



THE NAVAL ARCHITECT

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

JFE BallastAce®

Ballast Water Management System

Over 600 orders received (as of 1.2015)



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

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



Water treatment systems / Engine technology /
Bridge & communications / **March 2015**



MARITIME

PUT THE FUTURE OF YOUR FLEET IN SAFE HANDS

As your classification partner, our extensive maritime expertise, technical knowledge and regulatory foresight will help to ensure that your fleet meets the demands of the future. Our aim is safety, compliance and optimal operational performance throughout the lifetime of your

vessels, benefitting your business and the maritime industry as a whole. With DNV GL your fleet is in safe hands. Can you afford anything else?

[Learn more at **dnvgl.com/maritime**](https://www.dnvgl.com/maritime)

Editor Nick Savvides
Assistant Editor Samantha Fisk
Design/Production Manager Sandy Defraime
Group Sales Director John Payten
Assistant Advertising Manager Valder Gates
Advertisement Production Manager Stephen Bell
Subscriptions & Publications Manager Josie Smith
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
 © 2015 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 2015 subscription to *The Naval Architect* costs:

NAVAL ARCHITECT			
12 months	Print only†	Digital Only*	Print + Digital
UK	£177	£177	£227
Rest of Europe	£185	£177	£235
Rest of World	£198	£177	£248

10 issues per year;

†Includes p+p
 *Inclusive of VAT

Average Net Circulation 10,933
 1 January to December 2013
 ISSN 0306 0209



7 Editorial comment

Beyond LNG?

8-16 News

- 8-10 News
- 12 News analysis
- 14-16 Equipment news

18-30 In-depth

- 18-23 **Building materials** | MOSAIC becoming ship shape
- 24-26 **Profile** | Building social structures
- 28-30 **China Ship News** | Leveraging capital markets to promote shipbuilding development

55 Letters

57 Diary

MOSAIC in final stages

18



INVESTING IN
 THE ORIGINAL
 PAYS OFF

jetsgroup.com



Gastech

Conference & Exhibition

Singapore | Singapore EXPO | 27 - 30 October 2015

28TH EDITION

Hosted by:

BG GROUP



SUBMIT
YOUR
**TECHNICAL
ABSTRACT!**

THE 2015 EXHIBITION SEMINARS **CALL FOR PRESENTATIONS IS NOW OPEN!**



Showcasing latest developments and applications in gas technology

The Centres of Technical Excellence (CoTEs) are free-to-attend educational theatres at the Gastech Exhibition. They are dedicated to delivering knowledge and awareness of technological developments and applications in the gas industry.

Attracting thousands of technical professionals, the CoTEs will feature over 60 seminars where industry leaders and specialists can showcase their latest gas technology within 9 key sectors:

GAS PROCESSING

LNG & GAS CARRIER SHIP BUILDING

OFFSHORE TECHNOLOGY

LNG BUNKERING INFRASTRUCTURE

FLOATING LNG

LNG AS A MARINE FUEL

LIQUEFACTION

NATURAL GAS VEHICLES

SMALL TO MID-SCALE LNG

ORGANISED BY:

dmg events
global energy

SUPPORTED BY:

**ENERGY
MARKET
AUTHORITY**
Smart Energy. Sustainable Future

ie
Driving
Singapore's
External
Economy
Singapore

IN ASSOCIATION WITH:

S I E W
SINGAPORE INTERNATIONAL ENERGY WEEK

YourSingapore
.com

**SINGAPORE EXHIBITION
& CONVENTION BUREAU**

WE ARE INVITING ALL INDUSTRY PROFESSIONALS TO
SUBMIT THEIR ABSTRACTS FOR CONSIDERATION, FOR MORE
INFORMATION VISIT www.gastechsingapore.com/na-1

32-53 Features

Feature 1 Engine technology

32-35 Explaining the evolution of engines

Feature 2 Bridge & communications

36-37 Bridging the future

39-41 Fast and smart data

42 SAM Electronics powers up its development

43-44 Shaping the future

44 Alphatron lends a helping hand

Feature 3 Water treatment systems

45 Is UV a contender or a pretender

46-47 US regulations take the lead

48 Potable water testing

50 Closing the loop

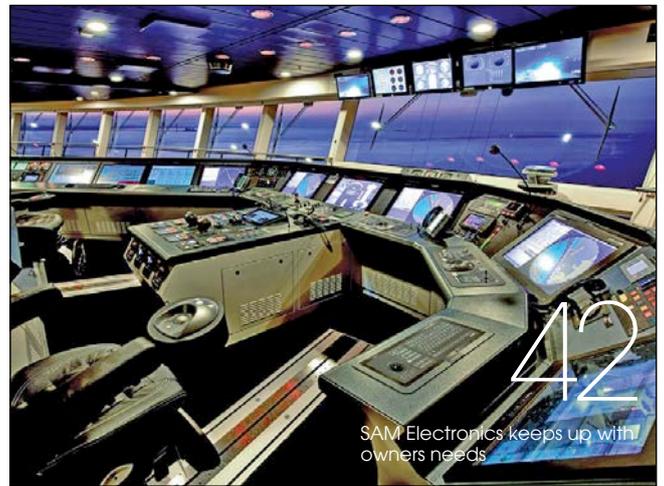
Feature 4 Foundation feature

51-53 Class rules, barriers or industry innovators?



36

Rolls-Royce and VTT develop the future bridge



SAM Electronics keeps up with owners needs

46

US takes the lead with BW regulations



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/na-digital.html> to read the digital editions, or download the free RINA Publications App.





*Confirm your position in
the Russian market at...*

NEVA 2015

ST. PETERSBURG, RUSSIA, 22 - 25 SEPTEMBER 2015



TWENTY-FOUR YEARS DEVELOPMENT
OF THE RUSSIAN COMMERCIAL
MARITIME INDUSTRIES

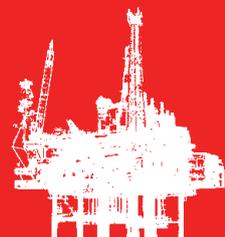
*THE 13TH INTERNATIONAL MARITIME
EXHIBITION AND CONFERENCES OF RUSSIA*



Contact Dolphin Exhibitions:

info@dolphin-exhibitions.com

www.transtec-neva.com





Beyond LNG?

Viking Grace was the first LNG-powered ferry to enter service, but is LNG the answer for sustainable shipping?

Technological development is in the spotlight. The industry in general and the shipping industry in particular are subject to sustained pressure from the green lobby who want to see a concerted effort to reduce greenhouse gas emissions significantly over the coming decades.

Currently the maritime industry's best hope in the short term has been the evolution of LNG as a fuel and the uptake of this fuel in certain regions is gathering pace, but LNG will not provide the answer to the industry's problems in the long term.

The sharp decrease in the price of oil has exposed the gas industry to new and unexpected pressures as demand for gas has tumbled in the face of crude oil's travails.

Whether the reduction in oil price is the result of the slow-down in global economic activity or coordinated efforts by producers to limit investment in the fledgling shale gas industry, thereby nipping the budding competition, the effect is already being felt as shale gas rigs are shut down in North America.

None of this has seriously impacted on the marine LNG power market; simply because the marine gas power is not only driven by cost, but also by regulation. Emission control areas (ECA) and sulphur emission control areas (SECA) in both the US and Europe, where most of the world's tonnage calls at one point or another, means that the cost to shipping of complying with these regulations in these regions has increased.

However, the cost has risen uniformly for all those that operate within the emission

control regions so competition has not been distorted, but the requirement to use either low sulphur fuel, install scrubber technology or switch to LNG power has meant that the marine gas market has an effective harbour wall against the lashing economic storms that are gathering in the open economy.

More regulation and more stringent regulation is on its way as the NO_x rules are imposed and when IMO finally agrees carbon rules, whether that is through a carbon tax or a carbon trading scheme.

LNG in the context of a carbon clean fuel can only be considered a bridging technology. The gas has a lower calorific value than HFO, engines that use LNG can suffer from methane slip, a more potent greenhouse gas than CO₂, and LNG only offers a carbon reduction of around 20% compared to HFO. With the increase in demand expected for shipping over the coming decades, resulting from an increase in the global population, there will be a net increase in carbon emissions from shipping unless action is taken now.

There appear to be few, if any, technologies that can bridge the carbon gap in the maritime industry. In the last couple of months we have heard from academics and industry cognoscenti presenting versions of an industry future, from remote controlled ships to the call for ship designers to "pick the low hanging fruit", that is make the simple to achieve changes that will immediately reduce a ship's carbon hull print.

In the coming months we will hear a lot more on how 'big data' will change the way

the industry operates. We will hear more about computational advances bringing high-powered super computers into the computational fluid dynamics field that will be able to model turbulence, that much maligned, malign force in vessel design. This month we have heard from MOSAIC, an EU-funded research project on shipbuilding materials, including composites. In addition, this month the Fraunhofer Institute for Systems and Innovation Research (ISI) in Karlsruhe, Germany, describe the evolution of engine technology and the agent-based model that the researchers say will define possible routes for technological development.

We are hoping that MOSAIC will be in a position to bring the results of their three-year research project to the July/August issue of *The Naval Architect*. Watch this space. Next month we will receive more information on the Danish initiative which has funded a number of research projects that the Danes hope will end with significant improvements in the efficiency of ships.

All of these new technologies will doubtless play a significant role in the development of a cleaner, more sustainable shipping industry. What these technologies demonstrate, however, is the futility of seeking a silver bullet that will offer an untroubled route to a cleaner industry. They show that the maritime industry will need to work hard at meeting the needs of a global society in the future, reducing emissions one step at a time. An evolutionary process that will be painful if, hopefully, ultimately successful. *NA*

Personnel

Tsuneishi appoints new president

Japanese shipyard Tsuneishi has appointed Kenji Kawano president of the company with effect from January this year.

Kawano, who was recently in London meeting clients, has worked with the company for 30 years. He says that he has taken over the leadership of the company at challenging times, with shipbuilding in recession and the global economic climate unfavourable for shipbuilders in general.

Tsuneishi, which has subsidiaries in China that opened in 2003 and Cebu in The Philippines, which opened in 1994, is drawing up a plan that Kawano says will help the yard to maintain its operations until a calmer global economic outlook is achieved.

Development of the Cebu yard 21 years ago was to help Tsuneishi compete with Korean shipbuilders as the value of the Yen increased. A similar situation exists now, but Kawano believes that the Filipino yard is well placed to produce vessels for the local market and for other South East Asian markets.

“Indonesia has 17,000 islands and The Philippines has 7,000 islands and they need ships,” says Kawano. “At the moment these countries often use old Japanese ships,” he added.

Tsuneishi sees this small vessel market as the key to its survival during this challenging economic period and it is a sector that it already has experience in with its South American yard which builds river barges in Paraguay.

New Tsuneishi president Kenji Kawano says the company will survive the economic downturn by looking for new markets



Careers

IMO launches Ambassadors Scheme

IMO secretary general, Koji Sekimizu, described the Ambassadors Scheme last month that he hopes will attract young people to the maritime industry.

Following February's Sub-Committee on Ship Design and Construction, Sekimizu told delegates that there is a need to promote the “full range” of maritime subjects including naval architecture and marine engineering.

He said that it was important for the industry to: “plant an understanding about the enticing prospects of a life in the maritime and seafaring professions in the minds of children and younger people, who have yet to decide on their future endeavours and career paths.”

He went on to say: “Ships of the future will require young talent to explore futuristic designs and, in my view, naval architecture is a hugely attractive profession, especially when you weigh the current number of young naval architects against the future demand for ships designed to meet society's increasingly stringent requirements for safety and environmental protection.”

The Ambassadors Scheme will see member governments appoint maritime ambassadors in their own countries who will be endorsed by IMO. Ambassadors will take part in outreach events, including visiting schools and other educational establishments to promote the maritime industry.

The scheme is set to be officially launched on World Maritime Day which this year falls on 24 September and carries the theme of maritime education and training.

Class

KR launches FOCO fuel tool

Complications in the fuel change in the period where vessels cross from the open sea to an Emission Control Area (ECA) can, in extreme cases, cause ships to lose power.

According to the Korean Register (KR) the current practice in this critical period is to rely on the knowledge and experience of the chief engineer which, the class society says, can lead to: “burning more of the expensive low sulphur fuel than is necessary”.

In an effort to aid ship operators, KR has developed FOCO, Fuel Oil Change Over, software developed specifically as an aid to chief engineers to make the change from HFO to low sulphur fuel as smooth as possible.

ECA zones require all ships to burn fuel with 0.1% sulphur content from 1 January this year, meaning that ships are required to either fit scrubber technology or switch from high sulphur content fuel, HFO, to the more expensive low sulphur distillate fuel.

Ballast Water Treatment & Ballast Tank Protection

Ballast Water Tank interior is
one of the most corrosive environment on ship

SAMGONG VOS system provides
solution against corrosion as well as BWTS



M/S SAMCO REDWOOD(318K VLCC, HSHI)
Installed VOS system(6,350 m³/h, BWTS)



Venturi Injector



SGG(Stripping Gas Generator)

**VOS system provides
ideal services with cost saving**

No use

Active substance(Neutralization Device), Filter

No need

Sacrificial Anodes in B.W.Tk, Air Vent Heads
Gas Detectors, Topping-up Generator(VLCC)

No limit

Fresh, Salty, Muddy or Polluted water

Spare parts

Free supply for five(5) years operation

Approved Cert.

- Marshall Island
- Netherland
- Panama
- Liberia
- Malta
- AMS of USCG



SAMGONG VOS CO., LTD
Licensee of N.E.I Treatment Systems, LLC, USA

“FOCO gives much more accurate timings that will save fuel and costs. The software also provides accurate technical data that can be used to report to port state control if change-over times are questioned,” says KR.

Education

HELMEPA set to announce Daifa scholarship

The Hellenic Marine Environment Protection Association (HELMEPA), will establish a €15,000 (US\$17,000) scholarship for students studying for one-year postgraduate courses in Naval Engineering, or Marine/Offshore Engineering and Technology, at universities in an EU member-state.

The scholarship was proposed by special secretary, Irene Daifa, in memory of her late father, Stavros Daifas, who was a founding member of HELMEPA.

The announcement of this latest scholarship will be made in March together with two other HELMEPA scholarships in memory of the association's Chairmen, George P. Livanos (shipping related studies) and Vassilis C. Constantakopoulos (environmental science).

Ferries

BV to class Seaspan ferries

Bureau Veritas (BV) has been selected as the class society for two LNG hybrid ferries being built at Turkish shipyard Sedef, based in Istanbul.

The two vessels, ordered in November of last year, will be 148.9m in length and are due for delivery in 2016. The ferries are unique in that they will have 4,500kW of power installed with two Wärtsilä WL9 34DF dual fuel engines, capable of operating on either diesel or LNG,

but will also have a battery pack of lithium ion batteries capable of producing 5,000kW of power. Propulsion will be provided by azimuthing drives and the vessels will operate at speeds of up to 16knots.

This extra redundancy, installed at the owner's request is as a “battery back-up in case of a black out and is not required by class,” confirmed BV's marine leader for environmental services, Martial Claudepierre.

The vessel's battery power will enable the ship to operate with zero emissions at certain key periods, such as when the vessel is in port as well as providing back up should the main power source fail says Claudepierre.

The ferries will operate in the Vancouver region and will be fitted with a vacuum insulated Type C tank of 200m³ that will rely on pressure to inject fuel into the engines. LNG fuel will be supplied by Fortis BC. [NA](#)

Clarifications

In the February issue (Stena's many happy returns) *The Naval Architect* intimated that Stena was operating a fruit service between Central America and Europe. However, we would like to make it clear that when the reefer ro-ro ships are built Stena RoRo AB has no intention of operating such a service.

Stena RoRo will only make available and finance these ships for the players in the reefer industry, i.e. the international fruit companies and the reefer ship owners and operators. *The Naval Architect* would like to apologise for this misunderstanding and for any embarrassment caused.

In the story entitled ‘Blue whale series surfaces’, published in the February 2015 issue, the caption reads “*Chipol Chiangjiang* has the largest lifting capacity in the world”; this should read the largest dwt in the world. *The Naval Architect* would like to apologise for the error and for any embarrassment caused.

The Seaspan hybrid ferries, due to be delivered in 2016, will have dual fuel engines as well as a battery pack for zero emissions operations





NOR OSLO JUNE 02-05 SHIPPING 2015

50 YEARS
LOOKING
FORWARD

Join your peers, partners and prospects at Nor-Shipping, where the maritime world gathers in Norway to explore the future.

Register today at www.nor-shipping.com

Main Sponsor:



Leading Sponsors:



Partners:



Organizer:



LNG remains in the frame in spite of crude oil price collapse

Falling oil prices may have eliminated much of the price advantage LNG had over diesel fuels, but LNG still holds the advantage over diesel environmentally, operationally and in price stability, a new report from FC Gas Intelligence suggests, writes *Sandra Speares*.

The new report, *LNG, Oil Prices, and the High Horsepower Market*, says that the Off-Road and High Horsepower sectors of the LNG industry have been under pressure through the halving of crude oil prices between June last year and January 2015.

However, at a time when new regulations have been introduced to cut sulphur content in fuels, LNG retains an advantage because it can beat the “toughest emissions standards that are enforced on diesel and other traditional fuels”. At a time when the industry is working to meet emissions regulations and the Tier IV diesel standards, natural gas engines look more attractive.

“Efforts to reduce methane emissions, particularly from oil and gas drilling, is creating new business opportunities to fuel heavy-duty drilling and pumping equipment. Using field gas to replace diesel saves money and helps the environment at the same time. The close price spread between LNG and diesel fuel will slow down conversion to LNG in the near term, since it is harder to cover the expense of new equipment without the fuel cost savings,” the report says. “But, the long-term trends remain very favourable for LNG.”

The report contains a number of interviews with industry specialists including the likes of engine manufacturer Wärtsilä. With the introduction of emission control areas (ECA) from 1 January, owners need either to install expensive scrubbing technology, burn ultra-low sulphur diesel (ULSD) or convert to LNG. All three choices are expensive, but running scrubbers on heavy fuel oil is the most expensive and carries the highest maintenance burden, according to the report.

“In the near term most ships are converting to dual fuel engines that burn both LNG and ultra-low sulphur diesel fuel. Dual fuel engines allow ship owners the flexibility to comply with ULSD, but take advantage of LNG where it is available. LNG bunkering is just beginning to be built out, so it will take a few years before the use of LNG is common.”

So how are the recent price shifts impacting the uptake of LNG for ships? According to John

Hatley of Wärtsilä: “Diesel has fallen 18% since its June high and natural gas has fallen about 35% in the US. Since diesel has not fallen nearly as much as crude, there is still a pretty strong case for LNG, although not as strong as it was before”.

He says that natural gas complies with all the emissions requirements, even the tighter requirements going forward. “Diesel engines require baggage in terms of after-treatment devices to comply with all those emissions attributes as emissions tighten. That baggage requires weight, maintenance to ensure it performs correctly, and initial costs and concerns.

No matter what type of diesel engine it is, it requires some form of after-treatment, be it exhaust gas recirculation (EGR) or selective catalytic reduction (SCR), which only go after nitrogen oxides, or a scrubber which only attacks sulphur and SOx. Whereas gas does not require any of this excess baggage or extra systems to make it work as well as the obligations to dispose of the residuals that come from those operations.

“When you look at it as an entire system, natural gas is safe, clean, and very efficient in burning cleanly. It is also fairly low cost and it avoids all this excess baggage in terms of additional supporting elements to meet compliance”. On the operation and maintenance side, the maintenance intervals have been expanded dramatically and pushed farther out in the future with fewer component replacement exchanges, he says, as LNG fuel is a very, very clean burning fuel. “We see LNG fuel as a strategic element of our on-going, future market activity”.

Tier IV emissions rules for diesel engines that are now in place require exhaust after-treatment devices that come with increased cost and maintenance requirements as well as the use of ULSD fuel that is premium priced.

Diesel Tier IV after-treatment devices vary by manufacturer, but include some combination of EGR or SCR to reduce formation of NOx, Hatley says. SCR requires use of a liquid urea reagent called diesel exhaust fluid (DEF) that must be refilled regularly. Some engines will also use diesel particulate filters that must be maintained. LNG fuel beats all Tier IV emission standards without the use of exhaust after-treatment devices, he believes. This simplifies engineering and reduces maintenance downtime. [NA](#)

REPAIR &
CONVERSION

DAMENSHIPREPAIR.COM



LIKE HER PASSENGERS SHE DESERVES THE BEST

WE BELIEVE ALL SHIPS HAVE MORE THAN ONE LIFE

We have decades of experience, highly skilled project teams, extensive newbuilding, engineering expertise and repair and conversion jobs. With our craftsmanship and facilities we can design, engineer and execute all kinds of conversion jobs to meet your needs.

We take pride in getting you back on track
Durk Jan Nederlof

WWW.DAMENSHIPREPAIR.COM

DAMEN

Environmental

Classy act from Alfa Laval

Alfa Laval's PureSOx system's first class approvals have been granted. Having already won the Environmental Award at the Lloyd's List Global Awards for its work with PureSOx, DFDS has now received approval from Lloyd's Register for *DFDS Petunia* and *Primula Seaways*. "By proving our ability as a scrubber supplier, approval confirms that customers can count on PureSOx for savings and compliance," says René Diks, manager marketing & sales, Exhaust Gas Cleaning at Alfa Laval.

This competence is a vital factor, given that the scrubber approval process is anything but smooth. "Unfortunately there are various interpretations from class societies, and there will continue to be some uncertainty regarding pH limits for scrubber water discharge," says Kate Schröder Jensen, development engineer, Exhaust Gas Cleaning at Alfa Laval and a specialist in the legal issues. "IMO's Pollution Prevention and Response subcommittee recently drafted an amendment to paragraph 10.1.2 (ii) in the scrubber guidelines, which would allow the use of calculation-based methodologies alongside measurements. Measurements have so far been the only practical method of getting open-loop seawater scrubbers approved, but they are not without problems. They need to be taken at full scrubber load based on maximum fuel-sulphur content, as well as while the vessel is 'at rest in harbour', which excludes ships that are directly shaft-driven. Our hope is that the MEPC will approve the text in May, as it will simplify the approvals of open-loop scrubbers."

Alfa Laval saw steady growth in exhaust gas cleaning in 2014. As the start of enforcement in Emission Control Areas (ECAs) now begins, the company says that it can now deliver class-approved systems and is prepared for an even higher order intake in 2015.

www.alfalaval.com

Propulsion

Voith equips CMAL's hybrid ferry

Caledonian Maritime Assets Ltd (CMAL), a corporation owned by the Scottish government, has looked to Voith propulsion systems for its new hybrid ferry. The reason for that are the satisfactory results already seen on two other ferries equipped with Voith Schneider Propellers (VSP), says the company. Like its sister vessels, *Hallaig* and *Lochinvar*, the ferry will



Voith are to supply CMAL ferries with its propulsion

be built by Ferguson Shipbuilders in Glasgow. For its new hybrid vessel, Scottish owner CMAL will use two VSP 16R5 EC/90-1 as well as two bow-tooth couplings and the Voith electronic control system.

www.voith.com

Paints & coatings

Hempel to acquire Jones-Blair

Hempel has announced the signing of a binding agreement to acquire Jones-Blair Company, a North American supplier for the protective and waterproofing markets. With the proposed acquisition, Hempel is expecting a significant expansion of its North American business in accordance with its global growth strategy.

According to Kim Junge Andersen, Hempel's Group executive vice president & CFO, the two company's product portfolios complement each other perfectly. "By combining our strengths, we can serve our customers better and with more complete solutions compared to what each of us could do on our own," he says. "The acquisition will provide Hempel with a solid and diverse platform for the continued development of our business in the region."

At the time of going to press the transaction was expected to close in early March 2015, subject to regulatory approval.

www.hempel.com

Class

IACS updates blue book

The Blue Book is an electronic library of technical resolutions (both past and present) adopted by IACS as a result of its technical work and provides

an example of how the aims and objectives of the Association are delivered for the benefit of international shipping.

The latest version of the Blue Book is available for downloading from the IACS website at www.iacs.org.uk/publications. Ship Designers, Consultants, Shipbuilders, Classification Societies, Shipowners, Shipbrokers, Insurers, Associations, Accredited Certification Bodies, flag States, Port State Control, MOUs and the shipping industry at large are able to download the package free of charge at any time.

IACS has said that the latest release of the IACS Blue Book package will continue to enhance its technical support to the shipping industry through IACS work and investment on technology, innovation, research and development both at the classification and statutory levels.

www.iacs.org.uk

Ancillary equipment

PurgExtra from HFT

For producing zero colour, non-oxidised weld roots, PurgExtra is the latest weld purging product range to be released by Huntingdon Fusion Techniques Limited HFT for the weld purging of tubes and pipes from 1 – 24 inch diameter.



The latest weld purging tubes from Huntingdon Fusion Technologies

The company says that this range compliments the PurgElite series, but in addition has extra purge gas inlets and corresponding exhaust ports.

Designed for the weld purging of Titanium in particular, as well as Ultra High Purity stainless steel joints, corrosion resistant alloy welding and duplex steel joints, the PurgExtra series allows the operator to purge normally at first and then when conditions are correct, to introduce additional gas at high flow rates to create a much faster purge and a much more efficient removal of unwanted gases.

www.huntingdonfusion.com

CAD /CAM

Holland Shipyards selects ShipConstructor

Holland Shipyards has selected SSI's ShipConstructor software for its new shipbuilding activities, in a deal which has been handled through SSI's dealer in the Benelux region, CADMatch. The company's decision is based on what it says are the multiple advantages ShipConstructor offers in comparison with other ship construction programs.

Florian den Besten, naval architect with Holland Shipyards, explained his company's thinking when purchasing new CAD/CAM software. He said: "First of all, the system is user-friendly as ShipConstructor is AutoCAD based and contains all features needed by our architects. Secondly, the architects appreciate the ease of making 2D drawings with the MarineDrafting application of the ShipConstructor Hull Structure Premium Suite. The 2D drawings are used for workshop and classification drawings. The simplification of the technical drawings, by using appropriate symbols, makes them clear and readable. Additionally, the related 3D visualisation tool, Autodesk Navisworks, makes the documents easily accessible by anyone throughout the company. The automatic nesting and collision checks are also very handy."

www.ssi-corporate.com

Class

ClassNK PrimeShip-HULL (HCSR) software release

Leading classification society ClassNK has announced the release of Ver. 2.0.0 of its PrimeShip-HULL (HCSR) ship design support software. The latest version of the software system is designed to fully reflect all rule amendments of the IACS Common Structural Rules (harmonised CSR) adopted in December 2014.

Developed in response to industry demands, PrimeShip-HULL (HCSR) is a powerful total design support tool capable of far more than conventional software. The ship design support system helps to assist in the development of safer ships compliant with the harmonised CSR and is available completely free of charge to all ClassNK clients.

www.classnk.com

CFD

Bosch Rexroth gives MARIN a wave

Bas Buchner, MARIN president and Ron van den Oetelaar, general manager Bosch Rexroth Benelux, have signed a contract for a new wave generator

for MARIN's new Concept Basin. Part of this contract is a complete new wave generation control system for the wave generators in the Offshore Basin and Seakeeping and Manoeuvring Basin, commissioned in 2000. These wave generators have been continuously operational ever since, providing realistic wave conditions for complex model tests. The wave generator in the Concept Basin will be installed in August 2015, making this updated facility ideal for model test research in the early design stage, to be used intensively by innovative small and medium size enterprises (SME's).

Buchner has said that: "Reliable and accurate wave generation is paramount for MARIN's services to make ships cleaner, smarter and safer. We are happy to continue our cooperation with the Dutch maritime partner Bosch Rexroth from Boxtel. When this project is finalised, we will have state-of-the-art wave generators in all our test facilities, simulating realistic wave conditions."

The update of the wave generators in the Offshore Basin and Seakeeping and Manoeuvring Basin will be carried out at the end of 2015/early 2016.

www.marin.nl

Bridge & communications

Marine Atlantic tunes in with Imtech Marine

Marine Atlantic Inc. (MAI) has selected Imtech Marine Canada to replace its ship to shore wireless communication system. The installation period was given a short timeframe, with the installation taking place in just three weeks.

In the government tender for the contract Marine Atlantic requested a 'reliable, up-to-date and scalable ship to shore communications platform'. Imtech Marine, through its service and navigation/communication brand Radio Holland, provided a completely integrated system – the hardware, but also the VSAT and a backup Fleet Broad Band Satellite Airtime.

Colin Tibbo, CIO of Marine Atlantic Inc. said: "Our service needs will continue to evolve as we work to strengthen onboard services to both customers and crew and we will continue to look to Imtech/Radio Holland for their expertise to ensure we have the systems in place to support our business."

www.imtech.com

Propulsion

Steerprop gets ferries deal

Steerprop has secured a deal to equip four ferries ordered by the Port of Tallin, Estonia. Two of the



The SP 35 CRP is the larger forerunner to the SP 45 CRP

ferries will be built at the Remontowa shipyard in Poland and the other two will be built at the Sefine shipyard in Turkey. Each ferry will be equipped with two Steerprop SP 45 CRP propulsors with the Steerprop Push-Pull Contra-Rotating Propellers technology. Each propulsor has a power rating of two 150kW in the ICE-1A ice class of the DNV GL classification.

These orders represent the continuance of old customer relationships as well as the beginning of new business relationships for Steerprop Ltd. The combined value of the orders is slightly less than €10 million (US\$11.4 million).

The ferries will operate between the Estonian mainland and the islands of Hiidenmaa and Saarenmaa. Each ferry will be 114m long and can transport 150 cars or 10 rail cars in addition to 600 passengers. The first propulsors will be delivered in November 2015 and the last in January 2016.

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



Tank Management Systems

Scanjet is the experienced supplier with high quality products and solutions for tank management systems including tank cleaning equipment, anti-pirate water cannons, level gauging systems and Scanvent P/V valves.



Anti-pirate water cannons



Radar and Pressure sensor Level Gauging Systems



Electro Pneumatic Level Gauging Systems



NEW
Scanvent P/V valves



Fixed installed tank cleaning machines



Portable cleaning and Gasfreeing fans



Phone: +46 31 338 7530
E-mail: sales@scanjet.se
Web: www.scanjet.se

Visit us at
OTC 2015
Booth 1917

creating seaworthy software

- ◎ Stability & Strength Assessment
- ◎ Cargo Management & Load Planning
- ◎ Ship Design & Production
- ◎ World-Wide Service & Support

www.autoship.com

Why go anywhere else?

autoship.com

MOSAIC becoming ship shape

After almost three years of intense research activity, MOSAIC, an EU-funded R&D project, is approaching its final stages of development. The project aims are to investigate two novel ideas; first, the introduction of high strength low alloyed steels in specific structural details; and the replacement of specific structural parts of the ship with composite materials

Although these technologies, high strength low alloyed steels (HSLA) and composites, can potentially achieve the objective of weight savings and reduced maintenance costs, the integration of these materials within a vessel steel structure is not without hurdles.

In particular, the welding of insert HSLA plate as well as the joining of the composite components with usual steel structures. For these reasons, the MOSAIC (Materials Onboard: Steel Advancement and Integrated Composites) consortium paid particular attention to the study of welding procedures and technologies and to the design of hybrid joints (steel to composite) able to guarantee a gradual and effective transition between composite and steel, through extensive test campaigns, numerical simulations and analytical calculations.

In order for the project to address the requests and necessities of the modern ship building market, the first activity performed in MOSAIC was the identification of suitable application cases for the systematic introduction of HSLA steels and composite components into the commercial maritime

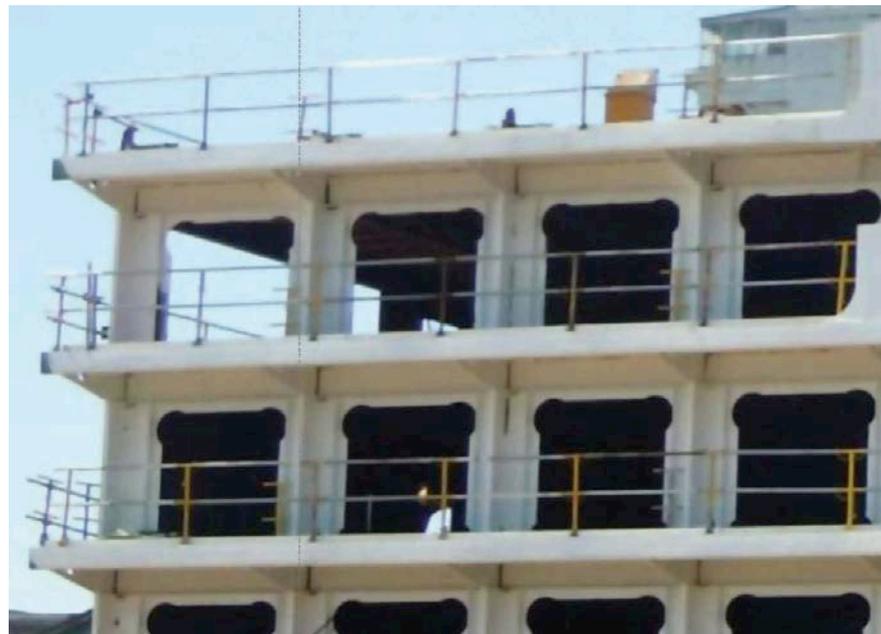


Figure 1: Example of bulkhead openings and balcony overhangs on cruise vessels (Fincantieri)

industry. Fourteen cases were identified for the HSLA steel applications and 20 cases for the composite applications, later filtered to

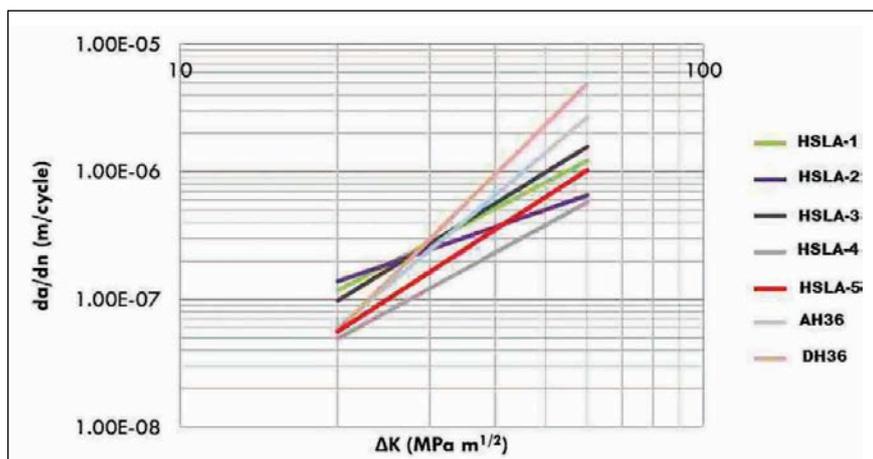
three cases for each material type, taking into account the criteria such as cost of production, consortium interest and market interest, etc.

This selection did not take into account only technical aspects, but also considerations on the current rules and regulations as well as economic frameworks. This activity was the driving force for the definition of material and joint tests and needed finite element simulations to be performed through the project and presented in this article.

HSLA steel

It is well known that the structural defects are the source of almost all structural failures in the majority of industrial sectors. The cause of a component structural failure is almost always a localised defect that incubates and grows over time into a

Figure 2: Fatigue crack growth rate: comparison between the HSLA steels and the common steels (UoB)



bulk component failure. Particularly for the marine industry, structural defects developing at stress concentration areas are a well-documented phenomenon, which poses a risk to the structural integrity of any vessel. Conventional mitigation measures are the use of insert plates with increased thickness or a redesign of the geometry of the structural detail with a significant increase in weight and the manufacturing cost of the structures. An alternative to these standard mitigation solutions could be the use of steel with improved mechanical properties such as the HSLA steels.

The categories of the HSLA steel include many standard and proprietary grades designed to provide specific desirable combinations of properties such as strength, toughness, formability, weldability and atmospheric corrosion resistance. These steels are not considered alloy steels, even though their desired properties are achieved by the use of small alloy additions. Instead, HSLA steels are classified as a separate steel category, which is similar to as-rolled mild-carbon steel with enhanced mechanical properties obtained by the addition of small amounts of alloying elements and, perhaps, special processing techniques such as controlled rolling and accelerated cooling methods. They are also not considered to be alloy steels in the normal sense because they are designed to

The Mosaic project

The project is co-funded by the European Commission within the 7th Framework Programme and was born out of cooperation between 11 companies and universities coordinated by the Italian research centre CETENA.

The MOSAIC consortium consists of three universities (NTUA, IST and UoB), one classification society (Lloyd's Register), two shipyards (ENP and Fincantieri), two institutes and joining technology centres (AIMEN and TWI), two research and consultancy companies (AS2CON and CETENA) and one shipowner (DANAOS).

meet specific mechanical properties rather than a chemical composition (HSLA steels have yield strengths greater than 275MPa or 40ksi).

In MOSAIC the mechanical properties of six types of HSLA steels were evaluated through extensive tests and compared to the properties of two conventional marine steels (grade AH36 and grade DH36 steel).

The following tests were performed in accordance with the ASTM, BS and ISO standard:

- Tensile test
- Impact test
- Fracture toughness test
- Fatigue crack growth test
- Microstructural characterisation.

Although all the considered HSLA steels presented considerably superior behaviour with respect to the conventional marine steels, only one HSLA was selected for the successive activities of the project. It is worth noting that not only the technical aspects were taken into account in this selection phase, but also factors such as the ease of supply and supply costs that play a decisive role in the choice of any shipyard when it comes to the selection of building material.

The next step of the project was to study the integration of the HSLA components with the other parts of the ship in conventional steel. For this purpose several combinations of welding joints were manufactured and tested: three steel combinations (HSLA to AH36, AH36 to AH36 and HSLA to HSLA), two thickness values and three welding techniques (arc welding, laser hybrid welding and the Friction Stir Welding method).

The implemented tests were the following:

- Tensile test
- Impact test
- Macrographic/microhardness test
- Corrosion test
- Magnetic particles test
- Radiographic test
- S-N curves.

The results gained from the before mentioned tests, performed on bulk steels and joints, were used as an input to study the application of HSLA insert plates in specific application cases identified at the start of the project.

The cases considered were the following:

1. Corner of the opening of the longitudinal bulkheads of the cruise ship
2. Misaligned plate and knuckled hopper
3. Lightening opening of the opening on the double bottom structure.

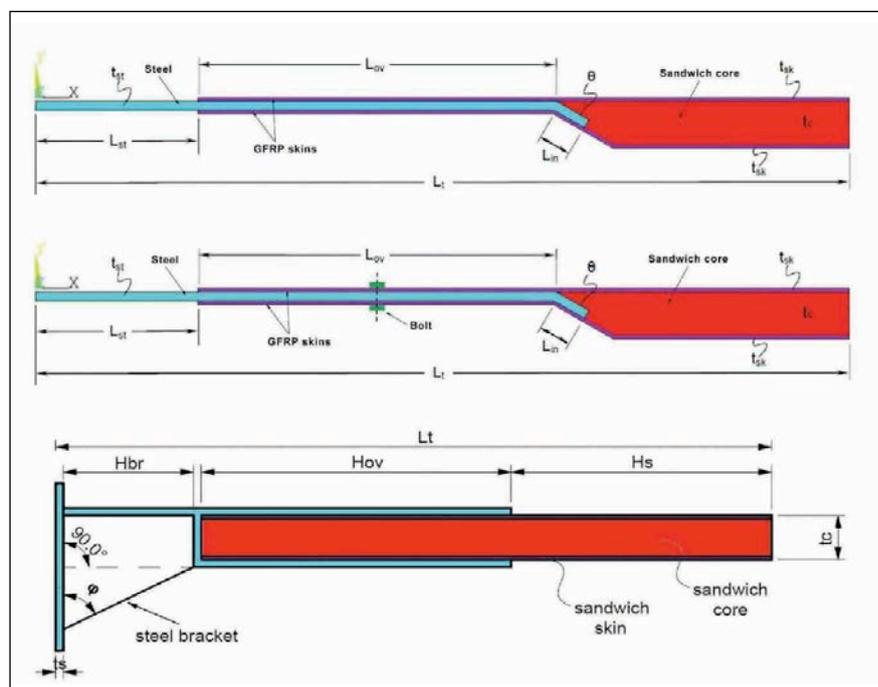


Figure 3: Composite-to-steel joints studied in MOSAIC (NTUA-STL, National Technical University of Athens, Shipbuilding Technology Laboratory)

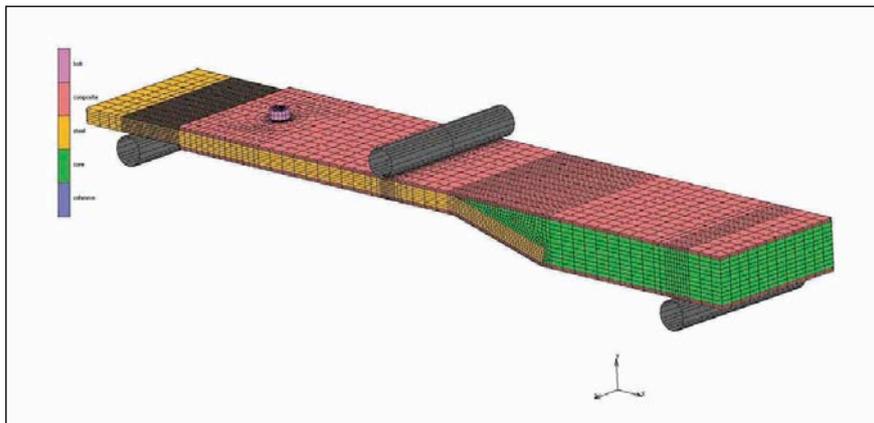


Figure 4: Numerical model of the joint subjected to the bending test (CETENA)

The first application case is particularly relevant to the cruise ship market as the actual trend is progressing towards building cruise ships with almost the entire cabin made in composite materials with an access on the longitudinal bulkheads to the balcony. These discontinuities of the stress flux acting on the longitudinal bulkheads generate stress concentrations at the corners of the openings where it is not difficult to find crack initiation phenomena. In accordance with the Rules prescriptions, this problem is usually mitigated by increasing the plate thickness up to two times the thickness value of the original plates close to the structural spot. Considering that on modern cruise ships there are several thousands of these openings, the added weight due to the extra thickness can become a significant fraction of the LSW (light ship weight).

The second and third (see figure 8) application case deal with typical situations on tanker and bulk carrier ships: the second is a zone where there is an intersection of hopper plates, girder, inner bottom plate and the floor, whereas the third is the corner of the lightening openings of the double bottom floor. These structures are usually prone to crack initiation phenomena and also in these situations the usual mitigation action leads to/provokes a local thickness increase.

The possibility of using HSLA insert plates of the same thickness of the original plates instead of thickness increasing is evaluated in the MOSAIC project. These activities were carried out by means of the finite element method (FEM). Both the refined numerical models of the structures entirely in conventional steel and of the

structure with the insert plate in HSLA were developed and analysed by means of commercial FEM codes.

One of the most challenging tasks was the transfer of global load of the ship to these refined models by means of the sub-modelling technique and following the SDA (Structural Design Assessment) (see figures 2 & 8) issued by Lloyd's Register. The numerical models were used to calculate the number of cycles necessary for the crack initiation through the S-N curves. The experimental evaluation of the S-N curves for the HSLA represents one of the most important findings of the project; in fact, the methodologies currently suggested by the Classification Societies for the estimation of the fatigue life of a structural component (nominal stress approach, hot spot stress approach and notch stress approach) require the knowledge of the S-N curve of that specific structural detail geometry and material. The S-N curves were determined for the corners of the openings on the longitudinal bulkheads following the guidelines of the IIW (International Institute of Welding).

The increase of the fatigue life due to the adoption of the HSLA steel plate was estimated comparing the results obtained from the models with the insert plate in HSLA steel with the results of the models in conventional steel.

The other significant result of these numerical analyses was the determination of how fast a crack propagates in the structure. The application of the LEFM (Linear Elastic Fracture Mechanics) theory in the FEM analyses led to the calculation of the SIF (Stress Intensity Factor), which was then



Figure 5: Debonded joint after the execution of the tensile test (NTUA-STL, National Technical University of Athens, Shipbuilding Technology Laboratory)

used to determine the crack propagation rate by means of the Paris-Erdogan formula. Also, in this case, it was possible to estimate the beneficial effect of the HSLA steel on a comparative basis.

Composites

Although composite materials have proven their adequacy as a marine structural material, as the plethora of operating vessels in composite indicates, there are no significant achievements regarding the integration of composite material parts in the structure of a large merchant ship.

The MOSAIC Project aims to fill this gap evaluating the possibility of replacing structures in steel of large vessels with structures in composite materials.

The success of this effort presupposes the research and the successful solutions of several engineering problems, the most important of them being the significant stiffness mismatch between steel and composites, which lead to stress concentrations and defining a way for effectively joining these two quite different materials to each other. This problem has



Figure 6: Joint subjected to bending test (IST, Instituto Superior Técnico, Universidade de Lisboa)

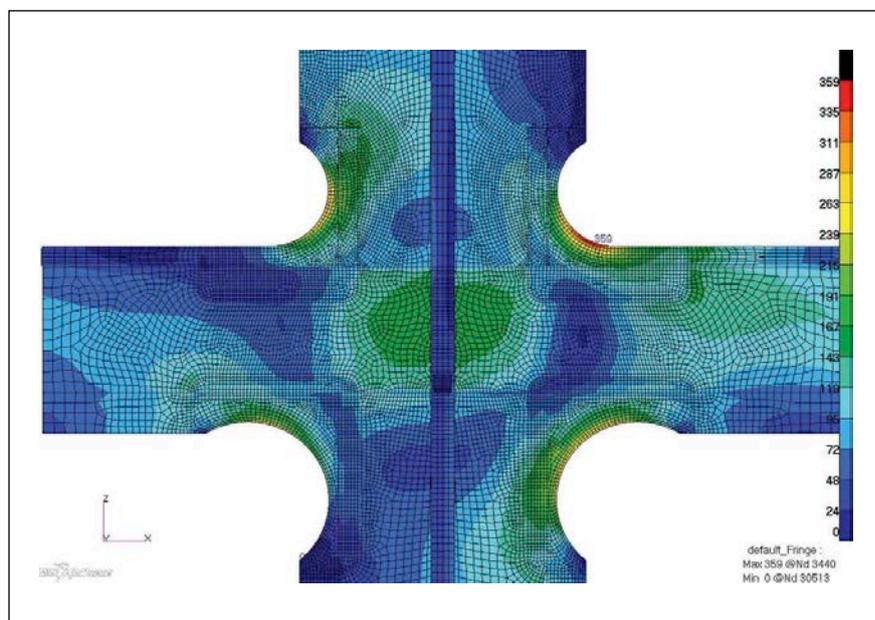
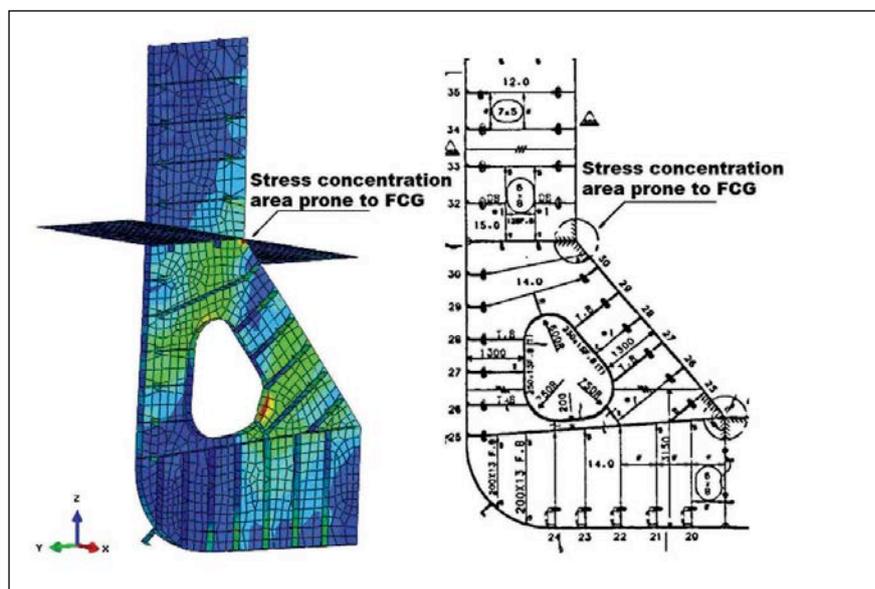


Figure 7: Numerical model of the corners of the openings on the bulkheads of the cruise ship (CETENA)



been faced in MOSAIC by studying hybrid joints (steel to composite), which allow an appropriate integration of the two materials (see figure 3).

As for the part of the project regarding the HSLA components, the approach that has been followed starts with the evaluation of the mechanical properties of composite materials, then the study of the joining with the pre-existent steel part of the ship and finally the onboard integration of the application cases identified at the start of the project.

The following eight different composite materials configurations were tested:

1. Glass/Epoxy using the hand lay-up method
2. Glass/Vinylester using the vacuum bagging method
3. Glass/Epoxy/PVC sandwich using the hand lay-up method
4. Glass/Vinylester/PVC sandwich using the vacuum bagging method
5. Glass/Vinylester/Balsa sandwich using the vacuum bagging method
6. Glass/Epoxy using the vacuum bagging method
7. Glass/Epoxy/PVC sandwich using the vacuum bagging method
8. Steel skins/PVC core sandwich, adhesively bonded.

Glass fibres were selected in order to keep the cost low while offering high strength. Besides, glass fibres are the most widely used type of reinforcement in shipbuilding while offering a wide variety of different applications. Regarding the selection of resin, epoxy and vinylester resins are predominant in the fabrication of high-performance structural composite systems in marine structures, whereas as regards the choice of sandwich core materials, PVC foam and balsa wood are the commonly used core materials, and are cost efficient with fair mechanical properties.

The mechanical characterisation of the composite materials was carried out measuring their tensile, compressive and in-plane shear properties (moduli, Poisson

Figure 8: Numerical model of the knuckled hopper (NTUA-STL, National Technical University of Athens, Shipbuilding Technology Laboratory)

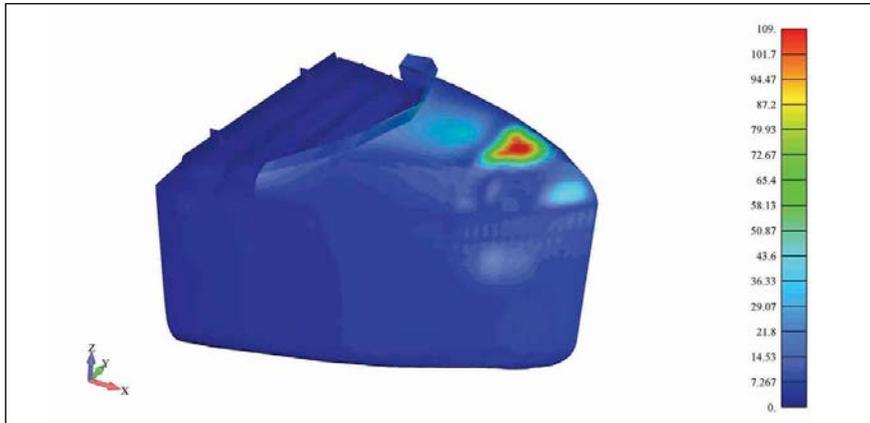


Figure 9: Numerical model of the bow enclosure (AS2CON)

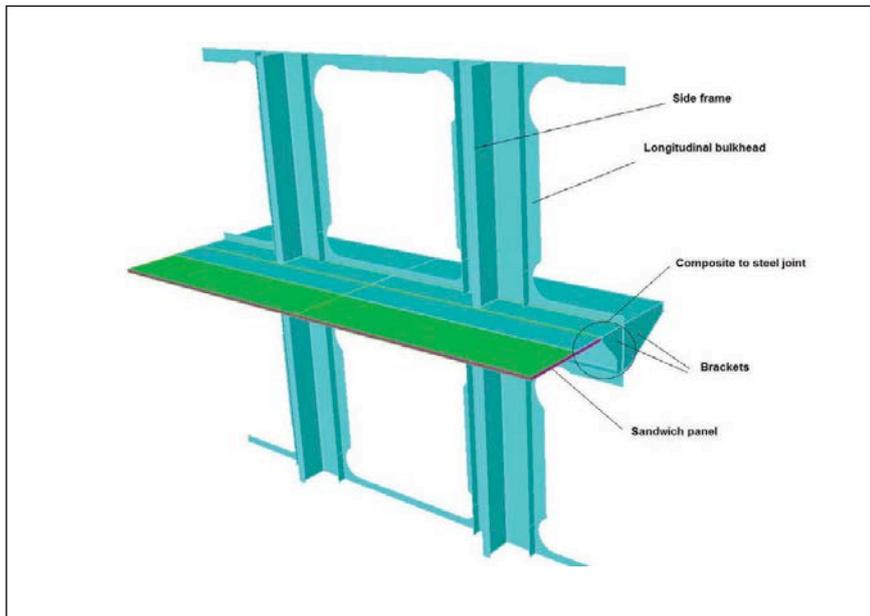


Figure 10: 3D sketch of the innovative solution for the balcony overhangs of cruise ships (CETENA)

ratios and strengths), the fibre content, the mass density and the flexural properties following the ISO/ASTM standard methods. The total number of tests was approximately equal to 200. On the basis of the results of this extensive test campaign the glass/vinylester/balsa system prepared with the vacuum bagging method was selected as the best candidate for the next activities of the project.

Aware of the crucial importance of an appropriate joining between the composite system and the steel structures, the MOSAIC Consortium applied significant efforts to investigate this topic. For this purpose, three composite-to-steel hybrid joints were designed and tested (see figures 3, 4 &

5). The design was carried out by means of FEM; a parametric study aimed at investigating the influence of the various geometric variables (e.g. composite skin thickness, core thickness, overlap length) throughout the joint performances. Predictions of the joint failures were investigated by means of cohesive elements and following the analytical approaches available in the literature. Then, the joints were tested in order to study their behaviour both in tensile and bending conditions.

The numerical analyses and the test results provided the data necessary to study the onboard integration of the composite components identified at the start of the project for:

1. Bow enclosure
2. Balcony overhangs
3. Patch reinforcement of the corners of the openings of the longitudinal bulkheads of the cruise ships.

The bow enclosure is a composite component of significant dimensions, which is used to improve the aerodynamic performances of the ship and to create a sort of sheltered superstructure in the fore part of the ship. The onboard integration of a bow enclosure in composite sandwich for a 5,000dwt Handymax tanker was designed and studied by AS2CON. The sandwich has a skin in carbon/vinylester fibres and a core in Divinycell foam. A numerical model of the whole bow enclosure (see figure 9) was developed and analysed in order to demonstrate that the bow enclosure can withstand the pressure due to the impact of the wave. The composite failure was checked by means of the Tsai-Hill criterion.

The balcony overhang is a typical structural component present on cruise ships (see figures 7). Since the trend of the shipbuilding industry is to build ships with almost 100% of the cabins with balcony, the total amount of weight of this item can easily reach several hundreds of tonnes. For this reason, the possibility to replace the balcony overhangs in steel with a structure in composite appears to be very promising and worthy of investigation. The innovative solution is made with a sandwich panel connected to the ship hull by means of one of the steel-to-composite hybrid joints previously studied in MOSAIC (see figure 10). The FEM analyses were used to design a composite structure that has mechanical performances comparable with the traditional structure entirely in steel.

The weight saving obtained from the adoption of a balcony in composites is estimated to be about 30%. Considering that on a modern large cruise ship the total length of the balcony can reach easily the length of about 3,800m, a rough estimation of the total saving of weight leads to the value of 100tonnes.

The third case considered is similar to the one considered in the HSLA part of the project: here the improvement of the fatigue performance of the corners of the openings of the longitudinal bulkheads of the cruise vessel

is obtained by means of a composite patch instead of the use of an HSLA insert plate.

Also, in this case, the design of the optimum patch was performed using the finite element model. The fatigue analyses were carried out using these three approaches:

1. DNV Fatigue Assessment Approach
2. High Cycle Fatigue Classical Method with Goodman Correction; and
3. Uniaxial stain-life fatigue analysis.

Large-scale tests

Once the laboratory tests were performed, that is, the numerical simulations and the design of the onboard integration, the final efforts of the MOSAIC project are dedicated to the design and testing of large sub-assemblies representing real marine structures where the technologies developed in the project can be applied.

The sub-assemblies representative of the following application case were manufactured:

- Corners of the openings of the longitudinal bulkheads of the cruise ship in these three variants:
 - _ Solution in conventional marine steel (taken as reference case)
 - _ Case with the HSLA insert
 - _ Case with the patch reinforcement.
- Balcony overhangs.

Owing to the limits imposed by the test facilities, the main challenge of these activities was to manufacture a sub-assembly able to represent the mechanical behaviour of the real structure and reproduce a realistic condition of load. Also, in this case, the finite element method helped to solve this issue; in fact the numerical models of the sub-assembly were developed and used to simulate the tests.

These tests are currently in progress and will be completed and presented at the end of the project. The success of these tests will be the key factor to judge the validity of the

technologies investigated in this project and to understand if they can find immediate utilisation in the industry.

Conclusions

MOSAIC will end in September 2015 with the completion of eight Work Packages, six of which are technical, one is dedicated to the dissemination and exploitation of results and one is dedicated to administration and coordination of the project.

The final outcome of the project will be the development of relevant guidelines for the design and application of these two new concepts in shipbuilding.

Scientific papers and articles with the results of the project have been issued in these three years. Furthermore, the MOSAIC Consortium is organising a special event which will be held in Lecco (Italy) in June 2015, where the main findings of the project will be presented and disseminated. **NA**

Journal of Marine Science and Technology

With support of the Japan Society for the Promotion of Science, the following three featured papers can be read free at <http://link.springer.com/journal/773>

- **Introduction of MMG standard method for ship maneuvering predictions**
by Prof. H. Yasukawa (Hiroshima Univ.) and Prof. Y. Yoshimura (Hokkaido Univ.)
- **A verification of the ITTC/ISO Speed/Power trials analysis**
by Prof. G. Strasser (Vienna Model Basin), Prof. K. Takagi (Univ. of Tokyo) et al.
- **On a novel method for approximation of FN diagram and setting ALARP borders**
by Drs. F. Kaneko, T. Arima (NMR1) et al.

For your subscription and/or manuscript submission
<http://link.springer.com/journal/773>



2013 Impact Factor 0.718

Official Journal of the Japan Society of Naval Architects and Ocean Engineers (JASNAOE), produced by Springer, provides a forum for the discussion of current issues in marine science and technology. It focuses on naval architecture, marine engineering and ocean engineering.



The Japan Society of Naval Architects and Ocean Engineers (JASNAOE)
<http://www.jasnaoe.or.jp/en/>

Building social structures

Last year, Howard Fireman, the senior vice president for Asset Performance Management at ABS, was awarded the prestigious David W. Taylor Medal for notable achievements in naval architecture and marine engineering. In this month's *Naval Architect* he talks about his achievements

The Taylor medal is the highest technical honour bestowed by the Society for Naval Architects and Marine Engineers (SNAME), and it is peer recognition for a long, distinguished career spent in the service of the marine community.

While the medal is awarded to an individual each year, Fireman, who joined ABS in 2013, was quick to share the accolades with colleagues, both past and present.

"When my work is regarded by [SNAME] as worthy of the David Taylor Medal, I sense not only the deepest appreciation for this distinction, but also a feeling of indebtedness to all those who have contributed before me, with me and beside me," he said in his October acceptance speech. "I would like to thank the many senior leaders, mentors, peers, all my staff and the teams that helped to develop these most amazing machines. This feeling of all working together toward the same direction is one of the most rewarding experiences of my career."

Fireman says he was attracted to naval architecture at a very young age. Like most kids, he had an early fascination with all things transportation, starting with model trains before his focus turned to ships. And, like most kids born in the 1950s, the national excitement surrounding the US space programme in the 1960s kindled his imagination for what was possible.

He was in his early teens when a family friend introduced him into naval architecture. "He discussed with me what he was doing, and I found it fascinating," Fireman told *The Naval Architect*. "It brings together every aspect of engineering."

After high school, Fireman went to the University of Michigan from where he graduated in 1979 with a BSE (Bachelor of Science in Engineering) in Naval Architecture & Marine Engineering. Shortly after, he joined the US Navy as an Engineer-in-Training. After a 30-month apprenticeship, Fireman was a fully fledged naval architect.



Taylor medal winner, Howard Fireman, advises those starting out in their careers to make certain they have a personal development plan

The US Navy sponsored him for graduate studies back at the University of Michigan, where he earned his Masters degree in Naval Architecture & Marine Engineering in 1985. He followed that up in 1993 with a Masters in Technical Management from Johns Hopkins University, a degree that would prepare him to lead complex technical projects and help to advance his career in both management and leadership.

Aside from working as a naval architect, Fireman has always been a dedicated student of his profession. When he learned that he had been awarded the Taylor Medal, he knew he had joined an elite circle of distinguished contributors to the development of naval architecture and marine engineering for the US Navy, and the US marine and international maritime industries.

He was also well acquainted with Rear Admiral David Watson Taylor's groundbreaking work, to which he paid tribute during his SNAME acceptance speech. If

you work in naval architecture, Fireman says, your career has been influenced by Taylor's work.

Among his many accomplishments, Taylor convinced the US Congress of the value of towing tanks and model tests in support of the US defence mission. He built the US' first experimental towing tank – known as the Experimental Model Basin – at the Washington Navy Yard; later, the US Government paid tribute to his innovation by naming the US Navy Laboratory in Carderock, Maryland, after Taylor.

Among Taylor's greatest achievements, says Fireman, was the development of the 'Taylor Standard Series' of 80 models with systematically varying proportions and prismatic coefficient published in 1910. Through that method, Taylor determined the effect of changing those characteristics, making it possible for industry to estimate the potential resistance of a ship of any given proportions.

In the wake of the *RMS Titanic* disaster of 1912, Taylor was assigned to investigate making ships more seaworthy by improving hull construction. Serving under the US Secretary of Commerce, he took a leading role in the first International Conference on Safety at Sea, which give life to SOLAS, and ultimately saved many lives.

During his 35 years in the US Navy, Fireman was recognised as an expert in the areas of ship design, hull form optimisation, total ownership costs, systems engineering, design integration, research and development and operational support. He also served as the US Navy's Chief Naval Architect and Director of Surface Ship Design and Systems Engineering.

His awards from Government, academia and industry are too numerous to count. But, he says there were three notable milestones that shaped his pre-ABS career.

In 1979, with a new BSE in hand, he was reassigned to the US Naval Academy for a stint in the Hydromechanics Laboratory.

“What a fantastic experience with research and getting to fully appreciate the benefits of sub-scale testing,” says Fireman. He co-authored two technical papers during his time there: one for SNAME’s Chesapeake section on the use of small models in ship design that was presented at the David Taylor Naval Ship Research and Development Center, and one for the American Towing Tank Conference: “Single Pass Open Water Propeller Testing”.

The second milestone came in 1985, when he joined a “really small and innovative” ship-design team for the US Navy’s SWATH T-AGOS 19 programme. The team Fireman joined designed the US Navy’s first SWATH ship. Short for ‘Small Waterplane Area Twin Hull’, typical SWATH designs are known for minimising the hull cross section area at the sea’s surface, where wave energy is located. In doing so, they help maximise vessel stability, even in high seas and at high speeds.

“It was a fantastic design experience, but the exposure to capsize testing, sea-keeping and hydrodynamic loads had a permanent impression on the importance of a full

range of sub-scale testing on the ship-design process,” Fireman claims.

His third milestone was his involvement in the design team for the DDG 1000 class of ship, guided missile destroyers with stealth capabilities.

“The DDG 1000 was the most amazing ship design that I had the opportunity to participate in. It had so many new technologies; the hull form and hydrodynamic challenges cannot be understated,” Fireman says. “The issues were far-reaching: creating a hull design to meet stealth requirements, dynamic stability, secondary loads, ship survivability, an all-electric integrated power system, combat and weapon systems. The design had many constraints, but one really worth mentioning was the most comprehensive model test/sub-scale programme ever undertaken, covering the full range of technical issues associated with speed-power, hydrodynamic loads, sea-keeping, and dynamic stability.”

Fireman’s US Navy career was heavily influenced by learning the importance of advanced analysis and model-testing, all used to validate design assumptions and performance verification.

He joined ABS in 2013, a move, he says, which has allowed him to apply the knowledge that he has accrued across a ‘wider spectrum’.

As senior vice president for Asset Performance Management (APM), he remains involved in activities related to vessel performance and safety, but his remit now also includes offshore assets and areas such as asset integrity management, energy efficiency and environmental performance.

The group also includes ABS Nautical Systems, a leader in the fleet management software solutions and services.

While Fireman is quick to point out that he has never designed a ship for a commercial customer, he says, in general, all designs face many of the same top level objectives: maximising payload, and minimising the costs to buy, build and operate.

Naval ships, which can have demands from many stakeholders, typically face a broader set of complex technical and operational requirements, an environment that raises the demand for advanced technologies and risk-management strategies, and adds cost.

“The hull form and hydrodynamic challenges (of the The DDG 1000 stealth destroyer) cannot be understated,” says Fireman



Commercial ship designs tend to be more business-driven, Fireman notes. But, these designs are beginning to become more complex with the implementation of many new regulations and standards governing areas such as emissions control and energy efficiency.

“Since joining ABS, I have already seen considerable change with the impact of new environmental regulations on ship designs. I wouldn’t call it a revolution, but it is certainly a fast-moving evolution,” he says. “There’s lots of new technology adding complexity to our clients’ business decisions, such as approval of new equipment, and then there’s the desire to improve energy efficiency to lower operational costs.”

He says it is an exciting time to be part of the marine and offshore industries, where innovation is giving rise to the new technologies that are required to keep pace with emerging regulations and market factors.

However, Fireman explains the ‘eco-system of innovation’ is not restricted to meeting regulatory needs.

“The APM team is working on the key technologies associated with the future of classification. Specifically, we are focused in the areas of structural integrity and machinery-integrity management to make classification activities less intrusive,” he says. “To that end, we’re looking at ways to take advantage of advanced sensor technologies along with machinery automation and controls.”

Under Fireman, the APM team is also committed to bringing the benefits of ‘big data’ analysis to the marine market.

“The power of data and information will provide insights into a new risk frontier, and expand the traditional class offerings,” he says. “Integrating the acquisition of this ‘new data’ will be central to our Nautical System Fleet Management solutions, providing a platform for our clients to be further aligned with the activities of their class society.”

With all that he has seen, Fireman says it’s the social element that keeps him coming to work every day. That, and

the challenge of finding the technical solutions to meet the shipowners’ growing list of operational challenges.

“I love working with people,” says Fireman. “Engineering is very social and I like building teams, solving problems, and having a daily sense of accomplishment keeps me motivated.”

If he was asked to share some professional insights with the present undergraduate class of naval architects, he’d tell them that engineers will always need to reassess their goals and keep up with technology.

Fireman notes: “The young professionals coming out of school are so much better equipped on a skills level than I was. But, I would tell them to always have a personal development plan for learning and self-improvement. Seek out good mentors and make a commitment to learning.”

“Every five-10 years, you will almost need a career reset, or realignment. We all must maintain our commitment to design, and support the ships and the people that sail on them. It is our professional and our ethical responsibility.” **NA**

The Royal Institution of Naval Architects

CONTRACT MANAGEMENT FOR SHIP CONSTRUCTION, REPAIR & DESIGN

22-24 April 2015

Dr Kenneth W FISHER, FRINA

This programme is a lessons-learned one, not some theoretical course on contract management. It bears a lot of “scar tissue” from marine contractual disasters. It is designed for; (a) project management who handle day-to-day relations with the other party, (b) persons who form contracts, and (c) senior managers who monitor contract-related resources/cash flow.

Topics to be covered:

- Contract management & mis-management
- Engineering/drawings
- Change orders
- Critical path
- Owner-furnished materials
- Contract performance documentation
- Hourly rates and overtime
- Post-delivery negotiations
- Claim avoidance
- Delay, disruption and acceleration

To register, visit the website or contact the RINA conference department:

Conference Department, RINA, 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/Contract_Management_Course_April_2015

Registration fee: RINA Members: £1120+VAT (Total £1344) Non Members: £12500+VAT (£1500) Group Fee (3 delegates or more): £1100+VAT (£1320)



PACIFIC 2015 International Maritime Conference

Sydney Exhibition Centre @ Glebe Island, Sydney Australia

6-8 October 2015

PRELIMINARY ANNOUNCEMENT AND CALL FOR ABSTRACTS



The Royal Institution of
Naval Architects



KEY DATES

- Abstract Submissions Open:
10 November 2014
- Registrations Open:
17 February 2015
- Abstract Submission Deadline
9 March 2015
- Author Acceptance Notification
6 April 2015
- Refereed Paper Submission
22 June 2015
- Full Paper Submission Deadline
13 July 2015
- Early Bird and Presenter Deadline
10 August 2015
- Conference
6-8 October 2015

Organised by the Royal Institution of Naval Architects and the Institute of Marine Engineering, Science and Technology, the Pacific 2015 International Maritime Conference will coincide with the prestigious Royal Australian Navy Sea Power Conference, Navy Week celebrations in Sydney and the **PACIFIC 2015** International Maritime Exposition which is organised by Maritime Australia Limited.

The conference program will be conducted in two streams of parallel sessions and will cover the following topics:

- Commercial Ship Technology
- Naval Ship Technology
- Submarine Technology
- Commercial Ships Operations
- Maritime Safety
- Maritime Environment Protection
- Offshore Resource Industry

Abstract submissions open from 10 November 2014 and prospective authors are invited to submit an abstract relating to the conference program topics in accordance with the instructions on abstract format and guidelines available on the conference website menu.

Abstracts are to be submitted online

www.pacific2015.com.au/international-maritime-conference



For further information contact the

PACIFIC 2015 International Maritime Conference Secretariat at:

PO Box 4095, Geelong VIC AUSTRALIA 3220

Phone: +61 (0)3 5282 0543 Fax: +61 (0)3 5282 4455

Email: imc2015@amda.com.au

Leveraging capital markets to promote shipbuilding development

China's shipbuilding industry has entered a phase in which slowing growth, serious overcapacity and high demand for technology innovation are the new norms. Song Tan, China Shipbuilding Industry Corporation Economic Research Centre reports

How Chinese shipyards can survive and grow against a backdrop of slow growth and overcapacity is a question lingering in the mind of many of the managers of shipbuilding enterprises in the country.

Xi Jinping, president of the People's Republic of China, has pointed out on a recent occasion the need to speed up the building of a strong supply and infrastructure system to bolster the country's military development. The two state-owned shipbuilding groups, China State Shipbuilding Corporation (CSSC) and China Shipbuilding Industry Corporation (CSIC) are the leaders in the field and an important national defence force. While reforms are being further implemented in the national defence sector, state-owned enterprises could be evaluated based on their market values in the future. Any moves of the two shipbuilding groups in either shipbuilding or capital markets would draw huge attention.

The announcement in November 2014, of the acquisition and restructuring plan of CSSC-controlled Guangzhou Shipyard International Company Limited has aroused much awareness in the stock market.

Consolidating resources

Guangzhou Shipyard International's shares had been suspended since April 2014 pending the announcement of the restructuring of material assets. When trading of its shares resumed on 3 November following the announcement of a detailed restructuring plan on 1 November, its share price soared in the A-share market (Shanghai Stock Exchange). GSI's shares closed at RMB37.26 (US\$5.96) per share on 8 December, translating to a market



Launching ceremony of an oil tanker in Guangzhou Shipyard International Company Limited

capitalisation of RMB38.4billion (US\$6.15 billion), up 117% from the closing price of RMB17.14 (US\$2.74) before the suspension.

Having acquired CSSC Guangzhou Longxue Shipbuilding in 2013, GSI took over CSSC Huangpu Wenchong Shipbuilding and Yangzhou Kejin Shipyard last year to further broaden its business scope and expand its production scale. Wenchong Shipbuilding is a long-standing military shipbuilder with its subsidiaries – namely Wenchong Shipyard, Wenchong Heavy Industry, Wenchong Bingsheng, Huangchuan Ocean Engineering, Nanhai Jianchuan and Longxue Zhiye – involved in the building and marketing of military and civil vessels, offshore equipment such as marine engineering support vessels and jack-up drilling rigs, as well as shiprepair and conversion.

Founded in 2004, Yangzhou Kejin is 100% controlled by an individual named Xie Chuanyong. The company is mainly engaged in the building and marketing of vessels under 50,000tonnes including product oil tankers, chemical carriers, liquefied gas tankers and offshore engineering vessels; as well as long-haul shipping of oil products and chemicals. Yangzhou Kejin owns shipbuilding assets including buildings, factories, equipment and land in Jiangdu district, Yangzhou.

GSI issued shares to fund the takeover of Yangzhou Kejin's shipbuilding assets, which has a book value of RMB1.3 billion (US\$208.04 million) and an estimated value of RMB1.66 billion (US\$265.66 million), translating to an estimated growth of 28.7%. Consideration was lowered to RMB970 million (US\$155.24 million) after negotiation between CSSC, GSI and Yangzhou Kejin had taken place.

GSI paid a total of RMB5.5 billion (US\$880.32 million) for a 100% stake in CSSC Huangpu Wenchong Shipbuilding and shipbuilding assets from Yangzhou Kejin Shipyard. GSI funded the acquisitions partly in cash and partly by issuing yuan-denominated A-shares to CSSC and Yangzhou Kejin. The Hong Kong- and Shanghai-listed company issued around 270m shares to CSSC and 68m shares to Yangzhou Kejin, at RMB14.17 (US\$2.27) per share.

GSI has also placed A-shares at RMB16.48 (US\$2.64) per share to a maximum of 10 specific subscribers to finance the takeover. The placement proceeds would not exceed 25% of the total consideration of the purchases, which is around RMB1.83 billion (US\$292.90 million). Proceeds from the placement were to pay for 15% of the consideration for Wenchong Shipbuilding, invest in the offshore engineering equipment construction facilities in Longxue as well as to provide liquidity to the listed company.

Following the acquisition, GSI's product portfolio covers both military and civil vessels. Its capacity in building both offshore equipment and specialised vessels has been enhanced. The listed shipbuilder has obtained the technology and capacity to build handysize liquefied chemical carriers through taking over Yangzhou Kejin.

This will allow GSI to enter that particular market. Wenchong Shipbuilding has also benefited from the deal that it has raised a considerable

amount of funds from the capital market. For Yangzhou Kejin, its owner sold it at a price that was lower than its book value and it will not be able to sell the shares in the three years immediately after the transaction. However, the seller is likely to realise greater value from their shares in the stock market, by holding them for three years, looking at the stock market's valuation of GSI and the current price-to-book ratio of 3.65.

From the perspective of CSSC, it has injected more assets into the subordinate listed entity, consolidated its subsidiaries leveraging capital markets, as well as gaining financial resources to fuel future acquisitions and development.

For the shareholders of GSI, in the first half of 2014 total operating income was RMB3.89 billion (US\$622.58 million) with net profit attributable to shareholders of the company amounting to RMB270 million (US\$43.21 million). In the same period of time, Huangpu Wenchong recorded a total operating income of RMB4.54 billion (US\$726.62 million) and a net profit attributable to shareholders of the company of RMB52 million (US\$8.32 million). It is believed that the valuation of GSI will increase as quality assets are being injected into the company.

GSI's acquisition of Huangpu Wenchong and Yangzhou Kejin is part of CSSC's effort to overhaul its development strategies. CSSC now controls three listed companies in the A-share market: China CSSC Holdings Ltd, CSSC Steel Structure Engineering Co and GSI.

To tackle the issue of internal competition in overlapping product areas, CSSC has started in a rather early stage to consolidate resources and update existing products. From a corporate structure perspective, CSSC is moving to group its subsidiaries according to where they are based, their product and service portfolios and business functions to build "mega-Hudong", "mega-GSI" and "mega-Jiangnan" groups of subsidiaries. For China CSSC Holdings and CSSC Steel Structure Engineering, the focus is on depositing non-performing assets and improving the performance of the listed entities.

Diversified plans

China Shipbuilding Industry Corporation has three listed companies in the A-share market: China Shipbuilding Industry Co Ltd, Fengfan Stock Ltd Co and Lepu Medical Technology Beijing Co Ltd. The group's diversifying strategy can be seen from the business scope of its subsidiaries.

In 2013, the Shanghai-listed China Shipbuilding Industry Co Ltd has started implementing a plan to publicly list all the CSIC Group core businesses. In May 2013, the listed company commenced acquisitions of the military equipment businesses of the CSIC Group, raising up to RMB8.48 billion (US\$1.36 billion) through private placement. Of the proceeds, RMB3.275 billion (US\$524.06 million) was used to take over the military equipment production technology and facilities of Dalian Shipbuilding Industry Co Ltd and Wuchang Shipbuilding Industry Group Co Ltd; up to RMB2.661 billion (US\$425.75 million) was used to support the technology improvement programmes of six military equipment projects and seven military-civil-cooperation projects; and up to RMB2.544 billion (US\$407.01 million) was provided as liquidity for the corporation.

In January 2014, the listed company completed the private placement raising RMB8.316 billion (US\$1.33 billion), CSIC Group and its members control around 60.1% of China Shipbuilding Industry Co Ltd. On 8 December 2014, the share price of China Shipbuilding Industry Co Ltd was RMB7.90 (US\$1.26) and the company's market capitalisation amounted to RMB145 billion (US\$23.20 billion).

The 300,000tonne tanker *Shinyo Saowalak* built by Dalian Shipbuilding Industry Co Ltd



Apart from owning a shipyard that can build aircraft carriers, CSIC Group also owns 28 research institutes. It is possible that some of these research institutes might be injected into the listed China Shipbuilding Industry Co Ltd in the future.

From 2001, CSIC has been ranked among the world 500 companies for four consecutive years. The group, the first shipbuilding enterprise to be included in the league, ranked number 403 in 2014 with an operating income of US\$30.5 billion.

According to public information, operating income of China Shipbuilding Industry Co Ltd amounts to about one-third of the CSIC group's operating income. China Shipbuilding Industry Co Ltd is expected to be the main platform for the group's related core businesses to go public therefore the listed company has huge potential.

Fengfan Stock, listed on the A-share market in 2004, is engaged in battery business; CSIC Group holds a 30.52% stake in the company. On 8 December 2014, Fengfan's share price was RMB15.88 (US\$2.54) per share and market capitalisation was RMB8.52 billion (US\$1.36 billion).

Although Fengfan's core business is not directly related to shipping, other CSIC subsidiaries could learn from the way it rewards its management. The company launched an employee encouragement scheme in 2014 giving 5.21 million restricted shares, amounting to about 0.98% of the company's share capital, to 149 senior and mid-level managers in a hope to boost loyalty and long-term performance. This could help retain the company's human capital and achieve sustainable development.

Capital operations

Entering the new century, shipyards in China have made big strides. The total production value of shipbuilding enterprises above a designated size, enterprises with an annual income from core business of at least RMB20 million (US\$3.2 million), surged to RMB790.3 billion (US\$126.5 billion) in 2012 from RMB50.3 billion (US\$8.05 billion) in 2000, representing a compound growth rate of 25.8%, higher than the 10.88% compound growth rate of the country's GDP in the same period of time.

China has overtaken South Korea to become the world's biggest shipbuilding country in terms of scale. However, the high growth rate is unlikely to be sustained with the shipping sector still being haunted by the aftermath of the financial crisis. The slowing down of economic growth has forced the shipbuilding sector to adjust its structure and upgrade its technology and enhance its efficiency. Support from capital markets is vital to the optimisation and adjustment of the shipbuilding industry.

“The high growth rate is unlikely to be sustained with the shipping sector still being haunted by the aftermath of the financial crisis”

In the “Decision of the Central Committee of the Communist Party of China on Some Major Issues Concerning Comprehensively Deepening the Reform” announced in the Third Plenary Session of the 18th Central Committee of the Communist Party, it was proposed unequivocally that state-owned enterprises should manage their assets and improve their competitiveness through various operations in a diversified-ownership economy.

The decision also proposes to improve the management of state-owned assets; to strengthen the regulatory regime of state-owned assets through monitoring the capital flow; to reform the authorisation and operation system of state-owned capital; to set up various state-owned capital operation companies; to support conditional restructuring of state-owned enterprises into state-owned capital investment companies; and to encourage state-owned enterprises to modernise their corporate management system. The decision pointed out that state-owned enterprises need to adapt to the international market practice, standardise their operational decision making process,

strive to preserve and grow the value of their assets, participate in fair competition, improve corporate efficiency and shoulder their corporate social responsibility.

How a stock is perceived in the stock market can be seen from its price-to-earnings ratio, price-to-book ratio, share price, market capitalisation, etc. In the future, state-owned enterprises are likely to be evaluated based on their market capitalisation. Apparently, the two key shipbuilding groups' operations in the capital market match the reform strategies proposed by the central government. It is expected that state-owned enterprises could raise their production efficiency and better preserve and grow the value of state-owned assets via their operations in the capital market.

Despite CSSC and CSIC adopting different strategies, injecting assets into the listed platforms through share issuance is an effective method to consolidate the corporate's internal resources for both groups. Shipbuilding enterprises can also raise a considerable amount of funding through the practice to see to the market changes brought by the financial crisis, optimise production and adapt to the intelligent and green products trend. Since capital raised in the stock market does not require scheduled repayment, it provides corporations with long-term funding and allows companies to implement long-term strategies and helps ease liquidity pressure.

Only sizeable enterprises have the resources for horizontal or vertical integrations. Leveraging on the capital market, key players can take over their targets without exhausting their own resources and achieve breakthrough with less investment and risk.

Employee share options or bonus schemes encourage managers to focus on the long-term development of companies as their bonuses are closely linked to the companies' shares prices which are determined by the fundamentals of the companies, i.e. their business performance and profits. Such schemes can boost the eagerness of employees effectively.

In conclusion, shipbuilding enterprises should form their strategies based on the development of the industry in order to raise their competitiveness. Shipbuilders should also utilise what the capital market has to offer to carry out mergers and acquisitions. **NA**



This selection of RINA branded items is now available to members for a limited period at a special discount.

50% all items now **half price!**

RINA
The Royal Institution
of Naval Architects

DESK CLOCK *Navigator world time clock featuring a dome lens and rotating bezel. The clock indicates the time around the world and sits on a glass base. Makes a nice desktop centre piece. Dimensions are: 60 x 60 x 90mm*

Usual price: £30

*postage UK £3 - EUR £6 - ROW £9

Sale
£15.50
+ postage*



RINA CUFFLINKS

A pair of hard enamelled cufflinks, with the colour RINA crest against a white background, complete within their own smart presentation box.

Usual price: £12

*postage UK £1.50
EUR £2.50 - ROW £3

Sale
£6.00
+ postage*



RINA LEATHER WALLET

Smart black leather wallet, with space for bank notes and credit cards with the gold RINA crest embossed on the front.

Usual price: £17

Sale
£8.50
+ postage*



To view these promotions and for the full range of items visit www.rina.org.uk

*postage UK £2.50 - EUR £3.50 - ROW £4.50

LADIES' SCARF *This scarf matches the colours of the RINA gentleman's tie. Made from 100% polyester twill it features the RINA crest. Size: 137cm x 23cm. As you can see pictured the scarf is both smart and distinctive.*

Sale
£2.50
+ postage*

Usual price: £5

*postage UK £1.50 - EUR £2.50 - ROW £3.50



Explaining the evolution of engines

An agent-based model of technological development in shipping, the SHIPTECH model, has been developed by Florian Senger and Jonathan Köhler, of the Fraunhofer Institute for Systems Innovations Research (ISI) in Karlsruhe, Germany, and they describe how the model works

Two of the major concerns of shipping are bunkering costs and recent environmental legislation introducing strict controls on sulphur and NOx emissions.

These factors among others are forcing shipowners and operators to consider alternative fuels. However, the decision process in developing and adopting new engines and propulsion systems is complex, because it involves a chain of decision makers.

Shipyards and propulsion system manufacturers must invest in R&D and then sell their designs to operators. Operators respond to demand for transport services from the logistics and tourist industry. There are already a range of low emission propulsion options and a wide range of designs for low carbon ships incorporating e.g. LNG, low sulphur diesel and wind technologies.

This complexity means that simulations of this ‘innovation system’ are required to assess the market prospects for different technologies and their potential cost and performance improvements.

The SHIPTECH model simulates these decision chains, using an agent-based (ABM) approach. It is not a market forecast model, but illustrates potential pathways of technology development over time, given the market demand, the willingness to invest in new technologies and the success of R&D efforts in imitating other manufacturers or in taking a technology lead.

ABMs look at the actors of a system and the interactions between them from the bottom up, to represent the complexity of a stochastically evolving system with structural change. Winter et al² amongst others made a proposal for a baseline evolutionary industry model. By following that approach a model of the shipping sector was developed, modelling explicitly, but in a simplified manner, the basic actors



SHIPTECH is not a market forecasting model, says Florian Senger, but is used to “simulate decision chains”

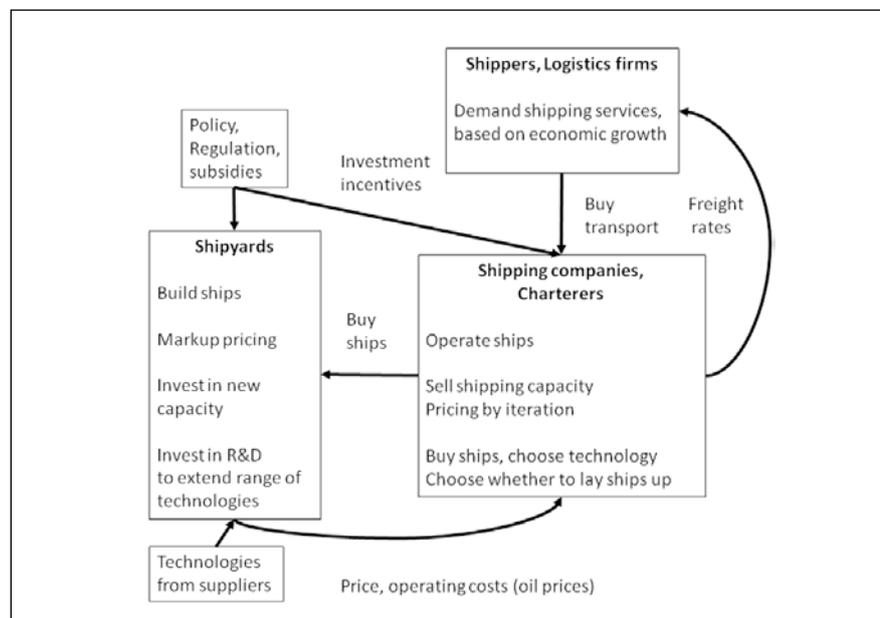


Jonathan Köhler says that the decision to move to a new propulsion system is complex, involving a series of decision makers

– engine developers, shipyards and shipping companies – as agents who act according to market constraints.

This logic was extended by the insights of the works of Köhler et al.³ and Frenken et al.⁴, with our agents performing a

Figure 1: Structure of the SHIPTECH model



research process in a “technology space”. This evolutionary research process consists of innovation and imitation steps as proposed by Hayek and the works of Nelson and Winter⁵, changing the genetic code representing our technology, similar to the work by Kerber et al.⁶

There are three types of agents in the SHIPTECH model: engine developers, shipyards and shipping companies. The engine developers are implemented according to an evolutionary logic: they produce engines according to orders they get from shipyards, with a certain propulsion technology. This is represented by analogy with biological evolution, where genes, consisting of a series of characteristics called alleles determine the system performance in the competitive environment.

In this model, these alleles represent parts of the engine such as system design, prime mover, ancillaries or the control system. The capabilities of the engine developers in these different aspects determine the overall engine system efficiency and hence fitness (i.e. competitiveness compared to the most efficient product on the market) of the engine produced.

In this version of the model fuel consumption is used as the only ‘fitness’ parameter in the shipbuilding market, assuming that production costs are a dependent variable. The operational costs

also depend on the costs of the fuel used by the particular technology, so the optimal costs of one technology compared to another can change over time, dependent on the fuel price development.

In every time step, the developers perform a process of stochastic innovation for their current technology alleles or imperfect imitation of a competitor’s technology alleles. The first stands for research, where the values of the alleles are changed stochastically corresponding to a search over the technology space. The developers next stochastically choose whether to develop their current technology or switch to a new technology and keep the new configuration, if the new engine operation costs (taking into account the current fuel prices) are lower than the current technology configuration.

The second stands for a process of copying the best performer in terms of operation costs, where the allele values are changed partly in the direction of the values of the developer with the lowest engine operation costs. The probability of switching the technology depends on the distance in technology space: e.g. the distance between diesel direct drive and LNG is smaller than between diesel direct drive and gas turbine. Again, the new values are kept, if the new engine operation costs are lower than the current ones.

The shipyards offer six classes of ships: bulker, tankers, ro-ro ferries, container

ships, cruise ships and special vessels. Depending on the offer of the developers, they equip them with one of the five technologies in the technology space: diesel direct drive, diesel electric drive, LNG, gas turbine and steam turbine.

The choice of technology is made in order to produce ships, which have optimal engine costs over its lifetime, taking into account production costs, fuel consumption and current fuel price. The costs of the whole ship over its lifetime are not solely dependent on the engine costs; to improve production and operating costs of the rest of the ship, yards have the possibility to invest in R&D.

Every yard is led according to one of two managing philosophies: being a pioneer or being a follower. Following this, yards decide whether they invest more of their budget in improving their ship designs by R&D or in increasing their capacity.

The third and most simplified type of agents are shipping companies. There is no distinction here between shipowners and charterers. These agents own and operate their fleets and change their composition to meet the demand of the world economy. They take different prices for the different parts of their fleet depending on class, technology and technological level, the latter effectively means operating costs, and changes them due to changes in demand.

A time step of the simulation, which corresponds to two years, consists of the following processes: first, for every ship class, the ships of all companies are sorted according to their prices and then ships are chosen as long as there is demand from the economy remaining. For simplicity it is assumed that these ships are then operated constantly during the entire time step.

The budget of the companies is decreased by the running costs of the ships in use (taking into account current fuel prices in that time step) and by the costs caused by the ships not in use and increased by the price the particular company demands for those in use. Afterwards, every company loses the ships

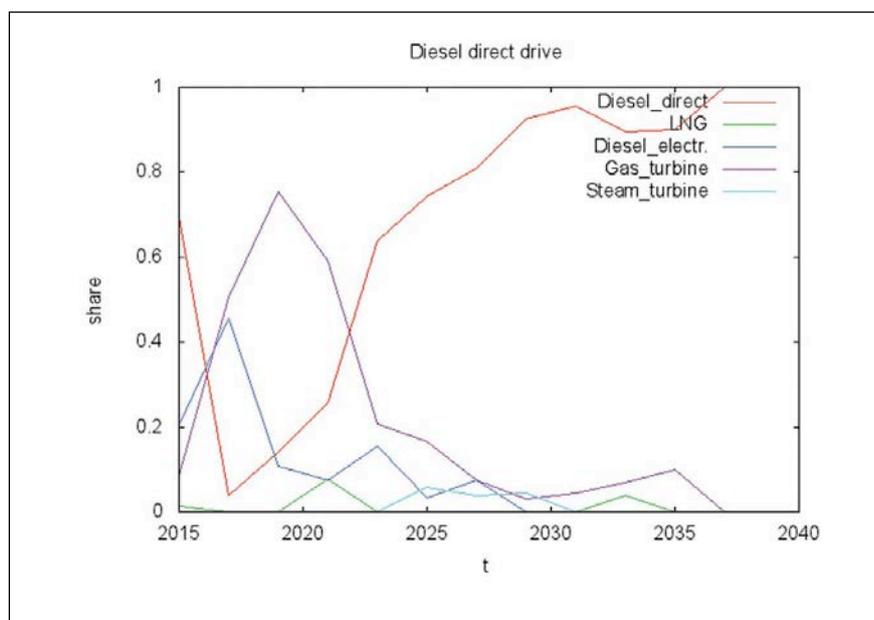


Figure 2: Technology shares 20% bunker fuel cost increase in 2017

that reached the end of their lifetime and then analyses which of the ships, that has not yet reached the end of its operational life, were not in use and decreases the prices of these ships as long as they can still operate at a profit; if this is no longer possible, it puts them out of service.

The company then analyses for every ship class, if there has been unsatisfied demand during this time step and calculates the share of this demand, it tries to meet, according to the relation of its budget to the budgets of the other companies and orders ships until either the budget, remaining after decreasing it by the ship price, falls beyond a certain threshold fixed at the beginning of the simulation or the number of ships is high enough.

Ordering a ship works as follows: to choose a ship, the company collects the offers of all shipyards whose unused capacity is still high enough to deliver the ship within the next time step and arranges them according to the ship costs over lifetime with respect to the current fuel prices.

If there is no yard with sufficient capacity, the same procedure is repeated with those yards whose unused capacity in the next time step is going to be adequate. This process is repeated twice at most, before the company decides to delay the ordering of the ship to the next time step. If the company succeeds in finding yards, it selects the one that offers the ship

with the lowest costs over its lifetime and makes an order; automatically the yard orders the engine.

During the entire ordering process the offers from the yards change. Whenever a yard operates at full capacity, it raises the prices; whenever the yard's favourite engine developer operates at full capacity, it selects the best of those with enough remaining capacity and offers ships with changed costs and correspondingly changed prices.

After the companies finish this step, the yards decrease their budget by the building costs of the ships started in that time step and the running costs corresponding to yards' capacity (energy, staff etc.). Any ship that has been finished in this time step is delivered to the company that ordered it and the price for it is transferred from the company to the yard.

Further on, the yards check if their current favourite developer offers the best engine costs over the vessel lifetime and change it, if not. Eventually, a decision about investing in an increased capacity or more R&D is made, regarding budget, kind of managing philosophy and degree of capacity utilisation (investing in more capacity is only an option, if the yard is working to full capacity, if not, the yard will automatically drop prices).

Finally, the developers proceed with their step: they decrease their budget by the building costs of the engines,

they start to build and the running costs corresponding to their capacity, deliver engines finished to the yards that ordered them (here again the price is transferred in this time step from the yard to the developer) and make a decision about investing in a capacity increase depending on their budget and capacity utilisation. Finally they perform their process of innovation and imitation as described above.

In general, every agent, whose budget has become too negative, is considered bankrupt and therefore deleted from the simulation context. Because the yards and developers do not get paid before delivering the ships/engines, they are allowed to draw a higher debt than the shipping companies.

Preliminary Results

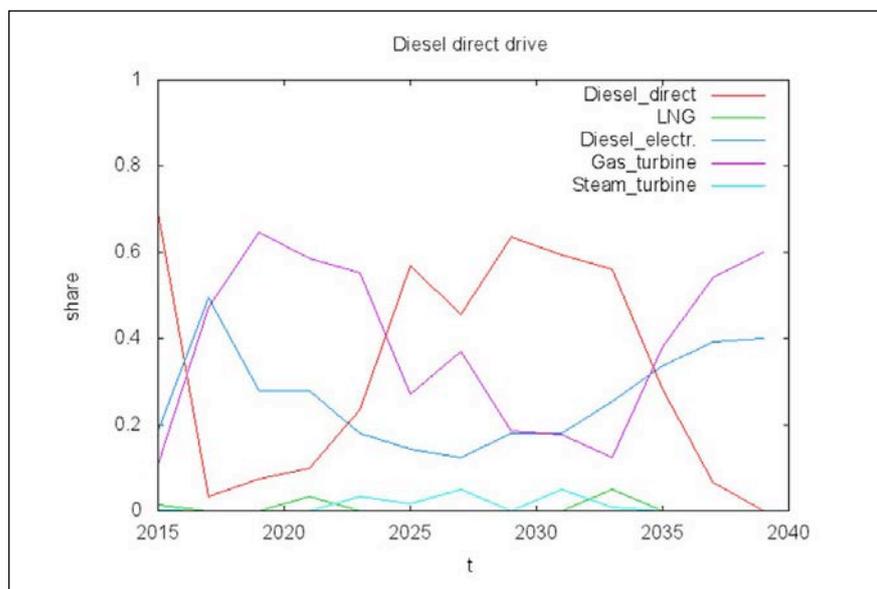
The initial scenarios that we have developed address the pressure on shipping to reduce bunker costs while meeting the demands of governments and society to make major reductions in sulphur and NOx emissions. The assumption is that regulations will make bunker fuels significantly more expensive from 2017, either through emissions pricing or the necessity of adopting alternative fuels and emissions reducing technologies.

Two scenarios were run, a 20% and 100% increase in the costs for bunker fuel powered engines from 2017. Initially, 88% of the whole fleet use diesel direct drive as propulsion technology, 5% use diesel electric, 5% gas turbines, 1% LNG and 1% steam turbines. We assumed that diesel direct drives nowadays are already very close to their optimal efficiency so that improvements in efficiency are relatively slow.

Diesel electric drives and steam are assumed to be relatively mature technologies as well, while there is a lot of potential for improvement for gas turbines (in particular through the adoption of combined cycles) and less, but still significant potential for improvement in LNG systems (including LNG fuel supply to global markets). Initial values and the energy efficiency and improvements over the time of the technologies were modelled according to these assumptions.

Figure 2 shows the resulting shares of the different technologies in newbuildings

Figure 3: Technology shares 100% bunker fuel cost increase in 2017



over time, from 2016-2030. Initially, newbuildings are dominated by diesel direct drive, but the 2017 cost shock persuades several yards and engine manufacturers to make a technology switch to either diesel-electric systems or gas turbines.

The choice of new technologies is partly stochastic, but in these scenarios, a gas turbine is seen as offering a higher potential for efficiency improvement through combined cycle arrangements and the adaption of new generation aviation engines. Diesel electric is also adopted, because the engine technology is already mature and the electric drive technology is already widely used in commercial applications.

LNG does not feature strongly in the scenarios, suggesting that the current development of LNG technology is strongly dependent on a particular combination of environmental legislation and fuel availability. However, it should be emphasised that the results are preliminary. This initial interest in alternative technologies does continue in the 20% scenario, with the costs of technology development outweighing the fuel cost disadvantage of bunker fuel. This illustrates the so-called 'lock-in' to the current technology, which has been optimised over a long period of time to maximised performance.

Alternative, less mature technologies suffer from a disadvantage because they require considerable up-front investment to become competitive. For a larger price

shock of 100% increase in 2017, but with the same stochastic technology investment decisions, the results change their nature. The disadvantage of bunker fuel is now so large that investment in alternative technologies improves their performance such that bunker fuel engines disappear from the market. As can be seen in figure 4, in both scenarios low-speed diesels recover initially, but this is not enough to overcome the price disadvantage for bunker fuel as more resources are allocated to development of the alternative technologies.

The success of an individual firm in developing complex new technologies is dependent on a highly complex and changing set of factors, such as the availability of engineers with experience of the new technology, the success in finding a shipowner willing to take the cost risk of a new demonstration technology, the success in developing the new ancillary systems, etc. The small number of developers means that a few decisions to change can lead to a major change in the technology shares in newbuildings.

Conclusions

Two main conclusions can be drawn from these preliminary results. Firstly, the pattern of technology adoption in a market with high development costs depends on the success of a small number of manufacturers. Second, the pattern of adoption of technology shares is highly

variable in a market with a small number of specialist firms.

Further work will consider the potential for the adoption of LNG fuels in more detail and will address the adoption of wind-assisted ships, which have been shown to offer considerable savings in fuel costs, but require a reassessment of design and operating practices. Furthermore, we will extend the concept of technology space to include other fitness criteria such as production and installation costs, the need to comply with emissions or environmental design standards (e.g. EEDI). *NA*

- [1] *Evolution and Self-Organization in Economics*, ed. by F. Schweitzer and G. Silverberg, Duncker & Humblot, Berlin, 1998
- [2] S. Winter, Y. Kaniovski and G. Dosi, *J. Evol. Econ.*, 2003 13: 355-383
- [3] Köhler J., Whitmarsh, L., Nykvist, B., Schilperoord, M., Bergman, N., Haxeltine A., 2009 *A transitions model for sustainable mobility, Ecological Economics*, 68, 2985-2995.
- [4] K. Frenken, P. Saviotti and M. Trommetter, *Research Policy* 28, 1999: 469-488
- [5] R. R. Nelson and S. G. Winter, *An Evolutionary Theory of Economic Change* The Belknap Press of Harvard University Press, Cambridge, MA 1982
- [6] W. Kerber and N.J. Saam, *J. Artif. Soc. Soc. Simul.* {bf 4}, 3, 2001

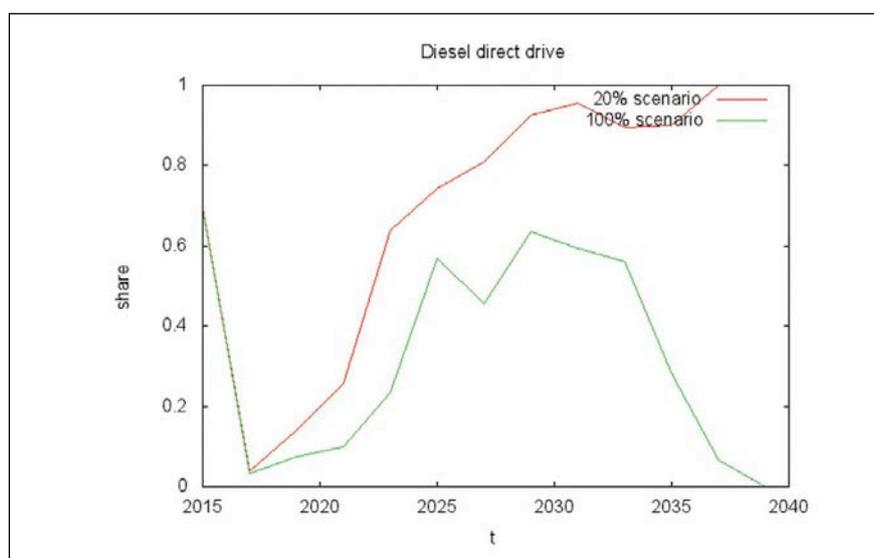


Figure 4: Low-speed diesel newbuilding technology shares in the two scenarios

Bridging the future

Rolls-Royce has over the past year introduced the concept of unmanned ships to the industry with the idea of the unified bridge, the first of which was installed in 2014 on a PSV

Rolls-Royce, working with the VTT Technical Research Centre of Finland and Alto University, has set out a vision for a future intelligent bridge, which VTT says could be a reality by 2025. It is known as the future operator Experience concept (oX), and is initially for tugs, cargo ships and platform supply vessels.

Liro Lindborg, development project manager for the oX concept says: “At the beginning of the project we carried out different background studies on different global trends and technology studies which focused especially on future interaction technologies, also literature reviews were carried out as part of research process. The technology studies also included benchmarking to other industries and we found similarities for example with the aviation industry both in military applications and also in commercial applications. For example augmented reality has been widely used on planes for quite some time already.”

User experience has been a key focus point of the solutions developed for the oX concept, which has been developed by studying the user experience of human operators on ships today.

“Studies of user work activity provided a basis for the radical design ideas included in oX”, says Hannu Karvonen, research scientist at VTT. “We also set up user experience goals, studied future trends, and let the users evaluate the draft concepts,” Karvonen continues.

“Novel and emerging interaction technologies have the potential to enhance work activities. Discussions with the professional mariners ensure that the new technologies were implemented and selected to the concept designs in a meaningful manner,” adds Michael Wahlström, research scientist, VTT.

The final concepts have been visualised using pictures and advanced 3D animation to illustrate just what could be achieved in the next decade.



This future bridge operation experience concept (oX) for remote operated cargo vessels is envisioned together with VTT Technical Research Centre of Finland in 2012-2014

The concept will utilise the latest digital technologies to create safer and more energy efficient ship operations. oX envisages a bridge environment with smart work stations, which automatically adapt to the individual's personal preferences. Furthermore, it will use augmented reality in heads-up displays on the bridge windows to support specific vessel operations, such as the transfer of cargo from a platform supply vessel to an oil rig. The system can also identify sea ice, tugs and other vessels that may not be visible to the crew, especially if they were on the bridge of a large container ship. In this way, it can visualise potential hazards that would otherwise be invisible to the human eye during night time or difficult weather conditions.

The oX uses virtual assistance to provide audio-visual warnings of hazards including the risk of ice or the approach of service vessels, such as pilot boats and tugs. Ultimately, see-through visions will enable those on the bridge to watch operations undertaken in blind-spots on vessels such as large container ships, with up to 11 tiers of containers on deck. With these solutions, the oX concept is a response to the increasing complexity of equipment now being fitted to ships.

“The need is for intelligent systems that can run themselves, with the crew becoming supervisors, concentrating on managing the exceptions when they arise”, says Lindborg. “The supervisory role provides the necessary input of human experience machines just don't have”, Lindborg adds.

Bridge system integration

Today, most onboard equipment and sub-systems function in isolation. Rolls-Royce says that is planning to take the lead in changing that. There is already ECDIS and also dynamic positioning, health monitoring and decision support systems. Operating the ship can be aided by automated reporting. What these technologies have in common is that they automate tasks previously done manually, a trend that is set to continue as availability of competent crew is on the decline. Finding new and improved ways of doing things is vital for continued safe operation and ultimately profitability.

Intelligent ship systems that will help make sense of the vast amount of information are coming from multiple sources. They will be capable of determining what information is important and require operator action and what is just routine data that can be stored

and used to build a detailed picture of the vessel's operating profile.

Unmanned ships

A notable focus of the oX concept is its applicability to unmanned vessels, which is where the industry could be headed if technical, legal and cultural challenges can be overcome, with proven safeguards for communication channels.

Unmanned cargo ships carrying a sizeable chunk of the world's trade from 2025 onwards may at first seem a far-fetched idea, says VTT. But, scientists from VTT and Rolls-Royce have been working on the concept for at least 18 months and now expect to have a small coastal prototype vessel in the water within the next three to four years.

Lindborg comments on this: "We have kept unmanned ships also in our mind when developing these concepts, but it has not been the only and ultimate goal. The goal has been to develop better user

experience for the people working at a bridge, whether the bridge operations are at the vessel itself or at a remote control centre. When it comes to unmanned ships, we believe that these concepts do steer into that direction and some of the features and solutions are enablers for those." He continues that: "we also think that before we can move to unmanned ships, more

"oX envisages a bridge environment with smart work stations, which automatically adapt to the individual's personal preferences"

novel solutions shall exist in sailing ships to enable the change in mindset. People need to trust the automation systems they operate more than they do today before we can move to unmanned vessels."

In fact, since Rolls-Royce went public with its unmanned ship concepts feedback has been resoundingly positive. Ship operators, flag states and even some class societies have been amongst those expressing an interest and, in some cases, a wish to be involved in the concept development.

"We are entering a truly exciting period in the history of shipping, where technology and in particular the smart use of big data is going to drive the next generation of ships," comments Lindborg. "Over the next 10-20 years we believe ship intelligence is going to be the driving force that will determine the future of the industry, the types of ships at sea, and the competence levels required of tomorrow's crew." *NA*

Thanks, Techcross

Techcross Makes Him Smile by Electro Clean™ System

Electro Clean™ 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.



BASIC DRY DOCK TRAINING COURSE

26th-29th May 2015, 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/Basic_Drydock_Training_Course_2015

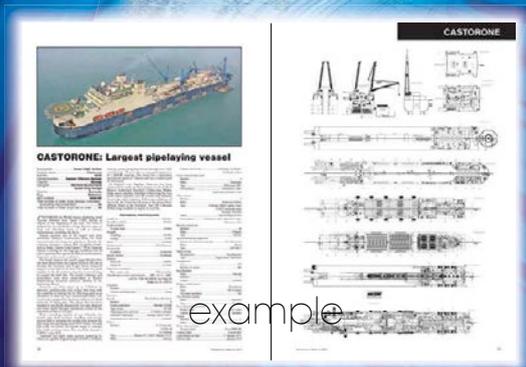
Courses are also available in San Diego, Virginia Beach, Boston, Victoria (Canada), Dubai, Melbourne and Singapore



Newbuildings included:

- Cascade
- Ceona Amazon
- Charlotte Schulte
- Emerald Sky
- Lewek Constellation
- Loch Seaforth
- Mein Schiff 3
- Mol Bravo
- Wedellsborg

plus many more...



SIGNIFICANT SHIPS

available in printed or CD ROM format

The Royal Institution of Naval Architects published the 25th edition of its annual **Significant Ships** series in February 2015. Produced in our usual technically-orientated style, **Significant Ships of 2014** presents approximately 50 of the most innovative and important commercial designs delivered during the year by shipyards worldwide. Emphasis will be 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.

Non-member £48 (RINA member £42)

or order a set:

One copy of **SIGNIFICANT SHIPS 2014** &
one copy of **SIGNIFICANT SMALL SHIPS 2014**
price £64 (RINA member £55)

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

Fast and smart data

Combining AIS data with various data sources can create new business intelligence as DNV GL's Kay Dausendschön explains. This helps to determine the cause of vessel delays, ports with shorter anchorage times or best retrofit solutions

At present, more than 400,000 ships worldwide are equipped with transponders. Their AIS (Automatic Identification System) data are received with intervals between every few seconds to up to a few hours (in remote areas of the oceans). AIS data include the identification of the ship, its position, speed, draught and main dimensions. AIS data are commercially available by various providers, who also offer AIS-data derived information of different quality. Originally introduced of navigational safety, AIS data can be a powerful source of information for business intelligence applications.

Typical issues that may be addressed through AIS data mining and post-processing software are:

- How do partners / competitors run their networks? How many direct connections and transshipment do they offer?
- Which charter vessels have higher chance of marine growth?
- Which ports / terminals have congestion issues?
- Do partners / competitors manage port operation faster? Why?
- Will the targeted berth be available on time?
- How do partners / competitors perform in terms of slow steaming and constant speed profile? How does that affect their fuel bill?
- How well are others performing regarding schedule integrity?
- What is the operational cost breakdown of other players?
- How much time do others spend in port and anchorage? How does this affect average speed?
- Which bunkering footprint do partners and competitors have?
- How efficient do others bunker?
- Where do competitors dry-dock?

All these examples basically only require AIS data, an electronic map and a set of GPS (Global Positioning System) coordinates to identify key areas (ports, quays, emission control areas, etc.). But, even more interesting insight can be gained



AIS data can be used to track ships worldwide – Business insight anywhere anytime

	daily	tactical	strategic
Fleet management	Fuel consumption monitoring	Charter fleet performance	New fleet operating profile
		Off-hire analysis	Carbon footprint profile
Port operations	Berth availability in next port of call	Turnaround time Anchorage time	Change port of call
Voyage operations	Schedule integrity speed profiles	Delay management of competitors	ECA zone routing
Overall operations	Average trade lane utilisation	Pro-forma schedules (port/anchorage/sea)	Cost curve modelling (fuel, asset, port, ...)
Purchasing	Recent bunkering activity in next ports	Choose experienced repair yard	Competitor bunkering footprint

Table I: AIS-based decision support for daily operation, tactical and strategic planning

from combining AIS data with other data, e.g. data on fuel consumption, emissions, weather and sea state, granular geospatial objects, or ship schedules. And such insight can support maritime business at operational, tactical or strategic level as outlined in Table I.

Prototype applications evolve

Business intelligence helps companies to take faster and smarter decisions. “Companies” in this sense may be different stakeholders in the maritime industry: ship operators and owners, port operators and authorities, insurance

companies, commodity traders, maritime service providers, etc. In order to generate the business intelligence, AIS data is merged with other data sources to extract new insight. With billions of data records per year and terabytes of data (“Big Data”), this demands powerful data warehousing and processing capabilities.

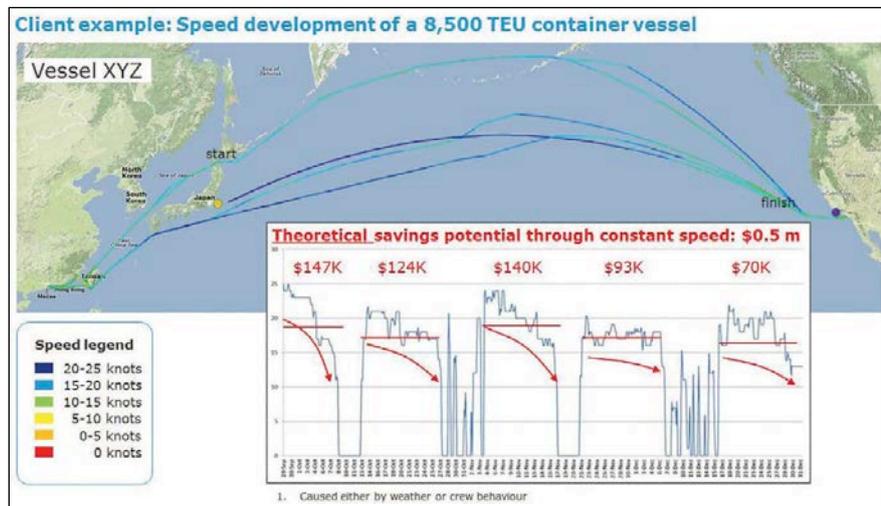
A few concrete examples may illustrate where our industries are heading: DNV GL was tasked with emission monitoring for of the Norwegian NOX fund. Initially, only the coastal traffic in Norwegian territorial waters was monitored via AIS to determine the emissions for each ship. By now, it is possible to establish emission inventories for any part of the world. Similarly, AIS data may be used to create accurate proxies on (daily) fuel consumption for a whole range of vessels. This is used e.g. in DNV GL’s “ECO Insight” tool to verify noon report data and to compare average fuel consumption against similar vessels of competitors on similar routes.

Dry-dock selection

A chemical tanker owner needs to send two of his chemical tankers to dry-dock in 6 months from now. His superintendent needs to send out tenders to suitable yards. From his experience, he knows a few that he used to send his vessels to some years ago, but his knowledge is a little rusty. Combining the chemical tanker movements with the geospatial object information of where all the yards are located can generate a quick overview which vessels went to which yards and how long they stayed there.

Delay management in container shipping

In container shipping, delays are of the rule rather than the exception. A delay can become costly as berths become unavailable, speeding up burns more fuel, cargo from skipped ports need to be repositioned, etc. Hence a good delay management system is important. An operations’ department manager would benefit from a review of where his services run out of schedule (root cause analysis) and what mitigation actions were taken (speed up, skip port, cut and run, etc.). With this information, he can discuss mitigating costs with the sales department that is interested in keeping the ship to its original port call schedule to avoid customer complaints. By combining schedule data with vessel port call/anchorage time data, we can pinpoint where operations went wrong and with speed data we can



Speed profiles reveal systematically too high speeds at voyage start



Long waiting and cargo handling times can be identified by AIS analyses

see where vessels increased their speed to catch up again. AIS data allow even a peek into competing services to see how competitors manage to keep their ships on schedule.

Port selection

An oil major has congestion problems in certain ports. The supply chain manager of the oil major believes that the vessel turnaround time is the problem as he believes that in other ports in the same region this all goes much faster. In order to reduce charter hire and avoid supply chain bottlenecks he is keen to identify how to reduce the berth turnaround time of the vessels. The AIS analysis could give average turnaround times for crude and product tankers in neighbouring ports for vessels of similar size as benchmark values.

Berth selection

A container carrier contemplates a schedule change and needs berthing availability of various terminals in ports within a region. Acquiring berthing availability can be a lengthy process mainly caused by delays in communications between container carrier and terminal operator. We could give a snapshot overview which terminals are under-utilised on which day of the week. Being able to see arrival and departure times of vessels by terminal for the recent weeks/months allow us a relatively accurate picture how busy/quiet each terminal is by period of the week. Of course, such observations are only the starting point for more detailed discussions with a terminal operator.

Voyage management

AIS data can be used to analyse own

and competitors' performance regarding voyage management. For example, AIS gives speed information with much higher data density than noon reports. Detailed AIS data can be used to derive various key indicators.

For one client, irregular speed patterns resulted in - US\$2 million higher fuel bill per year for an 8,500TEU containership. Table II gives three ship operators (made anonymous as A, B, and C), illustrating the quantitative insight harvested from our AIS analyses. In a subsequent root-cause analysis, the specific ship was tracked looking at mooring times, port times and transit times.

There are many more potential applications for AIS-based business intelligence, but these examples may suffice to realise the scope and power of this new technology. *NA*

Table II: AIS data analysis for overall operations for three ship operators A, B, and C on same trade

	A	B	C
Time share sea passage	69.5%	71.5%	70.0%
Time share manoeuvring	5.0%	5.4%	5.4%
Time share anchoring	7.4%	6.0%	6.0%
Time share mooring	18.1%	17.1%	17.8%
Average sea passage speed	16.5 kn	16.0 kn	16.1 kn
Standard deviation in speed	2.78 kn	2.45 kn	2.81 kn
Nautical miles / day	291 nm	291 nm	285 nm



SAM Electronics powers up its development

SAM Electronics has upped its game in the development of its bridge systems to meet with the future demands of the market

German bridge systems manufacturer, SAM Electronics, current in-house developments comprise of its ergonomically designed NACOS Platinum series of scalable systems with assemblies extending from small alarm-type or stand-alone ECDIS configurations to more complex assemblies found on large-tonnage tankers, containers and cruise liners.

The systems all feature standardised components and networked architecture, with which planned voyage routes can be reliably steered to an accuracy of better than half beam of a ship using precise position and speed measurement sensors.

As part of its Dynamic Positioning (DP) developments a SAM Electronics associate company, L-3 Dynamic Positioning & Control Systems in the US, has developed a companion DP system with triple-axis joystick controllers and interfaces for suitable environmental and NACOS Platinum position reference sensors. The company says that it features special cruise ship software for two main azimuth drives and three tunnel thrusters.

Integrated DP functionality is available via Multipilot workstations using a touch-screen interface. Modes to support station-keeping with reduced fuel consumption and machinery wear are among its claimed advantages. Systems have already been commissioned for NCL and Royal Caribbean Cruises' vessels.

Adding to its developments, SAM Electronics has seen further sales of its NACOS Platinum system which have been installed aboard Princess Cruises' new 141,000gt flagship *Royal Princess*. Built by Fincantieri at its Monfalcone yard, the system includes five X and S-band radars linked to 10 Multipilot 1100 multi-function workstations for combined displays of ARPA radar, ECDIS and conning operations in addition to those for automatic steering and voyage planning; the stations are in turn linked to a secondary series of seven consoles for selective presentation of navigational sensor data at various locations, including the captain's cabin. Subsidiary sensors, consisting of AIS, VDR, DGPS, doppler logs, echosounders,



A SAM Electronics NACOS Platinum integrated navigation bridge system aboard Royal Caribbean Cruises' liner *Quantum of the Seas*

gyros, rudder steering and indicator and wind/weather nav aids, also include SAM's latest Bridge Navigational Watch Alarm System (BNWAS).

Similar systems are operational aboard NCL's 145,000gt *Norwegian Getaway* and its sister vessel completed by Meyer Werft in 2013, *Norwegian Breakaway*. Other assemblies have been commissioned for Royal Caribbean Cruises' Quantum-class vessels also being built by Meyer Werft at its Papenburg yard, the third of which, *Anthem of the Seas*, is due to be launched this year.

Royal Caribbean's latest Oasis-class 227,700gt vessel under construction by STX France at its Saint-Nazaire yard, for delivery in 2016, will also be equipped with a NACOS Platinum system; with a capacity for 6,360 passengers and a crew of 2,100, the vessel will be one of the world's largest cruise liners.

Together with a Valmarine Valmatic automated monitoring facility, a NACOS system has been fitted to Viking Line's 57,000gt passenger ferry, *Viking Grace*, now serving the shallow waters of the Finnish and Swedish archipelago. Built by STX Finland at its Turku yard, it is the

world's largest LNG-fuelled ferry and the most environmentally friendly and energy-efficient one of its type. Meanwhile, a system is also operational aboard *Samsø Færgen*, the recently launched 100m double-end passenger/car ferry built by Remontowa Shipbuilding at its Gdansk yard, Poland for its Danish proprietor, Samsø Municipality. Initially LNG-fuelled, the eight-deck vessel is expected to become the world's first ferry to operate on locally supplied biogas and is currently serving domestic routes between the renewable-energy islands of Samsø and Hou on the Danish mainland.

Together with GMDSS A3 communications facilities and MCS automated monitoring and control configurations, NACOS Platinum systems are being installed on three Hamburg Sud 10,600TEU container ships being built by Daewoo Shipbuilding & Marine Engineering (DSME) for delivery this year. Similar collective equipment has also been recently fitted to two 8,000dwt multi-function cargo vessels recently completed by Flensburger Schiffbau-Gesellschaft (FSG) in Germany for RollDock, the Dutch shipping concern. **NA**

Shaping the future of the integrated bridge

Today the integrated bridge plays a major role in various shipbuilding programmes. However, in many cases the degree of integration is still limited and does not allow for a fully functional integration of different navigation systems or further ship systems on the bridge

Over the past years Raytheon Anschutz has seen increasing demand for higher level integrated bridge systems, reasonably the need for which has been driven by more sophisticated and safety-sensitive vessels such as cruise ships, specialised vessels and a few oil tankers.

The higher degree of integration simplifies operations and empowers the crew in their long-range business on the one hand and increases the availability of systems and functions, reliability and, above all, safety, on the other hand.

Such a high degree of integration becomes more relevant to the broader shipbuilding market when newbuildings are planned to incorporate new technologies for more efficient and economic ship handling.

From a shipowner's perspective, typical requirements are easy-to-operate systems that do not need too much training time, more efficient bridge operations through integration of additional applications in existing hardware, standardised and reliable installation procedures, as well as central service contacts for immediate attendance and minimum vessel downtimes.

From an operator's perspective, the following requirements typically arise:

- Easy to understand display with intuitive and standardised operation
- Central access to core navigation and administration routines
- Less workload through automation of routines and automatic performance monitoring
- Less stress through better alert management; and
- Safety through redundancies.

In modern bridge systems the key to a higher degree of integration is a network-based and task-oriented system architecture providing advanced system functions, which are in accordance with IMO's Performance Standards for Integrated Navigation Systems (INS) and ready for additional and future



Development of bridge systems moves on as modern technology and regulations evolve

enhancements commonly summed up under the E-Navigation term.

The new Performance Standards require INS to integrate the tasks of collision avoidance, route monitoring, route planning, navigation control data display, status and data display and a centralised human-machine interface for alert management on multi-functional displays.

INS also provides integration of sensor data and other information such as MSI, AIS, charts, radar, centralised alarm management, system status display and reliability indication for important equipment, just to name a few features that improve availability of function and data and help make navigation safer as well as bridge operations more efficient and simple. And finally, INS provides answers on many e-navigation requirements, particularly by the new Multi-Function Displays (MFDs), which bring the long-desired standardised workstation layout, ergonomics and symbology.

The MFD plays a key role within the new generation of integrated bridge and can be configured to offer the functions radar, chart

radar, ECDIS, conning, or any combination enabling access to, and control of, different tasks from any work place connected to the network. This not only simplifies procedures through central access, above all, this offers additional redundancies and highest availability of data and functions and increases operational safety.

To keep operations as simple as possible the MFD comes with the required harmonised human machine interface and data integration. Furthermore, for all displays a central switch-over of colours and central dimming is possible from any workplace on the bridge. Thereby, a standardised operating philosophy should not be limited to the displays, but the same buttons, surfaces and inscriptions should also apply as much as possible to all hardware units installed at the consoles such as steering control devices, thruster controls, autopilots, positioning systems and others, but also operator panels for radar, ECDIS and conning.

With an appropriate system architecture providing open data structures, data contents and interfaces to various sensors and onboard

Raytheon Anschütz's continued efforts

Further developments from Raytheon Anschütz have seen the launch of its latest generation Synapsis radar, which has seen further innovations on the Nautoscan NX radar transceivers; with networking technology and a modified pedestal.

Standard Ethernet technology replaces the analogue data transmission through expensive and complex special cables which is known from conventional radars. Radar status and radar video is generated in the transceiver, shared through a digital interface and distributed through gigabit LAN to an unlimited number of PC's without any analogue losses.

As part of the complete system redesign, critical parts such as the drive unit have been optimised to provide customers with maintenance-free operation and an extended life. Features such as automatic performance monitoring or a magnetron sleep mode for longer maintenance intervals are now integrated in the system.

Also, Raytheon Anschütz has supplied Norwegian shipowner Nor Lines with its ECDIS 24 systems. The contract includes 10 systems to be installed on five ships, with *Cometa* being the first vessel to be refitted. All five shipsets will be supplied and commissioned by Raytheon Anschütz Norwegian distributor Syberg.

systems, some manufacturers make possible even the functional integration of additional applications such as ship automation systems or dynamic positioning systems as required.

The INS can not only communicate with other onboard systems, but also to utilise and integrate shore-based data services such as online chart updating including tidal and route planning databases, NAVTEX services as above, or weather chart data for weather routing and weather observation during offshore operations. Service and spare part logistics also need continuous

communication between ship and shore and we see ship maintenance software solutions covering not only engine room stores, but also the bridge system.

Even if e-navigation still seems far away in the future, this shows that many similar features have already been introduced during the past few years. And the good news is that the first building-brick for the shipborne part of e-navigation is ready to install and use: the INS, as defined in IMO's performance standards MSC.252(83) / IEC 61924-2.

Raytheon Anschütz says that its INS became reality when the German navigation system manufacturer installed their Synapsis Intelligent Bridge Control system, the first IMO-compliant INS on a tanker newbuilding at 3. Maj Shipyard of Rijeka, Croatia.

Beyond its purely functional features, Synapsis comes with a new architecture, typically based on multifunctional workstations that share information through a redundant bridge ethernet network and serve the operator with central data access and control. Workstations connected to this network receive their data, tasks and configurations automatically while being continuously monitored for availability and data integrity. Having all information locally available, independent from the network infrastructure, increases availability of data and services and reliability in operation.

The workstations feature an innovative infrastructure software framework, which serves as the "Synapsis Integration Platform" within the bridge navigation network. All central services such as navigation control data processing, data storage and distribution, alarm monitoring and data display are concentrated and processed on the platform. Depending on the required task and display, the data is bundled, shared throughout the standardised network and presented by the end user applications. The platform also integrates tasks that have been previously performed separately by closed end user applications, such as configuration and task management, redundancy and back-up management. [NA](#)

Alphatron lends a helping hand

Dutch-based Alphatron has recently taken over Astron's Belgian distribution activities

Astron has ceased all sales and service activities of its maritime navigation and communications equipment due to the restructuring of its organisation. This also includes the official Belgian distributorship of the Japan Radio Company (JRC), which was transferred from Astron to Alphatron Marine Belgium from the start of 2015.

Bas Eerden, marketing and product development manager, Alphatron, explains

that: "When Astron management decided to cease maritime electronics activities in Belgium, it was obvious that we as good neighbours should take over. There are several Belgian shipowners and the major ports of Belgium are visited very well. With the need for a truly global support for Alphatron Marine and JRC products, no gap is acceptable in our service network. Since we already had a local office in Belgium for

some time, this was a good reason for us to expand that office."

Eerden adds that Alphatron believes that there is a greater requirement for a totally integrated solution by the owners and shipyards. "Where in the past bridge design and ergonomics were not taken so seriously, today they are, especially in Europe and for European owners." he says. [NA](#)

Is UV a contender or a pretender?

Ultraviolet ballast water treatment solutions are coming under scrutiny as the USCG regulations kick in and the technology is put to the test

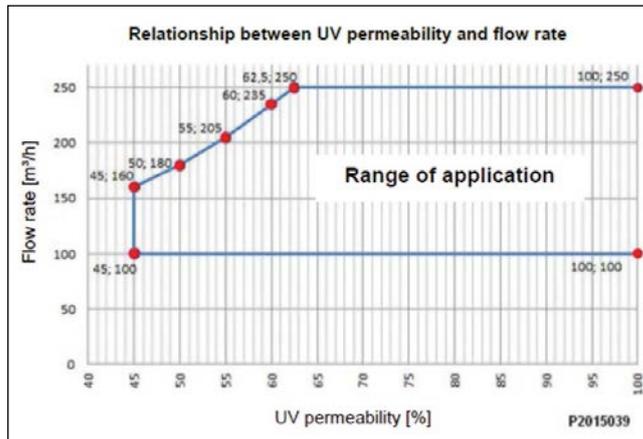
With over 50 ballast water treatment systems (BWTS) on the market, shipowners have a lot of options to look at for what to install onboard their vessels and also what will be able to meet with future regulations both from IMO and the USCG. However, the selection criteria is something that will be unique for each owner as they weigh up the variables.

Ralf Plump, PTP-Lead - Ship emissions, Environmental Research and Development, Hamburg, DNV GL says: “For instance a bulk/tanker with a comparably large amount of ballast water dosing systems with chemicals like chlorine might be perfect. Also, for builds that are quite small, have negligible power requirements and are good for large volume flow. But, you have to deal with hazardous materials onboard! And the ballast water in the tank needs reaction time and you may have an additional corrosion impact.”

Plump notes that whilst IMO and USCG regulations cover the biological efficiency of a BWTS, the class society looks at the technical practicalities and safety of the technology when it approves the systems. When using chemicals onboard the system must show that it is deemed safe and that the chemicals are handled in the correct way, hence for ease of use Plump says that ultraviolet (UV) systems are preferable and are currently leading the market in sales.

Sven Jadzinski, head of sales, GEA describes the BallastMaster UltraV system: “GEA can cover the whole throughput range starting at 150m³/h up to 2 x 3,000m³/h. But, we are focusing at this time mainly on UV technology without producing unwanted chemical by products.”

Although a UV system has no chemicals, there are other concerns about the feasibility of such systems in the future. One of which is the operation of the system across a broad range of water types and its ability to operate at an acceptable standard, especially for operations in cold clear water, which Plump highlights was the reason Wilhelmsen and Hamann withdrew their UV systems.



Relationship between UV permeability (%) and flow rate (m³/h) for GEA’s BallastMaster UltraV

For GEA’s UV treatment system’s permissible flow rate does depend on the water quality. GEA states in its BallastMaster UltraV OMM that: “The flow rate is checked with a flowmeter (10-9-049) that is installed downstream of the filters and the UV disinfection units.

“The maximum flow rate specified for the BallastMaster UltraV system is 250m³/h. However, the permissible flow rate depends on the water quality (UV transmission value). The worse the water quality is, the lower the permissible volume flow will be, in order to ensure sufficient disinfection under unfavourable conditions.

“The flowmeter (10-9-049) outputs a signal to the controller. The controller adjusts the motor-operated valve (10-7-025) accordingly, so that a maximum possible flow rate is always ensured.

“The maximum possible flow rate is calculated on the basis of the lowest measured value of the UV sensors (10-9-080, 083, 086). If the water quality falls below a certain limit, the maximum possible flow rate is adjusted according to the graphic (see figure), in order to ensure a sufficient UV dose.

“If the measured value signal from the UV sensor falls below a certain value, the flow rate is reduced automatically. The minimum flow rate through the system is 100m³/h, which corresponds to the maximum possible flow rate in the case of an UV sensor measured

value of less than 116W/m², that is, an UV permeability of 45%”

The other concern with UV treatment is the US Coast Guard (USCG) standards and what is acceptable for these as the coastguard stipulates that all living species need to be killed, which according to Plump UV technology does not do. Currently, the USCG is working on a solution that is expected to be in line with the IMO’s convention.

The USCG has announced that it is to amend its regulations on ballast water management by establishing a standard for the allowable concentration of living organisms in ballast water discharged from ships in waters of the US. It also said that it would be amending its regulations for engineering equipment by establishing an approval process for ballast water management systems.

Jeffery Lanz, director of the Coast Guard’s Office of Commercial Regulations and Standards, says: “This final rule establishes a ballast water discharge standard that is protective of the marine environment and is also consistent with the discharge standard adopted by the International Maritime Organization in 2004.”

BWTS manufacturers are still watching the development of these standards and in certain cases are telling owners to err on the side of caution when choosing a system and to look at all options before choosing. *NA*

US regulations take the lead

Whilst elements of confusion still exist between the IMO's ballast water convention and the US Coast Guard's regulations, there is an apparent shift in the market as both manufacturers and shipowners are starting to implement the more stringent US regulations

As the IMO's ballast water management convention (BWMC) still waits in the wings to be ratified, with 43 countries that have signed up to the convention – representing 32.54% of the world's tonnage, just short of the 35% needed for the introduction of the convention, the US has moved ahead with its regulations for ballast water. The US Coast Guard (USCG) regulations for ballast water came into effect in December 2013, ahead of the IMO's global rules.

One of the main concerns with the USCG regulations is that whilst systems can apply for an alternate management systems (AMS) certificate, there is yet to be any systems actually Type Approved to the USCG standards. The AMS certificate effectively covers the system to operate for five years onboard a vessel, whilst Type Approval of the system is gained.



Cathelco focuses on providing customers with clear advice, rather than system developments

Ricky Dixon, director of sales, that it has undertaken: "Ecochlor
Ecochlor explains the current process became one of the first to receive

Servowatch joins up with Cathelco

UK-based Servowatch has been working closely with Cathelco to develop a fully integrated alarm, monitoring and process control system for its combination filtration and UV BWTS, a key component of the IMO approval process and US Coast Guard (USCG) AMS acceptance.

Wayne Ross, Servowatch Systems' CEO, said: "By fully integrating Cathelco's ballast water management system with a ship's computer system, a single operator can control all of the functions from one location, saving considerable time and effort in complicated ballasting operations. But this is only one aspect of the technology; it also monitors the 'health' of all the major components and logs the data in a way that can be easily extracted for use in the Ballast Water Handbook – an essential part of the Type Approval requirements."

BWTS filters and UV chambers are constantly analysed so that cleaning cycles can be initiated with all data automatically logged in compliance with IMO requirements. This includes tank number, time/date of event, mode of operation, flow rate, temperature, power to UV lamps, UV transmission and calculated UV dose.

"Together, we have been able to develop a ballast water management system that has no restrictions on the salinities in which ships operate in US waters. It has been approved and accepted to work in marine, brackish and fresh water, allowing vessels to enter the Great Lakes and other inland waterways," said Cathelco's projects and development manager, Steve Ellis.

The system received IMO Type Approval and Alternate Management Systems (AMS) acceptance from the USCG in May and November 2014, respectively.

acceptance as the USCG AMS for its full line of ballast water treatment systems (BWTS) and we are actively pursuing USCG Type Approval.” This process can take up to 24 months from start to finish and “depends on variables such as the amount of testing needed, the proper biological conditions for testing, and the time required for the review process of both the independent laboratory and the USCG.” he added. “At the time of writing, no BWMS has received USCG Type Approval. Ecochlor has submitted our existing IMO Type Approval testing data to review for the Gap Analysis.”

There are still concerns in the market from manufacturers and owners about the USCG and the future standards that will need to be met. UK-based Coldharbour Marine welcomes the regulations, Warren Christie, commercial manager explains: “We are in talks with USCG. Our advice to owners is to look for a system that has a good chance of achieving the full USCG Type Approval. The interim AMS arrangements are no guarantee of a USCG certificate, and any vendor expressing the view that AMS is a clear stepping stone to USCG should be viewed with caution.”

There are still concerns surrounding the IMO convention, which recently announced that the G8 Guidelines were to be revised. “With revised G8 guidelines, there is concern with both the manufacturers and the owners of the possibility for new testing requirements. From experience, this process can be both costly and time-consuming and shipowners will be hesitant to install a system without additional guarantees. Is this talking about efficacy testing? Any future efficacy testing by shipowners that fails will only point to bad test procedures or human error,” explains Dixon.

Dixon adds that: “While IMO ratification will be part of the push for shipowners to install BWTS, they are first looking for some sort of standardisation and transparency of testing data in order to proceed in the decision-making process. With the implementation of the USCG Type

Techcross reacts to USCG standards

Korean-based Techcross has announced that it has submitted IMO Basic Approval applications for three new types of ballast water management systems. The development of the three systems, at a cost of US\$12 million, are being carried out by the Korean Government which initiated the project in April 2013, says the company. The company says that the systems are designed to comply with the more strict requirements of the USCG Phase II standards, which has not been finalised yet.

The three systems are the ECS-Hybrid, ECS-hyclor and the ECS-hychem system. Each system has applied multiple disinfection technology, electrolysis side-stream technology and chemical injection technology. Techcross says that it expects that Basic Approval will be granted on all three systems at the MEPC 68th meeting in May 2015. These systems will go through full-scale tests and apply for Final Approval and Type Approval based on IMO G9 and G8.

Approval, all ships in US waters will need to install a treatment system regardless of the BWTS Convention.”

Questions are rising over what it will mean for ballast water treatment systems with the USCG standards pushing the goal post higher and the IMO convention still yet to come into play and also a vast amount of treatment systems on the market.

Christie says that: “Some vendors are on version four or five of their originally developed systems, and we have seen welcome improvements in areas such as footprint and power consumption, but many basic flaws are still inherent in the technologies and designs used, and these have not



Ecochlor's system will undergo testing at the Golden Bear facility later this month

been addressed. There is little by way of thinking outside the box.”

Other manufacturers such as Cathelco are looking to support customers through clear information to help them make informed decisions, yet not having any current plans for development of its system.

Tore Andersen, CEO, Optimarin says: “We believe that there will be an updated technology in future, but may be not before 10 years from now. Optimarin will always upgrade our system gradually with small elements as the experience from operations is increasing.” He continues, “In this situation with many companies looking at a very big marked potential, you will get systems available that will not survive in the long run. We believe that during the coming 7-10 years there will be around 20 that will survive. Owners should look at makers with proven experience and especially for the retrofit.”

Both owners and BWTS manufacturers are looking at the future with a cautious eye, the USCG powered ahead of the game when it brought its regulations into play at the end of 2013, the IMO convention has yet to catch up as it still waits to be ratified, but a quiet certainty seems to be rippling through the market that this will happen sooner rather than later now that the USCG has kicked the market into action. **NA**

Potable water testing under MLC 2006

The subject of potable water, that is water used onboard for drinking, cooking, washing and bathing, has come under the spotlight in an effort to improve the lives and well-being of seafarers. Bentley Strafford-Stephenson, product marketing executive at Martek Marine highlights the latest legislative development

For too long, conditions onboard for crew have been secondary to anything else. Numerous vessel inspections have revealed poor sanitation, infected water and cases of legionella from poor drinking water quality.

Many crew members have resorted to buying bottled water at considerable expense to ensure clean, safe drinking water. The onus is now on the shipowner to ensure the supply of safe potable water onboard.

The International Labour Organisation (ILO) Convention 78 requires shipowners to “physically check quality of water at random using different outlets” and the World Health Organisation (WHO) has issued guidelines that state “source water is monitored at the port to ensure that water is safe. The ship’s master is responsible for operational monitoring: quality of source water: disinfectant residuals and pH (e.g., daily); microbial quality of treated water, particularly after maintenance or repairs.

“The frequency of monitoring should reflect the probable rate of change in water quality. For example, monitoring of drinking water on ships may be more frequent when the ship is new or recently commissioned, with frequencies decreasing in the light of review of results. Similarly, if the ship’s water system has been out of control, monitoring following restoration of the system would be more frequent until it is verified that the system is clearly under control.”

With the introduction of the Maritime Labour Convention (MLC 2006) in August 2013, the right of seafarers to have access to clean and safe potable water is strengthened. The legislation requires shipowners to perform “frequent documented inspections”. This ensures that shipowners are acting responsibly with a clear trail for port state control officers to inspect. Any vessels found to be contravening the MLC 2006 act risks detention and black listing.



Drinksafe aims to make water safer for crew

The International Chamber of Shipping (ICS) issued advice to shipowners prior to MLC coming into force to help them pre-empt port state control problems saying: “regardless of the progress which may or may not have been made by a vessel’s flag state; ships are required to meet the standards in the Convention. ICS recommends you prepare a Declaration of Maritime Labour Compliance (DMLC) Part II before 20 August for all your ships, which will serve as evidence that your ship meets MLC standards. To issue a DMLC you must, of course, have provided potable water test kits for your ships.”

Having the means to perform potable water testing onboard further evidences to PSC that a vessel is adhering to the requirements, but different flag administrations confuse what is required and the situation isn’t helped by the confusing way test kits are being offered to the market by various suppliers.

UK marine safety and environmental system manufacturer, Martek Marine, launched Drinksafe to offer shipowners a complete solution to the MLC

requirements. Drinksafe is a potable water testing kit designed for complete compliance with MLC rules as well as meeting all other legislation. Martek offers it in two variations - Drinksafe and Drinksafe Max.

Drinksafe comes with all hardware including incubator, UV lamp, goggles, disposable gloves, test log-book, manual and training DVD as well as tests for e-coli/coliforms with sterile containers, bacterial plate tests with syringes and a series of chlorine tests with comparator discs – DPD1 free chlorine, DPD3 total chlorine, pH and high range chlorine (super-chlorination). In addition, it also comes complete with colour comparator, test tubes, tablet crusher and brush.

Drinksafe Max comes with everything that Drinksafe contains plus a turbidity tester, enterococci tests with sterile containers, copper and iron tests with comparator discs. Legionella tests can also be purchased additionally. The kit includes more tests than all other kits and features no glass ampoules to break, no messy and difficult “thio-bags”, no instruments to calibrate and no need for sample dilution pots. [NA](#)

Ready to
meet IMO
MEPC 227 (64)



Priceless

ACO Marine
Advanced Wastewater Solution

Black and Grey Wastewater Management Solutions

Complete system solutions for wastewater management. Advanced Maripur membrane black and grey water treatment plants exceed all current and future legislation including MEPC 227 (64) which comes into force on or after 1st January 2016.

Fully automated Lipatomat fat, oil and grease separators handle wastewater from the galley. Push fit pipe systems in both stainless and galvanized steel complete the system.



For further information
or contact please visit:
www.acomarine.com



ACO Marine, s.r.o.
Mark Beavis - Managing Director
Nádražní 72, CZ - 15000 Praha 5,
Czech Republic
Tel.: +420 257 217 990,
Fax: +420 257 310 718,
E-mail: info@acomarine.com

expect zero

AQUATIC INVASIVE SPECIES



**Ecochlor® Ballast Water
Treatment Systems**
Unaffected by turbidity,
salinity or temperature

Best Data. Lowest Power.

Ecochlor systems are the most effective
and reliable systems on the market.

<http://www.ecochlor.com/testresults.php>

U S C G A M S A C C E P T E D



Closing the loop

Turning water into wine? Not quite, but ACO Marine can perform miracles with the wastewater

Can the loop be closed on the wastewater treatment process to allow vessel operators to recirculate treated effluent for domestic use onboard? It's not as far-fetched as you would think and, as stomach churning as it sounds, ship passengers and crew could soon be drinking and showering in water straight from the sewage treatment plant.

ACO Marine, the marine subsidiary of German water specialist ACO Group, has developed a system capable of turning the treated effluent from the wastewater separator into potable water and while the end result is of a standard fit for human consumption, its optimum use would be for general surface cleaning, laundry, showering, toilet flushing, engine cooling – in fact, any technical fresh water requirement.

Mark Beavis, ACO Marine's managing director, has sampled the wastewater filtered through the WM3 Water Maker and lives to tell the tale. "The water is sterilised more than 10 times by a combination of several technologies, including non-chemical sterilisation by ozone. A special function of the WM3 unit is that it removes even dead bacteria. I've had a glass of it and its

tastes just like the water you'd get from any bottled water supplier," he confesses.

According to Beavis, the sterilisation process is so effective that all types of produced water can be stored in vessel holding tanks for at least 120 days without any further treatment. "The WM3 closes the water treatment loop," he says.

Currently, high-energy consuming flash evaporators or reverse osmosis plants are typically used to generate freshwater onboard, especially on cruise ships and naval vessels where tanks are of insufficient capacity to slake the thirst of passengers and crew. The WM3, however, which has extremely low energy consumption, can reduce a ship's need to take on fresh water in port or make its own.

"The WM3 is not an alternative to those methods, but it is a very cost-effective solution for those operators conscious of their environmental footprint. It reduces the power per litre of water produced compared with conventional methods and can cut wastewater dumping significantly and fulfils any mandatory requirements for freshwater generation redundancy," Beavis claims.

No bigger than a small domestic refrigerator, with water-making capacities ranging from 6,000 to 24,000 litres per day, the ACO Marine WM3 purifier is suitable for use onboard all vessel types and can be easily retrofitted to ACO Marine's Maripur and Clarimar wastewater treatment solutions or in fact any wastewater treatment plant currently on the market.

"We have already had a lot of interest in the system, from the German Navy to Greenpeace," says Beavis. "It is environmentally friendly and very cost effective. The smallest unit can even run solely on solar power."

At the heart of the system is the company's hybrid technology of asymmetric selective membrane separation process or THASMS. This treats any type of input water and effectively removes all forms of biological, bacteriological, mineral, gas or toxic contamination, converting the treated effluent into pure, clear spring water.

"The entire process is chemical-free, based on physical, naturally occurring means controlled by an integral computer and our in-house software. The resultant water contains no bacteria (living or dead), undesirable metals and toxins nor any biological, gaseous or other forms of pollutant although vital minerals and vitamins can be added."

Many administrations stipulate that drinking water is pH adjusted with the addition of calcium to reduce corrosion in pipes and other components of the water supply system.

The main focus of the WM3 is on producing demineralised "pure" technical water with no mineral content that could cause scaling. Drinking water is a secondary benefit.

ACO Marine's parent group has been successful in supplying a TÜV-approved variant of the WM3 for land-based application and has now "marinised" the technology for use across all segments of the global merchant and offshore marine industry. [NA](#)



The WM3 is no larger than a domestic refrigerator, but can purify up to 24,000 litres of water a day

Class rules, barriers or industry innovators?

Right from its foundation in 1860 the Institution of Naval Architects was not afraid of tackling the difficult questions and exploring areas where knowledge is still being added today. In a series of stories looking back to the RINA's early years Richard White reports on the evolution of naval architecture

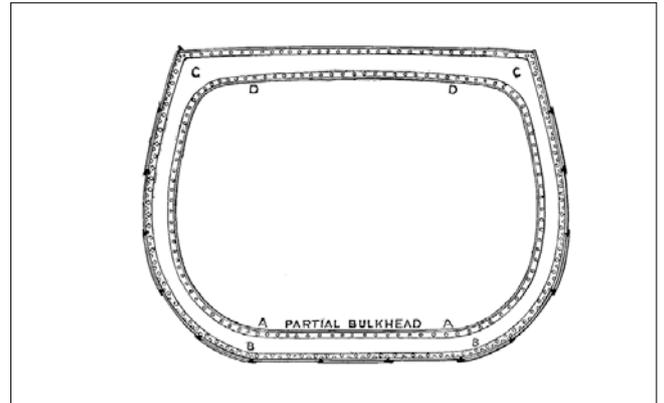
The first paper to be presented at the newly formed Institution of Naval Architects (INA) was on the mathematical theory of naval architecture. It reviewed early attempts to calculate the height of the vertical centre of gravity of a ship and stressed the importance of dynamic as well as static stability.

The 1860s were an era of transition, so quantifying the stability and general behaviour of sailing ships heeled over and making leeway was still of great interest, as were the resistance and powering requirements of steamships which were then invading more and more strongholds of sail.

Height of VCG was also the theme of the second paper, which described inclining experiments performed on several Royal Navy ships in the late 1850s. Being the Royal Navy there were plenty of men and plenty of broadside guns to act as movable masses. Various trials were carried out by shifting ballast, then moving groups of men from one side of the deck to the other, and then having the men move numbers of guns.

The inclinations achieved were compared with calculations of the metacentre, and also with data from the same experiments on other vessels. The conclusion was that the ability of a vessel to

Partial bulkhead, used in combination with full bulkheads and lengthwise stringers in Scott Russell's longitudinal system of construction



stand up to its canvas could be predicted, as could the effect of using up provisions, water and coal.

Strength of ships is today a major concern, given the continuing incidence of container ships breaking their backs. This was the subject of one of the first papers presented at the INA by William Fairbairn.

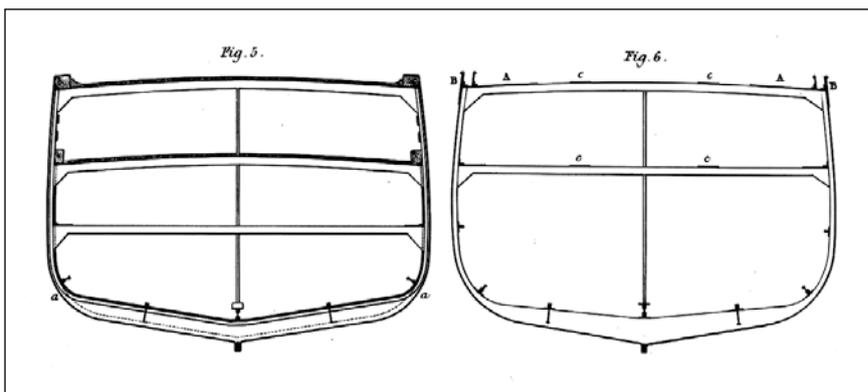
The material of greatest interest in 1860 was wrought iron. Steel was then just beginning to be used for ship structures, of interest for its strength but mistrusted because of variable quality, tendency to brittleness and liability to rapid corrosion.

Wrought iron was rapidly displacing wood in shipbuilding, and the question of the day was what strength values should be used in calculating ship structures. It

too was a highly variable material, slightly resembling wood in that its properties were different along the axis of rolling, at right angles and through the thickness, depending on the degree of working to expel slag threads, the origin of the iron ore and the smelting methods.

Even if a figure was settled on, the paper highlighted the divergence of opinion as to how best the iron should be distributed in the ship to achieve the required global and local strength while also minimising cost and weight. Decisions on longitudinal bending strength of the ship were made more important by the rapid increase in length of steamers, while at the same time L/B ratios were extending to eight or nine, "to obtain speed by giving sharp lines to the bow and stern and to ensure an increase in capacity for the same midship section by which the carrying powers of the ship are greatly augmented," Fairbairn wrote.

Fairbairn advocated treating the ship as a simple girder in bending in the hogging or sagging condition. In particular he was



Improvement in girder strength from wooden deck to partial iron overlaid with wood. But, *Great Eastern* had already shown a huge advance in large iron vessels with its double hull and cellular deck

worried by vessels of the type having far less cross section of iron at deck level than at the keel, and argued for approximately equal distribution, except perhaps in the case of vessels such as colliers which must take the ground and therefore needed more local strength in the bottom.

He commended *Great Eastern* as an example of good design, saying: “It is probably the strongest vessel in proportion to her size ever built. The designer, the late Brunel, was too sagacious an engineer to lose sight of the cellular system developed first in *Britannia’s* bridge to neglect its application to the deck as well as the hull of the monster ship.”

Given the variability of iron as a shipbuilding material Fairbairn recommended paying slightly more for good plates, and was of the opinion that “no plate ought to be used that will not stand a tensile strength of 20tons per square inch, and that the better qualities of plate varied from 22-25T/in², but that well-wrought plates equal to 20T would give the vessel, if well-constructed, an adequate durability and strength.”

This paper led to a lively discussion, in the fashion of the time not lacking in the number of words needed to make a point, or in the number of Latin quotations. John Scott Russell, himself an iron shipbuilder and a leading light in the early INA, rose to say he had opposed Lloyd’s Rules systematically over a good many years, but was now happy to say that as a result of their extended study of the progress of iron shipbuilding they had very much changed their rules of late, but they were not doing it fast enough.

He said he was not one of those who objects to the fixed rules, and considered they ought to exist so that people should know what they were about. He went on

to make a point that is still valid today – that is the difference between prescriptive and goal-based rules. To quote him referring to Lloyd’s Register: “they have made a rule that if you like I will call ‘the rule of exceptions. They say: ‘if you will build a ship in your own way and satisfy us that the ship you have built is stronger than the ship built according to our rules we will give you as good a classification as if you had conformed to these rules. I say that if they will continue to act on that system neither Fairbairn nor Napier nor Grantham nor myself will ever say a word more against Lloyd’s rules, but if they will not so act, then as far as our influence will reach we will say you have no business to put restrictions on us shipbuilders.”

Discussion of Fairbairn’s paper then moved on to a topic which is still under active discussion – longitudinal versus transverse framing, complete bulkheads or ring frames. Scott Russell took the opportunity of promoting one of his favourite themes; longitudinal framing for iron ships.

Naturally Lloyd’s wished to defend its position and perhaps explain its stance, and passages were read from Lloyd’s own book. “Considering that iron shipbuilding is yet in its infancy, and that there are no well-understood general rules for building iron ships, the committee have not deemed it desirable to frame a scheme compelling adoption of a particular mode or form of construction, but that certain general requirements should be put forward having for their basis thickness of plates and substance showing a minimum in each particular.”

It became clear that most practical shipbuilders treated Lloyd’s rules as the law. If an owner of a ship contracted that

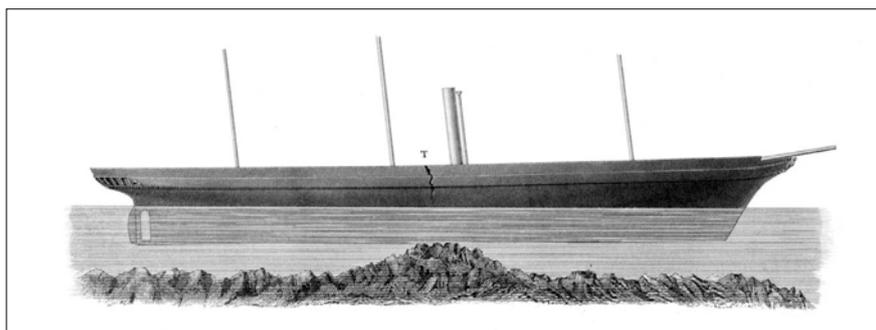
it should be classed for example 12 years at Lloyd’s, the competitive tender process would come into action, the specification would be handed round to three or four respectable builders and these men would rigidly adhere to the contract. Because they think the gross weight is quite enough, they keep to the minimum. They do not add iron they think is desirable, because they are not allowed to take it out where they think it is in excess.

Their judgements are absolutely bound, and this was thought to be the case with nine tenths of the builders scattered about the country. (At that time many of the scantling rules were linked primarily to gross tonnage). J R Napier felt it was good that Lloyd’s were willing to make some concessions as their rules were a great hindrance to the development of naval architecture.

The relation of length to breadth to depth played so important a part in calculating the strength of beams, but was entirely ignored by Lloyd’s, assuming tonnage as the only data necessary for determining the strength of a ship. He went on, however, to berate Fairbairn’s suggestions for strength calculations involving taking a few of the top and bottom plates and leaving the sides out of the calculation.

Napier considered that the forms of midship sections were so various that even the relative strengths could not be depended on. “The ordinary formula of the moment of inertia of the midship section around its neutral axis gives the relative strengths of vessels with little trouble and much greater certainty.”

Although at this meeting several had been critical of Lloyd’s Register and its rules, INA was quick to give a hearing to other viewpoints, publishing information about work LR had done on the strength of plates and of various types of riveting, modes of failure, and the design of butt straps. Plates typically 12in wide 2ft long and of various thicknesses were subjected to tensile stress in a chain proving machine. Plate variability was



Fairbairn highlighted the need for sufficient strength at deck level, not just in the bottom

large, due to slag rolled into the plate and consolidation defects.

Criticism of quality control was sharp: "During these experiments the woefulness of coarse grained and badly integrated iron was made manifest by 3/4in butt straps of this sort of iron

being torn to pieces when tested against plates of only 3/8 in in thickness, thereby showing the necessity of every means being taken to ensure the use of good iron only in shipbuilding.

"With this view we would suggest that whenever such bad iron has found to

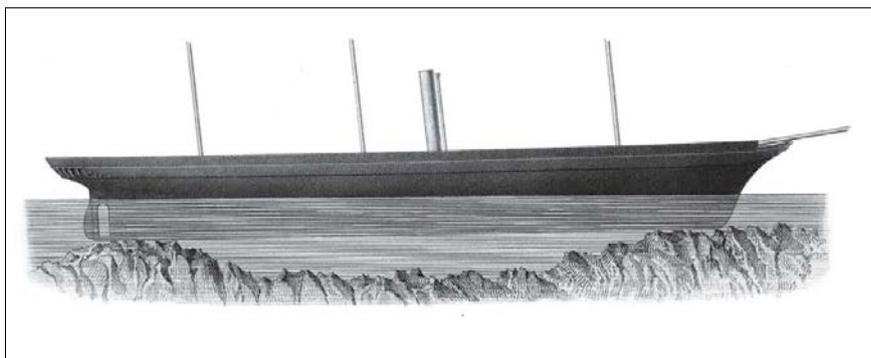
have been used in any ship, the same should be notified to the builders of the ship, and that they and the maker of the iron may be warned of the discredit and mischievous results likely to fall on them for the use of such materials."

It might be thought ungallant to repeat in 2015 criticism of classification societies from 1860, but it does show the everlasting tension between naval architects or practical shipbuilders and regulators. Substitute aluminium for iron, and most of the same arguments were used again at a more recent period of rapid change – the introduction of very large fast ferries.

For the innovative designer, class rules are often seen as a brake on progress and innovation, for others they are a levelling of playing fields, a guardian of good practice, and perhaps something of a comfort blanket. **NA**

Next month's story will report on the Lucy Ashton Trials.

Fairbairn also advocated treating long iron ships as box girders to use wrought iron efficiently, as had already been done in bridges



Newbuildings included:

- Ampere
- EDDY1
- Spirit of the sound
- NH 1816
- Thaiyak
- Karina
- AS14

plus many more...

example

SIGNIFICANT SMALL SHIPS

available in printed or cd-rom format

The Royal Institution of Naval Architects published **Significant Small Ships of 2014** in February 2015, following the success of the previous editions and the lead set by Significant Ships, now in its 17th year of publication. A total of approximately 28 new vessels are selected, each being singularly significant or the first in a series which will include: Fast Ferries, Passenger Vessels, Tugs and Workboats, Fishing and Offshore Patrol Vessels, etc. This mixed, but fascinating, selection of small craft, all between 15m and 100m in length, will be hand-picked by the same editorial team that produces Ship & Boat International, RINA's own leading small craft publication, and will be backed by its world-renowned resources.

Non-member £31.50 (RINA member £26)

or order a set:

One copy of **SIGNIFICANT SHIPS 2014** &
one copy of **SIGNIFICANT SMALL SHIPS 2014**
price £64 (RINA member £55)

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

The Royal Institution of Naval Architects

International Conference: Design & Construction of Super & Mega Yachts

13-14 May 2015, Genoa, Italy



Register Now

After years of downturn the Super and Mega Yacht industry is starting to revive, and the demand for new builds is increasing quarter on quarter. However, the coming into force of far reaching regulations such as the Maritime Labour Convention 2006 (MLC 2006), and the mandatory regulations on Energy Efficiency for Ships that include EEDI and SEEMP, adds an unknown quantity to the recovery. Designers, builders and owners have had to adapt to these new rules and in some cases lobby for yacht focussed 'equivalencies' from their flag states that will help maintain build orders.



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/superyacht2015

The Royal Institution of Naval Architects

International Conference: Ice Class Vessels

28th April 2015, London, UK



Registration Open

Many kinds of Vessel operate near the poles, all of which are exposed to a number of unique demands. Ice exerts structural loads on the hull and propeller when keeping station, sea spray and atmospheric conditions can create an accumulation of icing on important deck equipment, and the safety and wellbeing of the crew when exposed to below freezing temperatures, not only in normal operation but also in emergency conditions, all have an impact on how a vessel is designed to operate.



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/Ice_Class_Vessels

Still looking for that green bullet

Dear Sir,

The article “Is a radical shift in shipping on the horizon?” (February 2015) begs a serious question for our profession. Why have we as naval architects, and shippers in the wider context, not taken advantage of all the seemingly ‘low hanging fruit’ for carbon reduction that is identified in this article? With such obvious answers to the issue of shipping and climate change, have we all been negligent or asleep in not adopting the suggested technologies and practices?

Let’s take Flettner rotors first. Dr Flettner showed almost a century ago that better fuel efficiency is gained by putting the power through the propeller rather than using it to spin the rotors. Most undergraduate naval architects from my student days would have told you that. The efficiency could be greatly improved if you can generate enough power from waste heat to spin the rotors, but even then there is a significant efficiency factor for this and any sail device relating to wind direction.

Sails only work with favourable wind speeds and direction. There may be certain ship types and routes that can benefit from this technology, but most ships travel on variable routes depending on trading conditions. Of course, a ship’s routing can be optimised to make the best use of the wind – we did this a century and a half ago for sailing vessels. A quick glance at the ‘windjammer’ routes would demonstrate that optimising for wind on long distance routes is likely to require huge extra distances, eliminating the gains in fuel efficiency.

Nobody would suggest, for example, that we should abandon the Suez Canal and use the Cape because the sails would work better on that route. Similarly, kite assistance proposals have been around for more than 40 years and have found some specific applications. They have not caught on generally because of difficulties in their application and the wind factor previously mentioned.

Secondly let’s consider the reduction of time in ballast. In the 1950s the ‘OBO’ was developed to try to reduce ballast voyages with a hybrid ship designed to take wet and

dry cargoes. There were some operational difficulties: they were very difficult for crews to change from one mode to the other and there were safety (explosion) risks. The main reason they went out of favour, however, was the absence of suitable backhaul or cross-trading cargoes.

There may be certain routes where backhaul cargoes are possible, but this cannot be generalised. The inequitable distribution of the world’s resources and demands for those resources presents a barrier. For example, what backhaul cargo would a Capesize bulk carrier carry from China to Brazil for the return leg of an iron ore run?

The suggestion of load factor for container ships is similarly troublesome – re-distribution of empty boxes will remain a requirement for as long as trade flows predominantly in a single direction and unless we invent a disposable container. Some gain has been made with collapsible containers but this remains a persistent problem – but certainly not one that has not so far been noticed. Significant thought has already gone into this problem, without yet any significant solution emerging.

The potential for the reversal of globalisation is interesting from a shipping view point, but how will it affect shipping outside the liner trades in finished and semi-finished goods? There is nothing we can do about the unequal global distribution of oil, gas, ores, coal, grain, orange juice and all the other commodities that drive the global bulk trades, large and small.

Professor Stopford (January 2015) has talked much in recent years about parallels between the automotive and shipping sectors, asking the question why the impressive improvements in fuel efficiency achieved in motor cars hasn’t been mirrored in ships? The problem is that for a weight carrying vehicle, reduction of the weight of the vehicle itself is minimally helpful and there is, therefore, a limit to what can be done. For non-weight carriers, such as cruise ships, very impressive gains have been made by Meyer Werft, for example, through clever engineering of all systems, much as would be done for an automobile.

Slow steaming is good for carbon reduction and there are many areas where further optimisations can be made, but these have to be done in an economic way that is accessible to shippers and, as with everything, this is not easy. Most of the ground suggested in this article is very well trodden. Radical shifts in propulsion type, for example fuel cells, may yet have potential if we can get the technology to work on an economically viable basis, and produce hydrogen in a non-polluting process.

There are no ‘magic bullets’, if we ignore the potential for nuclear-powered merchant ships that is, that we have yet identified and as professionals we need to continue to progress the development and optimisation of what is possible, taking into account the nature of global trade and the shipping industry – something of an ‘elephant in the room’ for many engineering academic studies.

In maritime economics we teach that shipping is a ‘derived demand’ – that is to say that the demand for the ship is only incidental to the demand for moving cargo or providing another shipping service and that this defines the parameters of the ship needed. In ship design we might coin the phrase ‘derived design’ to discuss the same concept. Considering ship design without considering the trade the ship will serve is unrealistic and generalised results in ideal conditions are less relevant than they first appear.

Finally, the much-mentioned 90% of world trade carried by shipping is disputed, but it appears in almost every publication on this subject, including this article. Work carried out by LMIU using AIS data, published in 2009, estimated that it is more like 75% in terms of tonnes and 59% in terms of value. As researchers, we should be getting key statistics like this correct. *NA*

Yours sincerely

*Paul Stott
Senior Lecturer
School of Marine Science
and Technology
University of Newcastle upon Tyne*

SHIPBUILDING ICCAS Bremen • 2015

29th Sept - 1st Oct 2015 | BREMEN | GERMANY



Call for Papers

The 17th International Conference on Computer Applications in Shipbuilding (ICCAS) will review operational experience from existing computer applications in the design and build of ships and offshore structures and will cover a full range of topics including; engineering analysis, data modelling, PLM, CAD, CAM, integrated systems, knowledge management, systems engineering, simulation, visualisation, processes and standards.

It will also examine the advances in Information Technology which have contributed to increased productivity in both shipbuilding and maritime operations; including increasing co-operative working between shipyards, marine equipment and system manufacturers, engineering partners and shipping companies.

Sponsored by:



www.rina.org.uk/ICCAS-2015

The Royal Institution of Naval Architects

International Conference: ICSOT Korea

15-16 September 2015, Busan, Korea



Call for Papers

Safety of Offshore and Subsea Structures in
Extreme and Accidental Conditions

In deep-water operations, offshore installations may face extreme or accidental events in association with general, or site-specific, conditions. Such hazards include: leaks of gas and/ or oil, collisions, human error, structural failure, and blowouts. These emergency events sometimes result in catastrophic consequences that can lead to casualties, property damage and pollution. It is the responsibility of the designer, builder and operator to develop, and integrate, safety measures developed to mitigate the consequences from such hazards.

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

[conference website](http://www.rina.org.uk/ICSOT-2015)

March 25-26, 2015

Damaged Ship III, international conference, London, UK.
www.rina.org.uk/Damaged_Ship_III

April 21- 23, 2015

Sea Asia, international conference, Marina Bay Sands, Singapore.
www.sea-asia.com

April 28-29, 2015

Ice Class Vessels, international conference, London, UK.
www.rina.org.uk/Ice_Class_Vessels

May 4-7, 2015

OTC, international conference, Houston, USA.
www.otcnet.org/2015

May 13-14, 2015

Design & Construction of Super & Mega Yachts, international conference, Genoa, Italy.
www.rina.org.uk/SuperYachts2015

May 13-15, 2015

MAST, international conference, Yokohama, Japan.
www.mastconfex.com

May 19-21, 2015

IMDEX Asia, international conference, Singapore.
www.imdexasia.com

May 21-23, 2015

Bari-Ship, international conference, Imabari, Japan.
www.bariship.com

May 26-29, 2015

Basic Dry Dock Training, international conference, London, UK.
www.rina.org.uk/Basic_Drydock_Training_Course_2015

June 2-5, 2015

Nor-Shipping, international conference, Oslo, Norway.
www.norshipping.com

June 3-5, 2015

UDT, international conference, Rotterdam, The Netherlands.
www.udt-global.com/Exhibitor/UDT-2015

June 9-11, 2015

Seawork, international conference, Southampton, UK.
www.seawork.com

June 22-23, 2015

Decommissioning of Offshore & Subsea Structures, international conference, Glasgow, UK.
www.asranet.co.uk/Courses

July 1-5, 2015

IMDS, international conference, St Petersburg, Russia.
www.navalshow.ru

September 2-4, 2015

Structural Safety under Fire & Blast, international conference, Glasgow, UK.
www.asranet.co.uk/Courses

September 3-5, 2015

Baltexpo, international conference, Gdansk, Poland.
www.baltexpo.ztw.pl/en

September 8-11, 2015

Offshore Europe, international conference, Aberdeen, UK.
www.offshore-europe.co.uk

September 9-11, 2015

Seatrade Europe, international conference, Hamburg, Germany.
www.seatrade-europe.com

September 15-16, 2015

ICSOT Korea 2015, international conference, Busan, Korea.
www.rina.org.uk/ICSOT_Korea_2015

September 15-18, 2015

DSEI, international conference, London, UK.
www.dsei.co.uk

September 17-18, 2015

IMPA, international conference, London, UK.
www.impa.net

September 22-25, 2015

NEVA, international conference, St Petersburg, Russia.
www.transtec-neva.com

September 23-25, 2015

INMEX India, international conference,

Mumbai, India.
www.inmexindia.com

September 28-30, 2015

Middle East Workboats, international conference, Abu Dhabi, UAE.
www.middleeastworkboats.com

September 30- October 1, 2015

ICCAS 2015, international conference, Bremen, Germany.
www.rina.org.uk/ICCAS-2015

October 5-7, 2015

Floating Structures & Subsea Systems for Deepwater Operations, international conference, Glasgow, UK.
www.asranet.co.uk/Courses

October 6-8, 2015

Pacific 2015, international conference, Sydney, Australia.
www.rina.org.uk/international_maritime_exposition_2015

October 9-11, 2015

Light Weight Design of Marine Structures, international conference, Glasgow, UK.
www.asranet.co.uk/Courses

October 20-23, 2015

Kormarine, international conference, Busan, South Korea.
www.kormarine.com

October 27-30, 2015

Gastech, international conference, Singapore.
www.gastechsingapore.com

October 28-29, 2015

High Performance Sailing Yachts, international conference, Southampton, UK.
www.rina.org.uk/highperformancesailingyachts

November 3-6, 2015

Europort, international conference, Rotterdam, The Netherlands.
www.europort.nl

November 17-19, 2015

METS, international conference, Amsterdam, The Netherlands.
www.metstrade.com



Help a market leader build a great Australian business.

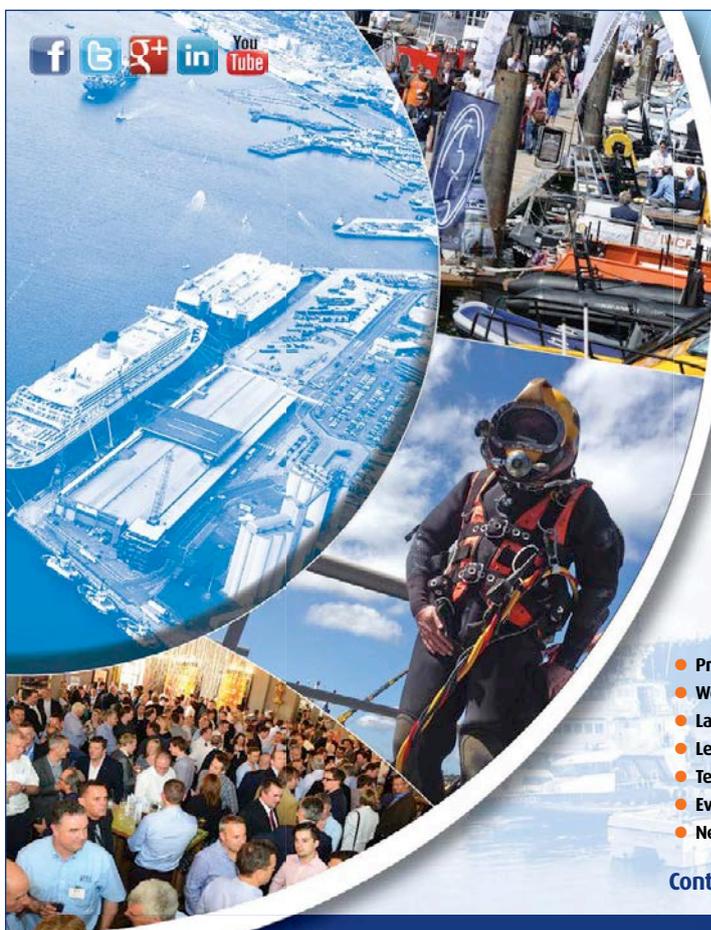
At Frazer-Nash, we employ dynamic and original thinkers who challenge all boundaries to find the perfect solution for our clients. This way of thinking has enabled us to grow into a rapidly expanding systems and engineering technology consultancy, with offices throughout Australia and the UK. We specialise in delivering creative engineering solutions to clients across the defence, energy and resources, transport and industrial sectors. Over the last 12 months our Australian business has seen exceptional growth, and we are now recruiting for a range of roles to support its ongoing development, with permanent positions available in our offices in Adelaide, Canberra and Melbourne.

- Combat Systems Engineers**
- Maritime Capability Development Consultants**
- Structural Integrity Engineers**
- Systems Engineers - Maritime Systems**
- Systems Engineer - Submarines**
- Systems Safety Consultants**

We offer permanent roles, competitive salaries and a comprehensive benefits package, including commitment to your training and professional development.

For full details of all of these roles, please visit us at www.fncaustralia.com.au or contact us at cv@fncaustralia.com.au

Due to the nature of the work that Frazer-Nash undertakes we will require successful candidates to gain Australian security clearance.



**sea
WORK
2015
INTERNATIONAL**

16-18 June 2015
ABP Port of Southampton, UK

COMMERCIAL MARINE & WORKBOAT EXHIBITION & CONFERENCE

Seawork International is the biggest and fastest growing event for the commercial marine and workboat sectors in Europe, attracting 550 international exhibitors and 7,350 high-calibre visitors from 70 countries

- Provides a one-stop shop for buyers and maritime sector specialists
- Workboats, fishing vessels, patrol boats, pilot boats, tugs to offshore vessels
- Latest in propulsion technology, new marine equipment, design and materials
- Learn from industry leading experts in topical seminars
- Test real products with over 550 international exhibitors in attendance
- Events and demonstration schedule from true innovators in your industry
- Network with maritime professionals in numerous restaurants and bars

Contact the team on +44 1329 825335 or info@seawork.com

seawork.com

A Mercator Media event [mercatormedia](http://mercatormedia.com)
magazines events online

blueprint
recruitment

Naval Architects



Principal Naval Architect / Structural Engineer
London and South Coast £45K – £65K or Contract £Neg
 Join a team of Engineers working on design & analysis to the highest industry standards. The position would suit candidates looking to take the next step in their career.

Senior Naval Architect
South West £40K – £55K or Contract £Neg
 Candidates will have experience with structural design of naval ships and submarines. Candidates will have experience of design to class and design to MoD requirements.

Junior – Intermediate Naval Architects
South Coast £24K – £34K
 We are looking for dynamic individuals keen to progress their career within Naval Architecture. Applicants will be familiar with hydrodynamics, stability analysis, mooring analysis or marine structures.

Senior - Principal Naval Architects (Hydrodynamics)
London / Greater London £55K - £80K or Contract £Neg
 The role requires an engineer with leadership qualities and technically proficient with hydrodynamics. Candidates must be capable of leading a small team of Naval Architects and to oversee technical performance.

www.blueprintrecruitment.com/vacancies

02392 603030 ashley.clarke@blueprintrecruit.com

faststream
recruitment group



Senior Naval Architect - London - To £70,000
 Specialist Marine Consultancy require a Senior Naval Architect to lead and manage a small team focused on design and computational analysis for LNG projects. You will have at least 8 years' experience with modern ship design, FEA, CAD and computational analysis.
 REF. 904814

Lead Naval Architect - Scotland - £Competitive
 One of the UK's leading design consultancies seeks an experienced Naval Architect to work alongside the current department head in providing technical expertise and mentoring for vessel designs of Naval and Offshore projects. The position comes with strong prospects of promotion to the head of department in a relatively short time. You will be degree qualified and ideally have chartered status. REF. 903945

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

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

Client	page	Client	page	Client	page
ACO Marine	49	Gastech Exhibition & Conference	4	Seawork 2015 International	58
Autoship Systems Corporation	17	Jets Vacuum AS	3	Tanabe Pneumatic Machinery Co. Ltd	41
Blueprint Recruitment	59	JFE Engineering Corporation	FC	Techcross	37
Damen Shipyards	13	Jotun Coatings	IBC	The Japan Society of Naval Architects & Ocean Engineers	23
DNV GL	IFC	Neva 2015	6	Veth Propulsion BV	17
Ecochlor	49	Nor-Shipping 2015	11	Wartsila	BC
Faststream Recruitment Ltd	59	Samgong	9		
Frazer-Nash Consultancy	58	Scanjet Marine AB	17		



Please note all prices include postage & packaging

LAMENTABLE INTELLIGENCE FROM THE ADMIRALTY

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)

2015

Members Part Ref: IJME15 Set Ref: ST15

Part A1	Part A2	Part A3	Part A4	Set
£16	£16	£16	£16	£45

Non-Members Part Ref: IJME15 Set Ref: ST15

Part A1	Part A2	Part A3	Part A4	Set
£23	£23	£23	£23	£79



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)

2015

Members Part Ref: IJSCT15 Set Ref: SS15

Part B1	Part B2	Set
£16	£16	£28

Non-Members Part Ref: IJSCT15 Set Ref: SS15

Part B1	Part B2	Set
£23	£23	£43



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

- 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.

quarterly publication
OFFSHORE
MARINE TECHNOLOGY
bi-monthly publication
WARSHIP
TECHNOLOGY

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.

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.

2015 SUBSCRIPTION

12 months	Print only†	Digital Only*	Print + Digital
UK	£177	£177	£227
Rest of Europe	£185	£177	£235
Rest of World	£198	£177	£248

†Includes p+p

*Inclusive of VAT

2015 SUBSCRIPTION

12 months	Print only†	Digital Only*	Print + Digital
UK	£130	£130	£160
Rest of Europe	£138	£130	£168
Rest of World	£157	£130	£187

†Includes p+p

*Inclusive of VAT

2015 SUBSCRIPTION

12 months	Print only†	Digital Only*	Print + Digital
UK	£60	£60	£80
Rest of Europe	£66	£60	£86
Rest of World	£74	£60	£94

†Includes p+p

*Inclusive of VAT

The Royal Institution of Naval Architects



International Conference:
High Performance Sailing Yachts
28-29 October 2015, Southampton, UK



Call for Papers

Innovations in hull design, materials, and sail design have contributed to the raising of the bar in speed and performance. The RINA High Performance Sailing Yacht conference will provide a forum for the presentation and discussion of the latest scientific and technologic research and its application in the complex field of high performance yachts and competitive sailing.



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/highperformancesailinyachts

The Royal Institution of Naval Architects



International Conference:
Education & Professional Development of
Engineers in the Maritime Industry
9-10 December 2015, London, UK



Call for Papers

In recent years higher education has seen a growth in the collaborations between institutions to deliver educational and training programmes. Significant developments are being made in the way educational and training programmes are delivered. These developments in the establishment of networks between institutions, and the innovations in programmes delivery, can be found across the educational and training sectors, including those organisations dedicated to the professional development of engineers in the maritime industries.



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/EPD2015



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



THE SMART WAY TO ENSURE ENVIRONMENTAL COMPLIANCE AND STOP MARINE INVASIONS



WÄRTSILÄ AQUARIUS® BALLAST WATER MANAGEMENT SYSTEMS

- ▶ Unique offering of different technologies for all ship types, sizes and conditions
- ▶ Type approved system complies with IMO Convention
- ▶ Partnership program covering all stages from fleet evaluation to lifecycle support
- ▶ Turnkey solutions

For environmental peace of mind Wärtsilä supply the widest range of marine technologies on earth, this includes a range of ballast water management solutions to help meet specific requirements of individual owners and their vessels. Our technologies use a simple two stage process involving filtration and a choice of either electro-chlorination (EC) or UV treatment. With our partnership program, we work in close co-operation with you on all stages of the project, and our turnkey solutions provide everything you need from the same place – from selection and configuration to engineering and supervision. Read more at www.wartsila.com

ENERGY
ENVIRONMENT
ECONOMY


WÄRTSILÄ