VPF is derived by methods based on the quality of life approach. In this study, two values for the VPF were suggested to be used: US$4 million and US$8 million.

An example showing the results of the cost-benefit assessment considering collision for the large Baltic ro-pax sample ship is shown in Figure 3.

The solid lines show the limiting cost, corresponding to the thresholds of US$4 million (green line) and US$8 million (red line). The dotted lines represent the upper 95% and lower 5% uncertainty limits. For each RCO, the associated cost in terms of Net Present Value (NPV) is plotted versus the attained index A. This enables a quick overview of the various RCOs and their cost-effectiveness.

Risk from watertight doors

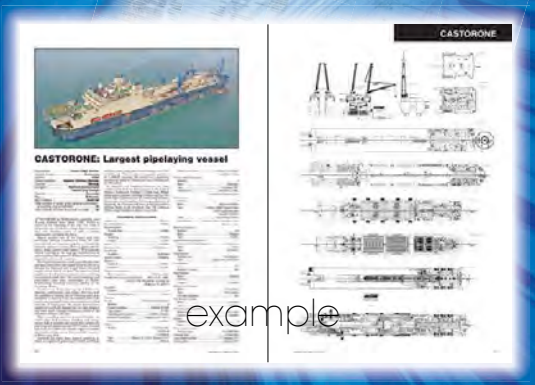
If one or more of the watertight doors are open when an accident leading to flooding occurs, the ship's survivability may be reduced compared with the design value, which has been based on the assumption that all watertight doors are closed. A simplified mathematical model was developed to quantify this impact based on the number of watertight doors, their category (accepted to remain open or always kept closed) the volume of connected spaces, the ship's total buoyant volume, and the time taken by the crew to respond to the flooding situation and for the doors to close. Rates of watertight door failures (reliability) were also accounted for.

The mathematical model was used to study RCOs, i.e. how the additional risk imposed by the watertight doors can be reduced by the rearrangement/removal of doors or categorisation. The RCOs studied suggest that the number of watertight doors in a category

Newbuildings included:

Othoni
UASC Al Khor
Navig8 Serenity
K. Younghung
Hoegh Target
D&K Abdul Razzak
Khalid Zaid Al Khalid
Maersk Tacoma
Dole Pacific
Navig8 Excel

plus many more...



SIGNIFICANT SHIPS

available in printed or CD ROM format

The Royal Institution of Naval Architects will publish the **26th** edition of its annual **Significant Ships** series in February 2016. Produced in our usual technically-orientated style, **Significant Ships of 2015** presents approximately 50 of the most innovative and important commercial designs delivered during the year by shipyards worldwide. Emphasis will is placed on newbuildings over 100m in length, although some significant smaller cargo ships, fast ferries and offshore vessels were considered, including a cross-section of ship types, with each vessel being either representative of its type or singularly significant. Each ship presentation comprises of a concise technical description, extensive tabular principal particulars including major equipment suppliers, detailed general arrangement plans and a colour ship photograph.

PRE PUBLICATION OFFER

Non-member £39 (RINA member £34.50)

or order a set:

One copy of **SIGNIFICANT SHIPS 2015** &
one copy of **SIGNIFICANT SMALL SHIPS 2015**
price £52 (RINA member £45)

When ordering please advise if printed or CD ROM format is required,

contact:

The Publications Department, RINA,
8-9 Northumberland Street, London WC2N 5DA, UK.
Tel:+44 (0)20 7235 4622 **Fax** +44 (0)20 7259 5912
E-mail: publications@rina.org.uk **Website:** www.rina.org.uk

HELKAMA

NEW
NEK 606 OFFSHORE
CABLES

THE PERFECT CONNECTION

We enable the perfect connection for your business.
Connect with us at helkamabica.com

IEC Marine and Offshore Cables • NEK 606 Offshore Cables • Flexible Cables • Industrial Cables • Optical Fibre Cables

which, under current regulations, may remain open under certain conditions needs to be reduced or removed altogether. This may in some cases involve redesigning the ship in order to ensure efficient operations.

Risk from grounding

Grounding accidents are usually associated with bottom damage. However, in a series of grounding accidents with severe consequences (the most recent of which is the accident involving *Costa Concordia*), the area of the hull breach was not at the bottom where the double bottom could offer protection, but at the side. This is why two different types of damage are considered: bottom damage, with a principally vertical direction of penetration, and side damage, with horizontal penetration. Since the second type of damage may also occur as a result of a contact accident, both grounding and contact accidents were included in the accident databases. The high-level risk model is shown in Figure 4.

In the GOALDS research project, statistical distributions of the extent, location, penetration, length and width of hull breaches were derived and could be used to represent the bottom grounding scenarios. In order to address side damage, additional investigations into accident databases were carried out for the purpose of deriving statistical distributions of the damage characteristics.

To assess survivability in a damaged condition, a non-zonal direct approach was adopted where the statistical distribution of the damage extent and location is applied directly to generate hull breaches along the hull. For each generated hull breach, the corresponding watertight compartments open to the sea are identified. By grouping different hull breaches leading to the same damage case, it is possible to determine the probability associated with this damage case, i.e. the p-factor. The attained index A is then obtained by the weighted sum of the probabilities of the damage occurring multiplied by their respective probability of survival using the same s-factor as for collision damage set forth by the SOLAS regulations. The attained indices (A) for bottom grounding damage and side grounding damage were then used in the risk model as the probability of surviving the grounding damage.

The grounding assessment is illustrated by using the large Baltic ro-pax as an example, see Figure 5. The attained indices for collision and bottom and side grounding, along with a 'mean' attained index for grounding, are shown for both the initial design and the recommended RCO from the collision studies.

Design variants with improved survivability in the case of collision accidents generally also showed improved survivability in the case of grounding and contact accidents as well.

It was also observed that the attained index for grounding was in general higher than the attained index for collision. However, the

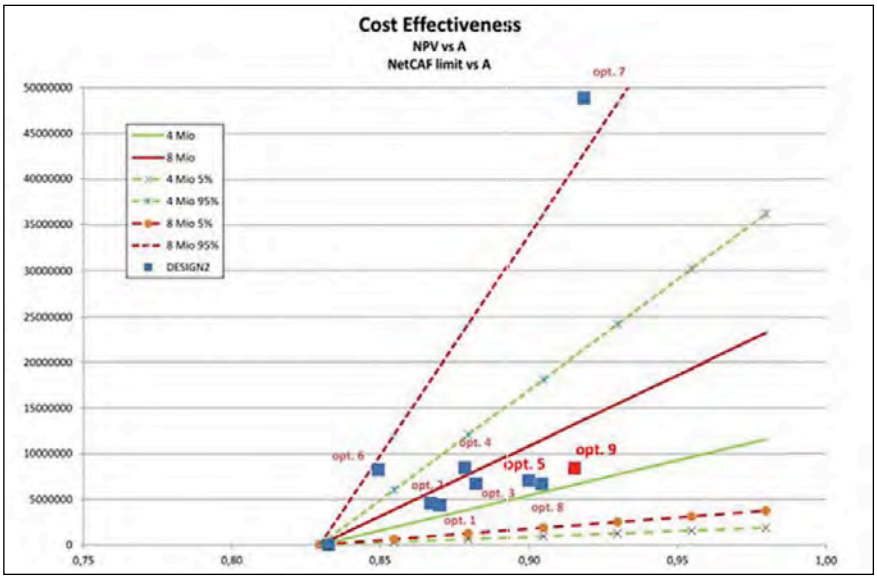


Figure 3: The cost benefit assessment, considering collisions, for a large ro-ro ship operating in the Baltic Sea

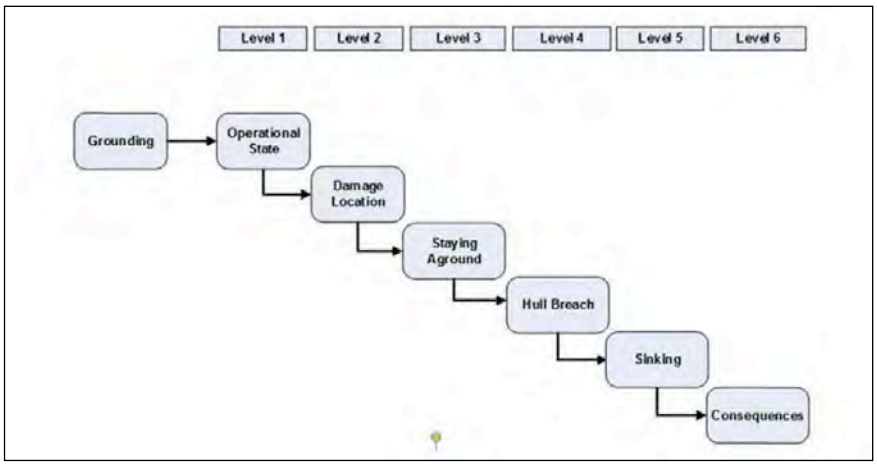


Figure 4: An event tree for a passenger ship grounding or contact accident

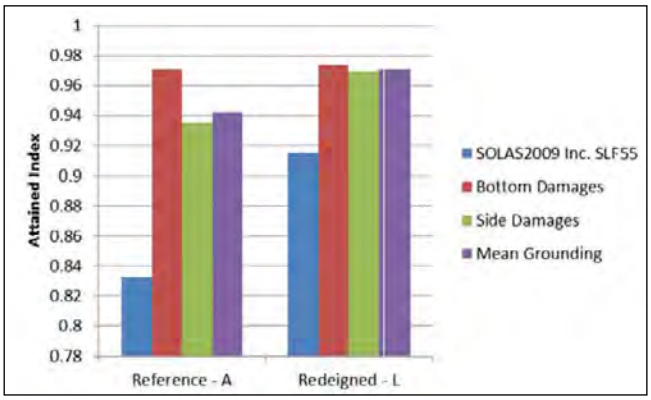


Figure 5: Grounding assessment for a large ro-pax ship operating in the Baltic Sea

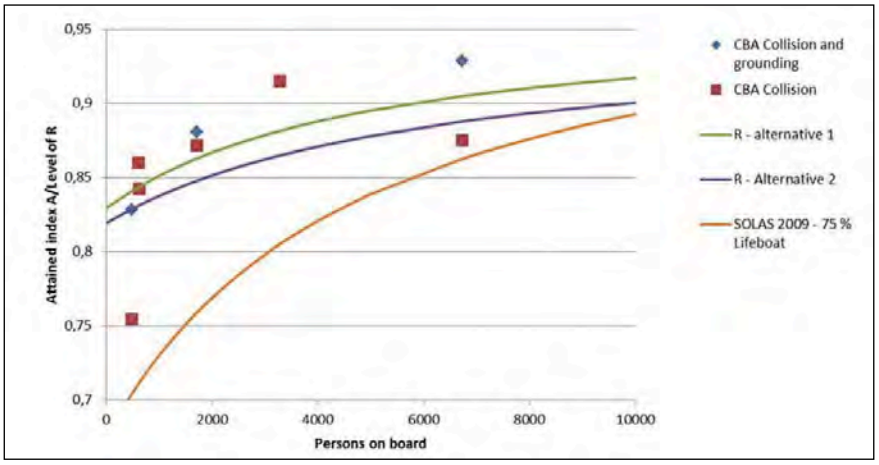


Figure 6: Assessment of the level of R for Risk Control Options that are cost-effective following a reduction in grounding risks

resulting risk to human life (PLL) is higher than that for collision. This is mainly due to the higher initial frequency of grounding and contact accidents compared with collision accidents, and this tendency is found for both ro-pax and cruise ships.

It was concluded that the watertight doors pose an additional risk; however, the general recommendation is to impose strict controls to ensure that the doors are kept closed.

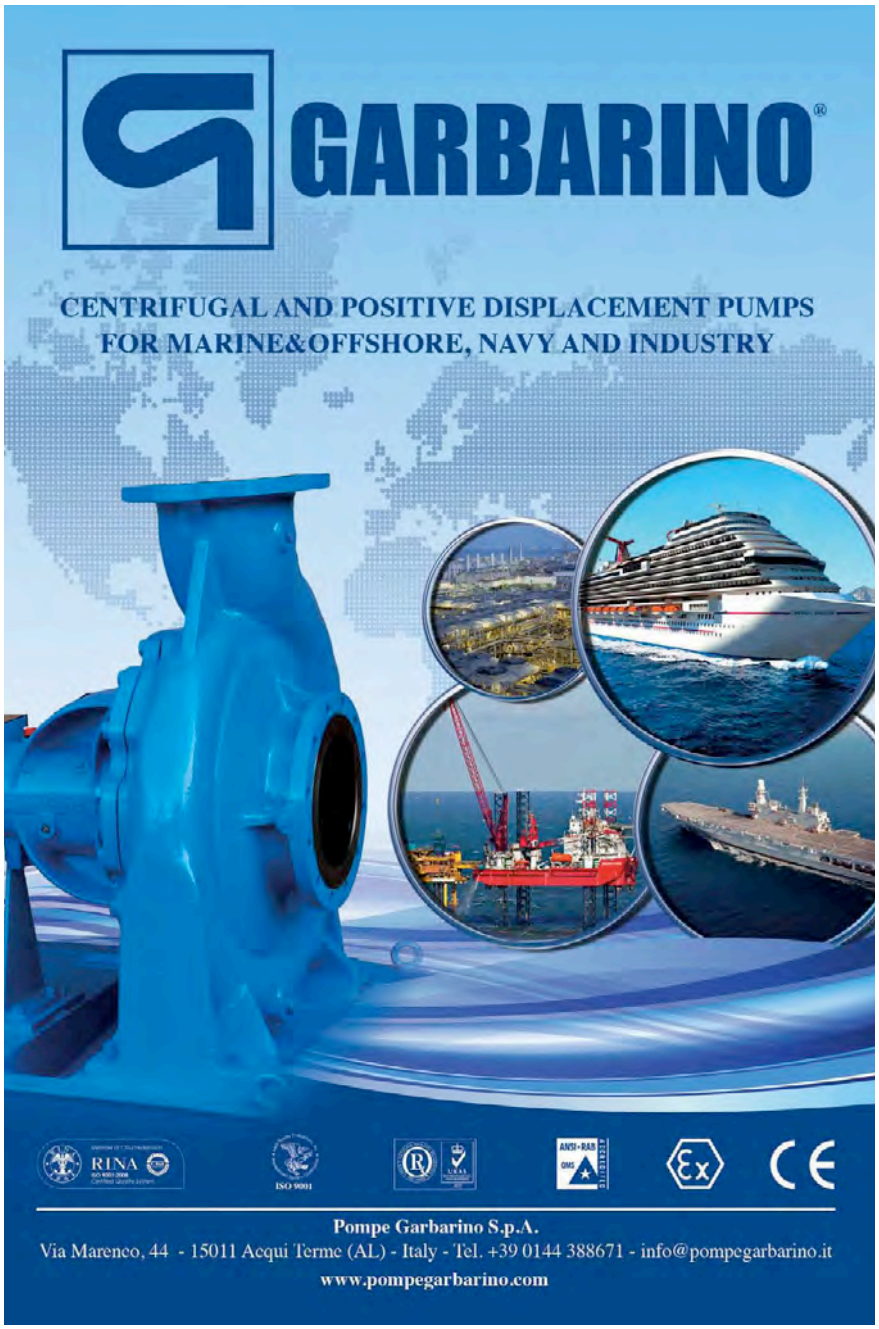
The results of assessments of the collision and grounding risks were used in a combined cost benefit assessment. It was seen that when the reduction in the risk from grounding is included in the cost benefit assessments, additional RCOs become cost-effective and the CAF levels are reduced. Using the large Baltic ro-pax as an example, it was seen that while the mean CAF value for the recommended design option L is US$6.46 million if only collision is considered, this value drops to US$1.98 million when a combined assessment of collision and grounding is performed.

Recommendations

The results of the assessment were used to suggest the level of R for collision. A slightly higher level of R can be suggested for the RCOs that become cost-effective when the reduction in the risk from grounding is taken into account. This is shown in Figure 6, which also includes for illustration the current level of R for ships with a 75% lifeboat capacity. It is seen that both proposals for a revised R represent a significant increase for small and medium-sized ships compared with the current standard, and are directly reflecting an increased level of safety for passenger transport at sea.

In addition, the achievements that have been made with respect to new methodologies for assessing risk from watertight doors, risk from grounding as well as the new software tools for grounding should be considered as a basis for further development and research. *NA*

For more information and downloading of reports, please visit the EMSA homepage: http://www.emsa.europa.eu/damage-stability-study.html.



JSC SSTC: PARTICIPATION IN DESIGN OF SHIPBUILDING AND SHIP REPAIR YARDS

JSC "Shipbuilding & Shiprepair Technology Center" (JSC SSTC) is a leading Russian design company for shipbuilding and ship repair yards.

DC "Soyuzproektverf", a structural division of JSC SSTC, celebrating its 85 years anniversary in 2016, designed major shipyards in Russia, as well as many production sites and facilities. JSC SSTC is currently focusing on development of complex construction projects and modernization of shipbuilding and ship repair yards throughout Russia.

Greatest modernization of production facilities in North-West region of Russia is being implemented by JSC SSTC at JSC "PO "Sevmash". This includes upgrade of all production facilities, reconstruction of transportation and handling complex together with hydraulic structures. The most important aspect here is reconstruction of transportation and handling complex together with hydraulic structures since it shall secure construction of heavy-tonnage ships. In general, reconstruction must bring the following results: establishment of docking place at upper stage of company's artificial basin equipped with jib crane of 1200 t capacity; construction of modern hull plating shop of 100 000 t annual capacity; modernization of slip to secure lifting/launching of ships up to 6000 t weight; construction of modern hull painting sections, automated and robotized sections together with hull plating, pipe processing and welding-assembly sites. This will raise technical-economic index of the company up to the level of leading world shipyards.

JSC "SC "Zvezdochka" JSC SSTC is now undertaking complex upgrade of its production facilities including reconstruction of hydraulic structures, ship transfer system, technical retooling of shops. It has been also planned to upgrade facilities to secure serial production of auxiliary vessels. The construction of the experimental complex for production of rudder propellers has been started recently. Construction of new production shop of modern propulsion systems shall start in the nearest future.

Since 2012 a project on transfer of submarine production facilities of JSC "Admiralteiskie verfi" to the southern site is being implemented. This will free the area of Novo-Admiralteisky island. In fact, submarines will be constructed at a new "compact" shipyard. Heavy-tonnage and auxiliary ships for Russian Navy will be constructed by large-block construction method at central site, which is subject for future reconstruction and retooling.

Fig. 1. New shipbuilding complex at Kotlin island

In order to develop shipbuilding industry in Western region and as per contract with Ministry of Industry and Trade of Russian Federation, JSC SSTC rendered research works in 2013 including analysis and selection of deployment site for universal shipyard oriented for construction of heavy-tonnage ships and developed concept design of new shipbuilding complex for construction of advanced heavy-tonnage ships in particular. Relevant research results were

Fig. 2. JSC "FEP "Zvezda"

submitted to Ministry of Industry and Trade of Russian Federation for further consideration (Fig. 1).

Within the frames of Far East shipbuilding development, at JSC "FEP "Zvezda" JSC SSTC is now implementing 1st stage of "Shipbuilding complex "Zvezda" including hull plating shop, painting chambers, building berth, outfitting shops and auxiliary sites (Fig. 2). The concept is being developed for establishing full-scale production facilities (2nd and 3rd stage).

In order to establish ship repair facilities for Pacific fleet at JSC "SRC "Dalzavod" JSC SSTC is developing design documentation for construction of deepwater quay with vertical ship's lift, building berths and covered berth, full-scale reconstruction of shops and power supply facilities. Modernization programs also include fundamental reconstruction of company's dry docks.

JSC SSTC participates in foreign projects for construction of facilities in India, Vietnam, Indonesia, Brazil, Venezuela and others. In Vietnam JSC SSTC implements two large-scale projects.

In 2007, the negotiations started regarding delivery of P.636 submarines in Socialist Republic of Vietnam and establishment of relevant onshore base infrastructure. Contract for two-stage design of onshore infrastructure was signed in 2009. In 2010 JSC SSTC completed development of 1st stage documentation – "Preliminary project proposals". These proposals included solutions securing basing, scheduled maintenance and dock repair of P.636 submarines and considered deployment of the following facilities as part of future Naval base: technologically connected buildings and structures of floating repair dock, stationary quay and floating berth, shiprepair workshop, stationary power supply, battery-charging station. This project secures simultaneous basing for several submarines, supply of utilities, scheduled and preventive maintenance, dock inspection, battery service and charging.

Documentation of 1st stage and master plan of submarine base with layout of mooring, docking and onshore facilities was approved in 2010. In 2011 JSC SSTC completed development of 2nd stage documentation and successfully defended it in Haiphong. Upon that, the documentation was submitted to design institutes of Socialist Republic of Vietnam for adaptation and civil part development.

In course of construction works, specialists of JSC SSTC were finalizing construction documents, supervising building of objects and structures, rendering technical support

Fig. 3. 3D model of X-52 dockyard. Rendered by Vietnam specialists

in installation and commissioning of equipment manufactured in Russia and delivered to Vietnam.

In April 2015, the acts were drawn up that JSC SSTC fulfilled all contractual obligations on establishment of the naval base and onshore infrastructure was put into operation. Timely completion of assembly works and commissioning allowed full-scaled basing of P.636 submarines, which excludes usage of onboard power supply systems and prevents their wearing at pier. Submarines were provided with all required utilities, such as power supply, high-pressured air, high-pressured nitrogen and cold water for conditioning of compartments.

In parallel to the project described above, JSC SSTC also participated in construction of X-52 dockyard which is another major joint project between Russia and Vietnam (Fig.3).

Design of dockyard and base was split in two stages. First stage known as "Preliminary project proposals" included solutions on factory and dockyard repairs of surface ships and P.636 submarines, such as new shops, sites and auxiliary production facilities: armament repair facility; partially covered berth, hull repair and mechanical repair shop; diesel engines repair shop, pipe and electric equipment repair shop, instruments and automated equipment repair shop, outfitting and electroplating shop; post-repair testing station for pumps, electric compressors, drying blocks, diesel engines, electric machines and equipment up to 100 kW capacity; testing complex for high pressure air systems; power supply unit; diesel electric station for special and backup power supply, ship power station with battery charging and service station, low pressure air compressor station and other facilities.

Master plan of the plant also included hydraulic facilities and other objects which had been designed by Vietnam specialists.

Documents of 1st stage and master plan of X-52 plant were approved by joint protocol in June, 2012. In 2013, 2nd stage documentation was developed and defended. Upon that, it was submitted to Vietnam specialists, which used it as a basis for development of construction documentation for facilities of X-52 plant. Construction documentation is currently under finalization and approval procedure at JSC SSTC.

The following works are now being conducted at the plant: construction of quay walls, ship lifting and launching devices, transfer berth and plant control room. The Russian party started manufacturing of special technological equipment for outfitting of plant shops as per 1st design stage.

JOINT STOCK CORPORATION
SHIPBUILDING & SHIPREPAIR
TECHNOLOGY CENTER

JSC "Shipbuilding & Shiprepair Technology Center"
7, Promyshlennaya Str., 198095, Saint Petersburg, Russia
Phone: +7 (812) 786-26-10
Fax: +7(812)786-04-59
E-mail: inbox@sstc.spb.ru

Counting the cost of cruising

Increasing regulation for the cruise industry and shipping in general, safety requirements, as well as the need to save costs, are key to running successful cruise operations. At the same time, demands by passengers for ever-more sophisticated technology are a major consideration as cruise lines seek to secure market share. Sandra Speares reports

Cruise companies like P&O and Cunard say they are making great strides in reducing waste onboard vessels as well as cutting emissions, which will continue to be a regulatory target, both at the IMO and within the EU, as well as by international players in the wake of the Paris climate conference last year.

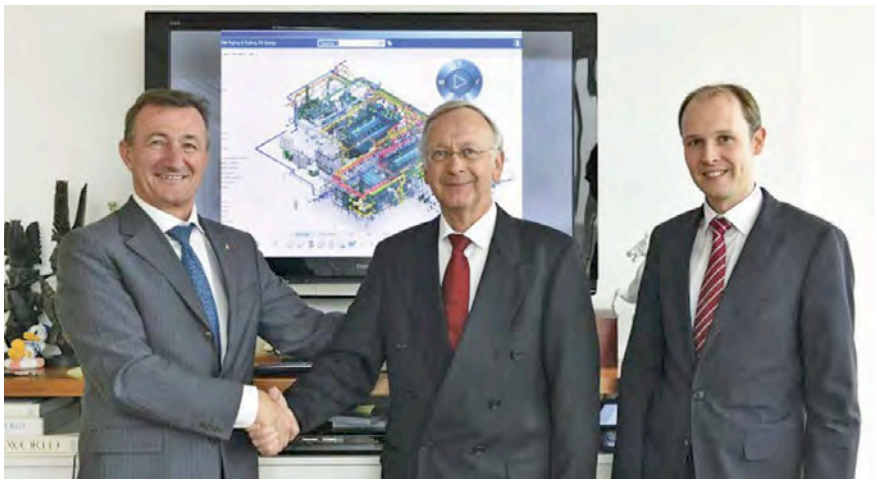
An array of energy-saving measures onboard ships in the fleets of both P&O Cruises and Cunard Line and a reduction in sea miles travelled resulted in a positive result with consumption 18% below the 2011 total, according to the 2014 sustainability report.

This reduction was also a factor in cutting CO_2 emissions by nearly 5%, helping to ensure that parent company Carnival Corporation was able to reach its target of reducing its greenhouse gases by 20% between 2005 and 2014 – a year ahead of schedule. The next target is 25% by 2020.

The company says: "It was not just fuel and emissions that were reduced as the level of food waste produced was also cut back for the second year in succession so the level was less than 75% of the 2012 total."

Carnival has ordered four next-generation cruise ships to be built for Costa Cruises and AIDA Cruises which will use LNG to generate 100% of the ship's power both in port and at sea, significantly reducing exhaust emissions. Attention will be focused on how well these ships perform, not least because of perceived supply problems for bunkering LNG in many ports and safety issues surrounding the use of LNG on passenger vessels.

Carnival will launch another four new ships in 2016 across four of its global cruise brands. These additions are part of the 17 ships scheduled for delivery for Carnival Corporation's 10 brands through 2020.



Meyer Werft adopts Dassault Systèmes' 3D EXPERIENCE platform and industry solution. From left, Bernard Charlès, director general Dassault Systèmes, Bernard Meyer and Dr Jan Meyer, CEOs, Meyer Werft, shake on the cooperation

The four new ships include: Holland America Line's *Koningsdam* – due to be delivered in April 2016; Carnival Cruise Line's *Carnival Vista*, also due in April; and AIDA Cruises' *AIDAprima*.

The *AIDAprima*'s filter system means that emissions of SOx, NOx and particulate matter are reduced by more than 90%, and the ship has benefitted from a new hull design to increase energy efficiency. The ship is also fitted with a Mitsubishi Air Lubrication System (MALS).

The 124,100gt vessel will be the newest flagship for AIDA Cruises, with 1,643 cabins. In addition to being one of the most technologically advanced vessels in the world, Carnival claims it will be the most environmentally friendly cruise ship in the world.

MALS saves energy and reduces CO_2 emissions by covering the ship's bottom like a carpet, with fine bubbles blown from the ship's bottom using a blower, reducing the frictional resistance between the ship hull and seawater as the ship cruises.

With its energy-saving benefit for heavy cargo ships already verified, MALS is scheduled for installation on grain carriers as well as passenger ships. MHI says it will "further boost its efficiency by applying our original highly-efficient blower, positioning an efficient air blowing outlet, calculated based on a leading-edge fluid dynamics simulation, and optimising the blowing air volume."

The fourth vessel is *Seabourn Encore* which will expand and build on the line's Odyssey-class ships. The 40,350gt ship will be configured with one additional deck and new expanded public areas, and is expected to carry 600 guests, based on double occupancy.

In December, Carnival Corporation announced that it has signed a memo of agreement with Italian shipbuilder Fincantieri to build four new cruise ships with final contracts expected to be signed this year. Two of the four new ships will

INTEGRATED CONTROL SYSTEMS FOR ADVANCED DIESEL-ELECTRIC ICEBREAKERS

At the present time the leading company in the field of automation of vessels and ships – the JSC Concern Avrora Scientific and Production Association is delivering the Integrated Control Systems of Technical Facilities (ICS TF) for diesel-electric icebreakers of the 21900M project.

These new ships are the modernized «Moskva» and «Saint-Petersburg» ice-breakers.

Designing of ICS TF «Zaliv-LK-21900M» was connected with solution of wide variety of problems. Among the most important are integration of technical facilities of the vessel into a unified technological complex, assurance of system reliability, unification of equipment, cost reduction, meeting the requirements of the customer and the regulatory agencies.

Fulfillment of the above mentioned tasks is achieved by means of a redundant 3-level system based on the advanced and unique imported and domestic technologies.

The ICS TF of the 21900M project has a client-server architecture. All the data received from ICS TF controllers and local automation systems, as well as commands of operators, come on two redundant high-reliability servers installed in different compartments.

SCADA project of the system is stored in the servers; operator's stations are clients, which receive information periodically or on request. Thus, the task of interfacing the levels of the system is solved, and unification of software enables an operator to display the information received from sensors or via interface channels from other systems on any of the stations. The servers archive all the necessary information and send the archive data to operator's stations on request. By means of this data exchange, an operator can analyze trends for quite a long period and diagnose in advance insignificant deviations of parameters, which are warning of serious failure of mechanisms.

Reliability of the servers is assured by the use of high-performance all-in-one PCs manufactured by the Concern. These AIO PCs are specially designed for severe operating conditions of a ship and have no comparable counterparts in the world. Reliability of these PCs operation is assured by the use of the novel achievements of electronics, which allow to exclude the use of moving mechanical parts in a PC. The PCs have passive cooling. Instead of usual shock and vibration-sensitive HDDs, the solid-state SLC data storage media of high recording resource and MTBF are used. Data in each server are recorded on two data storage devices. As a result, on completion of testing, it was proved that these all-in-one PCs withstand even more severe conditions than those of their usage.

Icebreaker of 21900M project

The ICS TF assures control from a pilothouse and a central control room (CCR), it also includes a station for monitoring of technical facilities installed in the cabin of a chief mechanical engineer. The equipment of operator's stations in a pilothouse is built into an integrated control console. Five-section control console manufactured by the Concern is installed in the central control room. The CCR console has common form factor designed for civil marine applications and tested as part of various systems for compliance with the requirements of the Russian Maritime Register of Shipping.

Thus, the ICS TF «Zaliv-LK-21900M» assures comprehensive performance of the following functions:

- acquisition, processing and transmission of data to ship systems;
- control of technical facilities (remote and automatic), including emergency protection of mechanisms and plants connected with the system;
- signaling of operation, malfunctions, change of modes of operating mechanisms and plants, when controlled parameters reach the limit values (alarm and warning signaling (AWS));
- generalized alarm and warning signaling in control rooms, cabins, service and public rooms, as well as group alarm and warning signaling with the use of light and sound columns;
- representation of information to an operator by means of video monitors, annunciator panels and other display devices about AWS, commands of engine-order telegraph and operation modes;
- tripping of signaling for inoperable mechanisms, monitoring of running hours of mechanisms;
- transmission of information to a voyage data recorder, self-checking of the system;
- engine-room personnel monitoring system, calling of chief mechanical engineer, possibility of appointment of chief mechanical engineer;
- storage of controlled parameters, including AWS, for the period of not less than half year, making of trends in real time and for a certain period of time, output of detailed information about alarms.

For more information you are welcome to visit www.avrorasystems.com

be built for Costa Asia for deployment in China, and one will be built for P&O Cruises Australia and Princess Cruises respectively.

Technology boost

Use of cutting edge technology is increasingly important in the shipbuilding industry and Dassault Systèmes and shipbuilder Meyer Werft have announced that Meyer Werft is deploying Dassault Systèmes' *On Time to Sea* and *Designed for Sea* systems when designing and building its cruise ships.

This deployment supports Meyer Werft's new Technology and Development Centre in Papenburg, which was announced in November 2015, and which will pool most of the design and development work from its 500 designers and engineers who are shaping the new features and developments of its future cruise ships. It will also support additional teams in Papenburg, sites in Rostock, Germany, and in Finland that are involved in building ocean-going cruise ships, river cruise ships, ferries and other vessels.

"Building cruise ships is a particularly complex task compared to other industries. One cruise ship is made of more than 10 million individual parts and assemblies, compared to about one million parts for today's largest passenger airplanes and about 10,000 parts for a car. The complexity, diversity and large volume of data involved require efficient solutions to design and build ships that stand out from those of competitors," the companies say.

With O*n Time to Sea* and *Designed for Sea*, Meyer Werft's design and development teams can now rely on a unified digital environment to monitor the entire lifecycle of a ship, from its construction and operation to its decommissioning decades later, the yard believes. Virtual design, engineering and project management applications help seamlessly address complex needs in product development and process requirements.

"Since the 1980s, we've continually optimised cruise ship design with state-of-the-art technologies and, now, a new age is beginning," said Philip Gennotte, technical director at Meyer Werft. "Today's shipbuilding is a highly modern industry that requires a combination of ideas, knowledge and technology in order to introduce sophisticated, future-oriented touristic concepts. Thanks to the 3DEXPERIENCE platform, we can foster collaborative creativity that fulfils the highest technical demands of customers worldwide from hull shape, hydrodynamics and fuel consumption, to capacity and onboard comfort and entertainment."

"Meyer Werft has been a long-term customer and partner of Dassault Systèmes and, by adopting the 3DEXPERIENCE platform and industry solution experiences, can differentiate itself in the marketplace," adds Alain Houard, vice president, for Marine & Offshore Industry at Dassault Systèmes. "Each cruise ship is a highly complex, large-scale project that must satisfy customer requirements as well as meet stringent safety regulations. Meyer Werft can efficiently manage this complexity while ensuring high quality standards that ultimately help its cruise line customers offer a best-in-class passenger experience."

Growth in Meyer Werft's workforce and the yard's orderbook led to the decision to build the new centre. Most of the design and development work for the shipyard's complex newbuilds will be pooled in the new building complex. The new building will offer a surface area of around 6,750m² on five levels. "In terms of technology, we must stay well ahead of the competition while still offering a high standard of cost-optimised quality. This balancing act will only succeed with highly qualified designers and development engineers working in ideal surroundings that give them plenty of space to think creatively," says managing director Lambert Kruse.

The total investment volume for the centre amounts to around €10 million (US$10.82 million) and construction work should be completed by mid-2016. "I have always given absolute priority to the successful on-going development of the Papenburg site. As agreed in the Site Continuation Contract, we will fulfil our share of the agreement," says Bernard Meyer.

Meanwhile, systems manufacturer Wärtsilä has an order to retrofit private residential ship *The World* with a Wärtsilä Advanced Wastewater treatment system and a Wärtsilä Nacos Platinum system for navigation and external communication purposes. The Wärtsilä Advanced Wastewater solution will replace an existing system and keep the vessel in full compliance with the IMO requirements concerning the prevention of pollution from ships. The equipment is scheduled for delivery in April, 2016.

Wärtsilä Hamworthy Membrane BioReactor (MBR) solutions are designed to facilitate the management and treatment of both grey and black wastewater, and to monitor discharges to the sea. The Wärtsilä system treats black and grey water so that the effluent can meet the most stringent marine discharge standards across the globe, including the latest nutrients removal requirements in the Baltic Sea.

Koningsdam during sea trials.
Citation: By courtesy of FINCANTIERI S.p.A.
All rights reserved

THE POWER 360°
TO TURN YOUR WORLD

A thruster by Veth Propulsion. A typical Dutch product. The end result is robust, powerful and inspired by your specific needs.

T +3178 615 22 66
www.vethpropulsion.com

VETH PROPULSION

Caring for seafarers 365 days a year

Life in the shipping industry today can be pressured and stressful. The Mission to Seafarers is there to give help and support to seafarers around the world.

Our centres offer an opportunity to relax and to use the telephone and email facilities to keep in touch with family and friends. We also assist with more serious problems such as being stranded far from home when a shipowner runs into financial difficulties, or being left unpaid for months.

We depend entirely on donations to continue our caring work for the people like you who play such a vital role in all our lives.

To donate online or for more information visit:

www.missiontoseafarers.org

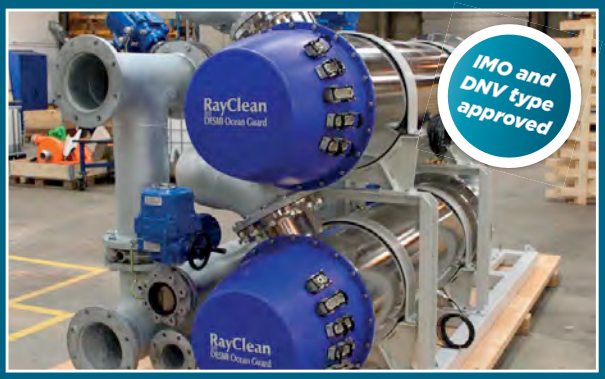
The Mission to Seafarers, St Michael Paternoster Royal
College Hill, London EC4R 2RL
Tel: +44 (0)20 7248 5202
Fax: +44 (0)20 7248 4177
Email: fundraising@missiontoseafarers.org
Registered charity no: 212432 Scottish Registered charity no: SCO39211

THE MISSION TO SEAFARERS

DESMI

OptiSave™ - Energy saving system

High-efficiency engine room pumps for every application incl. DESMI 48 Fast Track delivery of pumps



RayClean™ ballast water treatment systems

VISIT DESMI AT
STAND A-S11 - DANISH PAVILION
THIS IS THE ONE

14th EDITION APM2016
SHIPBUILDING & MARINE - WORKBOAT - OFFSHORE
16 - 18 MARCH 2016
Marina Bay Sands, Singapore
www.apmaritime.com
Asia Pacific MARITIME

MARINE & OFFSHORE | INDUSTRY | OIL SPILL RESPONSE | DEFENCE & FUEL | UTILITY

PROVEN TECHNOLOGY
www.desmi.com

The cornerstone has been laid for Meyer Werft's new Technology and Development Centre, Papenburg, Germany

The Wärtsilä Nacos Platinum system's combination of integrated voyage planning, monitoring, and track control significantly reduces the workload for ship navigators while improving navigational safety, the company says. The system to be supplied as part of this order includes the unique integration of an ice radar. *The World* is powered by Wärtsilä main and auxiliary engines, namely two 12-cylinder and three 8-cylinder Wärtsilä 32 engines.

"The MBR system being supplied for this very special vessel will enable it to comply with the very stringent regulations relating to wastewater discharge. Being a retrofit project, we had to design the system to fit the existing space. This created something of a design challenge, but our experience and know-how allowed us to meet the customer's needs and provide an optimal solution. Similarly, the navigational system represents the very latest technology," says Juha Kytölä, vice president of environmental solutions at Wärtsilä.

Wärtsilä and Carnival Corporation also announced last year that they had an agreement to pilot technologies and systems to optimise operations, most notably in the engine rooms of the Carnival fleet.

Wärtsilä's technologies and systems will be installed on several of Carnival Corporation's vessels. The technologies and systems include engine control and monitoring systems and safety and fuel efficiency packages as well as Wärtsilä's Asset Performance Optimisation Solution which maximises vessel performance and ensures that systems are operating at their full capabilities, increasing predictability of maintenance needs and fuel management. The fuel engine package is designed to significantly contribute to reducing fuel consumption.

Meanwhile, GE Marine has the order to supply propulsion technology for two new vessels for MSC Crociere which are set to be delivered by Fincantieri in 2017 and 2018.

GE has been selected to lead the Italian consortium that will power MSC Crociere's planned 'Seaside' platform. Fincantieri is employing sea proven technology from GE Marine that has "eliminated the need for harmonic filters and reactive power compensation and therefore offers improved safety among other benefits. The GE solution will also ensure a less complicated installation and cabling process while the reduced weight onboard ships brings fuel savings and altogether lowers MSC's operating costs," the company says.

"In an increasingly competitive market it is crucial to keep advancing with safer and more efficient solutions," said Massimo Costa, VP head of Purchasing Cruise BU at Fincantieri. "GE Power Conversion produces the right technology to simplify our operation," added Emilio La Scala, general manager of MSC Cruisetech.

Leading the project consortium with other Italian partners, GE will provide onboard technology that includes propulsion control along with transformers, VFDs core components, slow speed propulsion motors and distribution transformers.

As Tim Schweikert of GA Marine commented recently, innovation is paving the way for the marine industry in 2016: "The volatile state of the industry and stricter environment regulations mean we need to change the way we operate. Companies must rely on innovation using new technologies to increase productivity and meet the new environmental regulations on existing vessels, as well as taking a fresh look at new possibilities to cost effectively produce new vessels.

"To meet the new demand driven by strict environmental regulations, GE Marine offers its Combined Gas turbine Electric and Steam (COGES) system for various commercial marine applications, including LNG carriers, cruise ships and container ships. The COGES system enhances conversion of energy available in the fuel to produce electricity and power for all ship needs, including propulsion. GE's marine gas turbines can operate on various fuels including LNG boil-off gas or marine gas oil (MGO). No additional emissions reduction equipment is required to meet IMO Tier III or US EPA Tier 4 requirements."

GE Marine's latest Tier 4 Engine meets the new US Tier 4 and IMO III emissions standards, reducing NOx by more than 70% compared to EPA Tier 2 and IMO II emissions standards, while still maintaining world-class fuel efficiency and service intervals, he says. Its in-engine solution is based on exhaust gas recirculation technology, reducing the formation of NOx at combustion, thus eliminating the need for a urea-based after-treatment system.

"Because the engine does not need a urea-based selective catalytic reduction (SCR) after-treatment system, it requires only about 25% of the engine room space

versus other market solutions, reducing the need to make significant design changes on the vessel. This technology also eliminates the incremental operating expenses for urea use, catalyst replacements and maintenance on a SCR after treatment system."

With all eyes on operational expenditures in an uncertain market, technology will play a vital role in making marine operations as efficient and cost-effective as possible, he continues.

"To meet this demand, more shipbuilders will build vessels with technology at the forefront of the design process, using advanced modelling software which analyses a vessel's anticipated operational profile, and optimises the design from the offset.

"Using digital tools, vessels will also become greener, more efficient, and increasingly productive. GE's SeaStream Insight, for example, provides operators with a holistic view of their ships, allowing them to spot anomalies and other data which lead to better operational decision making and therefore fuel efficiency.

"With Predix at its core, SeaStream Insight allows preventative maintenance to be carried out before a failure occurs thanks to early warning signs made visible through data-driven analytics. This level of visibility allows operators to switch from a scheduled maintenance model to a condition-based one, reducing downtime and offering significant cost-savings."

Another ship delivered from Fincantieri this year was Viking Cruises' *Viking Star* which is the first ship built by Fincantieri to have two closed-loop scrubbers.

Scrubbers enable the ship to continue operating on heavy fuel oil instead of more expensive marine gas oil while still meeting the strict IMO regulations regarding SOx emissions. This solution allows an operation power consumption of approximately only 1.5% of engine power and the ship can operate in areas with low alkalinity waters by switching to freshwater mode, according to Fincantieri.

The energy needed to drive the system pumps will automatically be adjusted to the engine power, in order to prevent the unnecessary use of energy. Other characteristics of this type of scrubber are: lower investment costs, less space used, less energy consumption, less piping, lower maintenance costs.

The cruise ship is fitted with the Rolls-Royce Promas integrated rudder and propulsion system, the first time Promas has been installed on a newbuild cruise vessel. The selection of Promas has provided a system with a rudder integrated to the propeller that guarantees augmented propulsion efficiency with no loss of manoeuvrability. This solution improves performance in all areas – speed, manoeuvrability and noise. During sea trials, the ship had performance above expectations in both propulsion and manoeuvrability.

Robert Gustafsson, senior hydrodynamicist at Rolls-Royce commented on the design process: "The design challenges are wide ranging and complex. They rarely mean just meeting class requirements, and can include ensuring the system can operate efficiently in several different modes, and in different water depths, all at the same time. Every vessel and application has its unique points, but the experience used to arrive at the best solution does not change. In fact it continues to grow with time.

"The focus for these innovative cruise vessels is not only on efficiency and noise, but also manoeuvrability, as they are designed for direct access to most ports for easy and efficient embarkation and debarkation."

*Viking Star*is the second ship built by Fincantieri and one of the first in the world to have the safe return to port classification, which states that the ship in case of fire or flooding of some areas is capable of returning to the nearest port thanks to plant design, guaranteeing redundancy and functionality of main systems needed for ship propulsion and passenger safety and comfort. ***NA***

Carnival Vista under construction at Fincantieri.

Citation: By courtesy of FINCANTIERI S.p.A. All rights reserved

USCG rejects MPN method

In the wake of the US Coast Guard's decision to reject the Most Probable Number testing standard vendors of UV-based ballast water treatment systems will need to switch to the FDA/CMFDA standard to receive type approval of their systems in the US

The US Coast Guard's (USCG) decision last December that the MPN (Most Probable Number) testing method used by some UV ballast water management system (BWMS) vendors to prove the efficacy of their systems for US type approval is not considered an equivalent alternative testing method.

The USCG said: "A Coast Guard review concluded that the MPN test method is not equivalent because it does not measure the efficacy of the BWMS to the performance standard required by the regulations. The regulations specifically require ballast water treatment systems to be evaluated based on their ability to kill certain organisms. Since the proposed MPN method assesses the viability of an organism to colonise after treatment, it measures to a different standard than that required by the regulations."

There was concern amongst some BWMS providers that sales for their systems would be hit, particularly those that use UV as a cleansing agent. However, not every UV based BWMS used MPN method for USCG type approval.

Testing of PANASIA's GloEn-Patrol; the land-based tests were completed in cooperation with DNV GL

For example, PANASIA's filter and UV based BWMS used FDA/CMFDA for its USCG type approval from the beginning of the process. In October 2015, PANASIA BWMS, GloEn-Patrol commenced its land based testing in marine water at Golden Bear Facility (California, USA), where the test was successful and the system was passed; testing in fresh and brackish water will take place at a later date with PANASIA expecting US approval of its system later this year.

Testing of a number of UV and filter based BWMS was completed using FDA/CMFDA standards rather than the MPN standard rejected by USCG in December

According to PANASIA, GloEn-Patrol's filtration technology helped the system achieve the FDA/CMFDA standard even though it has a small amount of back flushing water. Compared to other filtration systems, which need up to 12.82litres/second water loss for back flushing to achieve 350m^3/hour Treatment Rated Capacity (TRC), the GloEn-Filter of PANASIA is operational only with 0.1 litre/second, making it approximately 130 times more efficient.

If the remaining issues, such as the G8 revision, are resolved, the IMO Convention will still not be ratified before next year. Even so, the USCG Type Approval is considered crucial and PANASIA cooperated with DNV/GL to meet the required FDA/CMFDA standards. *NA*

11 YEARS AT SEA

The Ecochlor® Ballast Water Treatment System: proven effective and reliable for over 11 years at sea. Meets or exceeds USCG and IMO standards.

ecochlor®

Ecochlor System: Simple operation, rugged construction, unique technology.
www.ecochlor.com

TECHCROSS

Techcross Makes Him Smile by Electro Cleen™ System

Electro Cleen™ System has
- Strong disinfection efficacy
- Low operation costs
- Easy installation & maintenance

www.techcross.com
T. +82 51 603 3500
F. +82 51 603 3599
E. inquiry@techcross.com

ECS ballast water management system keeps our marine ecosystem safe and clean.

Making Headway

OceanGuard, the ballast water treatment system designed and built by China's Headway marine equipment supplier is making inroads into the market as the system gains US type approval. Increasing demand has led to the company building a modern factory near its Qingdao headquarters

Chinese marine equipment company Headway is developing a new factory near Qingdao in anticipation of a surge in demand for ballast water treatment systems (BWTS) this year.

The ratification of the Ballast Water Management Convention by Indonesia, Ghana and Morocco has brought the tonnage threshold closer. There is now an expectation that the 35% tonnage mark will be reached in 2007.

Headway is in a good position to meet demand with the new production facilities expected to be available by late 2016 or early next year and the US type approval is expected to be completed by the end of this year also.

The type approval process was started in 2014 and the land based tests were concluded in May last year, testing took place in Denmark under the supervision of class society DNV GL.

OceanGuard, Headway's BWTS, has a small footprint according to the manufacturer and uses a low energy system: 0.8KW/hour for the smallest version, the HMT-50F, which has a flow rate of 10-50m3/hour; while the mid-range system the HMT-1000F uses 17KW/hour and processes up to 1,000m^3/hour; and the highest power consumption at 69KW/hour is consumed by the largest system in the range of 13 systems, the HMT-5000F, which has a flow rate of up to 5,500m^3/hour.

The system has already seen 285 installations, with around 80% of these sales for newbuild vessels and 30-40% of these sales were to foreign owners who operate a variety of vessel types, including Italy's cruise vessel operator Costa Crociere. Systems have also been fitted to tankers, bulk carriers, container vessels and, most recently, there has been an order for 12 systems to be fitted to Grimaldi's pure car and truck carrier newbuildings currently under construction at the Yangfan yard in China. Of the total 486 orders for OceanGuard the vast majority, 80%, come from foreign owners, says the company.

OceanGuard uses a filtration system that is effective for microbes greater than 50μ, water is then passed through a steriliser known as an EUT unit which uses electrocatalysis and ultrasound to kill bacteria. No chemicals are used in the process, says Headway.

An Advanced Electrocatalysis Oxidation Process (AEOP) produces hydroxyl radicals, and the company says: "These radicals have a high sterilisation efficiency, which are able to kill different bacteria, viruses, algae and dormant ovum in ballast water effectively (broad spectrum sterilisation) in a chained mode. The sterilisation process can be completed within the EUT Unit. The concentration of TRO (total residual oxidation) can be controlled within 2ppm, so that the TRO can carry out advanced management on the water in ballast tanks."

The system is operated from a control unit which "consists of a control system, recording system, display system and alarm system. It is in charge of the entire system controlling, including the processing of every monitoring signal, the alarm signal, the linkage of the system and the auto-control of the system start-up and shutdown order."

A breakdown in the system will trigger an audio and visual alarm and will automatically shut-down the BWTS and operators can control and adjust settings through the control unit.

According to ABB, which provides some of the electrics used in the Headway system, there were some teething problems; one was an issue of space and the other challenge was with the starting solution.

"There were issues with the behaviour of the motor control centre that manages the starts and stops of the motors running the pumps of the BWMS [ballast water management system]. Using older starting solutions such as star delta and direct online led to excessive starting torque, causing damage to the motors and pumps."

The solution was to use ABB's own softstarters. Switching to the PSE

Technical specifications for the OceanGuard BWTS

Model	Capacity Range(m³/h)	Rated Capacity (m³/h)	Power (kW)	dimension (mm x mm x mm)
HMT-100	30-120	100	2	370x380x1400
HMT-200	80-250	200	3.5	510x380x1400
HMT-300	150-350	300	5	510x380x1735
HMT-500	300-550	500	7	569x416x1815
HMT-600	350-750	600	10	600x470x1900
HMT-800	400-950	800	13.5	620x470x1900
HMT-1000	600-1200	1000	17	640x570x2100
HMT-1200	800-1400	1200	20	730x570x2100
HMT-1500	1000-1700	1500	25	730x620x2200
HMT-2000	1500-2300	2000	33.5	880x620x2200
HMT-2500	2000-2800	2500	42	1030x640x2210
HMT-3000	2200-3500	3000	50	1460x620x2200
HMT-6000	4500-6500	6000	100	1460x1240x2200
HMT-9000	6500-10000	9000	150	2060x1280x2210

The OceanGuard system with the filtration unit and EUT unit in blue

softstarter meant using a significantly more compact motor control centre than before. This solved the crucial issue of space for installation. The starting characteristics of the motors in Qingdao Headway Technology's BWMS also benefitted from ABB's softstarters. The ability to soft start motors and avoid excessive starting torque and current spikes, meant a longer lifespan for the system," says ABB.

According to Headway the cost of installation for the OceanGuard system is comparable with its competitors, but its operational costs are claimed to be significantly lower than many of the system's competitors.

In addition, the system has a number of sensors fitted that will give operators information on the operational status of the BWTS.

"Sensors include a salinity meter, flow meter and TRO sensor, and they can respectively measure the parameters of salinity, flow rate and TRO, in order to accurately reflect the operating status of the system in time. Adjustments will be made according to the data of sensors by the control unit for an ideal treatment effect. Salinity, flow rate and TRO are important parameters in the control process and through calling the internal store programme, the control unit can make the EUT unit proceed with the relevant initial operating mode and optimum TRO operating status," the company explains.

Operators can take up to two weeks to train in the use of the BWTS, but Headway believes this is the longest period, shorter training will be sufficient for crews that have a greater "understanding".

OceanGuard was developed in collaboration with universities in China and the Headway R&D department. The system is patented and represents a key step in the development of China's equipment manufacturers and the reputation that the country is trying to build. *NA*

REINTJES
POWER TRAIN SOLUTIONS

Visit us at
Asia Pacific
Maritime
Booth no. E-N36

WVS 430
783 kW at 1.600 rpm

REINTJES Gearboxes –
The best choice for your vessel!

REINTJES gearboxes of the **WVS/WLS** series impress with low weight and excellent running characteristics. These factors make the hydraulically operated gearboxes the ideal propulsion unit for fixed and controllable pitch propeller.

In the entire power range from 350 to 5,000 kW their outstanding features are optimal efficiency, high reliability and a long service life.

Call us today!
We have the ideal solution for your vessel, too!

REINTJES GmbH | Eugen-Reintjes-Straße 7 | 31785 Hameln | Germany
Phone +49 51 51/104-0 | marine@reintjes-gears.de | www.reintjes-gears.de

When tech giants fall

The decline and collapse of Nokia has fuelled a start-up boom that is revolutionising the maritime industry in Finland, something the global industry is beginning to recognise and value

The Finnish maritime industry is leveraging its experience as a centre for tech and software development to fast-track the next shipping revolution and firm up its position as a supplier of new and innovative tech solutions for the materialising world of Smart Ships and smart shipping (see *The Naval Architect*'s Smart Ship Supplement for more information).

While it is increasingly obvious that shipping will have to respond to new technological solutions, albeit with its general caution, the extent to which a fully integrated smart shipping network and its Big Data can be adopted is still unknown, and Finland is attempting to make the most of this uncertainty.

"It is likely that the new ecosystem based solutions [as opposed to traditional closed innovation systems] will change the fundamentals of marine traffic," says Ulla Tapaninen, PhD senior specialist, City of Helsinki, City Executive Office.

"The City of Helsinki has started a year ago on a project called MERIT. Its goal is to bring together smart marine technology companies and to form a successful cluster around them. The companies range from the traditional marine industry – machine manufacturers, shipyards and shipping companies – to small and large ICT companies offering smart solutions for example for ice and weather monitoring, sensoring, usability and navigation."

Tapaninen adds that other countries are thinking about Big Data and building maritime clouds where information between vessels and onshore is shared, but "the difference between what we are doing in Finland and what they are doing, is that we also have authorities with the cloud and are actually building its basics."

This kind of development provides possibility and opportunity, and it is this freedom of possibility that Finnish start-up companies are exploiting to the benefit of the marine industry. Companies that were originally small start-ups like Eniram or previously independent companies like NAPA have grown with the success of their Big Data offerings, while other companies are still emerging, such as the connectivity specialist KNL Networks and imaging specialist ICEYE.

MERIT's stand at Slush, a Finnish tech conference for budding start ups
Credit:City of Helsinki materials/Mikael Ahlfors

"It's going to be pretty interesting in the next five-10 years as technology is coming to maritime with a huge speed," says Toni Linden of KNL Networks.

Other industries have shown that big companies can no longer go it alone and function in the same way while the likes of Uber and Airbnb exist – the marine industry is no different. Wärtsilä's Marine Mastermind contest, a "quest for a game-changing start-up" that will develop the next generation of digital services, exemplifies this necessary change of tactic as large multi-national organisations have been forced to reach out to external companies for the best ideas. The logic is changing.

Why Finland?

Finland possesses a unique ecosystem for developing new technological applications for the maritime industry where others do not, says Tapaninen. Its historical ties to shipping as well as its experience of software and technological development from the boom days of Nokia has provided a strong background for the development of smart shipping and all relevant devices and systems that would support this momentum-gaining enterprise. As Nokia collapsed swathes of tech-savvy workers with valuable software experience were let loose, both to support other industries with their expertise and to start up their own companies with specialised services and capabilities.

In addition, Finland's efficient production chain allows small companies to quickly move from the hypothetical/R&D to making

prototypes and rolling out service-dependent infrastructure. KNL Networks for example, which will feature in *The Naval Architect*'s March issue, has established a complete product and a comprehensive communication service from inception to market in only five years – an impressive feat for any small start-up with high hopes. In this way, Finland's underpinning manufacturing network and marine cluster can only aid the future rise of subsequent innovators, further strengthening the nation's offering to the global maritime industry.

Perhaps most importantly for the coming of smart shipping, Finland's small size and population allows for greater integration and cooperation between different parties – something which is incredibly important for truly free-flowing data and is for many other European countries a greater challenge to currently achieve. There is already ongoing work with the Finnish Ministry of Transport to open up the maritime cloud and all the vessel and logistical information it collects for regulators. And so, as shown by the MERIT project too, the adage: working better together is at the heart of where the industry is moving and where the Finnish maritime industry sees its future.

The combination of this level of innovation and increasingly fluid data transfer and usage – ultimately allowed by close governmental and regulatory cooperation and the willingness of shipowners to take part – means Finland could well be the pace setter for digitalisation and its related services in the shipping industry. *NA*

KNL Networks' Cognitive Networked HF-radio, a new response to satellite bandwidth restrictions

A smoother path to air lubrication

Running a stream of air bubbles under a ship's hull to reduce hull resistance is not new, but its commercial application by a leading cruise owner suggests it might be time to revisit the concept

The Finnish naval architect and engineering company, Foreship, oversaw the successful design and installation of its own air lubrication system (ALS) in 2015 on both *Quantum of the Seas* and *Anthem of the Seas*, built by Meyer Werft. The system's installation meant that propulsive power could be reduced, and that when the ships were operating at cruising speeds, a net fuel saving equivalent to 7-8% was achieved, according to Royal Caribbean International (RCI). Foreship says a final evaluation of performance is still ongoing, but the company believes an overall net fuel saving within a defined speed range and set of conditions can be confirmed at roughly 5%.

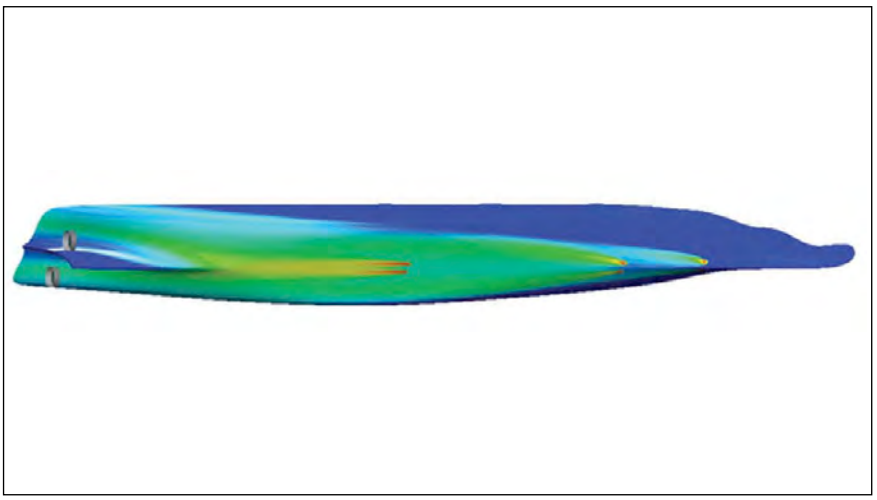
As the first air lubrication system installed on a cruise vessel, Foreship had to overcome challenges obstructing the uptake of alternative systems, but its success has now meant that 'several' retrofit cruise ship installations of its ALS are now also underway for RCI.

Similar in form to this uptake in orders, the company is also looking to expand the range of vessels that could utilise its ALS and has recently undertaken a feasibility study for a large ro-pax ferry with 4,100m freight lane capacity and 900 passengers. According to the company, simulations indicate that the ALS is suitable for ferries operating at less than 20kn which are characterised by high propulsion power. Where the normal service speed is 18kn, net savings of up to 10% (1,500kW) are predicted, depending on the air volume.

However, the company readily admits that there are limits to the current system's adoption for particular vessel types. One requirement is that the vessel must have easily available electric power for the compressors; at present "roughly half of the gross benefit is consumed by the power for the compressor," says Foreship.

"As the Foreship ALS is a custom made application that needs to be evaluated from case to case it is not possible to give a generic figure on how much compressor power is needed. Everything depends on the platform that is being evaluated and can also vary between different ship types such as cruise, ferry and general cargo. The most important thing in the end is the net gain."

For vessels where ALS would be appropriate, initial calculations envisage upfront investment being paid back within a reasonable time. The



A model of the ALS in action

company concedes that plummeting fuel prices have provided a new variable, but it adds that coming environmental regulations could counter this slump, as they will further increase ship operational costs and drive investment in energy efficiency technologies – technologies that will be critical in limiting the bottom line impact. According to the company, the ALS should reduce emissions including CO_2 in a directly proportionate way to the reduction of the fuel consumed.

When asked about the efficiency of the system in different weather conditions, Foreship replied that weather conditions, wave heights, side winds, currents etc. will influence the system and that "long term projections have been made for different conditions, but this is still under investigation."

Foreship's approach has drawn on its core competency in hull form optimisation as well as an extensive database detailing the impact of hull performance optimisation solutions in order to advance the concept of air lubrication. As part of its approach, the company oversees optimisation modelling at the early design stage, but also designs and tracks the performance of supplementary fuel saving devices such as stators, boss cap fins and rudder bulbs.

The company has previously pioneered 'in-waves optimisation' of hull forms based on CFD modelling to minimise wave resistance, and has developed RANS-CFD coding that simulate real conditions. Its initial 'in-waves' project compared the performance of a bulbous bow with a wave optimised vertical stem bow onboard a cruise vessel, establishing that resistance in waves of a wave optimised ship was better across a wide speed range. (See pages 32-33 July/August *The Naval Architect*).

This experience led the company to rethink under-hull air lubrication, and resulted in the decision to stream 'micro bubbles' (around 1mm in diameter) along the hull bottom. Solutions from other suppliers are available, but Foreship believes its ALS generates a larger surface area than systems where larger bubbles are used, reducing drag more effectively.

In development

Development of the ALS started in June 2011, initiating full scale CFD simulations to apply the solution to both newbuildings and existing ships. RCI's commercial application followed four years of design development that also included testing the concept in a vacuum tank and sea trials on a first cruise ship with ALS installation.

The path to market required the development of the distribution principle and the means to produce the micro bubbles in the most efficient way. Initially, Foreship's proprietary CFD-simulation method was used to model relative resistance reduction at different speeds as a function of the amount of injected air. Detailed box geometry was then optimised by CFD simulations, and verified in a cavitation tunnel at Marintek where pressure losses and noise were measured in addition to visual observations, ensuring the functionality of the bubble distribution boxes. CFD analysis was also used to mitigate the risk of cavitation, vibration or reduced propulsion efficiency caused by air emergence to the propellers.

Each ALS is customised to optimise the performance of an individual ship. Full scale RANS-CFD simulations are used in optimising both air volume and air feed locations, which are based on the drawings of the vessel selected. A complete design project includes the configuration of piping and the distribution principle by full scale CFD simulations and requires engineering documents like steel drawings and system diagrams. The simulation also clarifies the air distribution between the distribution locations and the expected piping system pressure losses, to develop precise recommendations for compressor layout.

Projected net savings are a function of resistance reduction evaluated against the required compressor power. For owners, the projected net saving on fuel is inferred from the percentage decrease in the brake power used for propulsion; the annual fuel saving on normal itineraries can then be estimated.

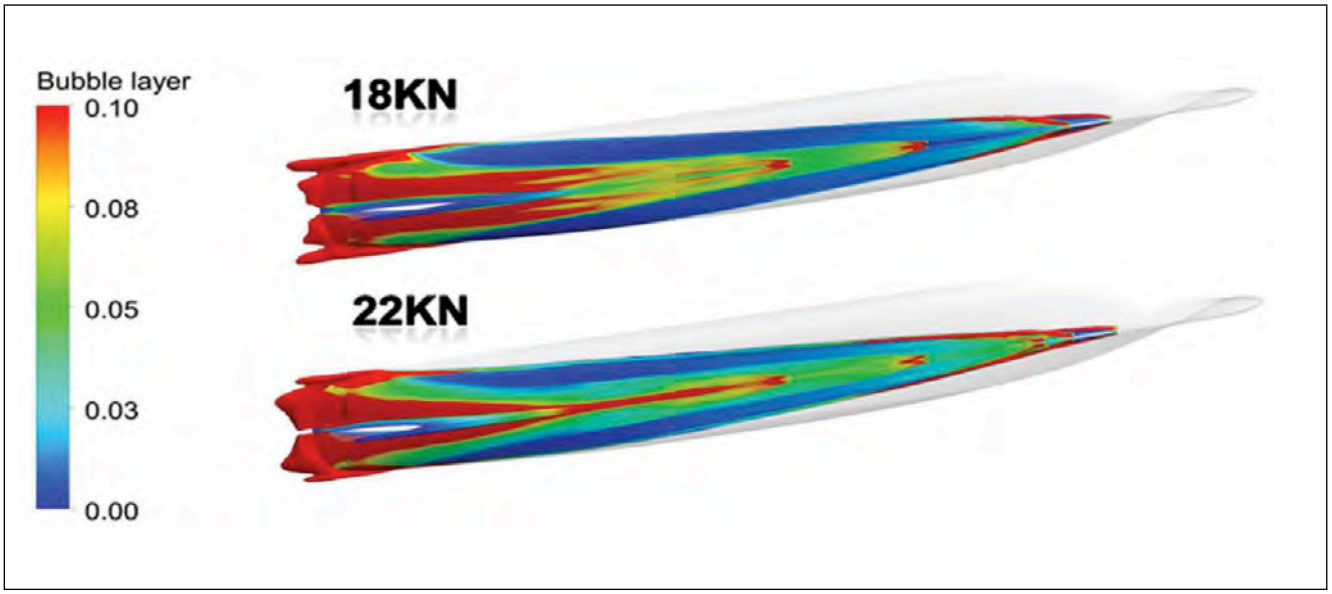
The range of efficacy

Foreship's CFD modelling indicates that performance gains begin to be seen above speeds of 14 knots up to 22 knots. Air bubbles tend to disperse sideways below 14knots, the company says, while speeds above 22 knots lessen the effect of the bubbles as they move too fast along the hull to create the required 'cushion'.

However, it must be stressed that the individual characteristics of a ship's hull are central to the full impact of the ALS in practice. An initial trial of the technology, undertaken onboard an unspecified cruise ship, showed the system achieving 6% fuel savings at 15 knots, and 8% at 22 knots. In this case, though, the effect was still discernible at lower speeds, and it was only below 12 knots that sideways dispersal of the micro-bubbles occurred.

Foreship stresses, therefore, that the ALS efficiency depends a lot on the vessel in question, and the benefit cannot be estimated without ship specific CFD-simulations.

As well as looking to maximise gains, a main design objective has been for the ALS solution to generate no additional resistance when the system is switched off at lower speeds, or due to, for example, a compressor failure. This means that large recesses or cavities in the ship's bottom, for example, were avoided.



Thickness of the bubble layer at different speeds

This lack of 'frictional penalty' suggests that the solution could be commercially viable across a range of vessel types. The company advises owners to undertake a feasibility study considering an optimised system's impact at different speeds before any recommendation is made, and suggests that the performance should also be compared to the itinerary of the vessel.

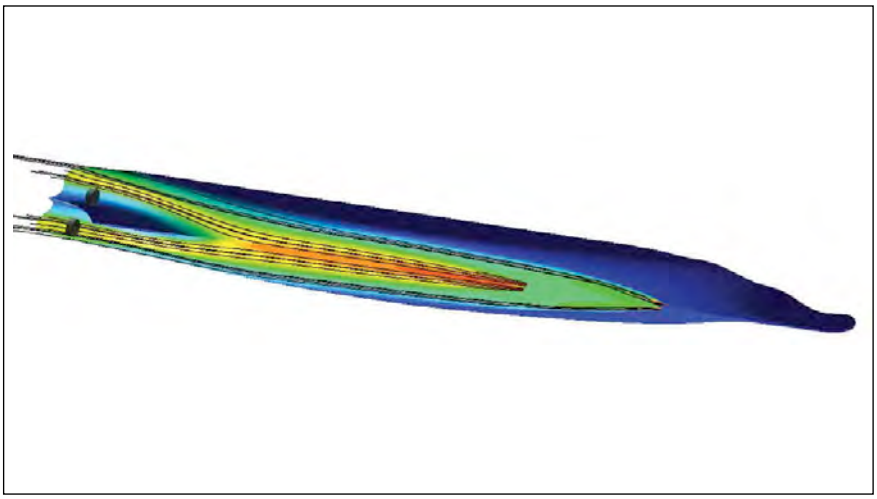
Making the case for ALS

To better understand the potential for savings on a cruise ship, Foreship made a comparison of 10 real itineraries, deriving average results that show the benefits of ALS once other parameters have been optimised.

Five typical Caribbean schedules and five typical to the Mediterranean were used in the study, revealing that a larger cruise vessel could be expected to have an annual fuel consumption of between 28,000 and 41,000 tonnes when the vessel is optimised in a 'traditional' way for a speed of 22.5 knots. This includes the hotel load. The fuel used for propulsion is typically around 50% of the annual total consumption.

When the same ship is optimised for speeds of 18 knots, the annual fuel consumption decreases by 45 – 868 tonnes, or 0.1% - 2.9%, depending on the operational profile, the average being 472 tonnes and 1.3%. The lowest saving is naturally achieved on a few relatively high speed itineraries with longer legs at high speed.

Spreading and streamlines of the ALS



When Foreship adds its 'in-waves optimisation' analysis, the additional saving annually is 325 – 692 tonnes, or 1.2% - 1.5 %, with the averages now 567 tonnes and 1.4%. Here the assumption is that a significant wave height of 1.4m represents the average conditions. As 'in-waves optimisation' helps at every speed, the annual saving is more uniform than on the more itinerary-dependent speed optimisation.

If the air lubrication system is added to the mix, full scale trial savings are assumed, even if the weather conditions may have a significant effect on the saving. In this case, ALS is only used at speeds above 15 knots, meaning that the high speed legs gain the most. According to Foreship, the annual saving is 59 – 1,719 tonnes or 0.2% - 3.6%. The average saving of the itineraries is 1,034 tonnes or 2.4%.

When all three – speed reduction, in-waves optimisation and ALS – are combined, the annual saving is between 1,189 – 2,613 tonnes, or 4.3% - 5.4%, with an average saving of 2,074 tonnes or 5%.

Foreship argues that theoretical hull form optimisation based on trial speed and calm seas should be a thing of the past and that today's ships should be optimised for the correct speed range and the correct conditions. CFD optimisation is possible for both, offering significant reductions in fuel consumption, and an air lubrication system can provide additional savings that should not be overlooked in the right scenario. *NA*

Feedback to design

As technologies and methods of accurate operational data collection from vessels at sea mature, architects will be increasingly able to design and redesign vessels with the real-time performance information such monitoring systems can provide

The aim for those developing and leveraging such information is to improve the design process, but also, crucially, to improve the accuracy of a vessel's operational profile, making it more efficient and more environmentally friendly. With this goal in mind a synthesis of current design practices and data that documents real sea conditions as well as the way a vessel reacts while operating in them is needed.

Today, vessels' required characteristics are set in shipbuilding contracts by considering the ideal operational profile. This means that, in regards to the vessel's performance, contractual points are typically set for design draft and service speed, and compliance with these requirements is later verified during a sea trial. As a result, the design and verification of the vessel's performance is limited to a single design point where calm seas are considered. This method proves problematic in operation as the operational environment and profile differ significantly with the assumptions made during design optimisation.

When one looks at vessels operating at low speeds, for example, viscous resistance has the highest contribution to the ship's total resistance. This drives blunt designs while considering the shape of the forebody in order to minimise the wetted surface area per volume ratio. However, this only applies to calm seas. When the vessel is operated in waves, the effect of added resistance in waves becomes larger, potentially driving a sharper bow design.

Because of this, a hull form which performs best in average, considering performance in calm sea and in waves, might offer a better optimised performance for the vessel. This can be seen, and achieved if desired, by analysing the data collected during real operations of vessels and by evaluating the probability of encountering a given condition. Combining the flexibility of a 3D product model with the data collected by performance monitoring systems will aid the process of optimising a vessel with respect to its actual operation.

Many within the marine industry, from paints and coatings companies to class societies are targeting the wealth of untapped onboard monitoring data, driving a software revolution and the rise of companies like NAPA and Eniram that can translate the data they receive into design information. This growth clearly suggests that the failure to embrace the potential of Big Data and its supporting technologies will leave industry players at a severe disadvantage, not only in the years to come, but right now, and at an ever growing rate.

ClassNK-NAPA Green is one data gathering and mining solution, and has been designed so that ship operators can access the data collected from the ship automation and navigational systems. It allows primary data, such as fuel oil consumption, emissions, loading conditions, voyages, and logbook entries to be monitored on a regular basis via a web application for the transfer and display of results and an onshore data centre that carries out further analysis. This can then reveal performance indicators such as the development of the vessel's performance, i.e. the performance baseline, and the extent of the decrease in hull performance, e.g. due to hull fouling, and whether action should be taken, or optimisations made.

A bulk carrier case study

NAPA and Sanoyas Shipbuilding Corporation analysed collected ship data from the operational profile of a 229m, 83,027dwt bulk carrier (delivered by Sanoyas in 2012) in order to find its best in average performance and whether a different hull form would be more efficient for the range of activities it undertakes and the weather conditions it experiences. Data including speed measurements, fuel consumption, floating position, and weather conditions information was used in order to perform the hull form optimisation, and had been gathered via the vessel's ClassNK-NAPA GREEN monitoring and voyage reporting solution.

TECHNICAL PARTICULARS

Reference vessel

Builder ..... .Sanoyas Shipbuilding Corporation
Length..... 229m
Breadth.....32.24
Depth..... 20.2m
Sumer draft 14.62m
Deadweight 83,027dwt
Gross.....43,656gt
Service speed 14.5kn
Main engine .....MAN B&W 6S60MC-C8
Delivery..... 19 December 2012

This data revealed that the 12.2m design draft of the vessel did not reflect the true operation of the vessel, which was found to typically operate in four loading conditions ranging from heavy ballast condition to full laden condition. The typical trims and speeds for these drafts can be seen in Table 1.

Weather conditions experienced during the monitored period of operation (see Table 2) were used in partnership with this data in order to calculate a combined probability from the probability that a given weather condition occurs and the probability that a given loading condition occurs. Design conditions were consequently derived from this calculation (see Table 3) and subsequently used in the

Table 1: The typical trims and speeds for the reference vessel's four most common loading conditions

Draft	Trim	Speed
8.1m	2.7m (aft)	12.5kn
12m	0.6m (aft)	11.9kn
13m	0.3m (aft)	10.5kn
14.8m	1.4m (aft)	12.5kn

Significant wave height	Occurrence	%	Wave period	Wind velocity
0.5	86,100	64	2.8	7.9
1	24,649	18	4.2	10.4
1.5	11,468	9	5.2	11.7
2	5,229	4	5.8	13.9
2.5	3,026	2	6.4	15.3
3	2,234	2	6.9	16.1
3.5	1,053	1	7.5	15.4
4	524	0	8.3	16.2
4.5	282	0	9.5	21.8

Table 2: Weather conditions operated in by the reference vessel

Speed	Draft aft	Draft fore	Significant Waveheight	Wave period	Wind velocity
12.44	6.65	9.35	0.5	2.8	7.9
12.44	6.65	9.35	1	4.2	10.4
12.44	6.65	9.35	1.5	5.2	11.7
12.44	6.65	9.35	2	5.8	13.9
12.44	6.65	9.35	2.5	6.4	15.3
12.44	6.65	9.35	3	6.9	16.1
12.44	6.65	9.35	3.5	7.5	15.4
12.44	6.65	9.35	4	8.3	16.2
12.44	6.65	9.35	4.5	9.5	21.8
11.9	11.7	12.3	0.5	2.8	7.9
11.9	11.7	12.3	1	4.2	10.4
11.9	11.7	12.3	1.5	5.2	11.7
11.9	11.7	12.3	2	5.8	13.9
11.9	11.7	12.3	2.5	6.4	15.3
11.9	11.7	12.3	3	6.9	16.1
11.9	11.7	12.3	3.5	7.5	15.4
11.9	11.7	12.3	4	8.3	16.2
11.9	11.7	12.3	4.5	9.5	21.8

Table 3: Design conditions used in the hull form optimisation

hull form optimisation, which took into account added resistance in waves and wind resistance experienced while operating at its different draft levels.

Optimising the bow

During the optimisation process, the vessel's bow shape was varied by Free Form Deformation (FFD) of the facet surface used for CFD and seakeeping calculations, so that a range of bows, from a very blunt bow to a long, sharp and slender bulbous bow, were studied.

The hull form used in the optimisation was based on the Japan Bulk Carrier developed by the National Maritime Research Institute (NMRI) and the Ship Building Research Centre of Japan (SRC), but transformed to match the main dimensions and hydrostatics of the reference vessel. This form was analysed with calculations for calm sea resistance with consideration of two loading conditions (laden condition and ballast condition) and then in relation to added resistance in waves and then wind resistance. After data had been gathered the abovementioned probability calculation could be used to find the power (fuel) consumption for different operational cases.

Applied methods in NAPA's bulk carrier efficiency study

1. **Calm sea resistance** was calculated by the RANS solver which has been integrated into NAPA; the solver is based on the FLOWPACK code developed by Prof. Yusuke Tahara, previously of Osaka Prefecture University and currently at the National Maritime Research Institute.
2. **Added resistance in waves** was calculated by using the Seakeeping subsystem in NAPA. This combines strip theory and a solution based on the reflection off a cylindrical wall to ensure coverage of the whole wave length regime.
3. **Wind resistance** was calculated based on the projected transverse wind area.
4. **Total energy efficiency** was calculated using an approximation of the yearly fuel oil consumption (1). The suitability of each design was then evaluated by the sum of fuel oil consumption for each design condition weighted by the probability of occurrence (2)

$$FOC = P_e \cdot SFOC \cdot 365 \cdot 24 \cdot R_{oper} \quad (1)$$

$$FOC_{tot} = \sum_{i=1}^{n} p \cdot FOC \quad (2)$$

*Three assumptions were applied to the study for simplicity: added resistance in waves was computed by the strip theory, which only allows head waves in the calculation; a clean hull was assumed; and a common panel model was applied to all loading conditions where dedicated panel models would provide more accurate results and take into account the floating position.

Blending factor for the freeform transformation of the geometry*	Relative effective power (laden condition) %	Relative effective power (ballast condition) %	Relative added resistance in waves %	Relative fuel oil consumption %
-1	6.11	6.12	14.07	6.31
-0.5	2.84	2.65	6.72	2.89
0	0.00	0.00	0.00	0.00
0.5	-2.60	-2.08	-5.98	-2.55
1	-4.75	-3.77	-11.36	-4.66
1.5	-6.26	-5.07	-8.78	-5.89
2	-7.25	-6.14	-20.18	-7.29

Table 4: The effect of different bows on performance following optimisation
*This is used for controlling the translation of the control points of the transformation lattice. The blending factor was the only variable used in the optimisation process.

The objective of the optimisation was to find a forebody for the reference vessel that would perform better in the conditions it has been operated in, as highlighted by its real ship data. Results of the study found that a slender bulb would be more favourable for the reference vessel's operational profile, as the longest bulb variant was around 7% more effective than the original hull form and about 13% more effective than the shortest bulbous bow. The savings potential in fuel costs because of this optimisation amounted to around 1,000 tonnes per year.

The total lead time of this study was a man-month or so and cost approximately €8,000 (US$8,647.52). When viewed in relation to the potential yearly saving of 5% of fuel costs the saving is in the hundreds of thousands each year. This makes a compelling case for any optimisation based on monitory data and a vessel's operational profile, especially when a parametric 3D model in the design of the vessel with purpose-built optimisation tools makes the optimisation comparably effortless. *NA*

**This article is based on a paper given at the RINA International Conference on Computer Applications in Shipbuilding (ICCAS 2015), 29th September - 1st October 2015, Bremen, Germany.*

Authors:

Jan Furustam, product manager, naval architecture, NAPA; Ilmo Kuutti, senior vice president, NAPA; Kenta Koike, manager, Sanoyas Shipbuilding Corporation; Ryo Yoshida, advanced design sect, Sanoyas Shipbuilding Corporation.

BASIC DRY DOCK TRAINING COURSE

DM Consulting ESTABLISHED 2000

15-18th March 2016, London, UK

DM Consulting's Basic Dry Dock Training is a 4-day course that covers the fundamentals and calculations of dry docking. The course begins with the basics and safety concerns, and progresses through all phases of dry docking: preparation, docking, lay period, and undocking. The course ends with a discussion of Accidents and Incidents.

It's designed to be relevant to Dock Masters, Docking Officers, Engineers, Naval Architects, Port Engineers and others involved in the dry docking of ships and vessels. The course is presented through classroom lectures, student participation in projects and practical application exercises. The course addresses the deck plate level of practical operation needed by the dock operator and the universally accepted mathematical calculations required to carry out operations in accordance with established sound engineering practices.

To register, visit the website or contact the RINA Conference Department: 8 - 9 Northumberland Street, London, WC2N 5DA
Tel: +44 (0)20 7235 4622 Ext: 331
Fax: +44 (0)20 7259 5912
email: conference@rina.org.uk

www.rina.org.uk/Drydock_Course_March2016

Courses are also available in San Diego, Honolulu and Sydney Australia

The Royal Institution of Naval Architects

International Conference:

Innovations in Small Craft Technology

13-14 April 2016, London, UK

Registration Open

Few sectors of the maritime industry have seen greater innovation in design than the small craft sector. Both commercial and recreational small craft have benefited from the inspirational ideas of designers - ideas which although perhaps considered revolutionary at the time, have had a longstanding impact on the design of small craft today. This conference aims to review the new and innovative technologies available to the small craft designer and builder.

To register, visit the website or contact the RINA Conference Department:
8 - 9 Northumberland Street,
London, WC2N 5DA
Tel: +44 (0)20 7235 4622 Ext: 331
Fax: +44 (0)20 7259 5912
email: conference@rina.org.uk

www.rina.org.uk/small-craft-innovation

The Royal Institution of Naval Architects

Intellectual Property Rights and the Naval Architect

22nd June 2016, RINA HQ, London, UK

One Day Seminar

Intellectual Property Rights (IPR) are an increasingly important part of a company's value. As developed countries move to knowledge based economies, protection of IPR becomes both more difficult and more important for designer, particularly in a more competetive market. In a global marketplace, international protection of IPR is complex and generally not well understood in sectors of the maritime industry.

The one-day Seminar on IPR and the Naval Architect will provide designers, and others involved in the marine industry, with an understanding of IPR law and the extent to which it protects inventions and designs. The seminar will consist of a number of sessions in which presentations on various aspects of IPR will be given by experts and practictioners, followed by discussion.

Session 1: Patents, copyrights and other forms of IPR protection.
Session 2: Scope of protection in a global industry
Session 3: Using IPR.
Session 4: Case studies
Session 5: Panel discussion

To register, visit the website or contact the RINA Conference Department:
8 - 9 Northumberland Street, London, WC2N 5DA, UK
Tel: +44 (0)20 7235 4622 **Ext:** 331 **Fax:** +44 (0)20 7259 5912 **Email:** conference@rina.org.uk

www.rina.org.uk/IPR_Seminar_2016

Analysing propeller wake fields to increase efficiency

Following wake field analysis of a 174,000m^3 twin skeg type LNG carrier model ship, researchers from the Hyundai Maritime Research Institute (HMRI) were able to design a twisted rudder using CFD with an improved efficiency of about 1% when compared with a symmetrical rudder

The shipping industry can no longer make vast efficiency savings with individual energy saving devices (ESDs), and so a move to manage energy use and emissions while considering a vessel's performance holistically is increasingly prevalent. This move is partially due to the increasing stricture of new emissions regulations such as the Energy Efficiency Design Index (EEDI), which are pressurising owners to use better designed vessels; however it is also because of a growing consensus that separate efficiency measures, be they in relation to bulbous bows, hull form or propeller design etc., cannot function optimally as individual/component systems and must instead be coordinated for the vessel to be best optimised as a whole.

Research and analysis of propeller wake fields by HMRI has been one response to the demand for greater fuel savings and carbon emissions cuts, but many kinds of ESDs have been developed and applied in order to reduce hydrodynamic resistance of the hull or increase propeller efficiency. Because this is the case, and such performances are highly related to a flow around a hull and its appendages, it is essential to predict the flow characteristics around the hull precisely in the early design stage.

CFD analysis was used to examine the hydrodynamic characteristics of the twin skeg type LNG carrier design and, consequently, to design the new twisted rudder, particularly focusing on the propeller wake field, but also the axial velocity contour, velocity vector field and flow angle at the leading edge of the rudder. This involved the use of a trimmed mesh, polyhedral mesh, and a prism layer that was provided by STAR-CCM+, and an approximate total of 1.5 million generated grids and roughly 350,000 rotational domain grids.

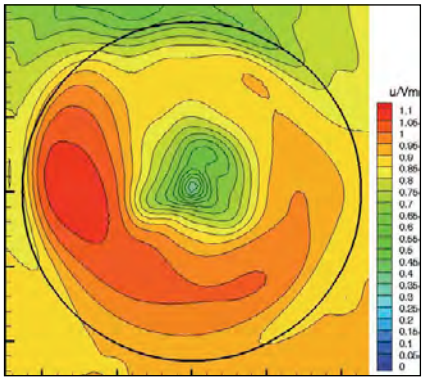


Figure 1: Axial velocity contours using CFD

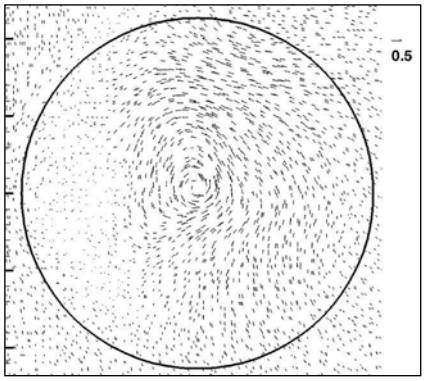


Figure 2: Velocity vector field using CFD

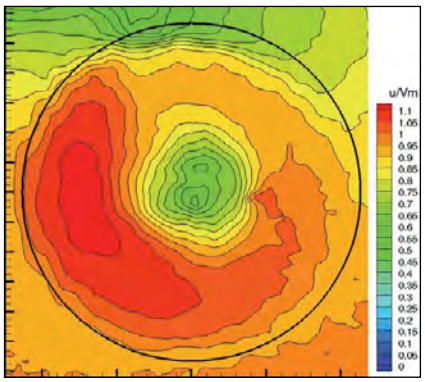


Figure 3: Axial velocity contours using SPIV

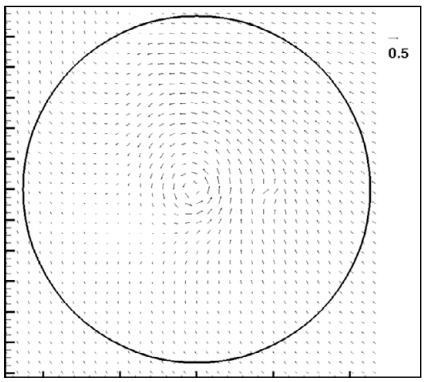


Figure 4: Velocity vector field using SPIV

In order to validate the computational method used, the CFD results of the original wake field analysis were compared with the experimental results of the same subject vessel via the use of a stereoscopic particle image velocimetry (SPIV) system during model testing at HMRI's towing tank. The results of both techniques can be seen in Figures 1 & 2 and Figures 3 & 4 respectively.

Figure 1 and Figure 3 show that the axial velocity at the upper part of the propeller is slower than the lower part. This is because the stern skeg causes flow to be slowly introduced into the propeller.

The results also show that the axial velocity of the left side (inboard) is faster

Table 1: Results of model test

Rudder:	rps of model propeller	Thrust of model propeller	Torque of model propeller	Delivered power for model scale	Propulsive efficiency
Symm.	100.0%	100.0%	100.0%	100.0%	100.0%
Twisted	99.6%	99.1%	98.8%	98.4%	101.2%

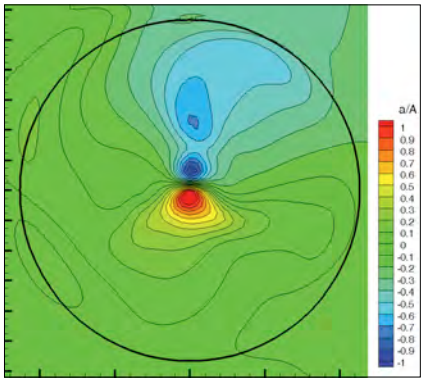


Figure 5: Flow Angle using SPIV CFD

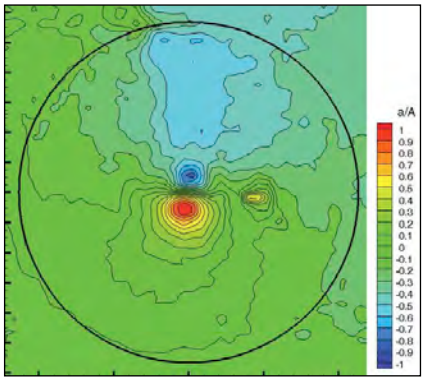


Figure 6: Flow Angle using SPIV

than the right side (outboard). This is because the propeller produces a greater thrust as the upward flow induced by the hull meets the downward flow induced by the counter-clockwise rotating propeller at the left side (inboard).

Because the direction of flow induced by the hull and the propeller are opposite at the lower part, the upward flow is very weak and the lateral flow does not appear, as shown in Figure 2 and Figure 4. In addition, the direction of flow induced by the hull and the propeller are the same at the upper part, so it appears that there is a very strong lateral flow.

The lateral angle is a very important factor when designing a twisted rudder because it has a decisive effect on propulsive efficiency. This can be calculated using the equation below:

$$a = tan^{-1}\left(\frac{v}{u}\right)$$

In this equation, 'a' is the lateral angle and 'u' and 'v' represent the velocity of the x-direction and y-direction. Figures 5 & 6 illustrate the lateral angle at the leading edge of the rudder as a dimensionless value using CFD and SPIV, and show that there is both a large lateral angle at the upper part and a relatively small lateral angle at the lower part. This large lateral angle means that the y-direction velocity is fast, while the small lateral angle in the lower part shows that the y-direction velocity is slower in this region. In addition, the lateral angle around the propeller hub appears very large, but this is because of slow x-direction velocity.

Armed with a better understanding of the propeller wake field flow it was possible to design a twisted rudder using the previously obtained CFD results (Figure 7). This design was then compared with a symmetrical rudder during a model test using a 3D method of interpretation in consideration of the form factor, which established the clear benefit of the twisted design (see Table 1).

Methodology:

A Cartesian coordinate system was used in this study, with the flow direction as the X-axis, the starboard side of the ship as the Y-axis, and the gravity opposite direction as the Z-axis (see Figure 8). The origin of the coordinate system is located at the point where the mid-ship, centre plane and water plane at the design draft meet.

The computational domain was 3.5LBP (length between perpendiculars) in a longitudinal direction, and 1.5LBP in a width direction and a depth direction. The rotational domain for implementing the propeller rotation consists of the cylinder, which had a diameter of 1.2Dprop (Dprop is the diameter of propeller) and a length of 1.0Lhub (Lhub is the length of hub.) All quantities used in this study were dimensionless.

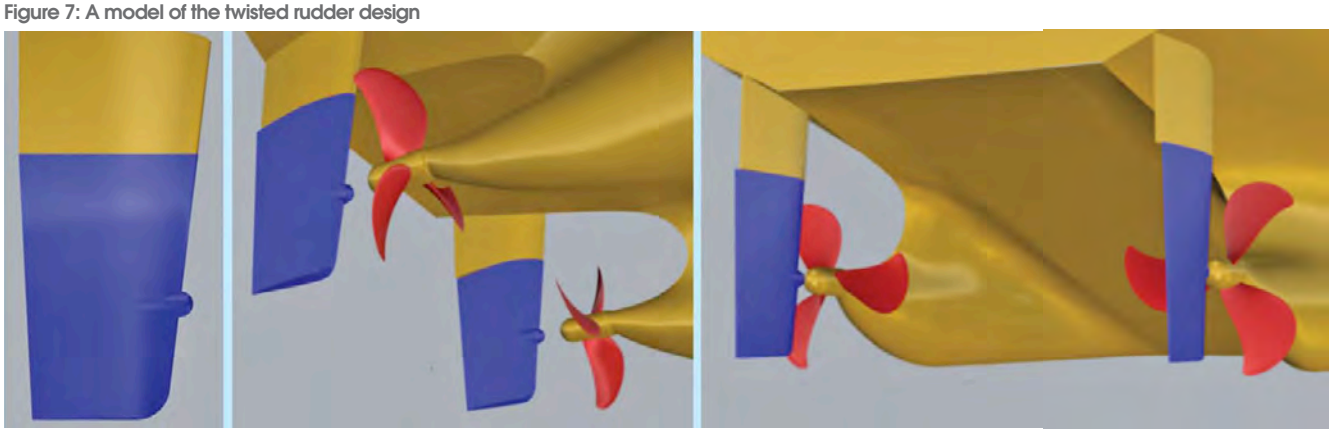
The governing equations used in this paper are the continuity equation (1) and momentum equations (2), where Ui = (U,V,W) represents the average velocity component for each axis, x_i = (x, y, z), and P, R_N and $-\overline{u_i u_j}$ represent static pressure, Reynolds number and Reynolds stress respectively. The turbulence model for calculating Reynolds stress was a Reynolds stress turbulence model.

$$\frac{\partial U_i}{\partial x_i} = 0 \quad (1)$$

$$\frac{\partial U_i}{\partial t} + U_j \frac{\partial U_i}{\partial x_j} = -\frac{\partial P}{\partial x_i} + \frac{\partial}{\partial x_i}\left(\frac{1}{R_N}\frac{\partial U_i}{\partial x_j} - \overline{u_i u_j}\right) \quad (2)$$

The trimmed mesh and polyhedral mesh are small in the complex flow and big in the simple flow, and reduce the total number of needed grids effectively. The grids also have a polyhedral characteristic. In this test case, the spatial gradient of the physical quantity

Figure 7: A model of the twisted rudder design



Time (s)	Δt (s)	Method of propeller motion:
0.000 ~ 50.000	0.1	Rotating Reference Frame
50.000 ~ 50.288	0.004	Rotation
50.288 ~ 50.576	0.002	Rotation
50.576 ~ 50.720	0.0004	Rotation

Table 2: Time interval (Δt) for calculations

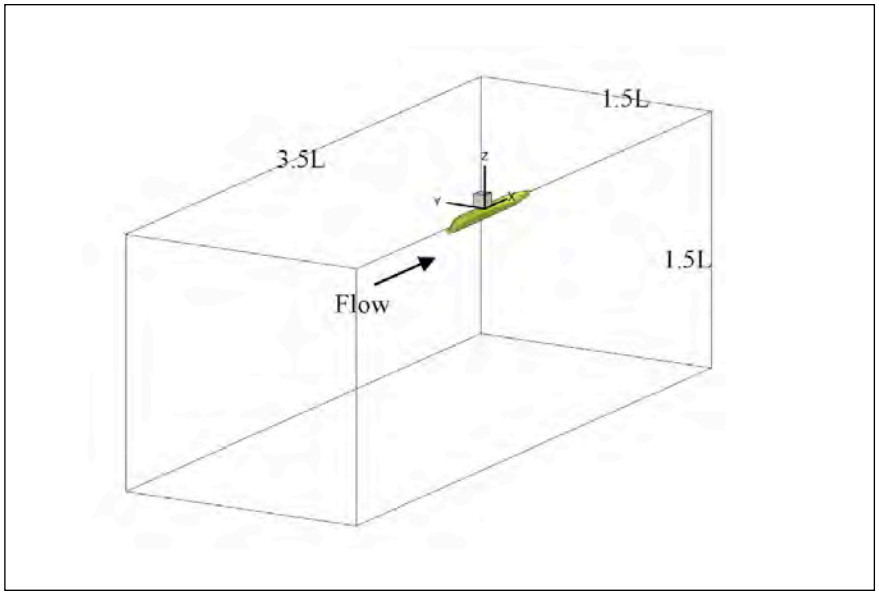


Figure 8: Cartesian coordinate system

has to use the least squares method to calculate the second order accuracy, which maintains the integrity of the CFD analysis. When the flux passing through the side of the grids is interpolated at the changed grid level (where the closer trimmed mesh which is fine and the farther trimmed mesh which is coarse meet), it is difficult to maintain the second order accuracy. Therefore a prism layer was applied around the hull and the propeller where the shear force is important. A maximum of six prism layers and the wall function were applied.

The Rotating Reference Frame and the Rotation provided by STAR-CCM+ were used to implement the propeller rotation. First, the Rotating Reference Frame is applied for the efficiency of calculation time and the convergence. After that, the Rotation is applied for the accuracy of calculation. A time interval is applied differently depending on the implementation of the propeller rotation, as shown in Table 2, while the inner iteration – a technique to find time-dependent solutions efficiently – is five each time interval. As the propeller rotates, the results periodically oscillated, so the results were averaged over the last three cycles.

The boundary condition of the inlet was fixed velocity and the outlet imposed pressure value so as to satisfy mass conservation of the entire computational domain. The bottom side and both sides of the calculation domain were applied to the symmetry boundary conditions.

Finally, because the propeller wake field analysis can be identified without a free surface, the symmetry boundary condition was applied instead of the free surface boundary condition to increase the efficiency of the calculation time. The calculation was performed without the rudder to analyse accurate propeller field flow. *NA*

**This article is based on a paper given at the RINA International Conference on Computer Applications in Shipbuilding (ICCAS 2015), 29th September - 1st October 2015, Bremen, Germany.*

Authors:

Young Ee Shon, researcher, HMRI; Bong Jun Chang, managing director, HMRI; Ji Myoung You, researcher, HMRI; Bum Woo Han, head researcher, HMRI.

ESCHER WYSS PROPELLERS
No Compromise

ANDRITZ Hydro

Photo of naval vessel with friendly permission of PIZ Marine, Germany

An optimal product impresses with all of its components. If you demand the highest standards of quality, then we have plenty in common.
Escher Wyss Propellers offer uncompromising performance, tailor-made to your requirements – with over 80 years of experience.

ANDRITZ HYDRO GmbH
Escher-Wyss-Weg 1, 88212 Ravensburg
Tel: +49 (751) 295 11-0, Fax +49 (751) 295 11-679

www.escherwysspropellers.com

The Royal Institution of Naval Architects

International Conference: Maritime Project Management

24-25 February 2016, London, UK

Registration Open

Marine vessels and structures are generally large, technically complex, costly, and traditionally low production volume items. A successful project requires the effective management of many different stakeholders; designers, fabricators, equipment manufacturers and regulatory bodies. Such projects are increasingly involving the management of multi-disciplinary and multi-cultural teams in different locations around the world. This conference aims to highlight the key elements in successful maritime project management, and to identify best practice and share experience that will help to deliver a benefit to the industry.

To regsiter, visit the website or contact the RINA Conference Department:
8 - 9 Northumberland Street,
London, WC2N 5DA
Tel: +44 (0)20 7235 4622 Ext: 331
Fax: +44 (0)20 7259 5912
email: conference@rina.org.uk

www.rina.org.uk/Project_Management

The Royal Institution of Naval Architects

Design & Operation of Ferries & Ro-Pax Vessels

25-26 May 2016, London, UK

Call for Papers

The last 10 years have seen a steady continued growth in the passenger ferry and Ro-Pax market, with particularly strong growth in passenger numbers. Despite the recent freight market downturn there is political pressure, particularly in Europe, to move more road traffic to intermodal maritime based logistics chain the so called “motorways of the sea” but these vessels are often still competing with fixed links (tunnels & bridges) and the budget airlines.

This conference seeks to investigate the curret trends in the design and operation of Passenger ferries and Ro-Pax vessels. Especially as designers have to cope with varying mixes of freight and passenger cars, depending upon the route and season.

To submit a paper, visit the website or contact the RINA Conference Department:
8 - 9 Northumberland Street,
London, WC2N 5DA
Tel: +44 (0)20 7235 4622 Ext: 331
Fax: +44 (0)20 7259 5912
email: conference@rina.org.uk

www.rina.org.uk/Ferries_Ro-pax


SWL
70 t
Goldhofer

Luxury cruise ship for Asia gets Azipod XO

ABB has delivered its latest Azipod XO podded propulsion unit to Meyer Werft to be installed on a new cruise ship for Dream Cruises, "the first-ever Asian based premium cruise line brand", according to Star Cruises, its parent company.

The unit provides 20.5MW of power and will help to power the 150,000gt *Genting Dream*, which has a total engine capacity of 76.8MW. The new vessel will be 335m long and 39.7m wide and will feature 1,680 cabins that can accommodate a total of 3,360 passengers.

Each of ABB's Azipods takes roughly two months for technicians to assemble, while the synchronous motors used in its design take shape over six months, according to the company.

The unit for *Genting Dream* has been transported from ABB's Vuosaari Harbour plant to Meyer Werft, Papenburg, Germany, where it will be installed. The vessel is scheduled for delivery in the autumn of 2016. *NA*

NCL facelift starts with *Epic* event

Norwegian Cruise Line (NCL) announced last month that it will spend US$400 million refurbishing the interiors of its fleet of cruise ships. The two-year renewal programme has been labelled 'The Norwegian Edge' and will include refurbishments on nine vessels in total

Heavy investment in the refurbishment of NCL's existing fleet comes as the company tries to ensure that all of its vessels are to the same standard as its newest ships. This work will involve the refreshing of décors, but also much more, according to the company: "As the cruise line with the youngest fleet in North America, this extensive enhancement programme will offer much more than the traditional soft goods décor updates, and serve to make the line's ships into essentially new vessels."

NCL's extensive refurbishment work began with *Norwegian Epic* in October 2015

While exact plans for the vessels' refurbishment have not been released, NCL president and chief operating officer, Andy Stuart ensures that the cruise line is setting a new standard: "Norwegian has a long history of investing in its fleet to offer guests the latest and greatest innovations, but the investment to raise our ships to The Norwegian Edge standard of excellence takes it to new levels."

NCL began work on the vessel refurbishments in October 2015 with the 155,873gt *Norwegian Epic*, built in 2010. The company can reveal that a number of new venues will be making their debut, including The Cavern Club, and that existing restaurants and venues, such as La Cucina, Cagney's, Le Bistro, Moderno Churrascaria, The Manhattan Room, and the Garden Café, as well as many public spaces, will receive makeovers with new furniture and flooring among the changes.

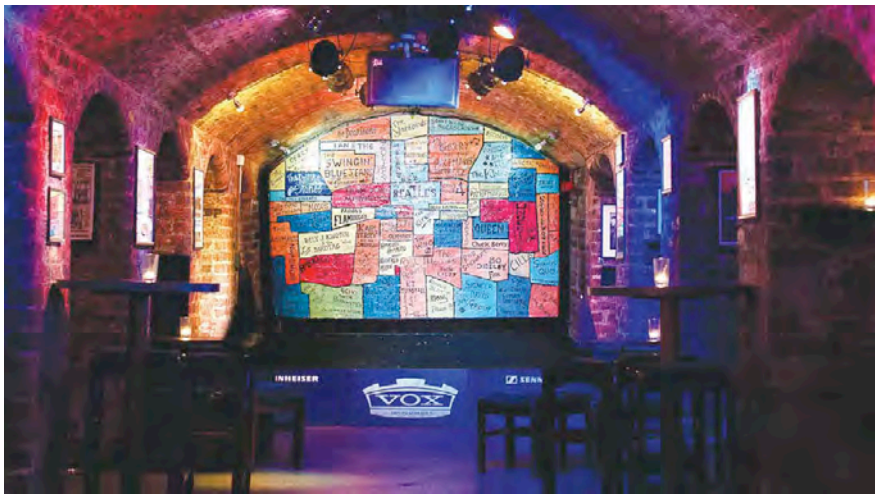
Norwegian Gem, a 93,530gt cruise ship built in 2007, followed suit in November of last year, undergoing similar cosmetic changes that include restaurant refreshes and the application of new teak flooring to outdoor spaces and the corridors of the upper decks. However, it also received interactive digital signage and wayfinding technology that should enhance the ship's customer experience.

A further seven vessels: *Pride of America, Norwegian Sun, Norwegian Dawn, Norwegian Spirit, Norwegian Sky, Norwegian Pearl,* and *Norwegian Jade* will be sent to drydock for enhancements between the spring of 2016 and the spring of 2017.

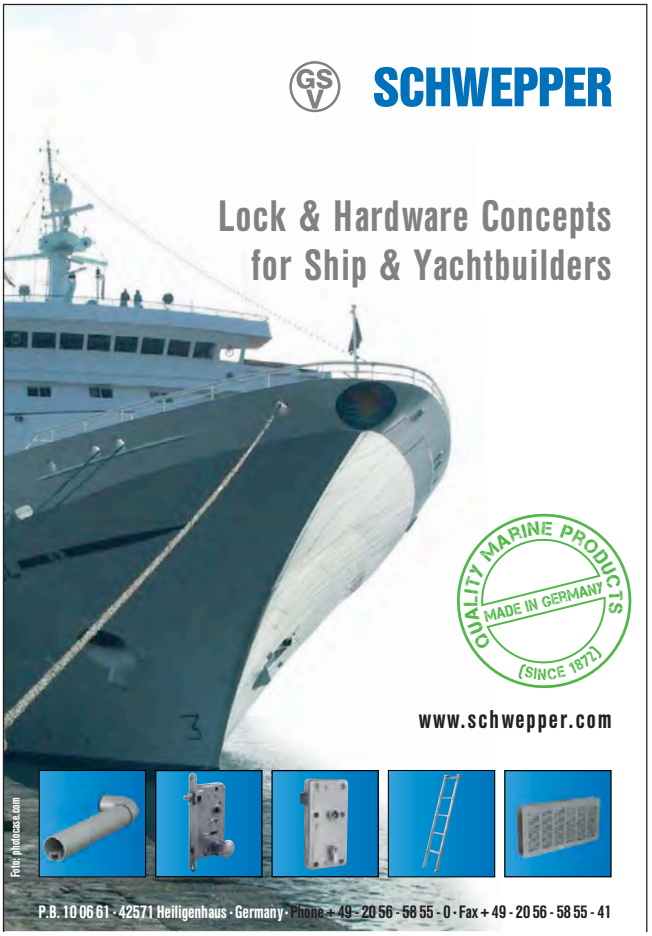
Stuart adds: "The new standards of The Norwegian Edge programme will entice our guests to return again and again to ships that will look and feel as if they were just delivered, with all new menus and new dining experiences, visiting incredible exclusive destinations that reflect the quality finishes, amenities and outstanding service found across the Norwegian fleet."

NCL's daughter company Regent Seven Seas Cruises has also announced a US$125m refurbishment programme that will modernise three vessels – *Seven Seas Navigator, Seven Seas Voyager* and *Seven Seas Mariner* – over a two year period. The works begin with *Seven Seas Navigator* in the spring of this year. ***NA***

The Cavern Club makes its debut aboard *Norwegian Epic*



*The Naval Architect Group (English & Chinese Editions)
1 January to 31 December 2014



The Royal Institution of Naval Architects

International Conference:

Wind Farm Support Vessels

30-31 March 2016, London, UK

Regsitration Open

Offshore wind farm support vessels have been one of the most dynamic maritime construction and operational sectors over the last 10 years. There are now believed to be about 400 vessels operating in the European market. Supply and service vessels are increasingly in demand as offshore windfarms continue to expand with new sites being developed in Europe, Asia, and the USA. Building on the success of previous two conferences, RINA returns to the subject to investigate the impact of new standards, new regulations, and new developments made within the industry.

To register, visit the website or contact the RINA Conference Department:
8 - 9 Northumberland Street,
London, WC2N 5DA
Tel: +44 (0)20 7235 4622 Ext: 331
Fax: +44 (0)20 7259 5912
email: conference@rina.org.uk

www.rina.org.uk/WFSV2016

Dispute in a box

Dear Sir,

Container shipping: a revolution in a box (TNA November 2015)
The author of the above paper does not know the background to the early OCL vessels. As you will see from the attached I am probably the only one still alive who was there!

The later vessels were not designed by OCEAN. P&O and FW worked on an initial design for the NZ trade and P&O built one ship - FW & ACT members cancelled there's. I had the job of settling damages for FW. Ocean probably had the job regarding Far East trade, but I think that the background, as attached, should see the light of day.

W.T. Cairns

Container shipping – a revolution…
I was the Furness Withy Rep on the OCL design steering committee. I had to be satisfied that all options would be investigated. I am probably the only member still alive – just. The committee was formed about 1966/7, it was chaired by Major General Prior Palmer (of El Alamein fame). He was a dictator and would not allow any points which, in his opinion, could cause delay. Whatever Marshal Meek said was treated as gospel. The PIC and BIC members took the view that 'Ocean' had been given the job so let them get on with it. So I was generally overruled.

The vessels 'Ocean' built in the 60s were typically old fashioned and could not bring about improvements in cargo handling. In my opinion 'Ocean' did untold damage to the UK shipbuilding industry with their love of rivets – in the mid 50s they would not accept welded eyeplates. They then went to Japan and accepted methods which they refused at home.

In the early 60s we in FW were well aware that cargo handling had to improve – we employed a Norwegian consultant who was well versed in unitisation and in 1965 we took delivery of two multi-hatch vessels – we squared off cargo spaces as much as possible and cargo tanks were only for liquids. The tween decks/hatches were strengthened for fork lift trucks. All the extras were subject to a thorough techno-economics analysis. Similar techniques applied later to our new tonnage in the west coast of S.A. trade, producing a marked improvement in profits. History suggests that we were 5-10 years late in our thinking and therefore 'ocean' were even more behind.

Now to the container ships. OCL and ACT (Bluestar Cunard & Ellerman) were agreed on a capacity of 1100TEU split between general & fridge. Stowage rates and service speed was also agreed. Otherwise, each consortium went their own way.

OCL obtained German tenders of £5m/ship. I cannot remember the D.Mark rate. Orders were placed; however the FW chairman insisted that one ship should be built in the UK. That went to the Clyde. Shortly after, Lloyd's List carried a note that ACT had placed orders for their ships costing £4m/ship.

There was consternation within O.C.L and I was charged with answering why. Were our ships 25% more expensive? ACT's dimensions were less than OCL's and I estimated (guessed) the difference would account for £0.5-0.6m and that the balance was due to a gold plated specification.

I then came across a technical paper in which David Moor (Vickers St Albans Tank) stated that Meek had asked him to modify the ship's lines in order to reduce excessive stability. This was not possible. However, hindsight suggests that alarm bells should have been ringing in Liverpool as the tune would have been "the suit is too big for the body" and more cargo was the only answer.

Face saving was achieved when the ships were modified later and the capacity increased to 1300TEUs – a 3rd tier of deck containers being added.

In conclusion I would remind the author that the first UK purpose-designed container ship to enter service was designed and built by Smith's Dock (South Bank) for Manchester Liners' North Atlantic Service. This was achieved by a true partnership of owner and builder. So the revolution actually started in the UK!

Yours W.T. Cairns (Fellow)

Following the production of January's Smart Ships supplement Michael Grey sent in this offering, proving once and for all that no idea is new.

A Forecast.
The Crewless Wireless Craft.

In days long past the paddle played its part in forward motion,
Soon challenged by the spreading sail unfurled on every ocean,
Large fleets propelled by coal-made steam for distant parts were loaded;
While others gained their impetus from mineral oil exploaded.

Electric power invisible, compact, its force expended,
A few short years its generous help to floating homes extended,
But now, (we speak in time not yet, prophetic is our vision)
The crewless, wireless ship we view (waste not your swift derision).

To-day with miriad cathode rays, atomic forces splitting
Electron speed to unseen craft are from the land transmitting,
A tube in shape, no deck, no keel, no funnel, ventilator,
No rudder, engine, mast or screw, nor even navigator.

Controlled by gyroscope its course, through aerial wave connected,
From port to port across the seas unshackled yet directed.
If solid matter in its path should threaten to destroy it.
Its telepathic sentient powers on courses new deploy it.

Till, as the distant port is neared, the waiting tuned receiver.
In action fixes guiding "wave" by tapping key and lever.
If weakly bolt or rivet false should cause the tube to founder,
The magnet will attract and with galvanic powers surround her.

So here we have the future ship, unloseable we deem her,
No longer need we navigate with paddle, sail or steamer.

Courtesy of Sea Breezes, August 1924 edition, page 255

faststream recruitment group

Marine Warranty Surveyor
£45-55K (DOE) - Leading Consultancy
Forward thinking client looking for Subsea experienced Naval Architects who want to get hands-on in the field.

Naval Architect/Technical Manager
£45-55K (neg. DOE) - Luxury Yachts
Join a progressive luxury yacht brand who are looking to build a dream team to expand their market share. Based in the South.

Naval Architect
£45-60K (DOE) - Submarines and Surface Ships
Make your next career move count with an organisation on the cutting edge of Marine Design and Engineering to the Global Defence sectors.

More jobs available online
Tel: +44 (0)23 8020 8760
Email: marine-uk@faststream.com
@shippingjobs www.faststream.com

General HydroStatics

* Rig wizard for finding critical axis and maximum VCG.
* Wind heeling moments in any direction derived from model.
* Multiple floating bodies - unique in the industry.
* Powerful macro language for automating launching, etc.
* IMO probabilistic damage for cargo & passenger vessels.
* GHS Load Monitor (GLM), the onboard configuration of GHS, allows GHS users to configure onboard systems and provide their clients the best combination of features.

GHS
General HydroStatics
Ship Stability and Strength Software

GHS ..... Full-featured naval architect's system
GHS Load Monitor (GLM) .....Onboard configuration
BHS ..... Basic hydrostatics and stability

Creative Systems, Inc.
Creators of GHS™
P.O. Box 1910 Port Townsend, WA 98368 USA
phone: (360) 385-6212 email: sales@ghsport.com
www.GHSport.com/home/index.htm
For 43 years, the software that naval architects love.

Investing in International Excellence

Newcastle University
UK | Malaysia | Singapore

The School of Marine Science and Technology (MAST) is the UK's longest established and largest marine school which provides a single base for all education, innovation and research related to the sea. Teaching is informed by internationally recognised and industrially relevant research and supported by specialised facilities which include our own dedicated research vessel The Princess Royal. We have a thriving research culture and support a large and growing cohort of postgraduate research students.

We are looking to appoint two self-motivated highly performing academics, one based in Newcastle and the other at our campus in Singapore. Both posts will be expected to play a central role in our core taught programmes and will have research interests that align with one, or more, of the School's research groups, with primary affiliation to the Marine Structures and Hydrodynamics and Structures research group.

Lecturer in Marine Hydrodynamics - Newcastle (D30083A)

You will be expected to have research interests that align with our teaching and research activities in the marine hydrodynamics area, the main focus of this research will be in the ship manoeuvring and seakeeping areas.

Lecturer in Naval Architecture/Ship Design - Singapore (S0021A)

You will be expected to have research interests with align with our teaching and research activities in the Naval Architecture/Ship Design area to join our team of staff at our campus in Singapore.

The posts are available on a full time permanent basis.

To find out more about the vacancies, and to apply, please visit www.ncl.ac.uk/vacancies

Closing date: 26 February 2016

For a confidential discussion about the roles, please contact either Professor Andrew Willmott (Head of School) e-mail andrew.willmott@ncl.ac.uk or Professor Bob Dow (Chair in Marine Structures) bob.dow@ncl.ac.uk

For more information about the School please visit http://www.ncl.ac.uk/marine/

Newcastle University values diversity and is committed to recruiting and supporting staff and students from all sectors of society.

Excellence with a Purpose

Athena SWAN Bronze Award

hr EXCELLENCE IN RESEARCH

Committed to Equal Opportunities www.ncl.ac.uk/vacancies

The Royal Institution of Naval Architects

Human Factors 2016

28-29 September 2016, London, UK

Call for Papers

The work of naval architects and marine engineers directly influence the operability and safety of the vessel and the seafarer. Decisions made at the design stage can influence human behaviour and health. And an improved understanding of ergonomics by engineers can 'design out' hazards and prevent incidents, both to the individual and the vessel.

With ever more complex systems and technology, greater improvements in safety can be achieved through a better understanding of human/system dynamics. A greater awareness of the role played by management structures, culture, procedures and regulation in safe and effective operation is also important to the effective running of the vessel and wellbeing of the crew.

To submit a a paper, visit the website or contact the RINA Conference Department:
8 - 9 Northumberland Street,
London, WC2N 5DA
Tel: +44 (0)20 7235 4622 Ext: 331
Fax: +44 (0)20 7259 5912
email: conference@rina.org.uk

www.rina.org.uk/HumanFactors2016

ADVERTISERS' INDEX

If you would like to receive further information on the advertisers' featured within *The Naval Architect* please contact **John Payten, Group Sales Director,** jpayten@rina.org.uk

2-day complimentary subscription

For your **2-day free subscription** to view this product online and in full, **please visit: http://vp.imo.org/Public/TrialSetup.aspx** and choose product IMO-Vega from the drop-down menu

THE IMO-Vega DATABASE

All of the necessary information on safety and pollution prevention requirements applicable to ships at your fingertips

Scan here for your **free trial**

DNV·GL

IMO INTERNATIONAL MARITIME ORGANIZATION

RINA publications

Books

Please note all prices include postage & packaging

LAMENTABLE INTELLIGENCE FROM THE ADMIRALITY
By Chris Thomas
HMS Vanguard sank in thick fog in Dublin Bay in September 1875 rammed by her sister ship. No lives were lost (except perhaps that of the Captain's dog) but this one event provides valuable insight into naval history of the late nineteenth century. Chris Thomas examines what happened, setting it in the context of naval life, the social and economic situation of officers and ratings. He describes the furore caused by the unjust verdict of the Court Martial, vividly illustrating the joys and trials of the seagoing life in the Victorian era, and the tragic effect on the life of Captain Richard Dawkins and his family.
Price: UK £9.00 EUR £10.00 OVS £12.00
AMAZON PRICE: £12.74

SHIPS AND SHIPBUILDERS: PIONEERS OF SHIP DESIGN AND CONSTRUCTION
By Fred Walker FRINA
Ships and Shipbuilders describes the lives and work of more than 120 great engineers, scientists, shipwrights and naval architects who shaped ship design and shipbuilding world wide. Told chronologically, such well-known names as Anthony Deane, Peter the Great, James Watt, and Isambard Kingdom Brunel share space with lesser known characters like the luckless Frederic Sauvage, a pioneer of screw propulsion who, unable to interest the French navy in his tests in the early 1830s, was bankrupted and landed in debtor's prison. With the inclusion of such names as Ben Lexcen, the Australian yacht designer who developed the controversial winged keel for the 1983 America's Cup, the story is brought right up to date.
Price UK £12.50 EUR £16 OVS £18
AMAZON PRICE: £21.25

THE ROYAL INSTITUTION OF NAVAL ARCHITECTS 1860-2010
Published to commemorate the 150th anniversary of the founding of the Institution, The Royal Institution of Naval Architects 1860-2010 provides a history of the Institution as reflected in the development of the naval architecture profession and the maritime industry over that time. In the book, members give their personal views on the development of their sector of the maritime industry and how it will develop in the future.
Price UK £5.50 EUR £6 OVS £7
NOT ON AMAZON

International Journal of Maritime Engineering (IJME)

2016

Members Part Ref: IJME16 Set Ref: ST16

Part A1	Part A2	Part A3	Part A4	Set
£17	£17	£17	£17	£47

Non-Members Part Ref:IJME16 Set Ref: ST116

Part A1	Part A2	Part A3	Part A4	Set
£24	£24	£24	£24	£81

IJME - is published in March, June, September & December. The IJME provides a forum for the reporting and discussion of technical and scientific issues associated with the design, construction and operation of marine vessels & offshore structures

International Journal of Small Craft Technology (IJSCT)

2016

Members Part Ref: IJSCT16 Set Ref: SS16

Part B1	Part B2	Set
£17	£17	£29

Non-Members Part Ref: IJSCT16 Set Ref: SS116

Part B1	Part B2	Set
£24	£24	£44

IJSCT - is published in June & December. The IJSCT provides a forum for the specialist reporting & discussion on technical & scientific issues associated with research & development of recreational & commercial small craft.

Each month RINA offers up to 70% discount on the normal price of its publications.
Please visit the website at www.rina.org.uk/bookshop-bargains
to see this months specials.

Journals

THE NAVAL ARCHITECT

Published 10 times a year

quarterly publication
OFFSHORE MARINE TECHNOLOGY
bi-monthly publication
WARSHIP TECHNOLOGY

- Providing up-to-date technical information on commercial ship design, construction and equipment.
- Regular reports on centres of shipbuilding activity worldwide.
- Comprehensive, technical descriptions of the latest newbuildings.
- News, views, rules & regulations, technology, CAD/CAM, innovations.

2016 Subscription

12 months	Print only†	Digital Only*	Print + Digital
UK	£182	£182	£232
Rest of Europe	£190	£182	£240
Rest of World	£204	£182	£254

†Incudes p+p
*Inclusive of VAT

SHIP & BOAT INTERNATIONAL

Published 6 times a year

- In depth coverage of small craft/small ship design, building & technology.
- Specialist sections include: fast ferries, tugs, salvage & offshore, patrol & paramilitary craft, coastal & inland waterway vessels, pilot boats, propulsion and transmissions.
- Advances in construction materials, electronics, marine equipment.
- Contract news and the latest market developments.

2016 Subscription

12 months	Print only†	Digital Only*	Print + Digital
UK	£134	£134	£164
Rest of Europe	£142	£134	£172
Rest of World	£162	£134	£192

†Incudes p+p
*Inclusive of VAT

SHIPREPAIR & CONVERSION TECHNOLOGY

Published Quarterly

- In depth coverage of all aspects of shiprepair and conversion work and comprehensive technical descriptions of major conversion projects.
- Regular regional surveys on the major shiprepair centres.
- Developments in shipboard and shipyard equipment technology.
- Contract news, appointments, industry views, new regulations.

2016 Subscription

12 months	Print only†	Digital Only*	Print + Digital
UK	£62	£62	£82
Rest of Europe	£68	£62	£88
Rest of World	£76	£62	£97

†Incudes p+p
*Inclusive of VAT

RINA publications

Conference Papers

If the CD ROM format is required please add CD after the reference number.

		Non-Members	*Members*
2015	**Education & Professional Development of Engineers in the Maritime Industry 2015** Ref: EDU15	£135	£115
	ICSOT India Ref: ICSOTINDIA15	£135	£115
	ICSOT Indonesia Ref: ICSOTIN15	£135	£115
	Energy Efficient Ship Ref: EEF15	£135	£115
	Pacific 2015 Ref: PACIFIC15	£39	£34
	ICCAS 2015 Ref: ICCAS15	£150	£180
	ICSOT Korea Ref: ICSOTKOR15	£135	£115
	Marine Design Ref: MD15	£135	£115
	Warship 2015: Surface Vessels Ref: WS15	£135	£115
	Mega and Super Yachts Ref: MSY15	£135	£115
	Ice Class Vessels Ref: ICE15	£135	£115
	Damaged Ship III Ref: DS15	£130	£110
	Structural Load and Fatigue on Floating Structures Ref: SLF15	£40	£35
	Design & Operation of Wind Farm Support Vessels Ref: WFV15	£130	£110
2014	**Experimental & Computational Marine Hydrodynamics** Ref: CEMH14 **PDF Only**	£91	£80
	Historic Ships Ref: HIST14	£130	£110
	ICSOT Indonesia: Developments in Ship Design & Construction Ref: ICSOTIN14 **PDF Only**	£130	£110
	Marine Heavy Transport & lift IV Ref: MHTL14	£130	£110
	Influence of EEDI on Ship Design Ref: EEDI14 **CD Only**	£130	£110
	Marine Design Ref: MD14 **CD Only**	£130	£110
	Warship 2014: Naval Submarines & UUV's Ref: WS14	£130	£110
	Design & Operation of Container Ships Ref: CON14	£130	£110
	Education & Professional Development Ref: EDU14 **CD Only**	£130	£110
	Fire at Sea Ref: FIRE14 **CD Only**	£130	£110
	Human Factors in Ship Design & Operation Ref: HF14	£130	£110
	Wind Farm Vessels Ref: WFV14 **CD Only**	£130	£110

For further information on previous editions please contact the Publications department on:
Tel: +44 (0) 20 7235 4622, Email: publications@rina.org.uk or Website: http://www.rina.org.uk

Payment Details: Payments must be made in pounds sterling to **RINA** by sterling cheque drawn on a UK bank, International Money Order or Credit Card, we accept Visa, Mastercard, or AMEX.

I enclose a cheque for _____ payable to RINA.

Please charge my Credit Card No: _____

Expiry date: __/__/__ Security code: _____ Signature: _____

Print name: _____

Name: _____

Address: _____

Country: _____ Postcode: _____

Tel: _____ Fax: _____ Email: _____

Please allow 30 days for dispatch and delivery. Post to:

The Publications Department, RINA, 8-9 Northumberland Street, London WC2N 5DA, UK.

Tel: +44 (0)20 7235 4622 or **Fax: +44 (0)20 7259 5912.**

ORDER FORM

Please send me the following:

REF NA FEB 16

REFERENCE	QUANTITY	PRICE
	TOTAL:	

For a publications catalogue please call the Publications Department on
+44 (0)20 7235 4622 e-mail: publications@rina.org.uk or visit our website at http://www.rina.org.uk

February 24-25, 2016
Maritime Project Management, international conference, London, UK
www.rina.org.uk/project-management

February 24-26, 2016
Vietship, international conference, Hanoi, Vietnam
www.vietship-exhibition.com.vn

March 14-17, 2016
Seatrade Cruise Global 2016, international conference, Fort Lauderdale, USA
www.cruiseshippingevents.com/miami

March 15-16, 2016
Basic Dry Dock Training, course, London, UK
www.rina.org.uk/drydock_course_march2016

March 15-17, 2016
Oceanology, international conference, London, UK
www.oceanologyinternational.com

March 16-18, 2016
Asia Pacific, international conference, Marina Bay Sands, Singapore
www.apmaritime.com

March 29-31, 2016
China Maritime, international conference, Beijing, China.
www.chinamaritime.com.cn/en/AboutUs/GeneralInfo

March 30-31, 2016
Wind Farm Support Vessels, international conference, London, UK
www.rina.org.uk/wfsv2016

April 13-14, 2016
Innovation in Small Craft Technologies, international conference, London, UK
www.rina.org.uk/Small_craft_tech

April 13-15, 2016
Sea Japan, international conference, Tokyo, Japan
www.seajapan.ne.jp/en

April 20, 2016
RINA Annual Dinner, London, UK
www.rina.org.uk/Annual_Dinner_2016

April 27-29, 2016
Contract Management for Ship Construction, Repair & Design Course, London, UK
www.rina.org.uk/CMC2016

May 2-5, 2016
Offshore Technology Conference, international conference, Houston, Texas, USA.
http://2016.otcnet.org

May 10-12, 2016
Europort, international conference, Romania
www.europort.nl/about-europort/europort-exports/europort-romania

May 23-27, 2016
ITS, international conference, Boston, USA
www.tugandosv.com/its2016-introduction

May 25-26, 2016
Design & Operation of Ferries & Ro-Pax Vessels, international conference, London, UK
www.rina.org.uk/Ferries_Ro-pax

June 6-10, 2016
Posidonia, international conference, Athens, Greece
www.posidonia-events.com/for-visitors/general-info.aspx

June 6-10, 2016
CIMAC, international congress, Helsinki, Finland
www.cimac.com/events/cimac-congress/index

June 14-16, 2016
Seawork, international conference, Southampton, UK
www.seawork.com

June 15-16, 2016
Warship: Advanced Technologies in Naval Design, Construction & Operation, international conference, London, UK
www.rina.org.uk/Warship2016

June 21-23, 2016
Electric and Hybrid, international conference, Amsterdam, The Netherlands
www.electricandhybridmarineworldexpo.com

August 11-13, 2016
Marintec Brazil, international conference, Rio de Janeiro, Brazil
http://marintecsa.com.br/en

August 29 – September 1, 2016
Offshore Northern Seas, international conference, Stavanger, Norway
www.ons.no/2016

September 6-9, 2016
SMM, international conference, Hamburg, Germany
www.smm-hamburg.com/en

September 12-15, 2016
Basic Dry Dock Training Course, London, UK
www.rina.org.uk/Drydock_Course_September_2016

September 21-23, 2016
Seatrade Cruise Med, international convention, Santa Cruz de Tenerife
www.seatradecruiseevents.com/med

September 28-29, 2016
Human Factors in Ship Design & Operation, international conference, London, UK
www.rina.org.uk/HumanFactors2016

October 26-27, 2016
Design & Construction of LNG Ships, international conference, London, UK
www.rina.org.uk/LNG_Shipping

November 23-24, 2016
Energy Efficient Ships, international conference, London, UK.
www.rina.org.uk/EES_2016

December 7-8, 2016
Historic Ships, international conference, London, UK
www.rina.org.uk/Historic_Ships_2016

December 9-10, 2016
Computational & Experimental Marine Hydrodynamics, international conference, India
www.rina.org.uk/Computational_Experimental_Marine_Hydrodynamics2016

JOTUN

RETURN OF INVESTMENT – GUARANTEED

SeaQuantum X200
The ultimate fuel saver

Jotun's Hull Performance Solutions will deliver a 13,5% improvement in propulsion efficiency as compared to market average. We either deliver guaranteed high performance or we pay back the additional investment.

Invest in knowledge: jotun.com/hps | Contact: hps@jotun.com

www.saxmedia.no

CBS EXECUTIVE MBA
IN SHIPPING & LOGISTICS

EXECUTIVE MBA
IN SHIPPING AND LOGISTICS (THE BLUE MBA)

A unique industry needs a unique MBA. Take your career to the very top international level by joining the world's premier Executive MBA designed specifically for Shipping and Logistics professionals.

Work from anywhere in the world on this world-class module-based Executive MBA, joining up for just 8 one-week sessions spread over 22 months.

Class start: September 2017
Visit www.cbs.dk/mbs or email info.mbs@cbs.dk

CBS COPENHAGEN BUSINESS SCHOOL
HANDELSHØJSKOLEN

EFMD EQUIS ACCREDITED
AACSB ACCREDITED
ASSOCIATION AMBA ACCREDITED