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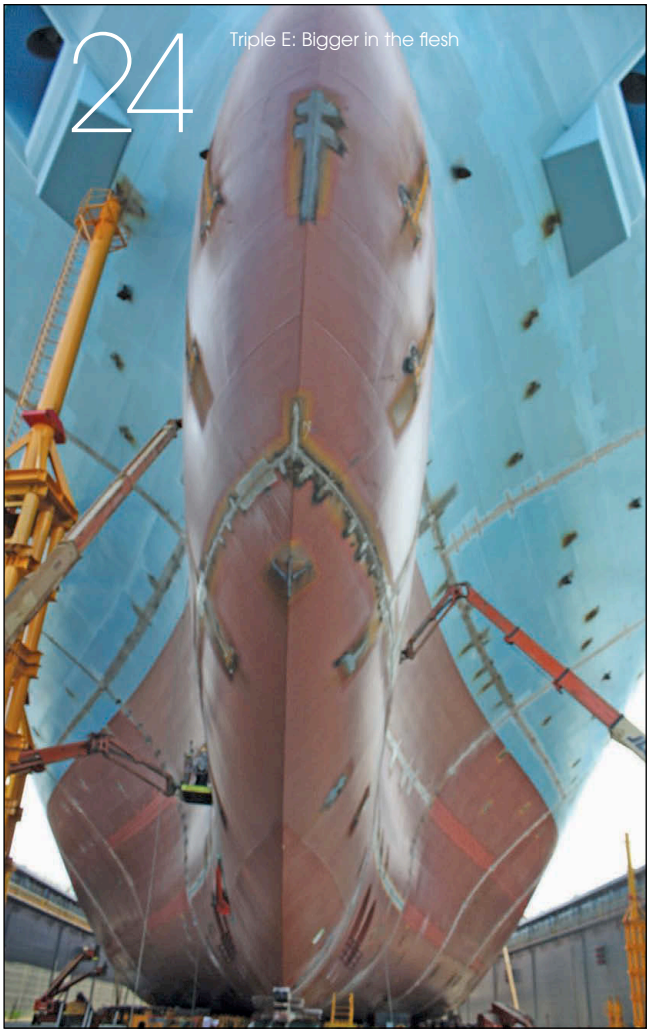

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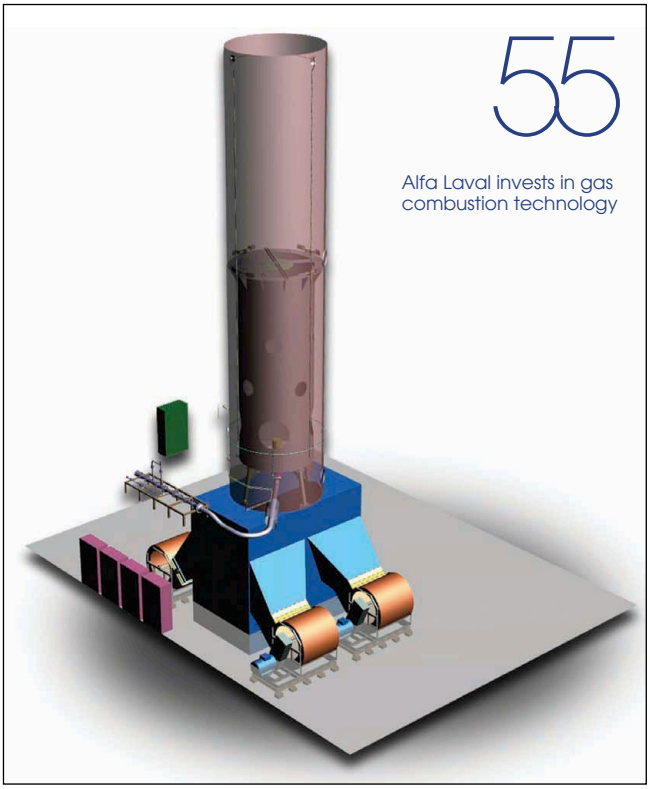

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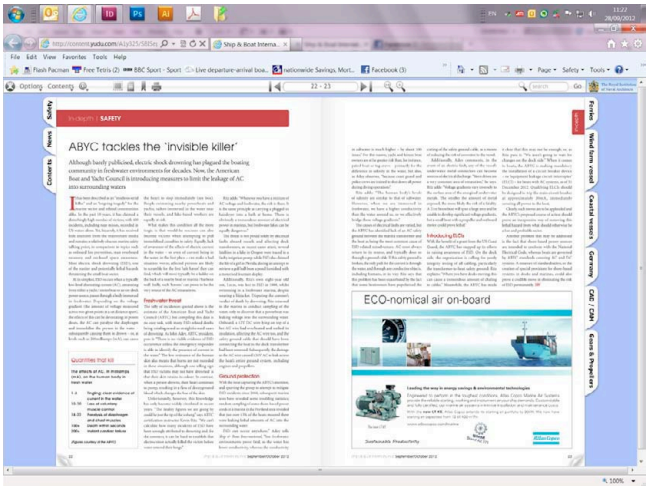

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Second Announcement

Continuing growth in passenger numbers mean that vessels are now operating in locations that are more environmentally sensitive and even more remote. This places new challenges not only on the design requirements of new and existing vessels, but also the operational capability and safety procedures. Recent events - such as the loss of the *Costa Concordia* and a number of machine space fires that have left vessels stranded - highlight the need to review and understand the impact of proposed legislation and the importance of continual regulatory development.

The need to balance economic and environmental efficiency with increased passengers expectations of comfort and onboard amenities, along with improved passenger and crew safety, brings new challenges for those involved in the design, construction and operation of today's passenger vessel. To further investigate this aspect of the industry, RINA invites papers from naval architects, class societies, operators, researchers, and builders on all related topics, including:

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Trading places

Majestic Maersk the second of the 18,000TEU Triple E vessels at the Daewoo Shipbuilding and Marine Engineering shipyard; Will a change in trading patterns negate the the savings in fuel and emissions?

According to popular belief among maritime aficionados the maritime industry is the most efficient and greenest method of moving cargo around the world.

The bigger a ship is the less pollution per tonne of cargo transported is emitted. Slow to join the green party, until that is owners realised they could save money by slowing ships down, the IMO has in recent years driven the shipping industry to take part in an environmental revolution.

The IMO has agreed a series of regulations that have the potential to change the economics of shipping substantially.

It is, then, no accident that Maersk is about to take delivery of the largest container ship ever built (again) as the delivery of its first 18,000TEU vessel is expected within the month.

Maersk Mc-Kinney Møller will be up to 50% more efficient than most of the modern container ships built to date. It has an optimised hull and waste heat recovery system with twin skegs and an optimised bulbous bow. The vessel will operate on significantly reduced fuel consumption and its per box fuel consumption, at least for the westbound leg of the Asia/Europe trade, will be significantly reduced if the ships are full.

Devils, as they say, are often to be found in the details. And the detail for Maersk here is that little matter of the global economy, which is not performing at its optimum levels currently.

As a result Maersk will "profile" the Triple E ships, at least to begin with, as 15,500TEU ships, meaning that the company will only market that many slots. That is an admission that the global economy cannot currently support the next level in size of container ship.

Obviously that means that big ships are going cheap at the yards at the moment, encouraging owners to invest. China Shipping Container Line has obliged, reportedly picking up a series of five vessels that will out-muscle the Triple E, the 18,500TEU ships were picked up for a snip, reportedly US$50 million per ship less than Maersk paid for their mega-carriers.

Details of the China Shipping vessels have yet to be released, but figures on the trades that they will be plying make for pitiful reading. A total of 843,000TEU in westbound capacity compared to 729,000TEU in cargo for the first quarter, traditionally a quieter period, however, there are reportedly a further 31 ships of 10,000TEU or larger yet to be delivered this year.

Although it appears that the short-term effect on the economics of the Asia to Europe trade seems clear it is unclear what the net effect on the environment of all these new ships will be, even if they are far greener.

In the past shipping lines deployed eight high speed container ships in services between Asia and Europe, today with vessels sailing at up to 10knots slower a weekly service loop needs 10 ships to maintain the weekly schedule.

On balance owners have calculated that more of their new vessels sailing at significantly slower speeds will use far less fuel, saving owners money and the environment in the process.

Just how much CO_2 will be saved is not clear. However, the IMO has agreed to update its method of calculating emissions from the shipping industry. A statement released after the close of the meeting of MEPC 65 said: "The MEPC approved the terms of reference and agreed to initiate a study for an updated greenhouse gas (GHG) emissions' estimate for international shipping".

According to the IMO the latest study will update "key figures" from the second IMO study which dates back to 2009 and which estimated that international shipping released around 870 million tonnes of CO_2 into the atmosphere, equivalent to around 2.7% of total emissions created by humans and about the same as Germany.

Aside from new container ships there has been a decline in the ordering of tankers and bulk carriers, while a new group of vessels, LNG tankers, is also beginning to flourish. There will be some offset for LNG power, but the general trend is for an increase in the total number of vessels in the commercial fleet.

The suspicion is that while individual ships have become more efficient the current trading patterns which see manufactured goods transported from low wage countries to established economies may be about to change again.

In part this may be driven by the very regulations that the IMO has established to reduce emissions from international shipping. Namely, regulations such as the Energy Efficiency Design Index, the NOx reduction regulations, which MEPC has agreed to delay by five years to 2021, the SOx regulations and any market-based measures to control carbon emissions, which could increase the cost of shipping transportation.

In addition if trading patterns do change will owners be stuck with vessels that are too large for the trades that they were initially designed to operate in and will they have to be operated only part loaded,

Classification

Class war

One International Association of Classification Societies member has admitted that there is a "fierce" price war is currently being fought between class societies battling it out for market share.

According to a senior source class societies are battling it out for market share by offering discounts on services. However, he added this could prove detrimental to the industry as a whole in the medium to longer term because the decline in profits for the class societies will affect the level of research undertaken by class.

"Class societies channel their profits back into R&D projects and any decline in profits means a decline in research. However, the IMO relies on this R&D for technical information on which it bases its new regulations," explained the source.

Shipyards

STX on downward spiral

A senior yard source told *The Naval Architect* that he expects the troubled Korean Shipbuilder STX to be broken up. The senior executive says that the government is expected to inject a further US$100 million or so in an effort to ease the cash flow difficulties being experienced by the shipbuilder.

The Government has already extended loan periods and the company has closed its Dalian operations while selling off parts of its European subsidiaries in an effort to stabilise the shipbuilder.

According to the source the Seoul government cannot afford to allow STX to collapse as the shipbuilder is not only a large direct employer, of around 50,000 staff, but many thousands of workers would be indirectly affected by its collapse, including sub-contractors, equipment manufacturers and related industries.

The source blamed STX's policy for buying unprofitable foreign operations for the company's plight. "They paid US$1 billion for STX Europe and US$2 billion for STX Dalian, but there was not enough profit from these operations to repay the loans [that were taken by STX to buy the foreign operations]".

The Korean Development Bank will try to soften the blow of the collapse of the shipbuilder by attempting to maintain the more profitable elements of the yards in an effort to ensure that small and medium sized suppliers are not also bankrupted by the demise of their far larger client.

However, the source added that STX had already received significant levels of funding to shore up the company that the banks will have to write off in the long run.

A number of Korean yards have needed financial help as the recession has hit the shipbuilding industry very hard. Smaller yards are particularly vulnerable and some of these have already effectively lost the fight for survival, most notably Shina SB and Twenty First Century. Sungdong is also in financial difficulties, but has a plan to diversify into the offshore market and may return to building blocks for the larger yards, its original service.

Shipyards

Yard overcapacity must be addressed

Shipbuilding overcapacity will need to be addressed in order for the industry to return to profitability says JH Chung VP marketing at Samsung Heavy Industries (SHI).

SHI believes that the recession in shipbuilding will finally ease during the next year, helped on with the necessity caused by new regulation, primarily the Energy Efficiency Design Index (EEDI) and the need to eradicate NOx, SOx and particulate emissions.

Chung believes that the industry will have stabilised by 2020 at a level that is acceptable, with the major Korean yards maintaining production for larger and more complex ships. However, Chung says that SHI will double its revenues by 2020 due to the increase in the offshore market, which is currently around 60% of the company's orderbook.

"The shipping market is unlikely to have the peaks and troughs that we saw in 2008 or 2010," explains Chung, though he projected that on the standard shipbuilding side the trend that started after the recession that sees the yard building fewer, but higher value ships will continue.

This year SHI expects to build 120 vessels with a value of US$37 billion, compared to last year's 130 vessels valued at US$38 billion and 180 vessels valued at US$38 billion in 2011. "We are building more complex ships," explains Chung, "some 90% of ships built this year will be LNG carriers compared to 70% in 2011.

LNG

KOGAS ship deal this year

A deal to build a number of LNG vessels for the Korean gas supplier KOGAS is expected to be reached by the end of this year. Some of the ships will be built at the Samsung yard, but all of the ships will include the new membrane containment system the KG1.

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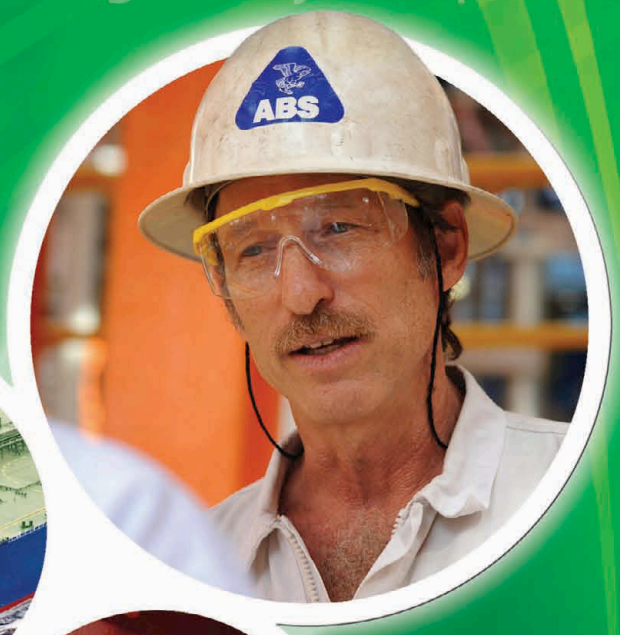

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The KG1 system was designed collaboratively by Daewoo Shipbuilding and Marine Engineering, Samsung Heavy Industries and KOGAS which wants develop its own system to transport gas supplies.

KOGAS has said that it will build a number of specialist vessels and operate them for a number of years before dismantling the system to see how well the membrane has performed.

Container ships

CSCL challenges Maersk's supremacy

One of China's major container carriers, China Shipping Container Lines (CSCL) has placed an order for five vessels each of 18,400TEU capacity in a direct challenge to the Maersk's supremacy in the mega-ship market.

The five vessels will be built at Hyundai Heavy Industries (HHI)at a cost of US$700 million.

These ships will be slightly larger than the Triple E vessels due to be delivered from July this year to Danish shipping line Maersk.

The CSCL ships will feature an electronically-controlled main engine will maximise fuel efficiency, and reduce noise, vibrations and carbon emissions by automatically controlling fuel consumption to suit sailing speed and sea conditions.

The vessels will also be fitted with two EcoBallast seawater treatment systems. Each EcoBallast system can treat 3,000m^3 of seawater per hour by filtering, and sterilising bacteria and plankton bigger than 50µm with ultraviolet rays.

Each of the container ships will measure 400m in length, a 58.6m beam and 30.5m in depth and are scheduled to be handed over from the second half of 2014.

The type approval tests for MAN's G-Type ultra-long stroke engine were performed at Hyundai Heavy Industries and completed in May

Engines

Teekay opts for MAN power

Canadian tanker operator Teekay has ordered four long range, 113,000dwt, vessels from STX Offshore & Shipbuilding. The vessels will be built at the Jinhae shipyard in Changwon and are scheduled for delivery from the second half of 2015. Teekay has options for up to 12 more vessels of a similar type.

Each of the vessels will be powered by MAN's latest units, the MAN B&W G60ME-C, ultra- long stroke engine which is expected to improve the fuel efficiency of the ships considerably. Teekay believes that with the optimisation of the vessels and the latest engines the vessels will record improved efficiencies of between 20 and 30% over existing LR tonnage.

The ultra-long-stroke G60ME-C9 engine passed its type approval tests at Hyundai Heavy Industries in April and the engine manufacturer says that there are now over 200 orders for the G-Type units. *NA*

Correction:

In the May issue of *The Naval Architect* we ran a story under the banner Ro-ro feature about the *MPV Shansi* operated by China Navigation Company. This was an error as the class of ships featured are clearly multi-purpose vessels and not con-ro ships as stated. This was entirely a *Naval Architect* error and we would like to offer our sincere apologies to both China Navigation and the story author David Tinsley.


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IMO delays BWMC regulation

Shipowners will be feeling a measure of relief as the IMO's Marine Environment Protection Committee agreed to a rescheduling of the Ballast Water Management Convention (BWMC) implementation dates, *writes Sandra Speares.*

Operators have been worried that the timing of any implementation of the convention would lead to a bottleneck as ships vie for space at yards to fit the necessary ballast water treatment equipment.

According to tanker owners association INTERTANKO, the change to the dates "will smooth the installation scheduling for ships installing ballast water management systems (BWMS), a trial period for port state control and new guidance on BWMS type approvals".

Katharina Stanzel, INTERTANKO managing director, commented: "INTERTANKO applauds the progress that has been made by the IMO's MEPC on the challenges of implementing the Ballast Water Management Convention, specifically related to the implementation schedule, port state control and improved transparency of ballast water equipment capabilities."

MEPC65 approved a draft Assembly resolution, which recommends that ships not be required to install a BWMS until its first renewal survey after entry into force of the BWM Convention, the resolution is expected to be adopted by the Assembly in November.

"This revised schedule is more logically pinned to the entry into force date of the Ballast Water Convention and allows for the installation of the ballast water treatment system to be undertaken at the first renewal survey after entry into force", explained INTERTANKO's senior manager for environment, Tim Wilkins.

MEPC 65 also adopted a circular to initiate a trial period for the sampling and testing of ballast water by port state control, during which port state control will refrain from detaining a ship or taking criminal sanctions in the event that a BWMS does not meet the discharge. "This will allow time for PSC to determine which sampling and testing techniques work in practice and importantly will also allow the industry to identify any further problems associated with the operation of type approved BWMS," said Wilkins.

The third development relates to increasing the transparency of the type approval process and the adoption of amendments to both the type approval certification documents as well as the guidance to administrations on the type approval process. "With these amendments accepted the revised documents will mean more information is provided to the industry and the owners on the capabilities of the BWMS as well as the ranges and limiting conditions in which the BWMS can operate".

The International Chamber of Shipping has raised concerns on the robustness of the type-approval process for the expensive new treatment equipment (estimated to be US$1 – 5 million per ship), the methodology for sampling during port state control inspections, and the time scale that will be available for as many as 60,000 existing ships to retrofit the new equipment.

According to David Tongue, director of regulatory affairs at ICS what MEPC has agreed "is certainly going in the right direction" but, ICS still has some concerns about the type approval process and the number of the type approved systems that are available. He says he feels that a mandatory type approval test regime for treatment equipment is needed.

When the G8 guidelines on the approval of ballast water treatment systems were first released "no-one had an idea of what was required," he said. Since then additional layers of complexity have been added, and the environmental bar has been raised.

MEPC has agreed there should be a five year phase in period to fit treatment systems to the existing fleet following entry into force of the BWM convention, pegged to the ships renewal survey date. All ships built before the entry into force of the convention are deemed to be existing ships. It was also agreed that the renewal survey to be used to determine a ship's regulation D-2 compliance date was that which was applicable to the IOPP certificate under MARPOL Annex I and not the International Ballast Water Convention certification, which means that 20% of the world fleet will be fitted per year over the five year survey cycle.

"Nothing has yet been done about making G8 type approval in a mandatory manner, which is one thing we are pressing for," Tongue said. There are still concerns about the robustness of the type approval process because everything at the moment is recommendatory". The committee did accept additional guidelines produced by BLG 17 on additional inclusions for type approval certification including water quality. The certification will now have limitations on operational parameters dictated by what parameters are used for type approval.

There was not a particularly pragmatic result on the issue of using drinking water as ballast water, he said. The US stance is that it will only accept its own municipal drinking water; additionally water produced on board would need to go through the G9 process to ensure that it does not prove harmful to the environment or to human health.

A growing number of administrations have indicated their support for ICS's position that the BWM Convention was designed to assure the ability to meet the required standard by a treatment system installed on an operating vessel, not only in the rarefied atmosphere of a test facility. *NA*

The Future is Clear

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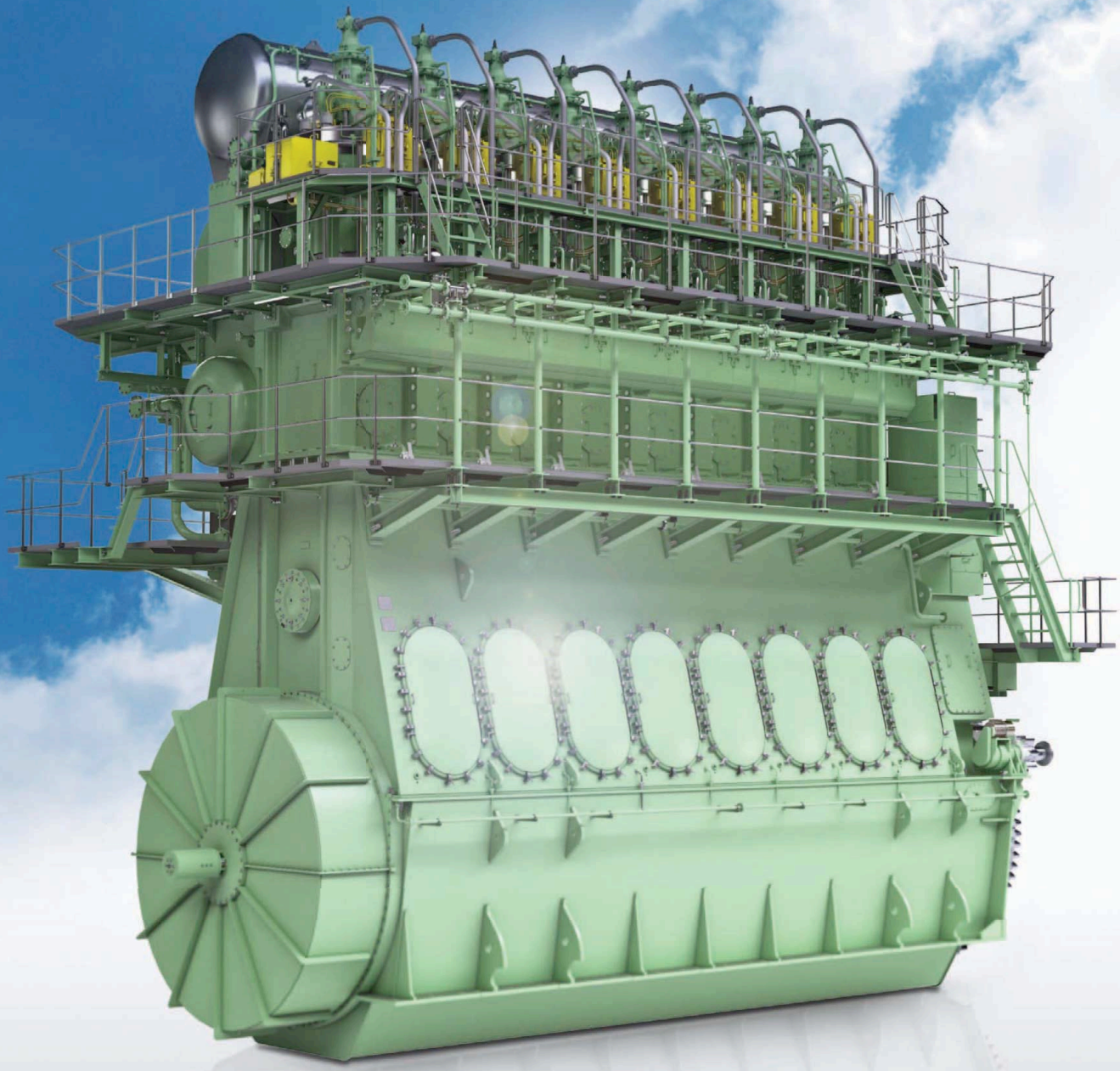

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Ancillary equipment

Post-Panamax contracts for TTS

TTS Group ASA has, through its subsidiary TTS Marine AB in Gothenburg, signed two new contracts for the supply of equipment in South Korea with a total value of approximately NOK150 million (US$27, 119 million).

One of the contracts is with Hyundai Samho Heavy Industries Co., Ltd shipyard and the other is with Hyundai Mipo Dockyards Co., Ltd. Both contracts are for the delivery of technology and equipment for six Post-Panamax car carriers to be built over the next two years.

The contract will see TTS deliver its car deck design, stern ramps and technological solutions that will greatly increase the efficiency of the next generation of car carriers, the company claims. The available deck area has been expanded by 5-10%, and the ships are built lower than before. The equipment deliveries will be completed within 2014.

www.ttsgroup.com

CAD/CAM

Fincantieri signs up Pemamek

Fincantieri has ordered a profile processing line and one side welding station with laser-hybrid process and integrated milling, from the Finnish company Pemamek.

The contract consists of a full turn-key delivery with designing, manufacturing, assembly, installation and training. The delivery of these solutions will take place during the summer of 2013 at Monfalcone.

The solution that has been provided to Fincantieri has been specially designed for the shipyard and is highly automated to bring better capacity and quality to the shipyard production. The system will be set up as a profile processing line, which consists of edge blasting and milling functions before a fully robotised cutting and sorting system and is the most advanced available on the market.

The plate joining system will consist of large one sided welding station with the laser-hybrid welding process integrated together with the tandem metal active gas (MAG) process for welding various ranges of thicknesses. The station also includes PEMA's milling machine technology and rigid clamping systems for the in-feeding and out-feeding of the plates with related conveyors.

www.pemamek.com

Building sophisticated ships requires a unique approach

Paints & coatings

Jotun launches Jotachar JF750

Jotun has announced the launch of its Jotachar JF750, its next-generation in passive fire protection (PFP) coating system that will significantly reduce installation time and cuts material costs, claims the company.

According to Andy Czainski, Jotun's global PFP sales director, Jotachar JF750 is the only mesh-free epoxy intumescent coating solution available to the market where jet fire protection is required for safety critical steel structures, divisions and vessels. "The formulation of Jotachar JF750 incorporates an advanced fibre matrix system in the material" he explains. "This technology, combined with a robust and temperature stable insulating char, eliminates the need for additional mesh reinforcement, reducing complexity and making it significantly faster to apply, hence saving time and cost."

Jotachar JF 750 has undergone several fire tests where it has exceeded in all and demonstrating its structural fire protection for up to three hours. Czainski stated that: "All fire and blast resistance testing has been witnessed by Lloyds Register. Witnessing of testing by a major classification society, in addition to endorsement of our 3rd party fire assessments undertaken by Exova Warrington Fire (UK), is a pre-requisite for product Type Approval from Lloyds Register, DNV and other major classification societies".

www.jotun.com

Green technology

Eminox SCR solution for Tier III

Eminox, one of Europe's emissions technology providers, is turning its attention to marine engines in preparation for the Tier III legislation coming into force in 2016. Using its expertise in developing Selective Catalytic Reduction (SCR) exhaust after-treatment solutions for on and off-road manufacturers, it is offering both silencer and after treatment solutions from concept through to manufacture within its range of in-house facilities.

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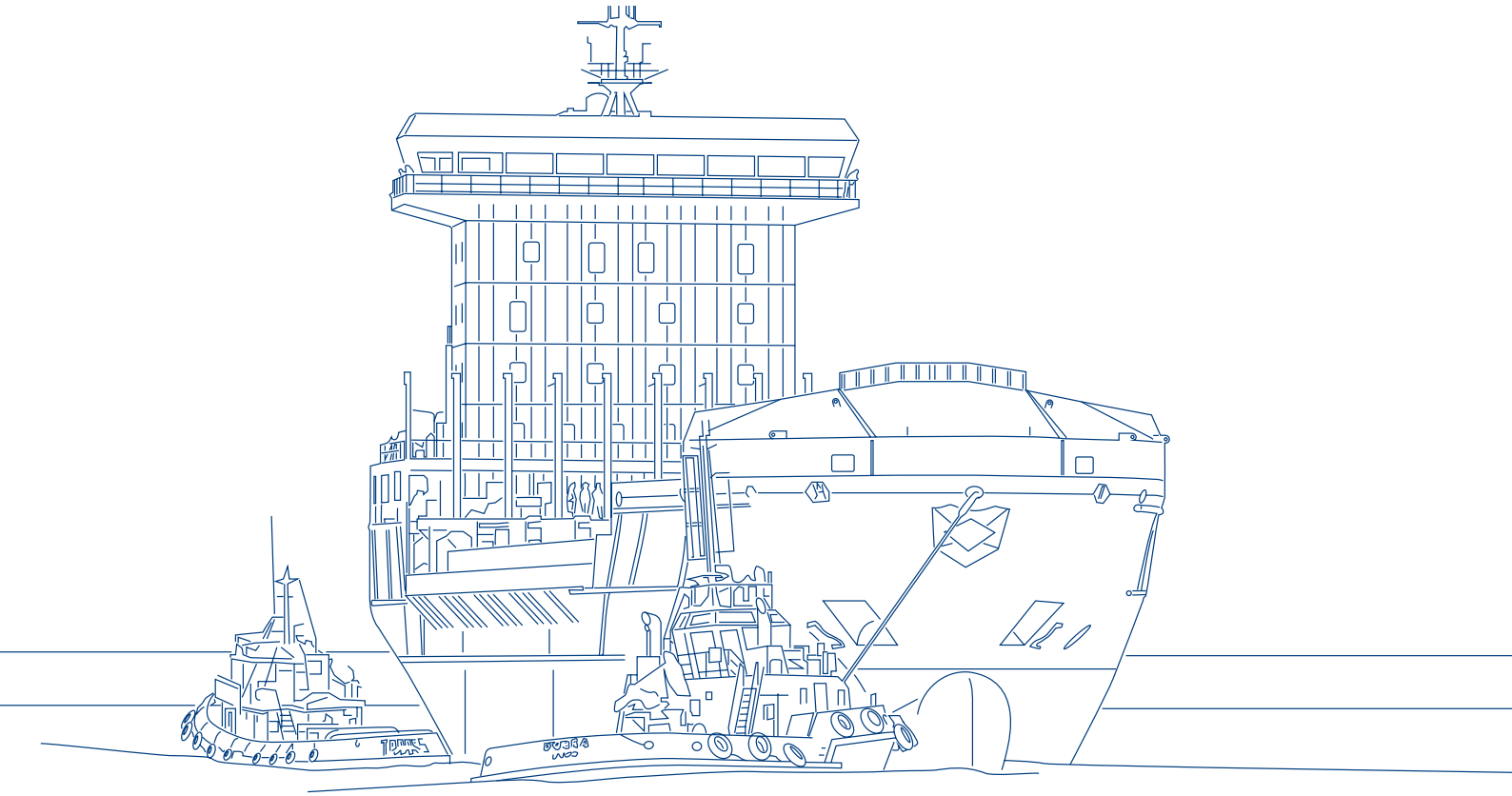

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Eminox SCR solutions are capable of reducing NOx emissions by more than 80% and incorporate space saving mixing technology for installation into vessels with a restricted space, claims the company. Designs have also been developed including specialist urea injection and regeneration strategies to avoid urea deposits.

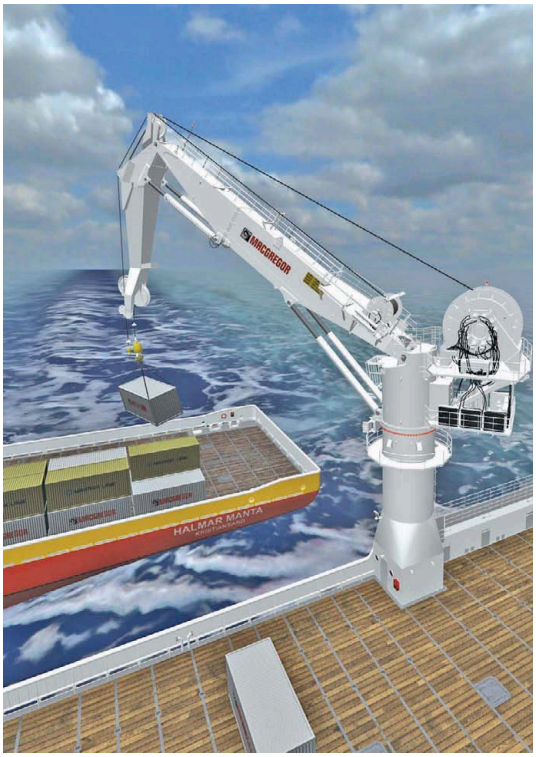
Eminox's engineering teams use a variety of tools and techniques, including CAD design, computational fluid dynamics, noise vibration and harshness analysis and finite element analysis, to deliver its concepts. Eminox can also offer in-house rapid prototyping, in-house tooling, a cellular layout for flexible manufacturing and validation tools for fast and flexible response.
www.eminox.com

Deck equipment

C-HOW MacGregor's new tool

MacGregor has introduced C-HOW, a simulation platform that allows customers to run particular equipment through various simulated conditions and operations. "The C-HOW software is extremely flexible," says Frode Grøvan, sales and marketing director, MacGregor Advanced Load Handling. "Simulation detail can be varied depending on the level of functionality required: C-HOW is modular and scalable, so modules can be added or removed as requirements change. Furthermore, its use is not limited to MacGregor equipment; it can be tailored for products from other manufacturers installed on our customers' vessels."

MacGregor offers better user experience with the launch of it simulation platform



At a basic level, C-HOW can be used as an interactive calculation tool, while at the other end of the scale it can be incorporated in immersive training hardware, such as in the advanced crane simulator.

Although MacGregor has only just introduced C-HOW to the market, it noted that customers are already expressing serious interest.
www.macgregor-group.com

Ballast water

W&O to supply Hyde systems in US and Canada

Hyde Marine, Inc., has announced that it has named W&O Supply as its exclusive sales distributor in the US and Canada for Hyde GUARDIAN Ballast Water Treatment Systems (BWTS).

In April 2013, the Hyde GUARDIAN BWTS earned the Alternate Management System (AMS) approval from the United States Coast Guard (USCG).

AMS approval is an interim measure that allows BWTS to be used on vessels for five years after the vessel is required to comply with the USCG Ballast Water Discharge Standards. The five-year period is designed to allow the BWTS manufacturer sufficient time to obtain US Type Approval and ensure the ship operator's compliance with US ballast water regulations into the future.

Tested and validated at the Royal Netherlands Institute for Sea Research (NIOZ), one of the most challenging ballast water test facilities in the world, the Hyde GUARDIAN BWTS ultimately became the first BWTS accepted into the US Coast Guard's Shipboard Technology Evaluation Program (STEP), which facilitates the development of effective BWTS technologies for vessel owners seeking alternatives to ballast water exchange.
www.hydemarine.com

CAD/CAM

Dassault Systèmes acquires FE-DESIGN

Dassault Systèmes has acquired FE-DESIGN Group, which produces software for design optimisation for the early-stage in product development. The acquisition of FE-DESIGN, based in Karlsruhe, Germany, will expand Dassault Systèmes' SIMULIA applications to be able to provide a better design optimisation solution, claims the company. It is expected that FE-DESIGN's products will enhance Dassault Systèmes' 3DEXPERIENCE platform

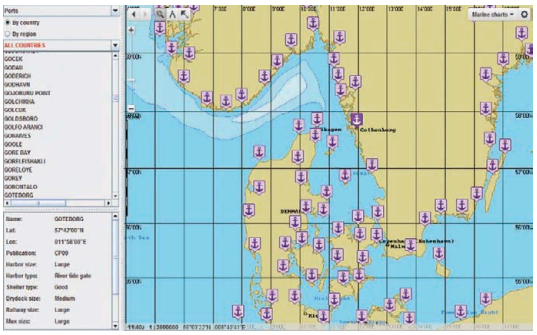
and its ability to automate the process of simulating the right design more quickly and more efficiently, the company explained.
www.3ds.com

Bridge & communications

Transas launches FleetView Online

Transas Marine has released its latest version of its FleetView Online web-based SSAS-tracking service. The latest FleetView Online version has an improved user interface, object overlay and chart navigation controls.

The latest development to the solution is its "Vessel on map" functionality that will allow users to include a small PNG image showing vessel's location in Positon reports & SSAS alerts email and track history for the previous week.



Transas improves its tracking abilities

The object overlay on the charts have been updated to enhance visual appearance and improve the user experience at lower scales. Previous toolbars have been removed and navigation controls added to the chart display to improve viewing ability.

Significant improvements have also been done for Port Service functionality. With this option ports icons are displayed directly on the chart display. Additional detailed information is listed in the port information window. As usual, ports can be selected from the list where users can zoom into the port location.

Daily Position Report (DPR) messages can be now forwarded in NMEA-based format which makes it easier to integrate FleetView Online data with a shipping company's monitoring programme. In addition, object clustering in the AIS data has been added to improve display at larger scales.
www.transas.com

Accommodation

UMS handles the waste better

Uson Marine has launched its food waste shredder with integrated macerator which is now installed in a number of ships worldwide. Suitable for newbuilds or retrofitting on existing vessels, the shredder has been designed and tested for galley food waste.

The Uson food waste shredder has an integrated macerator fitted below the shredder head. Synchronised in operation, the two-stage process can handle all food waste fractions, including bones, hard shells, fish skins, long fiber food waste and large quantities of pasta, potatoes, and rice, etc.

The Uson food waste shredder is of the slow rotating type (20rpm), designed for heavy duty shredding with minimum noise. It is equipped with an extremely durable shredder head in Hardox steel and the material in the shredder knives is Hardox 400 extremely high-strength hardened steel.
www.usonmarine.se

Bridge & communications

NAVTOR distribution easier with NavStick

E-navigation business NAVTOR has announced an agreement with the United Kingdom Hydrographic Office (UKHO) that will see its ADMIRALTY Vector Chart Service (AVCS) distributed on the NAVTOR NavStick USB device. The deal will also see all Admiralty Digital Publications made available on the NavStick.

At present AVCS is distributed to mariners via mailed CDs, with updates also mainly being delivered through the post. NAVTOR's NavStick will provide an intelligent, quick and effortless way for navigators to access all the latest information.

NAVTOR Business and Communication Manager Willy Zeiler explained: "This is a major step forward for the industry, and a brand new distribution model," he notes. "The NavStick USB device gives mariners access to global AVCS coverage and all licences for predefined operation areas. Installation onto the ship's ECDIS is simple, while NAVTOR's online programme NavSync allows the user to retrieve AVCS updates with just a few clicks when the NavStick is connected to the bridge computer."

The IMO's ECDIS mandate requires all registered vessels to use ENCs as their prime navigation charts. This mandate came into operation last year, with a need to comply with regulations by 2018.
www.navtor.com

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COMPIT in Cortona

The picturesque Tuscan town of Cortona was the host for the twelfth International Conference on Computer IT Applications in the maritime industries (COMPIT). This article discusses selected conference papers. Rachel Pawling reports

A wide range of papers, 45 in all, were presented at this year's conference, including CFD, ship design, CAD tools and simulation, robotics and operational aspects including efficiency and emissions. With over 70 attendees representing organisations in 20 nations world-wide, including academia, research organisations, software suppliers, classification societies and shipbuilders.

Simulations for all occasions

In addition to papers describing developments in numerical modelling and analysis methods such as CFD, the conference saw papers presented on the range of uses of simulations in ship design.

Harries, Dölerud & Sames provided details on a simulation method developed to allow a statistical evaluation of the time taken to load and unload containers from a range of container ship designs. The production of a relatively simple representation of the container ships allowed a large number of simulation runs to be carried out and statistical data to be developed on the efficiency of the container ports with varying numbers of cranes and required container moves.

This approach was able to identify changes in port efficiency with design decisions such as length and beam, and the relationship between these and the port infrastructure available. The paper by Abel et al, considering simulations for use by classification societies during certification, provided details on the difficulties and methods for integrating simulations operating on different timescales – steady-state and transient models.

This type of integration is particularly important for assessing the effects of operations in extreme environments, such as in ice – an area of interest for many classification societies.

Gosch presented a wider summary of the various simulation tools that can be used to design safer ro-pax vessels. The two main areas of safety improvement discussed were dynamic stability in roll when encountering larger seas, and the possibilities for designing energy-absorbing collision resistant side structures to limit side shell penetration in a collision.

These two aspects of ship design have very different mathematical approaches – probabilistic for the dynamic stability and FEM for the structural design, and a proposal was made that these will be combined in future developments.

Koch, Blanco-Davis & Zhou described the application of simulation to the evaluation of retrofits, with particular reference to the environmental impact. Their paper described a method and software tools to perform a complete Life Cycle Analysis (LCA) of refits, with models ranging in scope from individual shipyard processes to the complete shipyard layout itself and the performance enhancement likely to be experienced with the retrofit in service.

Design developments

The use of computers in ship design, particularly at the early stages, was discussed in several papers. Andrews presented a discussion of the conceptual and procedural features that make the earliest stages of ship design fundamentally different to the later stages of detail development to allow production.

Noting that ship design is an example of a "wicked problem", (where in the earliest stages the main difficulty is not defining the solution, rather it is defining the nature of the problem to be solved) Andrews argued for concept ship design being a process of "requirements elucidation", a divergent and exploratory design phase with complex trade-offs and requiring holistic design tools with different capabilities to those used in detailed design. These tools, Andrews argued, should be flexible enough to foster creativity in the designer, encouraging exploration and incorporating architectural as well as numerical modelling and analysis.

Against this discussion of the background and context of early stage design, several papers were presented focussing on specific methods and tools. Pawling et al described an approach to incorporating "style" in early stage design, with particular reference to the overall configuration and detailed layout of ships.

The authors provided a conceptual definition of style in ship design as being cross-cutting, in that a single stylistic choice will affect multiple aspects of the design solution and performance. Style was proposed to be a potential mechanism for integration of semi-automated methods of layout development, in that it could be used to describe and store arrangement information.

Pawling et al then outlined a proposed approach to integrating the early-stage arrangement tools previously developed by their three universities. One of the methods of analysing ship layouts, the network approach, was described in more detail by Parker & Singer. This approach represents the demands on the general arrangement of the ship as connection between nodes in a network, and uses mathematical models of network analysis to allow the evaluation of configuration drivers from the relationship data without the need to generate complete arrangements, either by hand or automatically.

A broad view of mid-term developments in CAD for ship design was presented by Koelman. This paper, winning its' author the 2013 GL COMPIT award, considered a range of technologies and techniques that could see application in computer aided ship design over the next decade. Five main areas were covered; modelling and representation of ship shapes (including hullform definition and

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internal subdivision), collaboration in ship design and ship design tool development, the potential for new empirical resistance series based on systematic CFD simulations, potential scenarios for the broader computing environment used in ship design and the future of the ship design process itself.

An emergent technology highlighted by Koelman as ideal for ship design was 3D printing. This technology allows home users to rapidly print plastic models of designs generated in commercial CAD packages, with the example application being the production of a model of the hull of an inland waterways vessel to illicit feedback from the operators – with the rare occurrence of a presenter being able to literally show the audience their hullform model.

Efficiency in design and operation

A strong theme at this year's conference was the use of CAD and IT tools to improve ship efficiency both in the design stage and during operation.

The importance of CFD in evaluating devices for improving propeller inflow and performance was illustrated by Lee et al, with a focus on using the analysis to understand the mechanisms behind the changes in performance. CFD was also applied to the ship efficiency problem by Hansen & Hochkirch, who described the use of CFD simulations to evaluate the performance of a container ship at different loading conditions and trim angles. This calculated database was then used to develop guidance on the optimum trim for reduced fuel consumption, which could be provided to the crew via on-board software tools.

The main focus in ship efficiency, however, was on measurement and processing of gathered ship data. Two papers covering developments by Finnish company Eniram described their work in this area. Avist & Pjörre provided details of a monitoring and processing system designed to extract incident wave height and direction from motion sensors fitted to the ship.

The objective behind this research being to provide more accurate data on the conditions experienced by ships on regular voyages to improve route optimisation. Salonen & Heikkinen then continued this theme by describing the measurements and significant post processing required to obtain robust statistical datasets describing the propulsion plant fuel efficiency.

Difficulties highlighted in this area included missing data, changing calibration in measurement equipment and the need to account for the varying performance of the engine with the wide range of fuel density and sulphur content encountered.

Ignatius et al then provided an illustration of what can be done with the type of data, in the form of ABBs software tools to advise crews on the trim and power plant optimisation. Using both internal models of the ship and measured data during operations, this paper notably linked the tools directly to the IMO MEPC Ship Energy Efficiency Management Plan (SEEMP), the development and implementation of which became mandatory at the start of this year.

Robotics and unmanned craft

Although less well represented in the number of papers, a theme reoccurring at this year's COMPIT conference was that of robotics and unmanned craft in general. Given the increasing use of these vehicles in civil, scientific and naval sectors, combined with on-going interest in reducing crew numbers and associated costs, this subject seems likely to be discussed at future conferences. The two main areas presented were hardware and control.

Bibuli et al described the development of a prototype Co-operative Autonomous Robotic Towing system (CART); a small submersible robot to be deployed from tugs to secure messenger lines allowing a disabled vessel to be taken in tow.

The paper outlined the hardware design and testing and also described the control systems needed to allow the CART to secure a messenger line without the tug having to close with the disabled vessel. The command and control theme was also addressed by Caiti et al who described the use of co-operative algorithms to allow small unmanned craft to undertake underwater archaeological surveys in the Tuscan Archipelago.

At the opposite end of the size spectrum, Porathe et al introduced the EU FP7 funded MUNIN project, which runs from 2012 to 2015 and aims to develop a completely autonomous Handymax Bulker. Challenges faced by this effort range from surveillance and sensor capabilities to the legal issues associated with the operation of an unmanned ship – as opposed to the small vehicles deployed for oceanographic research – on the high seas.

COMPIT 2014

After a rich and varied programme of papers, the conference finished off with the announcement of the venue and dates for next year. COMPIT 2014 will be held in Redworth, UK, at the Redworth Hall Hotel, between the 12th and 14th of May. Further details, as well as the proceedings from this and previous conferences, can be found on the website at www.compit.info. *NA*

Papers highlighted

Eloïse Croonenborghs, Thomas Sauder, Sébastien Fouques, Svein-Arne Reinholdtsen, *CFD Prediction of Wind and Current Loads on a Complex Semi-Submersible Geometry*

George Korbetis, Dimitris Georgoulas, *Efficient Use of CAE Pre- and Post-Processing in Offshore Structures Design*

Karsten Hochkirch, Benoit Mallol, *On the Importance of Full-Scale CFD Simulations for Ships*

Shaun Hunter, Justin Freimuth, Nick Danese, *Utilizing a Robust Fatigue Screening Process for Initial Design and Throughout the Ship Life-Cycle*

Henner Eisen, *The Spectral Method Re-Engineered: High-Performance Finite-Element-Based Fatigue Assessment Processes for Ship Structures*

Stefan Harries, Erik Dölerud, Pierre C. Sames, *Port Efficiency Simulations for the Design of Container Ships*

Andreas Abel, Uwe Schreiber, Erik Werner, *Bridging the Gap between Steady-State and Transient Simulation for Torsional Vibrations under Ice Impact*

Thomas Gosch, *Simulation-Based Design Approach for Safer RoPax Vessels*

Thomas Koch, Eduardo Blanco-Davis, Peilin Zhou, *Analysis of Economic and Environmental Performance of Retrofits using Simulation*

Darren Larkins, Denis Morais, Mark Waldie, *Democratization of Virtual Reality in Shipbuilding*

Fedor Titov, Axel Friedewald, *Handling Human Models in Virtual Reality Applications with MS Kinect*

Nick Danese, Runar Aasen, *Exploiting Weight Data to Support Engineering and Corporate Decision-Making Processes*

Runar Aasen, Patrick Roberts, Nick Danese, Lawrence Leibman, *Utilizing CAD/CAM Models for Ongoing Weight Estimation and Control*

David Thomson, Philippe Renard, *The Digital Handover – Shipyards as Producers of Life-Cycle Maintenance Models*

David Andrews, *The True Nature of Ship Concept Design – And What it Means for the Future Development of CASD*

Rachel Pawling, David Andrews, Rebecca Piks, David Singer, Etienne Duchateau, Hans Hopman, *An Integrated Approach to Style Definition in Early Stage Design*

Morgan C. Parker, David J. Singer, *The Impact of Design Tools: Looking for Insights with a Network Theoretic Approach*

Herbert J. Koelman, *A Mid-Term Outlook on Computer Aided Ship Design*

Yi-Fang Hsieh, Sing-Kwan Lee, Zhiyong Zhou, *Design Evaluation of Energy-Saving Devices for Full Form Ship Propulsion*

Heikki Hansen, Karsten Hochkirch, *Lean ECO-Assistant Production for Trim Optimisation*

Pyry Åvist, Jussi Pyörre, *Modelling the Impact of Significant Wave Height and Wave Vector using an On-board Attitude Sensor Network*

Sami Salonen, Aatos Heikkinen, *Robust Characterization of Ship Power Plant Fuel Efficiency*

Jukka Ignatius, Jan-Erik Räsänen, Kalevi Tervo, Jan-Jaap Stoker, Tim Ellis, *A Comprehensive Performance Management Solution*

Gabriele Bruzzone, Marco Bibuli, Massimo Caccia, Enrica Zereik, Giorgio Bruzzone, Mauro Giacopelli, Edoardo Spirandelli, *Cooperative Autonomous Robotic Towing System – Exploitation of Autonomous Marine Vehicles in Emergency Towing Procedures*

Andrea Caiti, Vincenzo Calabrò, Francesco Di Corato, Daniele Meucci, Andrea Munafò, *Distributed Cooperative Algorithms for Autonomous Underwater Vehicles in Marine Search Missions*

Thomas Porathe, Hans-Christoph Burmeister, Ørnulf Jan Rødseth, *Maritime Unmanned Navigation through Intelligence in Networks: The MUNIN project*

Triple E, the shape of ships to come

Significant changes to the design of Maersk's Latest vessels, due to be delivered this month, will keep the ships ahead of the game in the container industry, by reducing both costs and emmissions

A new era will formally begin this month when Maersk's first Triple E ship, the 18,270TEU behemoth *Maersk McKinney Møller* is delivered to the Danish shipping company. Not only will this be the biggest container ship ever built, it is claimed that it will reduce carbon emissions by 50% per box.

The vessels, five to be delivered this year, will only be the largest ships for a comparatively short time as China Shipping has recently ordered a series of 18,500TEU ships.

However, for now the largest container ships in the world have some significant changes to their design that will help the vessels achieve significant fuel savings, including a new slender hull, twin skegs with propellers designed and manufactured in Germany and rudders that have bulbs immediately in front of the propellers designed to improve the hydrodynamics of the vessels.

The slender design of the vessel means that the ships will have more cargo on deck and for this reason the lashing bridges are one stack higher than the standard design.

Looking toward the stern of *Maersk McKinney Møller* displaying the four-high lashing bridges and the un-named fourth Triple E in the background

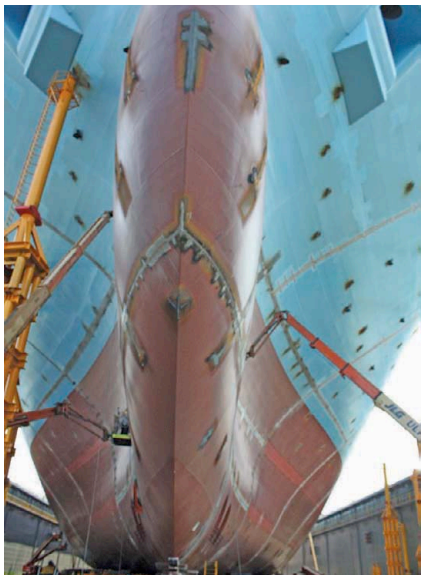
This in turn means that there were concerns over the stability of the vessels during the design stage, so the yard and owners agreed to add an anti-roll tank (ART) to the vessels. So far these tanks have only been used on anchor handling vessels, according to Peter Bertlesen, lead hull superintendent for Maersk at Daewoo Shipping and Marine Engineering's (DSME), Geoje shipyard.

The ballast tank is located beneath the accommodation block and is filled with seawater to the required level, depending on the cargo load and cargo mix.

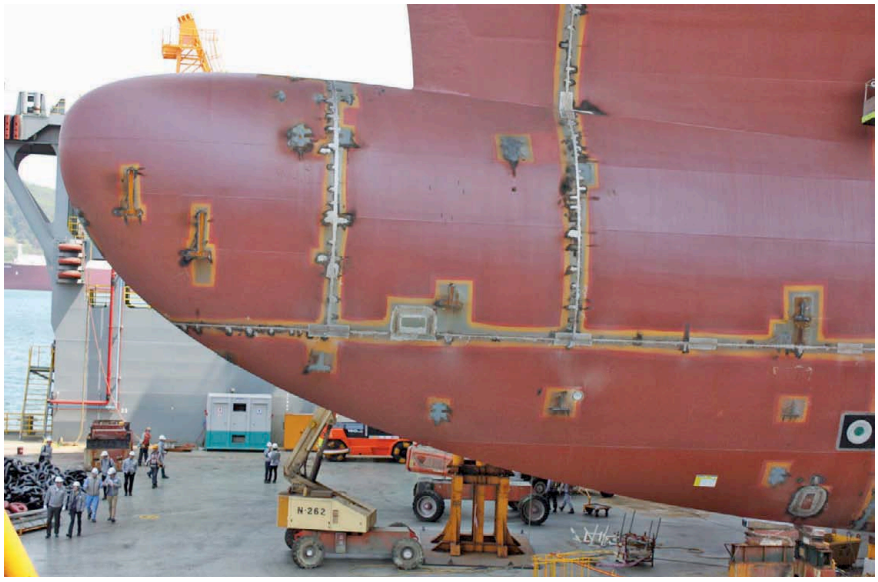
The slender hull design was particularly pronounced when compared to the outline of a standard 10,000TEU vessel, also being built at DSME whose stern profile displayed a U-shaped design when compared to the triple E's more pronounced V-Shape (see photo comparison on next page).

At the front of the vessel which is optimised for speeds of between 15 and 23knots the bulbous bow is considerably smaller than on standard pre-slow steaming designed ships. The bow flares considerably to allow for the

Triple E construction manager Sang-boo Lee says the cooperation between Maersk and DSME has been running smoothly despite some minor design difficulties



Triple E's bulbous bow and sleek hull lines on display



Each bulbous bow is designed to meet the operational profile of the ship, on the Triple E the bulbous bow is considerably smaller due to the comparatively slow speeds that the vessels will operate at

maximum cargo intake and to improve the hydrodynamics.

Towards the rear of the vessel the twin skegs with rudders have also been optimised for hydrodynamic efficiency.

Maersk are particularly sensitive about the design of the rudders, which they asked should not be photographed by visiting journalists, and the company refused to talk about the capacity of the waste heat recovery systems (WHRS) fitted to the ships, because, Maersk says, they cannot be certain how effective the systems will be until the results of the 12-days of seatrials, which were due to take place late last month, are known.

There are two WHRS, one for each main engine and the system merges to a single unit further along the system, where the production of steam takes place.

Built at the Daewoo Shipbuilding and Marine Engineering (DSME) yard at Okpo on Geoje Island in Korea, the Triple E vessels will be delivered on time, but as the construction manager for *Maersk McKinney Møller*, Sang-boo Lee admitted there had been some teething problems. Notably according to Lee the shaft generator space was designed too small and the redesign had cost the yard three days in construction time.

Bizarrely, Bertelsen and the Maersk employees overseeing the building project were baffled by suggestions that there had been any significant problems with the design for the shaft generator space. In fact, Bertelsen says, there had been a minor problem with the foundations for the shaft generator which needed to be moved.

Aside, from this minor blip both DSME and Maersk were happy with the way the build had progressed. The vessels themselves are constructed from 385 blocks with 85-90% of the steel built at DSME's Chinese subsidiary, DSSC, Daewoo Shipbuilding Shandong China.

In total some 40% of the vessels were built in China and the parts then shipped to Geoje Island for assembly. Some 250 staff have worked on the build of each Triple E vessel, around 20% more than on the standard builds, says Lee.

Four of the vessels are nearing completion, with *Majestic Maersk* and *Mary Maersk* the second and third vessels respectively and the fourth un-named; blocks for a fifth vessel also to be delivered this year are already arriving at the Okpo yard.

Formal naming of the first vessel is due to take place in mid-June with delivery expected shortly after. Maersk says the vessels will initially be deployed on its AE10 North Europe service, but the company will profile the vessels and market them as 15,000TEU ships due to the continuing difficulties in the market.

Even as the inevitable economic recovery finally materialises these ships will remain the shape of vessels to come; sleek, fuel efficient and far cleaner than ships that sailed before them. *NA*

On the left the U-shaped stern profile of a standard 10,000TEU container ship compared to the sleeker V-shaped Triple E to the right

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Power made in China

China's engine makers achieve a breakthrough by innovation, reports Liu Ying

Not long ago, the L32/44CR and DK36 series of high-powered medium-speed diesel engines developed by China had been examined and accepted by the Ministry of Industry and Information Technology.

The project was led by Zhenjiang CME Company Limited, and Anqing CSSC Diesel Engine Company Limited (ACD) also participated in the project. Meanwhile, the China Classification Society (CCS) has given its first certificate for a medium-speed natural gas engine to the 6230SG natural gas engine developed by Guangzhou Diesel Engine Factory Company Limited.

The above engine manufacturers are not alone among the marine engine makers in China. In recent years, medium-speed and high-speed engine producers in China have strengthened their R&D efforts and increased the proportion of Chinese-made products in their portfolios. They have also launched products with self-owned intellectual property and developed a new profit model. All these have helped China's engine makers to compete with their foreign counterparts.

From imports to own brands

Importing technology of well-known foreign brands is the choice of many Chinese engine makers. In the marine medium-speed and high-speed engine sector, many Chinese engine manufacturers have imported technologies from Europe and Japan. During the "import-digest-absorb" process, Chinese engine companies have improved their R&D capability and tried to build whole engines using only local technologies.

The L32/44CR and DK36 series high-powered medium-speed diesel engines were both imported models. But through the "import-digest-absorb" process, Chinese engine manufacturers have grasped the techniques of making cylinder heads and the multi-ladle pouring process for large-scale casting; and managed to produce key parts, such as machine bodies, cylinder heads, crankshafts and overhead camshafts etc using their own technology.

The NY9320 medium-speed engine developed by Nanche Yuchai Sichuan Engine Co Ltd

More than 60% of the two engine models are made with Chinese companies' self-developed technologies.

Apart from Zhenjiang CME and ACD, other engine manufacturers are also speeding up their R&D, hoping to lay a solid foundation for producing whole engines with self-developed technologies. Last May, Hudong Heavy Machinery Company Limited, Ningbo C.S.I. Power & Machinery Group Company Limited and Shaanxi Diesel Engine Heavy Industry Company Limited jointly launched a "Marine medium-speed diesel engine critical technologies and samples development project". The project, aims to develop high-powered medium-speed diesel engines, and has been included into the "Twelfth five-year plan - national technology support scheme".

Many companies have managed to produce whole engines using self-developed technologies in recent years, and have launched their own branded products. Among these manufacturers is Guangzhou Diesel Engine Factory which launched its 9G32 high-efficiency high-powered medium-speed engine in 2009.

Guangzhou Diesel Engine Factory owns the intellectual property rights of the 9G32 model whose rated power reaches 4,400kW. This model meets the IMO Tier II emission requirements and has been awarded certificates by CCS, Bureau Veritas, ClassNK and Germanischer Lloyd.

Guangzhou Diesel Engine Factory has developed the G32 series which is wholly designed and manufactured in China and is well-received by Chinese and foreign shipowners.

Apart from Guangzhou Diesel Engine Factory, CSIC Diesel Power Company Limited has also launched its self-developed 6CS21/32 medium-speed engine. This model gained its certification from CCS in 2011. The fuel efficiency of this model is better than many other comparable foreign engine models. The 6CS21/32 model's nitrogen oxide emissions do not only meet the requirements of IMO Tier II standards, but is also 15% lower than the requirement and has the potential to fulfil the Tier III standards.

In late 2011, Nanche Yuchai Sichuan Engine Co Ltd developed the NY9320 high-powered medium-speed engine of which the company owns the intellectual property rights. This model was produced with electronic fuel injection (EFI) technology and its single cylinder efficiency reaches 510kW. The launch of the NY9320 filled the gap in the market for medium-speed high-powered engines with single cylinder efficiency exceeding 500kW in China's engine production sector.

There is still a huge technology gap between Chinese enterprises and renowned foreign engine makers who have a long history and strong R&D capability. In order to fill the gap, industry experts have proposed a solution that combines production, learning and research efforts. Many Chinese companies have managed to raise the proportion of Chinese-made parts in imported engine models and started their own R&D initiatives.

In the L32/44CR and DK36 series high-powered medium-speed diesel engines development project, Dalian University of Technology, Zhenjiang CME and ACD have cooperated to develop a diesel engine combustion process and common rail system calculation model. They have proposed a solution to control the temperature inside the cylinder based on the Miller cycle in order to lower nitrogen oxide emissions and have designed a common rail system that is suitable for China's marine diesel engine. That project has already been granted four invention patents and a utility model patent.

Guangzhou Diesel Engine Factory is another champion in R&D. It has built a close relationship with China Shipbuilding Industry Corp's Shanghai Marine Diesel Engine Research Institute (SMDERI). In 2007, the Guangzhou Diesel Engine Factory launched a 6G32 engine model which was jointly developed by the company and SMDERI.

The 9G32 engine model is another product of their cooperation. Industry experts have said that the success of the G32 series helped raise the R&D capacity of China as the key technologies of the series can be used in other engine models. The Guangzhou Diesel Engine Factory has also teamed up with Norway's MARINTEK on product development. Not long ago, a medium-speed natural gas engine developed by them gained type approval from CCS.

Another engine maker CNPC Jichai Power Equipment Company (Jichai) has imported technologies from Austria. Jichai, together with Austria's AVL, developed the 26/32 series diesel engine of which the intellectual property rights are owned by the two developers. Important technical indices such as average effective pressure, heat efficiency and emissions of this series have all reached international standards.

High-speed engine manufacturers have also joined the R&D bandwagon. Henan Diesel Engine Industry Co Ltd has worked with Harbin University of Science and Technology and SMDERI, and they have achieved a breakthrough in critical technologies for high-speed, high-powered diesel engines, such as high precision thin-wall body casting, flexible processing of large-scale crankshafts and flexible processing of connecting rods, etc.

The company has been granted 22 patents, and has raised its own competitiveness and R&D capability. Last year, the HND622V20 high-speed diesel engine developed by Henan Diesel Engine Industry entered the installation stage. That engine model's maximum efficiency can reach 3,000kW when its speed reaches 1,500rpm.

One-Stop-Shop supply model

In recent years, the development modes of foreign engine manufacturers have diversified. On top of technology export and charging patent royalties, they have also expanded in China through setting up joint venture local production bases. These enterprises have also promoted a one-stop-shop supply mode for marine power systems in order to earn higher profits. Chinese companies have learnt from their experience and started to offer one-stop-shop supply services.

Guangzhou Diesel Engine Factory has supplied the propulsion systems for two new green vessels belonging to China National Offshore Oil Corp (CNOOC) that operate in the Bohai Bay area. The systems include Guangzhou Diesel Engine Factory's 8230ZC diesel engine and gear box, controllable pitch propeller, shaft generator, thrust unit and the control and maintenance units for the main thrust. The majority of the system's units are made-in-China with only a very limited portion being imported.

Last October, CSIC 704 Institute supplied controllable pitch propellers to China's third generation 1,000tonne naval surveillance vessels which have been examined and accepted. Together with the gear box, main engine, control and monitoring units provided earlier also by CSIC 704 Institute, the institute has completed its first integrated system supply transaction. In March, CSIC 704 Institute won a contract to supply power systems for 1,500tonne a number of naval surveillance vessels. That contract, including the supply of power generators, distribution boards, power management systems, was the largest supply contract with the broadest scope CSIC 704 institute has won so far.

In February, the General Office of State Council issued "Opinion on Strengthening Diesels Industry Energy Conservation and Emissions Reduction" and proposed that China should promote the application of advanced technologies and equipment in marine medium-speed engines, such as electronic fuel injection (EFI) systems, intelligent control technology, high pressure ratio turbochargers, diesel/natural gas dual-fuel internal combustion engines and flue gas recycling technology.

As China's engine manufacturers continue their R&D efforts, it is expected that more and more Chinese-built vessels will be equipped with engines made in China. *NA*

Eniram powers up efficiencies

Finnish-based dynamic trim assistant and data analysis specialist has remodelled its data capturing to be able offer customers more energy and cost saving solutions

Analytics is the new buzz word for today's modern world, where meaningful patterns in data can be gathered and used to describe, predict, and improve business performance. Analytics relies on the simultaneous application of statistics, computer programming and operations research to quantify performance.

Eniram has released two more software solutions its Engine Load Assistant (ELA) and the Optimum Speed Assistant (OSA) that will analyse data gathered from the ships to give options on how the vessel can run more efficiently. Both systems use the same core data collection platform as Eniram's original product, its Dynamic Trim Assistant (DTA).

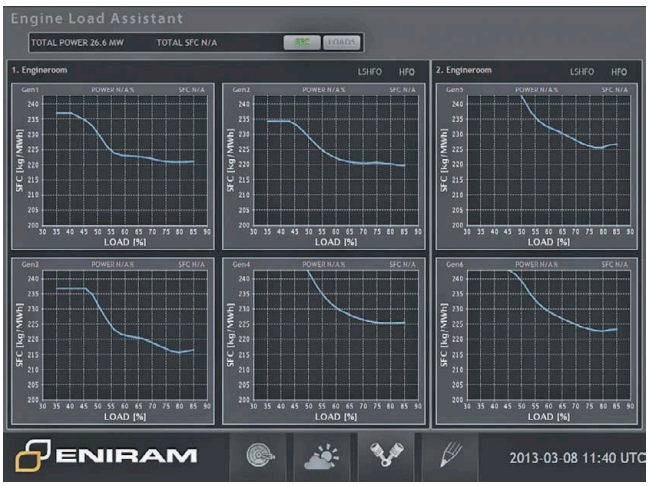
"With the DTA we needed to model all the effects on a ship, such as waves, wind, etc. From this we developed a stack of technology, so we started to ask ourselves can we use this model for something else", says Pyry Åvist, product marketing director, Eniram.

Åvist notes that the first thing that came to mind was speed analysis. The data that Eniram collected from vessels could be used to calculate the speed of a vessel and at what points that it was losing efficiency due to its speed. The OSA that Eniram has developed allows vessels to attain the best levels of fuel and speed efficiency as possible, by supporting efficient speed management while taking into account the dynamic changes in weather and ocean currents.

The application automatically receives route information from radar, GPS or ECDIS. The crew selects the target waypoint (such as the location where the pilot will arrive) and the desired arrival time. The system calculates an optimum RPM profile to reach the waypoint 'just-In-time' with the least amount of fuel consumption possible.

The system collects real-time data that measures a range of operational and environmental factors impacting a vessel's performance and the amount of fuel required. Key data considerations include:

- Estimated Time of Arrival (ETA)
- Weather forecast, including wind and wave, etc.
- Expected and actual sea currents
- Seabed profile (to minimise squatting)
- Propulsion plant efficiency in various loads
- Hydro- and aerodynamic performance of the vessel
- ECA zones & different fuel types
- Engine running and start-up costs
- Speed restriction areas.



The engine load management along with the optimum speed assistant software will help vessels become more fuel efficient

Applying a combination of statistical modelling, forecast data and real-time data monitoring of prevailing conditions, OSA delivers speed-setting guidance to help the crew maintain a steady and most economical speed during the voyage. The benefits of using the system are that it will help reduce NOx, SOx and CO_2 and will reduce fuel costs by 3-5%, claims Eniram.

"For this software you need to understand the power plant and how it works. Also, there is the different fuel price range and whether you are sailing in an emission control area (ECA) or non-ECA to be able to get optimal RPM", says Åvist.

The other new offering made by Eniram is its ELA which gives the crew real-time insight into how the engines are performing and the amount of fuel being used. This information is then presented as fuel efficiency curves, one for each engine.

The efficiency of an engine is the ratio of the engine's power output to the fuel consumed by the power plant; this indicator is called SFOC (Specific fuel oil consumption). High engine efficiency is imperative to achieve low SFOC and the potential cost savings. In a multi-engine room environment, using ELA to monitor the load of each engine enables load balancing decisions to reduce fuel consumption. For example when a low power output is required, one engine could be shut off leaving two engines to run on full load, where they are most efficient, and significant fuel savings can be made when not using the third engine.

The rate of fuel consumption and any observed changes to consumption levels over time can be important indicators of engine wear and changes in vessel conditions.

Åvist points out that Eniram is aiming for larger commercial vessels, beyond the cruise market with its technology. He claims that up to 7% savings can be gained from these technologies, but also adds a cautionary note that you can never get the full potential of savings due to operational problems that can cause delays. He notes that 2-3% in savings is more likely. With these two extra solutions, Eniram is looking to provide customers with a complete performance package. *NA*

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CSR-H; where are we and where are we going?

Soon after the publication of Common Structural Rules (CSR) in April 2006, the International Association of Classification Societies (IACS) identified the need for their harmonisation. Philippe Baumans, director of Development Department, Bureau Veritas reports

Due to time constraints it was not possible to harmonise the CSR in 2006 and that meant that different methodologies were used for tankers and bulkers, involving how to treat FE analysis and buckling for example. Industry complained to IACS that the two CSRs were not harmonised.

IACS took the decision to keep the CSRs as they were, to use them for one or two years and to start harmonisation based on the feedback gained from the original rules.

In 2007 IACS set up a Project Management team to manage the harmonisation and develop one set of rules, CSR-H. I was one of the two people on that team. We were tasked to deliver:

- A Rule text, made of a part common to the two ship types and a part specific to each ship type
- Technical backgrounds.

The scope of application of the Harmonised Common Structural Rules (CSR-H) remains the same as those for CSR for oil tankers (length > 150m with double bottom and double sides) and for CSR for bulk carriers - length > 90m, ship generally constructed with single deck, double bottom, hopper side tanks and topside tanks and with single or double side skin construction in cargo area and intended primarily to carry dry cargoes in bulk, including hybrid arrangement ships.

Project teams addressed the following areas:

- Loads
- Buckling
- FE analysis
- Corrosion
- Welding
- Ship in service
- Fatigue
- Prescriptive for the Principles and details

Philippe Baumans,director of Development Department, Bureau Veritas Bureau Veritas points the way forward for CSR-H

- Prescriptive for the local scantlings
- Consequence assessment.

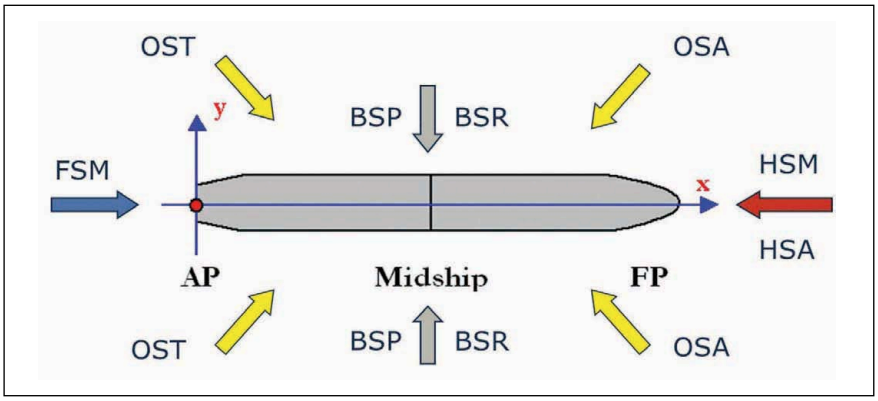
IACS decided that the CSR-H should be in conformity with the IMO Guidelines on Goal Based Standards (GBS). A specific group was created to check the CSR-H is in compliance with the IMO requirements. An external group from the industry was also created. This External Advisory Group (EAG) was made of 10 members belonging to the following associations:

- BIMCO
- CANSI (China Association of the Naional Shipbuilding Industry)
- ICS (International Chamber of Shipping, 3 members)
- INTERCARGO (2 members)
- KOSHIPA (Korean Shipbuilders Association)
- OCIMF (Oil Companies International Marine Forum)
- SAJ (The Shipbuilders' Association of Japan)

Loads

The first issue to solve in such a project is to be sure we start with the same kind of loads. The project team reanalysed the scatter diagram of the North Atlantic and came to the conclusion that at this level of knowledge the IACS Recommendation No. 34 is still valid and applicable. Using FE complete ship models, the project

Figure 1: Equivalent Design Waves (EDW) for extreme loads



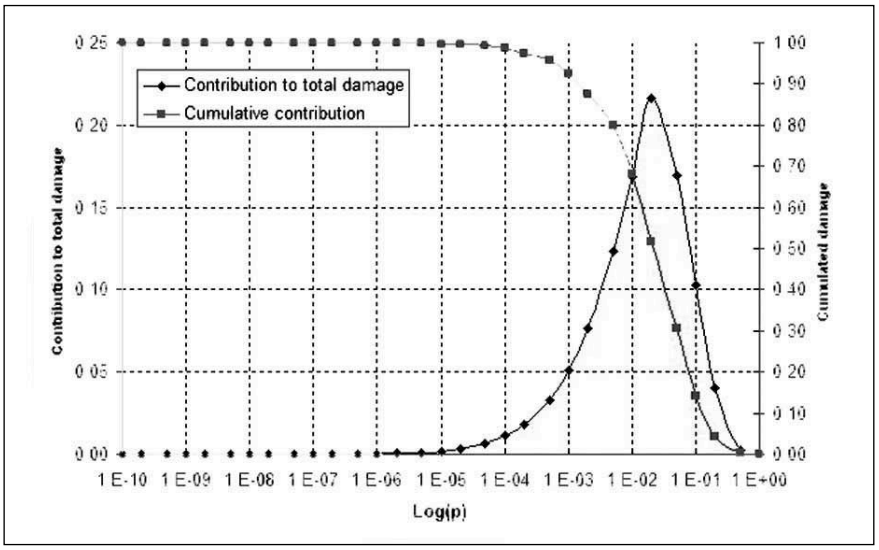


Figure 2: Contribution to fatigue damage

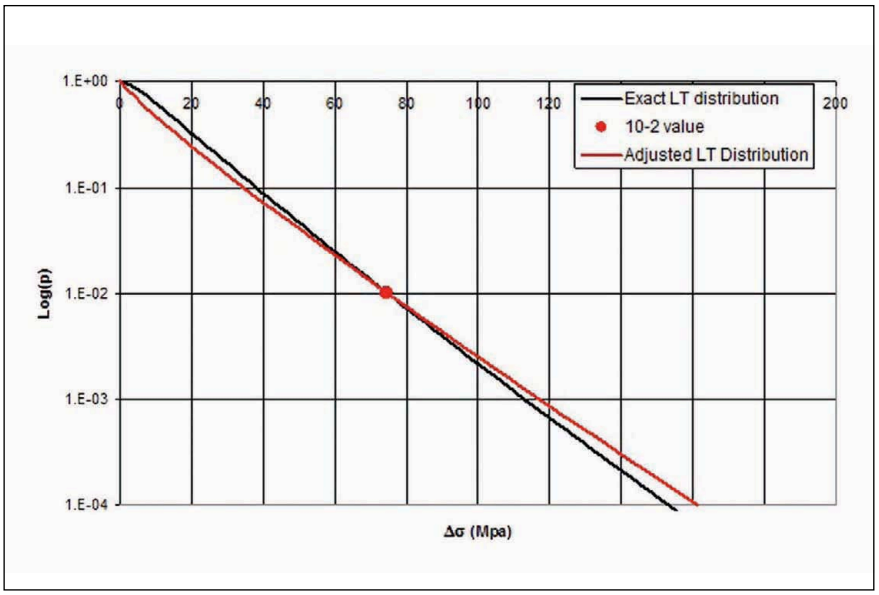


Figure 3: Long term distribution of stress

team analysed the ship responses to the extreme hydrodynamic long term loads, i.e. corresponding to a probability of exceeding 10-8 or to about 25 years, and defined 38 Equivalent Design Waves (EDW) maximising different effects. The question was to select among them the necessary EDWs giving the same responses to the ship as the hydrodynamic calculations.

The predominant EDW which are critical for the yielding, buckling and ultimate strength assessments of structural members of bulk carriers and double hull oil tankers can be represented by a few specific regular waves. Furthermore, the predominant EDWs, shown in Figure 1, can be identified with good accuracy using response functions of the following predominant load components without using stress response functions:

- Maximises vertical wave bending moment amidships (EDW "HSM"; head sea).
- Maximises vertical acceleration at fore perpendicular in head sea (EDW "HSA"; head sea).
- Maximises vertical wave bending moment amidships (EDW "FSM"; following sea).
- Maximises rolling motion (EDW "BSR"; beam sea).
- Maximises hydrodynamic pressure at the waterline amidships (EDW "BSP; beam sea).
- Maximises torsional moment at 0.25L with respect to the bottom centreline (EDW "OST"; oblique sea).
- Maximises pitching acceleration (EDW "OSA"; oblique sea).

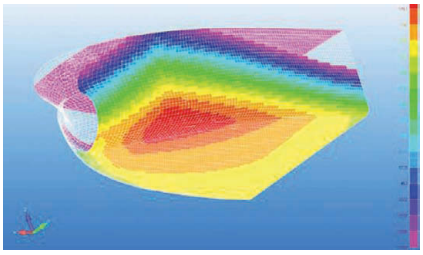
For the strength assessments with yielding and buckling failure modes, the maximum stress is only interesting at the probability level corresponding to the design load scenario evaluated, i.e. 10-8. For fatigue, however, we are interested in the accumulation of damage caused by different stresses ranges, in other words, in long term distribution of stress ranges. In order to define this distribution, the state of art is to assume a two-parameter Weibull distribution: a scaling factor, i.e. reference stress range, and a shape parameter. Finally, for the calculation of the fatigue damage, the total number of cycles for the design life of the ship is necessary as well. The project team has demonstrated that the stresses around the probability of exceedance of 10-2 have the maximum contribution to the fatigue damage (See Figure 2). So this 10-2 probability was selected to define the reference stress in order to minimise the errors on the long term distribution of stresses estimated (See Figure 3).

The procedure as defined for the extreme loads was applied also for the determination of the EDW for the fatigue loads. Five governing cases were obtained: two symmetrical load cases (HSM and FSM), two asymmetrical load cases (BSR and BSP) and one oblique case (OST).

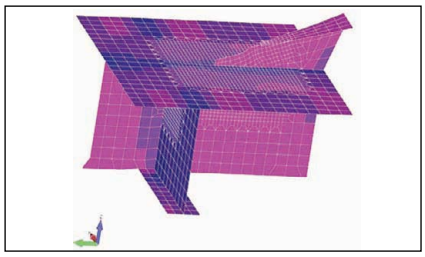
Buckling

A big issue was to solve for the buckling assessment of the FE analysis. Two different methods were in use, a closed form method for the CSR for bulk carriers and non-linear buckling capacity software for the CSR oil tankers.

The buckling project team made a comparison between the two methods and the results of a non-linear finite analysis programme. One hundred and forty four stiffened panels made of different plate thicknesses, stiffened with flat bars, bulbous bars, angle bars and tee bars of



Shell stress analysis using FE analysis



Finite Element analysis showing detail in fine mesh

several scantlings were tested for load cases corresponding to compression of the plate panel edges, shear and/or pressure. Although the closed form method and the non-linear buckling capacity software provided similar results which were close to those obtained from the non-linear finite analysis programme, IACS decided to keep only the closed form method after some improvements.

The buckling tool box as it has been implemented in the Rules provides requirements for plate panels, stiffeners and primary supporting members concerning the slenderness and the buckling capacity. The tool box is used either for the prescriptive approach of a 2D local section or for the verification of results of three cargo hold FE analysis.

Some specificity has been considered for the behaviour of elements of an FE model. The behaviour differs for stiffened or unstiffened panels and depends on the capacity of their edges to be deformed in their own plane further to the application of the loads (i.e. the long edges of a double bottom girder not fitted below a longitudinal bulkhead) or to remain straight, as it is the case for the double bottom girder beneath the longitudinal bulkhead. According to this behaviour called the pull-in effect, a method A or a method B is to be used. A particular case is applied to the side shell of the single side skin bulk carrier mainly due to the boundary conditions applicable to the corresponding plate panels.

FE analysis

At first, the FE project team identified the differences between the tanker and the bulker approach in the CSR Finite Element methodology. They found that the model extent (3 cargo hold model) and its location in way of the midship were identical but the type of FE calculation method (direct or superimposition method), the boundary conditions, the balancing method and the permissible stresses were different. In addition a challenge was to correctly consider the warping effect of the bulk carriers subject to torsional effect.

The FE group selected the direct method and addressed the boundary conditions allowing the effect of the warping behaviour of the three cargo hold model. The results of a full ship model of bulk carrier match quite well with the ones of the three cargo hold model. Based on Industry previous requests the scope of application of the FE assessment was extended over the cargo region inclusive of the transition areas in the engine room and in the forward part.

A larger amount of work was the selection of the governing dynamic load cases according to the EDW defined by the Load project team, for the FE models in the midship area, for the aftmost cargo hold, for the foremost cargo hold and in between, i.e. outside amidships. This work was performed for the different ship types, the different cargo arrangement (tankers) and the different loading capacities (bulkers) using the buckling and yielding failure modes.

In addition to the coarse mesh analysis, a list of structural details was requested to be checked in fine mesh (50 by 50mm). In order to save working time, a "screening" method was implemented. The principle is to estimate in advance the stress concentration factor in yielding some details and to apply it to the coarse mesh results modelled with an S by S meshing pattern, S being the spacing between stiffeners.

Fatigue

Between the several possible reference stresses used for fatigue calculations, such as nominal, hot spot or notch stresses, the Fatigue project team selected the hot spot approach and the corresponding S-N curve with two slopes. The details considered for the fatigue assessment are either welded structural details or non-welded free edge such as a hatch corner of the bulk carrier. The fatigue calculation is applied for ships of over 150m in length.

The fatigue damage is calculated according to the Miner-Palmgren summation for all relevant loading conditions for the predominant dynamic load case. The stress ranges used in this criterion come from the long term histogram established from the reference stress defined at 10-2 probability level and the two parameter Weibull distribution function.

Different correction factors are applied: the mean stress effect to account the fact that the detail under investigation can be partially in compression, the thickness effect to account the fatigue behaviour of details designed with thicker plates, the warping effect for accounting the additional stresses applied to the deck stiffeners located next to the hatch corner of a bulker and the material strength.

At an earlier stage in a ship project, the end connection details of the longitudinal stiffeners passing through transverse primary supporting members or transverse bulkhead can be assessed in fatigue with the simplified approach. For other details listed in the Rules such as the bilge hopper knuckle connection, the connections of transverse bulkhead lower stools to the inner bottom plating, the cruciform connections of the side stringers or the deck plating in way of the hatch corners for example, the fatigue assessment is made using the hot spot stress from a very fine mesh analysis. Examples of detail design standard having shown good performance for fatigue are provided in the Rules. When the structural details are built according

to those design standards the fatigue calculation may be not requested by the Society.

Goal Based Standards

In May 2010, IMO adopted Goal-Base Standards to enter into force on 1st July 2016. IACS has put the CSR-H into compliance with the IMO Guidelines.

The Harmonisation project has required a large amount of work by highly skilled engineers of all IACS members to improve calculation methods and the structural verification approach.

It was necessary to measure the impact on these Harmonised Rules compared to the current CSRs. A special project team, called Consequence Assessment project team, was created to apply the CSR-H Rules on CSR compliant ships. Comparisons were made between the CSR and CSR-H request as well as between the CSR design and the CSR-H requests.

The enormous work is performed and updated at each issue of the Rules and it may be understood that for each Rule release, the software engineers need some time to issue the updated version of their software. This explains why there is a gap between the release of a Rule version and the Consequence Assessment corresponding to this Rule version.

The software development is the neck of the bottle and some classification societies are faster than others in their development.

The way forward

Today we still have some major milestones in the project. From July to December 2012 the industry was invited to review the first external release of the harmonised Rules. Last April, IACS issued the second external release for the Rules and the technical background. The second public review started on 1 April and will end on 31 August this year. During this period, industry comments are invited to be submitted to IACS and the project teams who will answer them. This will be followed by a period for the Rule update if needed.

On 1 November the last external draft release will be submitted to the class society Technical Committees. And in December 2013 the IACS Council must adopt the last Rule version, as amended further to the technical committee comments.

In parallel, IACS will loop into the Rule requirements based on the consequence assessment results issued by the CA Project Team.

On 31st December 2013 IACS members must submit to IMO their package and request the IMO audit according to the GBS requirements.

As far as Bureau Veritas is concerned, we consider it is important that the plan approval surveyors are well aware of the evolution and philosophy of the Rule drafts. Extensive training has kept our people up to date, as has investment in modifying our software. This is a big project for IACS and Bureau Veritas is happy to be at the heart of it. *NA*

Testing times

Len Swantek, director of Global Regulatory Compliance at Victaulic, outlines the regulatory type approval process for its pipe-joining products from design to post production, and explains the importance of maintaining high standards for quality and performance

For shipbuilders, type approval by the International Association of Classification Societies (IACS) is a key criterion in the selection and installation of products and systems for a wide range of shipboard applications. For manufacturers, meeting IACS standards is a major factor in the design, development and qualification of products to ensure the highest levels of safety, fitness for purpose and reliability.

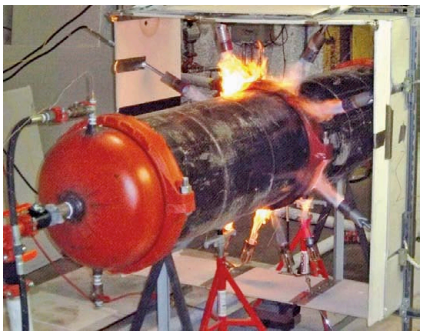
Of all the market segments where Victaulic mechanical pipe joining products are used, the maritime industry is one of the most strictly regulated. Product testing carried out here is among the most challenging and diverse of all markets and industries – and rightly so. Products need to withstand a wide range of forces and loading conditions generated by vibration, temperature fluctuations, pressure surges, movement resulting from wave motion, not to mention exposure to weather and seawater that pose a constant threat for corrosion of metallic components. If a piping system were to be compromised at sea, it could have serious consequences for the vessel and its occupants.

For the maritime market, there are 13 classification agencies within the IACS organisation. Victaulic submits new products for design assessment, performance evaluation and type approval to a large number of these. IACS sets the minimum standard for all of the classification agencies. However, each individual agency may add requirements as needed for a particular system or on a discretionary basis for a critical application. This leads to some variation between agencies, resulting in further challenges during the testing and qualification process.

Regulation is a highly complex and costly business for most manufacturers. With a large range of grooved-end couplings, fittings and valves used in many on-board piping systems, Victaulic has a number of different products in the approval cycle at any given time. Each model and size is subjected to a number of both short- and long-term tests. Additionally, each manufacturing location will be subjected to periodic audits to ensure product quality and consistency is being maintained. Both processes - product testing and factory production control auditing - require considerable management and coordination to meet both agency requirements and customer / market demands.

Len Swantek, director at Victaulic emphasises the need for a workable type approval system

DNV carried out fire tests to test components in extreme conditions



Getting the groundwork right

Before the company can even begin the regulatory process to obtain type approval, a tremendous amount of time is allocated to research and development and internal testing. The product development process can easily extend over 18 months and entails design, modelling, construction and internal testing of prototypes. The process also includes making adjustments as needed to ensure the product can meet both agency requirements and the established ratings for temperature, pressure, end load, vibration, fire exposure and other possible service conditions. Concurrent with this is process development to assure consistency of global manufacturing to a wide range of international standards.

Once a new design is finalised and the manufacturing controls are worked out, rigorous internal pre-qualification testing is carried out in preparation for regulatory type approval testing requirements. Victaulic replicates known scenarios that could be encountered, applying process technology and even re-engineering products as necessary.

External assessment

Once the product passes internal testing, the external assessment process is initiated by sending a comprehensive data "package" to each agency that will issue its own unique type approval certification. The information includes application forms, detailed product specifications, manufacturing drawings and any performance data already validated by one of the IACS members within the past five years. The specific approval objectives along with a test proposal outline is also provided for the agencies' technical review. The components of this package must be accurate and complete, and can take weeks and often several months to compile.

Mechanical bolted couplings are generally understood by the agencies to have pressure holding capabilities that meet or exceed

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Pulling out all the stops

Prompt action from Victaulic and DNV led to a 600mm coupling being approved for use in fire protection, ballast systems and sea and fresh water cooling applications, after completing fire endurance testing. Approval resulted from what is believed to be the first successful fire endurance test of a large-diameter mechanical joint.

A shipyard working on the construction of piping systems under DNV surveillance wanted to use the Victaulic W77 flexible coupling to avoid welding on the vessel it was building. To do so it needed to satisfy the International Association of Classification Society (IACS) fire resistance standards through DNV. An additional requirement since the product had achieved DNV type approval certification some years prior.

With just three months lead time, Victaulic had to act quickly yet still go through all the essential detailed steps: apply for approval, provide a technical data package, explain its test methodology and arrange for a DNV surveyor to observe and record the fire testing.

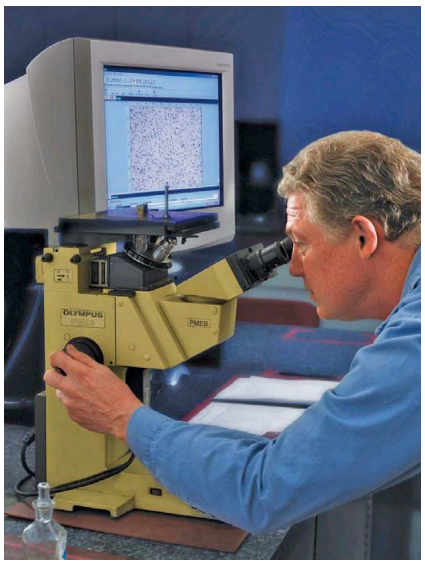
The procedure was led by Victaulic's Product Certification Coordinator, with assistance from the company's Fire Safety Engineering group. To expose the test coupling to an external temperature of at least 800° C (1,472° F), the team constructed a large test assembly, with a special radial burner arrangement that would engulf the coupling with direct fire from six, uniformly spaced, burners.

The liquid propane gas fuel supply provided more than sufficient British Thermal Units (BTU's) to meet and exceed the required test conditions. Once stabilisation of external and internal temperatures was achieved direct fire exposure was maintained for 30 minutes. What made the test particularly challenging was the need to circulate hot water through the assembly at an inlet temperature of 80°C and a maximum outlet temperature of 85°C. The EPDM gasket was exposed to dry intense heat on its outer surface (coupling side) without the benefit of a cooling effect on its wetted surface (pipe side).

Other than some discoloration of the coupling's exterior factory paint coating, the coupling was unaffected by the intense heat at each burner location. Upon successful completion of the 30-minute flame exposure, the test assembly was hydrostatically pressurised to 1.5 times the joint rating, in this case 30bar (435psi), and checked for signs of leakage. The coupling successfully completed this testing, with leak-tight performance evident throughout the test period. While experiencing one of the most severe temperature conditions for an elastomeric seal, the EPDM gasket met all criteria for approval certification.

All test conditions and parameters were confirmed to be in accordance with the DNV Rules for the Classification of Ships, which further stipulates a fire endurance test in accordance with ISO-19921:2005---Ships and Marine Technology – Fire Resistance of Metallic Pipe Components with Resilient and Elastomeric Seals – Test Methods.

From planning and preparation to execution and evaluation, the entire process was completed within three months – demonstrating how a proactive approach to product testing can meet both agency requirements and market demand.



Rigorous internal testing is carried out before the regulatory process begins

the performance ratings of flanged, welded or threaded systems. This makes the review process a bit easier, yet each system application being applied for will be examined individually, along with any restrictions imposed by the IACS standards. The agency engineering review process is typically completed within a four- to six-month period for any given product category.

Following the design review and acceptance of the proposed test plan, the agency will advise the scope of testing required and the number of test samples that will need to be prepared. At this point, the difficult and time-consuming task begins to coordinate all of the required testing with a number of independent laboratories which are accredited by one or more of the participating IACS members.

To facilitate performance testing, product samples, pipes of various specifications and other related equipment must be sent to the appropriate test facilities. This is another time-critical operation – as any delays on the part of the manufacturer could result in a lost position in the testing laboratory's queue. At this stage, documentation must already be available in multiple languages for examiners to assemble equipment themselves, based on an assumed level of skill equal to that of the end user. The testing process can take many months and occasionally more than a year to complete.

The approval authorities are also concerned with the manufacturing and

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Mechanical pipe-joining products have a wide range of maritime applications

It is more than a 'slip-on joint': maritime users recognise the strength, durability and long-term serviceability of mechanical couplings

assembly locations of specific finished parts or sub-assemblies. Victaulic manufactures in multiple locations globally to optimise supply chain logistics. However, this can greatly increase costs, as each location must be certified and audited, both for the initial type approval certification as well as part of an ongoing surveillance programme required to maintain valid certification. In the event of a non-conformance at this late stage a manufacturer risks losing valuable time to market.

Audit management

Audit management is the final phase in the regulatory cycle. This phase starts when a Type Approval is officially released and only ends when the product is no longer produced. Through various follow-up procedures and factory production control audits, manufacturing procedures are re-evaluated annually on a set schedule that coincides with the term of validity for each type approval certificate.

Auditing is important, since the governing IACS standards are updated on a periodic schedule. These standards are likely to become ever more stringent following the analysis of forensic evidence from equipment failures, accidents and other events at sea. Manufacturers may have little advance notice of pending revisions to these standards and often need to act quickly to keep pace and maintain a competitive position in the market.

Therefore, a clear understanding of the most up-to-date requirements is vital to the successful completion of the approval cycle and managing time to market.

On occasions approval may be required for a specific application which is not part of the normal type approval scheme. In one such example a customer wanted to use Victaulic products on hydraulic winching equipment, which required an extremely heavy load capability to lift chains and anchors up from the ocean bed at a depth of 200m.

In a case like this, a manufacturer must refer to the approving authority to identify specific tests that would be needed to gain special approval – either as an addition to the existing certificate or through a separate approval. The administration, time and cost implications of such programmes are evident.

Ultimately, product conformity brings peace of mind to ship builders, operators and owners. The safety and reliability of vessels at sea depends on it. *NA*

Manufacturing locations are subjected to audits to ensure product quality and consistency

New HQ means KR is sitting pretty

Dr. Chon Young-kee was elected to the position of chairman & CEO at an extraordinary meeting of the Korean Register of Shipping (KR). *The Naval Architect* asks what the future holds for the class society?

Expansion and diversification appear to be the watch words of the new KR chairman. Dr Chon expects to expand the class society's activities into the offshore market, on-shore power and the new and renewable energy industries.

The company continues to expand, having exceeded 60 million GT on its books for the first time in its history and with the opening of its new Busan head office the company believe it is well placed to take advantage of the massive shipbuilding expertise and capacity that surrounds it.

"Our ultimate aim is to become a "total engineering service provider". To achieve this we will make some changes to our organisational structure in order to create synergies with our sister companies - iKR (Innovation KR) and KRE (KR Engineering Co. Ltd)," he explains.

Key to the aim of being a total engineering service provider is the need to develop environmentally friendly technology for KR's clients through related R&D projects, says Dr Chon.

"The focus of our work is to reduce greenhouse gases and limit the impact that vessels, plant and machinery have on the natural environment. We have a team of experts working on a range of projects including analysis, economic feasibility and technical validity of a variety of green ship technologies. These include energy efficiency, GHG reduction, fuel alternatives, new hull form and renewables," he says.

Dr Chon says that the banking crisis is having a "perverse" effect on ship design

Included in this R&D strategy is the "search for new vessels power sources" which further includes fuel-cell technology.

According to Dr Chon the banking crisis is having a perverse effect on ship design, he explains that: "With ship lending now scarce, owners are seeking designs that are optimised to save fuel and, thus, more kind to the environment. Less money is not, in our experience, encouraging owners or yards to cut costs and compromise on safety, but it is favouring eco-ships – which is a good thing." *NA*

RS to class worlds largest icebreaker

Baltisky shipyard, Russia is currently constructing an icebreaker, which will be classed by the Russian Maritime Register of Shipping (RS) and is set to be the largest icebreaker on the market

The icebreaker, project 22220, has a 20% increase in power performance, which is delivered by a 60MW nuclear power plant onboard. RS has noted that compared to plants operated by the nuclear fleet, the main equipment life between repair yards has been increased by 70%, the plant mass has been reduced and the core refuelling period for the fuel unit increased to seven years. The vessel will be fitted with a RITM-200 nuclear reactor supplied by Rosatom's Nizhniy Novgorod-based OKBM Afrikantov, Russia.

RS classes latest icebreaker design

The vessel's initial design was carried out by the CDB Aisberg, Russia back in 2009. One of the specifications of the design is that that it has an increased displacement allowing the vessel to operate at two working drafts both in deepwater areas of the Arctic (Barents, Pechora and Kara Seas) and in the estuaries of Siberian rivers such as the Yensei and Ob.

The vessel will be 170m in length and 34m wide and have a displacement of 33,540tonnes and will be class to RS notations KM ✪ Icebreaker9 [2] AUT2-ICS OMBO EPP. Construction of the vessel started in April and is scheduled to be finished in 2017. *NA*

Canal plus

Some analysts believe the new Panama Canal locks will have little impact on bulk carrier design, others believe it will it be a 'game changer' for naval architects. Mike King reports

The shipping industry has long viewed the technical limitations of the Panama Canal as a critical arbiter of design. Hence, of course, the entire fleet of ships which can fit through the canal at its current limits are called 'Panamax' vessels and those that are too large are called 'post-Panamax'.

New, larger Panama Canal locks are due to open in 2014 and be fully operational a year later, although many now expect the initial opening date to slip to mid-2015. But, it remains unclear whether the new dimensions will join the lexicon of naval architecture in quite the same way as the original 'Panamax' limitations, at least where bulk carriers are concerned.

The new locks will allow a third lane of traffic and longer, wider ships of up 49m beam to transit the Panama Canal than is currently possible. This will enable bulk carriers of up to 180,000dwt carrying 140,000tonnes of cargo to transit with a draft limit of 50 feet, compared to current capacity for bulk carriers of some 85,000dwt.

The Panama Canal Authority itself concedes that at present only about 30% of total oceangoing transits of the canal by all vessel types are by ships designed to 'Panamax' specifications.

One bulk shipping analyst believes there has been little reason operationally over the last decade to build most bulk carriers to suit the Panama Canal's present limitations, and he claims that will remain the case even after the bigger locks are opened. Peter Malpas, global research director of Braemar Seascope, said that in the year 2000 about 15% of 'Panamax' bulk shipping trade transited the canal. By 2008 the figure was nearer 5% as the traditional cargoes hauled in Panamax vessels were instead transferred to the new breed of supramaxes.

Indeed, research by Braemar found that only about 5% of the existing active bulk carrier Panamax fleet has ever used the canal. "Most bulk trades have no reason to use the canal," said Malpas. "Shippers have always wanted reliable and low cost freight for commodities. They've never wanted cargoes that quickly; they want them cheaply. So there has never been that much appetite for the canal."

Panamax bulk carriers were originally designed to maximise the grain trade from the US Gulf to Japan via the canal. Early designs began in the range of 58,000-60,000dwt. "As the Panamax design became ever bigger, its draft became deeper, as designs kept the 225m LOA and beam 32.26m," said Malpas. "This eventually made them inefficient trading via the Panama Canal as the gap between a Panama cargo and the full cargo capacity of modern vessels became ever wider."

Malpas believes that very few of the bulk carriers being built by shipowners and yards to fit the dimensions of an expanded Panama Canal will actually use the new locks. Over the last six years a new breed of intermediate sized vessels between a standard capesize and Panamax vessel – often referred to as post-Panamax or mini-cape vessels – have been designed which possess a wider beam than the current Panama Canal and a dwt range between 85,000dwt and 120,000dwt. These vessels will fit through the new locks, but according to Malpas, they have quite properly been designed for the routes on which they are most likely to be used, for example, from Australia to shallow draft ports in Japan. That is, on routes and to ports where they plug the capacity gap between traditional Panamax and Capesize size vessels.

"It's a common misconception that this growing global fleet of post-panamax vessels in the 85,000dwt-100,000dwt range and mini capes of 100,000-120,000dwt were

Only about 5% of the existing bulk fleet has ever used the canal, owners want cheap transit rather than fast transits for their bulk cargoes. *Nordic Wuhan* is the first of the latest generation of seahorse bulkers and sports a Mewis Duct

designed with the new locks in mind," he said.

"Both designs fit the new locks, and there is a degree of comfort in this for owners in building canal-suitable vessels, but that's coincidental.

Malpas said most of the post-panamax and mini-cape ships currently in operation were built because, as capesize ships increased in size and Panamax vessels maxed out on beam at 32.2m, a capacity gap in the bulk carrier fleet developed. "That created a vacuum, especially in draft or storage restricted ports in places like Japan," he explained.

"These ships were built for trades such coal from Australia into Asia, not for the new Panama Canal locks.

"I can see some coal and grains from the US Gulf using the canal depending on the tolls, but not that much more.

"Established large bulk carrier trades such as coal imports to India or South American grain exports are also unlikely to use the canal, having a range of other route options.

"The level of tolls is likely to be the swing factor for bulkers and will be adjusted depending on demand for canal transit by container ships.

However, Konstantinos Chatzitolios, Bureau Veritas product manager for dry cargo and container ships, takes a decidedly different view of the impact the new locks will have on ship designs. He argues that designers only deviate from current lock restrictions when there are clear operating gains from doing so. The same logic, he insists, will be applied to the new lock's dimension.

So, for example, he believes that whatever the ship type no sensible ship owner will order a vessel of around 70,000dwt with a breadth of over 32.2m – that is, so it fits through the existing Panama Canal - unless such a design resulted in indisputable operational gains such as fuel savings. "For bulk carriers, this is not the case and the breadth restriction is kept even if the ship owner does not intend to operate his ship via the Panama Canal," he said. "The ability to pass the canal adds a good selling point to the ship as an asset in case of a re-sale.

"The best argument for this is the number of Panamax ships currently in the global orderbook. 738 ships out of a total of 1,974 bulk carriers [figures taken from the third quarter of 2012] of over 10,000dwt are Panamax bulk carriers. In other words, the displacement hull of the bulk carrier will not gain from an increase in breadth to such an extent that it leads to wider beam designs. If that was the case we would have seen such designs long ago."

But, he argues, for container ships, the 32.2m limitations of the current canal locks pose a limiting constraint which has a considerable effect compared to the optimum design. Such ships need to be faster than bulkers, they have a slender form and a further restriction in breadth presents an additional challenge to the stability of the ship, which means the use of ballast to compensate for their reduced righting moment which adds to deadweight and reduces payload.

"The new Panama Canal locks will be able to facilitate ships with a maximum breadth of 49m and give designers the freedom to increase the breadth of the Post Panamax container ships, thereby improving their stability," he explained.

"Less ballast is now needed in order to obtain the necessary stability. Less ballast gives a better payload to deadweight ratio and lighter ship scantlings. Also, less ballast coating is used which reduces the capital cost of construction together with the lighter scantlings."

And, he also notes, the breadth of a container ship is directly linked to the rows of boxes that can fit on deck so that for every 2.5m increase in breadth, an additional row of container ships can usually be fitted onboard more or less.

"Bulk carriers will benefit from the new canal locks only by the fact that larger ships will be able to navigate from Panama," he said. "A larger ship is by default more efficient and environmentally friendly in terms of payload transferred for the same distance. A clear trend for mini capes points to this direction.

"All in all, the new Panama Canal locks will be a game changer and will affect a wide range of designs and ships.

"The maximum dimensions of the new Panama Canal locks - the 366m length, the 49m breadth and the 15m draft - will be once more taught in the Universities of Naval Architecture and memorised by naval architects as was the case for the relevant dimensions of the first canal locks." *NA*

The Panama Canal's Miraflores Locks, looking northwards, towards the Miraflores Lake. In the foreground, on the end of the approach wall, a large illuminated arrow can be seen; this rotates to indicate to ships which chamber they are to enter

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Taking the rough with the smooth

At the RINA paints and coatings conference the opening address, '*A note on current anti-fouling issues*', was made by Dr Bob Townsin and presented by Darren Broderick of Safinah Ltd. An edited version follows

The introduction of organo – metallic biocides into anti-fouling coatings, and, in particular, ablative tri–butyl tin coatings (SPC TBT), led to the expectation that fouling was 'yesterday's problem'. Paint roughness then became the predominant cause of surface resistance penalties. The total banning of TBT has led to the use of less virulent biocides, or, non–biocidal, low surface energy, foul release coatings and even hard coatings for underwater brush cleaning. These current panaceas for hull fouling seem variously less effective as anti-fouling measures than SPC TBT.

In addition to the economic penalties arising from a fouled hull, some ports and harbour authorities are becoming concerned about sedimentary problems and invasive species, the latter of which are thought to arise from inadequate fouling prevention, in addition to the notorious invasion from ballast water discharge. The underwater cleaning of a fouled hull is clearly a relevant issue.

All these circumstances have led to marine coatings manufacturers, and their ship-owning customers, to pay increasing attention to the effectiveness of the various anti-fouling products on offer. The high cost of recoating and any subsequent economic fouling penalties, have led some paint companies to attempt to devise guarantees of effectiveness of their products, based upon some measures of speed/power performance of a ship from out-docking after anti-fouling coating. Such in-service data collection and analysis is notoriously difficult.

Before discussing the assessment of fouling penalties further, it is worth considering the period after out-docking and before slime and fouling first appear, the surface roughness of the newly applied anti-fouling coating is then the issue. The recent addition of a new source of supply of hull roughness analysers is to be welcomed in this connection.

Hull roughness pre-fouling

Some authorities are proposing and developing standardised procedures for the measurement of hull roughness. Such a standard procedure would be welcome to ensure the consistency and reliability upon which subsequent roughness penalty calculations depend. (The paper itself contains a procedure for the guidance of roughness surveyors, in an Appendix.)

It is worth remembering that hull roughness measurement were originally designed at about the time of the Lucy Ashton experiments, to improve the accuracy of speed/power acceptance trials for a newbuild. No fouling or sliming would be present. The accuracy of these trials will be referred to later as a benchmark for in-service data collection.

Fouling assessment

Diver reported, visual descriptions of fouling, is a way to assess its severity. Fouling type (eg. brown or green weed, shell), can be reported, together with an estimate of percentage underwater area covered. Such reports could be more rigorous. Recorded locations related to severity observed, would help, but the missing parameter is a measure of local fouling intensity. Without such a measure and its hull distribution, there will be no method to calculate the fouling resistance penalty, as can be done with roughness.

One possibility would be the use by divers of a comparator, rather reminiscent of the Rubert propeller roughness comparator gauge, but using a visual rather than a tactile comparison. Some authorities (eg NACE international corrosion society), are considering the visual assessment and reporting of fouling, leading to a standard procedure, such a standard might then allow an empirical relationship to be developed between observed fouling intensity and its resultant added drag. Such a development would require the testing of variously fouled planes in a model basin.

Until such developments are forthcoming it remains, in particular cases, to correlate reported fouling, based upon a standard, with a direct measure of the consequent in-service speed/power fouling penalty.

Fouling penalties

The purpose of in-service speed/power monitoring should not merely be an indication of speed loss or power increase due to fouling, but should provide the ship operator with sufficient and reliable data to enable decisions to be made about possible palliative measures. The shipowner needs to decide when, where and what to do about fouling: eg. underwater cleaning? Dry-docking? Or soldier on until the next scheduled docking?

It follows that in-service performance data collection should be as near as possible to the reliability and accuracy of acceptance trial data. Today, a number of organisations offer speed/power performance monitoring systems: some are designed to validate paint company guarantees, some are shipowner generated, some claim independence. Monitoring systems on offer vary in their approach: for example, some collect all data and correct, inter alia, for weather effects, some use only fair weather data, some conduct 'mini trials'. Not surprisingly, authorities are seeking a transparent, standardised method for data collection and analysis. Such an outcome would be welcome to those grappling with this difficult techno-economic problem. (An insight into the difficulties and accuracy of data collection at sea may be had from an article in the April 2013 *The Naval Architect* – '*Speed and power, trials and tribulations*' – *Henk van den Boom et al.*)

Hull cleaning

A competitive market is being developed for in-water, hull cleaning. For many years, diving companies have offered underwater

repair and maintenance services: propeller polishing and hull cleaning with diver controlled brush carts, are examples. Currently, much effort is being directed to the development of robotic, adherent, hull cleaning vehicles, eg. HullBUG and the HISMAR Project.

Although robotic cleaners may be regarded as autonomous, they will still require an umbilical connection, probably for power and possibly for video signals or other facilities, depending upon the design. The robotic vehicle may not be able to negotiate the curvature of the bilge and bilge keels are likely to be insuperable obstacles for the umbilical, so that cleaning the undersides presents problems. Robotic cleaners are, therefore, able to clear slime and weed from the sides, but less able to tackle any shell on the bottom. The development of these robots may be regarded as providing an important but palliative solution to the inter-docking fouling problem.

An issue with any form of underwater cleaning is whether the cleaning will damage the antifouling coating. High pressure water jetting is advocated as less damaging than rotating brushes. Another idea is to hard coat the hull and brush frequently to mitigate fouling.

Whilst antifouling coatings remain less than totally effective, remotely controlled or autonomous, robotic, underwater cleaners are likely to become more common. As already recognised, their development will require means to collect their debris, in order to satisfy harbour authorities.

Conclusions

It should not be difficult to agree a standard for roughness surveys and analysis.

An interim standard for the visual assessment of fouling and its distribution would be welcome, but work should proceed to develop a measurement system for fouling which could then be related to added resistance.

To develop a standard system for in-service speed/power monitoring would require a study of the many current practices to identify their strengths and shortcomings. It may be that more than one standard type would result.

Whilst awaiting possible anti-fouling developments by chemists and marine biologists, it seems likely that underwater cleaning technology will develop. *NA*

Hempel gets slick with SilicOne

Danish paints and coatings manufacture Hempel has launched its latest coating that it says will keep yachts cleaner for longer

SilicOne is a biocide free fouling release paint that was unveiled earlier this year. The paint is based on silicone and hydrogel technology, which will give better fouling control over organisms such as seaweed and barnacles, highlights the company.

"Development of the paint was prompted by two factors; First of all the increasing pressure from authorities to limit the use of antifouling products containing biocides, secondly Hempel had a SiliCone product developed for commercial shipping, and the technology was deemed to be ready for transferal into the yacht market", says Thomas Christian Olsen, European yacht marketing manager, Hempel.

The hydrogel creates an invisible barrier between the hull's surface and the water. Fouling organisms perceive the hull as a liquid and so do not attach themselves to the surface with a great force, making the process of cleaning them off easier.

"In the first year the Silic One system will be costly compared to conventional antifouling due to the fact that a new coat of primer, as well as tiecoat is needed. The second year and onwards the SilicOne system will be less costly due to the fact that a single coat of SilicOne is all that is needed compared to conventional antifouling paints where two coats every year are recommended", notes Olsen.

Hempel launches new coating for yachts

The original product was developed for commercial shipping, which has been vigorously tested in towing tanks as well as in full scale tests, says the company.

After the technology was adapted for the yacht market, full scale tests on yachts have been conducted over the last several years. Based on real life testing on yachts in the Mediterranean as well as northern European and Scandinavian waters the product has been improved, and then retested to check if desired results have been achieved. Due to the technology involved it is expected that this paint will be able to save owners time and money. But, the manufacturer cannot accurately predict how much of either will be saved. *NA*

A new standard in marine coatings testing

Do ballast water treatments cause long or short term damage to the coatings applied to the ballast tanks of ships? A new specification created for NACE should arm the industry with the information it needs. John Carter, strategic account director for Exova's General Engineering Division explains further

Shipowners, yard operators and insurers are asking what effect treated ballast water could have on coatings and corrosion rates. There is evidence available from testing on the effect of some of the typical chemicals used by ballast water treatment manufacturers, but there is still information missing relating to the systems in practice.

Ballast water is carried by ships to keep them upright during loading and offloading operations, to provide balance and stability during sailing. It is usually held in dedicated tanks located around cargo holds and near the bow and stern of a ship. Coatings in these tanks must be able to cope with long term exposure to a range of water types and temperatures.

There are two IMO regulations in conflict when dealing with ballast water coatings. The first is the Performance Standard for Protective Coatings (PSPC), part of the SOLAS regulations II-1/3-2, which has the objective of providing a coating with a 15 year life span.

It is mandatory that newbuild ballast tanks comply with the PSPC including that they be corrosion resistant to natural sea water with high, low and cycling temperatures. Application, maintenance and repair must be documented in detail.

The second is the Ballast Water Management Convention, which dictates that water treatment to remove alien organisms which may enter the tanks from the water in which a ship finds itself. These organisms, are then released sometimes many thousands of miles from the original place, 'invading,' waters in other parts of the world.

This is where the issue arises. Current technologies to treat ballast water and prevent these invasions often make use of active substances, which may have an adverse effect on the ballast tank coatings, piping systems and anodes themselves. However, there is no independent test method to prove either way.

For PSPC ballast tank coatings in service, the coatings must be removed and reapplied if they are found to be poor on inspection. This re-application is expensive for many reasons, such as dry docking, re-blasting, off hire time and cost of re-coating itself.

John Carter, strategic account director for Exova's General Engineering Division explains the link between ballast tank coatings and ballast water treatment systems

Examining the issue

Within the Ballast Water Management Convention, initially there was no requirement to demonstrate the impact of treated water on ballast tank coatings. However, the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP), requested research to be done to evaluate the effect on corrosion.

There was a very limited method put forward naming a number of specifications, but with no details on method or assessments. NACE International – the Corrosion Society, which acts as a Non-Governmental Organisation to the IMO – quickly highlighted the need to develop a suitable test method, which harmonised the testing requirements of PSPC at the request of GESAMP.

NACE formed a taskforce, led by myself as chairman, to develop a task method in conjunction with all interested parties from the industry, taking in shipowners, shipyards, ballast water treatment manufacturers, paint manufacturers and test institutes.

This expert working group has been studying 'testing of coating suitability, anode consumption, and corrosion evaluation with use of ballast water treatment systems' to develop a suitable new specification for testing.

The facts

What is the impact of ballast water treatment on ballast tank coatings through-life?

- Ballast water treatment alters the composition of the water and environment within the tank
- It depends on the treatment system used
- It depends on the type of water used for ballast
- The oxidising species created to remove organisms are of concern for coatings and corrosion.

What are the treatment systems?

- Physical treatment including ultrasound and deoxygenating
- Ultra-violet light (UV) and UV plus oxidation
- Chemical treatment – non-oxidising including menadione and coagulant, and oxidising, including ozone and chlorine.

What is the possible cause? The treatments creating oxidising species which are of concern for coatings and corrosion:

- Electrochlorination: OCI-, OBr-, O_3, OOH-
- Ozone: O_3, OBr-
- Chemical addition: ClO_2
- UV: free radicals eg. Cl_2-, Br_2-, ClBr-, CO_3-

Some systems remove oxygen through nitrogen saturation and venture oxygen stripping. Anaerobic corrosion can also be an issue due to sulphur reducing bacteria.

Testing

With accurate test data, ballast water treatment systems (BWTS) can demonstrate compatibility with coatings and impact on corrosion of exposed steel. Owners, yards and paint suppliers can make informed decisions as to which BWTS and coating system to use.

Insurance cover can then be provided based on comparison with untreated sea water and fresh water.

But, how do we get the data? We have proposed that the industry should evaluate exposure to treated ballast water vs. untreated, using methods that already exist for: sample preparation (PSPC), coating evaluation (ISO 4628), corrosion (ASTM G31) assessments and ballast tank exposure simulation (PSPC).

NACE Standard TM 0112-2012

NACE Standard TM 0112-2012 Test will be to determine the potential corrosion effects of ballast water treatment systems on ballast tanks.

The new standard is based on the existing PSPC and BSEN ISO2812-2 methods for coated materials. For uncoated materials, this standard is based on ASTMG31.

Current testing in accordance with the PSPC uses seawater as the test medium. However, a large number of international ports have fresh water, including Hamburg, Germany, the US Mississippi River and Shenzhen in China.

Therefore, testing in fresh water should be considered as an alternative that could be performed at the request of the company or shipbuilder, when knowledge of the proposed working conditions of the vessel are known.

For coated steel, with generic coatings including hydrocarbon resin modified epoxy, unmodified epoxy, aluminium pigmented unmodified epoxy and coal tar, the coatings systems shall be subjected to cyclic exposure to both treated and untreated seawater and fresh water.

If the BWTS-treated water does not affect the coating, the assessments following the exposure should show negligible differences within the working tolerances of the test method.

For testing of *uncoated* materials, the test uses a modified version of ASTM G31 to compare weight loss or gain, and surface effects on a set of standard test coupons, using both treated and untreated seawater/freshwater.

Test coupons shall be made of each of the following materials: stainless steel, copper, brass and fluoroelastomer, which will be tested over a period of 182 days at 35°C.

The new specification was issued as a test standard by NACE in June 2012 and is being used as the basis of the test protocol to be adopted by IMO during MEPC 65 in May 2013. *NA*

Smooth sailing from Sigma

PPG has launched its latest Sigma coating that will meet the needs of the 'entry-level' market

Sigma Syladvance 700 is based on patented Silyl acrylate polymer technology which has self-smoothing properties for better fouling protection. Self-smoothing is the key property delivered by the silyl acrylate binder and reduces hull roughness in time and therefore hull friction which reduces fuel consumption, claims the company.

"SYLADVANCE 700 has a different active package and therefore has a more restricted scope in terms of ship speed and activity when compared to our premium SYLADVANCE 800 product", notes Sijmen Visser.

Based on the Sigma Syladvance 800 premium, Syladvance 700 extends the Sigma portfolio to cater for the 'entry-level' market. "Antifouling coatings have evolved over the past decade, in some part due to technological advances, but also because of the very real need for vessel operators to reduce fuel costs whilst continuing to optimise voyage efficiency", explains Visser. "PPG's Sigma Syladvance 700 product can be specified for drydock maintenance and repair projects. Its predictable polishing rate allows us to provide a tailor-made solution for each vessel's profile and sailing pattern. As a result, owners and operators can confidently expect to achieve a controlled performance for up to 60 months." *NA*

Sigma launches latest coating

Smoothing the way into the future

International Paint's global marketing director, Paul Robbins reflects on the need for shipping to continue to innovate in all aspects of the industry, highlighting the company's latest developments

The long-term trajectory for bunker prices, notwithstanding minor fluctuations, is rising. Significantly so, following the implementation of the 2015 emission control area (ECA) regulation, which will see vessels only burning fuel with a sulphur content of 0.1% or below in designated areas, where the premium for distillates could be as high as US$400 per tonne above the heavy fuel oil price.

As prices increase, shipowners, operators and charterers will continue to negotiate charter party agreements around who exactly should shoulder the fuel burden. Although a recent development, owners and operators have expressed significant interest in choosing vessels that will save fuel costs and emit less carbon and other greenhouse gases (GHGs). We are already seeing premiums being charged for energy and eco-efficient ships in the newbuild market, demonstrating the market need for these vessels. It should not be long before these financial incentives filter down to the charter market where organisations that can offer the more fuel-efficient vessels will unquestionably have a competitive market edge.

Drivers of innovation

A number of forces are converging - including competition, technological advancements and regulatory concerns - which have the potential to drive innovation, bringing sustainable growth to the shipping industry and delivering a shot in the arm for global trade.

Utilising simple, proven and readily available technology can help vessel owners achieve improved fuel-efficiency now.

International Paint's marine biologists, hydrodynamicists and polymer scientists, have worked closely with highly respected global academic institutions, to pioneer the development of coatings technologies that address industry issues. For hull performance that means achieving predictability in fouling control, not seen since the days of tributyltin and helping solve the thorny issue of slime fouling on ships hulls. Two innovative new technologies from international points, will improve vessel-operating performance, increase efficiency and help control fuel costs and emissions.

Paul Robbins, global marketing director, International Paint looks at the future of paints and coating

One of the latest products Intercept 8000 LPP is a biocidal antifouling based on advanced patented LUBYON polymer technology, Intercept 8000 LPP, provides customers with consistent and predictable linear polishing according to the manufacturers. This will enable shipowners and operators to plan and budget effectively throughout the drydock cycle of the vessel.

The coating has a superhydrophilic surface meaning that when it is immersed, the seawater has a lubricating effect, resulting in less friction, lower fuel consumption and associated emissions savings of 5% compared with typical controlled-depletion polymer antifoulings.

The coating surface also swells on contact with seawater, helping to smooth out imperfections and potentially further reducing drag. The biocide release rate is largely unaffected by seawater temperature, meaning the coating has trading flexibility and can operate across global routes and through all seasons.

Further significant investment in research and development has also enabled us to bring to market Intersleek 1100SR a biocide-free, fluoropolymer technology that tackles the 'slime challenge'. Slime, a complex, varied and dynamic organism begins to colonise surfaces as soon as they enter the water, has been proven to have an adverse effect on the efficiency of all vessel types. According to a recent formula produced by Michael P Schultz, professor in the department of naval architecture and ocean engineering at the US Naval Academy, at today's bunker prices, the effects of slime potentially cost the shipping industry 44million extra tonnes of bunker fuel, which equates to US$28.6 billion in additional fuel costs and an extra 134 million tonnes of CO_2 emissions every year.

Intersleek 1100SR, contains a patented fluoropolymer that has been developed by enhancing the slime-resistant polymer groups used in earlier generations of Intersleek technology. It is designed for all commercial vessels, even those operating a slow or ultra-slow steaming strategy. The Fluoropolymer Foul Release technology produces fuel savings and associated emissions reduction of up to 9%. To date over 1600 vessels are now using Intersleek technology, as a means of improving both operational and environmental efficiencies.

To measure is to know

For the market to fully realise the fuel and emissions reductions benefits of new and emerging technologies, it will need to fully trust the fundamental data and analysis behind performance and efficiency claims; this lack of independence is an issue which has been lobbied against the clean technology sector for some time now.

To measure is to know, and real-time, automated performance monitoring has the potential to enable the crew onboard a vessel

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to take necessary actions early in response to changing conditions that can adversely affect fuel consumption. From an onshore management perspective, real-time, onboard performance monitoring enables long-term trends to be measured and analysed to enable faster and more precise decision making within the long-term goal of developing more efficient fleet operations.

However, as things stand, most ship owners and operators have limited information about the fuel consumption and the energy efficiency of their fleet. For most, performance analysis is carried out manually with operators comparing energy performance reports and audits in isolation against budget estimates.

Many shipowners and operators today have to rely on inadequate information and data to justify investments. If they don't have confidence in the fuel and emissions reduction figures that are claimed, the take up of these technologies and further innovation will be stifled and customers will spend more on fuel than they need to at a time when budgets are being significantly stretched and charterers increasingly scrutinising their fuel spend. With current technology and innovation there is the scope for a meaningful framework and roadmap for calculating fuel consumption and a level playing field provided for all.

With hull coatings being the most widely used eco-efficient technology on the market, and as a leading global marine coatings supplier, International Paint has the opportunity, and responsibility to lead the way. However, it should not, and cannot be up to hull coatings companies to set the parameters and methodologies by which their products are measured; a principle that is relevant to all clean technology and their manufacturers.

The best and most appropriate thing we can do is let independent, third party expert fuel and emissions monitoring organisations develop a standard model that can be applied to measure fuel consumption and the savings available through technologies. Tapping into accurate, high-quality and high-frequency fuel consumption and vessel performance data, collected from ships' sensors monitoring engine torque, navigational systems and the speed log, throughout the service life of a vessel could become a fundamental way of improving operational efficiency of the global shipping fleet. Ensuring independence is critical and the most responsible and effective way to generate credibility and accurate eco-efficiency benefits for clean technology manufacturers, which will serve to build trust with customers and the wider shipping industry.

Accurate measurement can only serve to challenge coatings manufacturers to continue to develop technology to better serve future demands for greater efficiency within the industry. Technology providers for their part must seek to understand customers' needs and calibrate investment in research and development to stay ahead of the challenges that emerge. The current economic challenges and the realisation of multi-faceted regulation facing the industry are not the first time in shipping's long history that it has been faced with making hugely impactful decisions. As in the past, challenges should inspire innovation to create long-term sustainability. Investing in innovation now is most certainly the way ahead. *NA*

Jotun gets resilient

Jotun's latest coating SeaLion Resilient will give better hull protection with its new and improved technology

Jotun's SeaLion Resilient utilises epoxy-polysiloxane a compound of resins and hardeners that when combined with Jotun's fouling release coatings (FRC) will prevent the settling of organisms on the hull.

Joruum Sætnøe, product manager antifouling, Jotun explains: "The product is a combination of epoxy and FRC which gives a combination of properties not found in any other product on the market. SeaLion Resilient has fouling release properties and at the same time the coating is hard.

The coating has been specifically formulated for owners and managers seeking improved maintenance and docking efficiency. According to the company the properties of SeaLion Resilient significantly reduce the risk of mechanical damage and maintain hull condition throughout the service period. By simplifying maintenance and reducing the need for repair, SeaLion Resilient can contribute to a significant reduction in off-hire time and docking and labour costs, while keeping paint consumption to a minimum.

"We have tested the coating and found that it also has very beneficial anticorrosive (AC) properties. According to our test the SeaLion Resilient can substitute one layer of anticorrosion coating. This benefit can be exploited into an even simpler system (one layer less with AC), or the system has an improved anticorrosive protection compared to competitor systems", adds Sætnøe.

In addition to the coating features reducing mechanical damage, the coating is claimed to resist fouling and provides a smooth surface that decreases drag and hence reducing carbon emissions through fuel savings, claims the company. The coating requires only two coats and it is said to be easy to apply, cutting drydocking times, giving owners significant maintenance and repair savings.

Aimed at the cruise ship market, Sætnøe says: "We are confident that cruise ship owners will recognise the value of using a product that combines a glossy appearance with anti-abrasive qualities that effectively prevents most types of mechanical damage," she says. "And for owners operating Caribbean cruises, where warm and shallow waters contribute to rapid fouling, SeaLion Resilient helps reduce costs related to underwater cleaning and cuts the risk of transferring of invasive species to highly regulated areas." *NA*

Russia keeps its finger on the pulse

Sovcomflot invests in the LNG market with the expansion of its fleet of LNG/LPG carriers

The Russian Federation holds 21.4% of the world's proven natural gas reserves and accounts for 18.5% of total production according to the BP Statistical review of World Energy – June 2012 which excludes flared and recycled gas.

Backed by these significant gas resources, the development of LNG technologies is a key element of the Russian Federation's energy strategy for the period to 2020. Russia's first industrial LNG plant was launched on Sakhalin Island (The Sakhalin-2 Project) in February 2009. It enabled the commencement of gas exports to new markets in the Pacific, previously inaccessible to Russian companies. SCF Sovcomflot has since been mastering the technology of LNG seaborne transportation and currently has a fleet of six LNG carriers, with four more vessels on order and scheduled for delivery by the end of 2014.

Russia's shipbuilders are now seriously considering the possibility of building LNG tankers in Russia, which will be capable of operating in the harsh conditions of the Arctic and Far-Eastern seas. Already cooperation exists between Russian and international shipbuilders with the construction of LNG vessels.

Dmitry Rusanov Head of Gas at SCF highlights the LNG developments at Sovcomflot

SCF Sovcomflot – LNG/LPG vessels on order

Dmitry Rusanov, head of the Gas Division of SCF Sovcomflot says: "During 2011-2012 we expanded our shipbuilding programme, which for the moment consists of six cutting edge vessels, all of which are of a type highly demanded by the market. All gas-carriers on order are already employed with long time-charter agreements with the world majors - Gazprom, Shell and SIBUR. It's a good achievement for a relatively young, seven-year old, player in the demanding LNG market."

Velikiy Novgorod and *Pskov* are two technologically advanced Atlanticmax Ice2 (1C) class gas carriers, each with a cargo capacity of some 170,000m^3. The vessels are currently under construction at the STX Offshore & Shipbuilding yard in South Korea. They are being equipped with specialist features to enable them to work in low temperature conditions. Their design enables them to transport gas year-round from almost any LNG terminal in the world. The vessels will be engaged on long-term (15 years) time charter to Gazprom Global LNG and are scheduled for delivery in December 2013 (*Velikiy Novgorod*) and April 2014 (*Pskov*).

SCF Melampus and *SCF Mitre* are Atlanticmax 170,000m^3 LNG carriers of the same class as *Velikiy Novgorod* and *Pskov*, also currently under construction at STX Offshore & Shipbuilding in South Korea. Both vessels will operate under long-term (10 years) time charter to Shell International Trading and Shipping Company (STASCO), following the signing of an agreement between the parties in June 2012.

The vessels are being built with the participation of JSC United Shipbuilding Corporation (USC), Russia. The first tanker is due to be commissioned late 2014 and the second vessel in early 2015. The involvement in the project of Russian shipbuilders will facilitate the establishment of domestic production

	Vessel type	Name	Yard	DWT	Ice class	Delivery	Employment
1	LNG	Velikiy Novgorod	STX	94 700	Ice2	15.12.13	15Y TC / Gazprom
		Pskov					
2				94 700	Ice2	25.04.14	15Y TC / Gazprom
3		SCF Melampus		94 700	Ice2	24.08.14	10Y TC / Shell
4							
		SCF Mitre		94 700	Ice2	31.10.14	10Y TC / Shell
5	LPG	Sibur Voronezh	HMD	22 819	1B	16.07.13	10Y TC / SIBUR
6		Sibur Tobol		22 819	1B	23.09.13	10Y TC / SIBUR

LNG/LPG vessel deliveries for 2013/14

of sophisticated, higher value ships in Russia and will provide for the future specialised gas carrier needs of Russian oil & gas companies, for work on the continental shelf, in order to develop Arctic and Subarctic offshore fields. Shell will play an active role in the allocation of gas-carriers to serve Russian production, something which is covered by the agreement previously signed between Shell, SCF Sovcomflot and USC in 2011

SCF Sovcomflot has two ice class 1B LPG tankers of 20,600m^3 capacity (*Sibur Voronezh* and *Sibur Tobol*) under construction at the Hyundai Mipo Dockyard in South Korea. The vessels were designed with the participation of SCF specialists, in accordance with SIBUR's requirements and the latest technical advances.

The tankers will have a range of competitive advantages over other existing tonnage of their class. These ships are specially designed to be fitted with a ballast water management system – a compulsory prerequisite for vessels from the end of 2012. The structural design of the vessels includes a reinforced hull for year-round operations in the harsh climatic conditions of the North Atlantic.

Velikiy Novgorod is due for delivery at the end of the year

These robust vessels will have an active service life of 25 years, although this figure will significantly increase if they are used under normal climatic conditions. The design of these 1B ice class vessels (Ice3 in the Russian Maritime Register of Shipping) will allow them to operate effectively in the low temperatures of the Baltic Sea during their winter.

The vessels are being built under the supervision of two classification societies – Lloyd's Register and the Russian Maritime Register of Shipping. During vessel construction, Russian manufacturers will provide navigational equipment, components, machinery, spare parts and software development. The first ship is due to be completed in the second half of 2013.

In March 2012, the Group signed a long-term (10 years) time charter agreement with SIBUR, a leader in Russia's oil and chemical industry, for these two LPG tankers to perform regular year-round transportation. SIBUR plans to commence export deliveries of LPG during 2013, from its own terminal at the Baltic port of Ust-Luga in Russia. ***NA***

Super slick LNG carriers

Chugoku Marine Paints (CMP) brings forth its coating product suited to the Gas Carrier market

Launched back in 2011, CMP has highlighted that under further testing the Seaflo Neo product was shown to be effective for the gas carrier market, with potential fuel savings of 3-5%. Seaflo Neo SL is meeting the current high requirements/demands of discerning gas carrier owners/managers and operators transporting high value cargo, and is proving to be a competent alternative to the foul release coatings used on such vessels, says CMP.

The Seaflo Neo series has been extensively tested and benchmarked against Chugoku's portfolio of antifoulings and the CMP Bioclean low surface energy systems on the Double Cylinder Friction Resistance Equipment (DCFRE). This equipment was designed by The Tokyo University of Science with the National Maritime Research Institute and CMP is able to look at torque and coefficients of friction at speeds normal to ship operation.

With the DCFRE looking at cylindrical test pieces of over 20 times the size of a laboratory test piece, it is then able to provide information on the various shapes seen on the vessels hulls, which when analysed by 3D imaging can show the flow over the surfaces which by design have degrees of curvature.

The results from the DCFRE have shown significant advances in understanding the performance of conventional as well as high performance antifoulings as indicated earlier, but demonstrated how Seaflo Neo series can virtually match the low surface energy CMP Bioclean system in respect of low friction, the company highlights.

A real breakthrough From the Research, was due to the fact the DCFRE uses a torque measurement system which corresponds to the drag on the outer surface of the coated cylinder (which varies depending upon the surface topography arising from the natural surface arrived at from the coating's self-levelling characteristics, different number of coats and extent of overspray) it was possible to obtain coefficients of friction and to do so in sea water, hence enabling the use of Reynolds numbers including that of seawater to categorise and rank the antifoulings.

The friction increasing ratio (FIR) increased due to the peak and trough heights of the surface profile as well as the distance between the spacing between the profiles. From the FIR and consideration of the hull form of various vessel types it is possible to predict further fuel savings. ***NA***

LR's Clean Sky thinking

A new LNG fuelled bulk carrier design developed by COSCO Shipyard Group, Golden Union and Lloyd's Register (LR) is set to help shipowners get beyond the concept stage for gas powered bulk carriers

Gas technology is needed more than ever as gas exploration, production and consumption all continue to grow. This activity is creating growing demand for gas infrastructure and the expertise to design, build and operate new assets in safety. Lloyd's Register has itself been looking at the potential for an LNG fuelled bulk carrier design.

The new 'Clean Sky' bulk carrier design, incorporating an LNG-as-fuel system, developed by COSCO, Golden Union and LR emerged out of a project started in June 2011 to investigate the potential to develop a commercially viable bulk carrier design based on an existing COSCO conventional design, but employing gas powered propulsion systems.

The 'Clean Sky' design builds in flexibility by enabling owners to choose dual, or tri-fuel engines able to burn, heavy fuel oil (HFO) or diesel, as well as LNG.

Nick Brown, Lloyd's Register's area general manager and marine manager, Greater China, says: "This news moves the industry far beyond the concept stage. A 'Clean Sky' ship could be built next year. We have addressed the technology issues; the approval in principle that we have issued comes after exhaustive risk investigations into the gas containment, bunkering systems and performance assessment."

LR's Clean Sky concept

Various containment systems and configurations were considered by the project team, but the final choice was for a single, 1,160m^3 type 'C' tank that sits aft on the port side (see accompanying images). LR notes that this type of tank was used based on the practicality of storage at this scale and also because of the cost effectiveness and practicality to fabricate and operate for the quantity of LNG required.

LR has developed specific risk methodology for shipowners and shipbuilders developing new ideas predicated on the use of hazard identification (HAZID) and hazard and operability (HAZOP) tools that have been applied to projects such as *Viking Grace*, which are a four stage process covering: a scoping exercise; concept assessment; a detailed synthesis of design solutions where needed; and a final assessment, which has also been used for this concept.

To date, LNG-as-fuel research, technology development and newbuilding activities have focused on specific niche sectors such as ferries, offshore vessels and short sea, or inland, trades.

With LNG not currently available in large volumes at most ports, specialist provision is required. Practically, then, LNG is currently most suitable for ferries and small vessels that trade between fixed points allowing operators to secure control of bunkering facilities. The small scale of these operations provides manageability and flexibility of bunker supply options. Short voyage length and regular port calls reduce the issue of the amount of space needed for bunker tanks (for the equivalent energy - as far more space is required for storage tanks)," notes Brown.

The additional space required for LNG tanks would not be a major concern in deep sea bulkers and tankers. But, in containerships substantial cargo space would be taken by LNG tanks. Although the regular trade to specific ports by containerships provides an aspect of similarity with ferries trading between fixed points. "For example, tank space issues aside, a large containership trading Europe-Asia could likely manage with LNG bunkering in two locations, one in Europe and one in Asia, such as might be available in the near future at Rotterdam and Singapore", LR points out.

The local drivers include government support, air emissions regulations and local availability of LNG. This is the case in Norway, for example, where short haul gas from the North Sea is available and fiscal support for LNG through the NOx Fund encourages use of LNG into sectors including offshore.

"Additionally, local air emission rules are a factor – LNG is a means of compliance with

TECHNICAL PARTICULARS

'Clean Sky' class design Kamsarmax bulk carrier

Length overall:	229.0m
Breadth:	32.26m
Depth:	20.25m
Draft, design:	12.20m
Draft, scantling:	14.50m
Deadweight:	81,000dwt
Engine:	MAN B&W 6S60ME C-8.2 – GI Tier II
Gas containment:	1 x 1,160m^3 'C' type tank
Speed:	14.10knots (excluding any Energy Saving Devices)

SECA requirements - as is societal support for clean gas and the perception that gas is better. A final factor is price", Brown says.

As the Clean Sky was based on an existing COSCO bulk carrier design there were specific challenges and considerations to be addressed. "The challenges are similar for tankers," Brown says. "Clearly there are benefits with using clean gas technology. The key issues now are commercial."

LNG presents different levels of risk to conventional fuel oils. The main issue addressed was the safe and practical location of the LNG bunker containment system – what type and number of tanks was a critical decision and once agreement was reached on ideal requirements ensuring a suitable location could be identified allowing for safety and operational bunkering requirements.

"We had two risk assessment workshops held in the shipyard, with involvements of experts and specialists in every discipline from shipowner, shipyard design department, engine maker, containment system maker, Lloyd's Register etc", Brown adds. The workshop was facilitated by LR's Risk Assessment Expert and concluded with a HAZOP/HAZID report summarising the comments from each expert.

The design is in principle the same as the predecessor COSCO design with several improvements to make the ship more efficient. Besides the major upgrade to dual fuelled propulsion systems, the deckhouse has been optimised with fairings to reduce wind resistance and there are also options to use a waste heat recovery system.

With existing bulker designs well proven in operations it made sense to marry the best of both worlds. The bunker storage system has relatively little impact on the vessel forward of the engine room bulkhead so little change was required in this respect.

The spread of LNG into deep sea mainstream trades will be a much longer process than into inland vessel and if it takes place will likely occur in the container trades, bulk or tank sectors when the operator knows LNG will be reasonably available – and, crucially, at what price. The Clean Sky design still enables HFO and MDO consumption providing the owner of such a ship with the flexibility of fuel choice.

Part of the infrastructure challenge is the need for ports and terminals that can carry out LNG bunkering operations in safety.

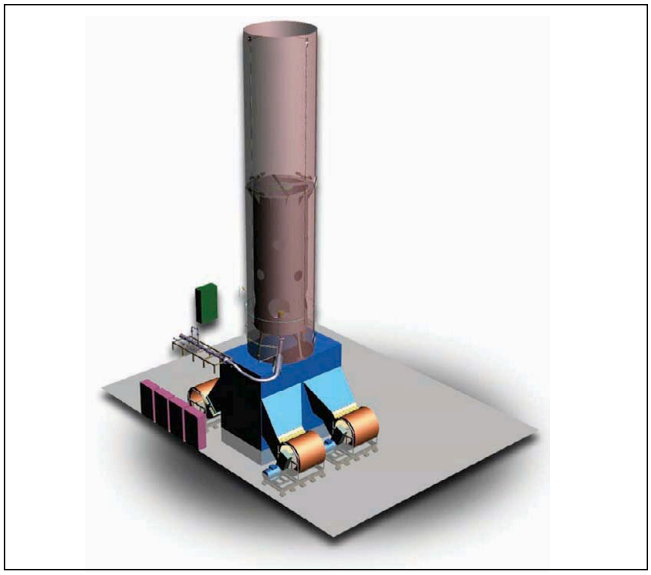
Brown concludes: "When we talk about gas, you need to look at the whole supply chain. LNG powered bulkers will need the appropriate support and port infrastructure – we can help with these issues. The big question now is whether investment will follow this technological understanding." *NA*

Alfa Laval enters the LNG market

Swedish-based Alfa Laval has entered the gas market with its recent acquisition of gas combustion technology company Snecma

The growing global demand for LNG has increased the demand for new LNG carriers. While steam propulsion has been the mainstay on LNG carriers for decades, rising fuel costs, environmental regulations and the continuing shortage of qualified seagoing engineers are forcing LNG shipowners to re-evaluate critical systems onboard.

Following Alfa Laval's recent acquisition of gas combustion technology from Snecma, part of the Safran Group, the company is set to provide owners of LNG carriers using dual-fuel diesel electric (DFDE) engines or low-speed diesel (LSD) engines with a compact gas combustion unit (GCU) that will lower installation costs and operating expenditures compared to comparable units, the company claims.



Alfa Laval gets in on the LNG scene with its latest GCU

The selection of DFDE or LSD engines as economical green alternatives to the traditional steam propulsion systems onboard is one example of fuel-saving and environmental conservation efforts undertaken by LNG shipowners. The use of these engines provides additional means with which to regulate LNG cargo tank pressure. In some cases, this is accomplished by re-liquefaction but, in most cases, gas combustion units have been introduced to burn boil-off gas safely.

According to industry estimates, approximately 85% of all LNG carriers using either two- or four-stroke dual fuel engines today have some type of combustion chamber to regulate the pressure in the cargo tanks by burning boil-off gas from the cargo tanks under safe and controlled conditions.

"The Alfa Laval GCU is not, by any means, new technology," admits René Fich Jespersen, Alfa Laval's general manager, new boiler & global sales support, marine & diesel division. The GCU unit has a simplified design overall with fewer parts than comparable systems, straightforward operation, compact design, no pilot fuel and a small carbon footprint.

"Only the burner, combustion chamber and monitoring sensors are in the stack of the Alfa Laval GCU," says Jespersen. "The design philosophy behind the Alfa Laval GCU essentially shares the same approach as that of our heat exchangers, separators and other equipment and solutions; in other words, we always put great effort into making designs simpler, more reliable, more economical and more efficient."

The GCU can handle capacities of 3, 4.5, 6 and 9t/h methane using either single or dual combustion chambers. In addition, the Alfa GCU is approved by major classification societies, including ABS, Bureau Veritas, DNV and Lloyd's Register.

Further cost savings in the unit have been made in that no oil is needed for ignition of the flame; and there is no perforated dome, refractory lining or expansion joints required. Because of the reduced parts this has enabled Alfa Laval to give the unit a smaller footprint;

"The beauty of the Alfa Laval GCU is that it is by far simpler and more reliable system than the other gas combustion units out there," says Jespersen. "It is easier for shipyards to install, allowing great flexibility to arrange the unit in the vessel, and it's easier for the crew to operate and maintain as well."

Alfa Laval says that unlike other gas combustion units, its GCU has low-noise fans that serve a dual purpose – both as combustion air fans as well as dilution air fans for exhaust gas. This effectively does away with the need for separate fans along with the associated ductwork, cabling and silencers.

Operating costs will be reduced because the GCU uses an electrical ignition device that enables fast start-up. This eliminates the requirement for a marine diesel oil (MDO) or distillate marine fuel (DMA) system with the requisite tank, pilot and oil lines. The self-purging burner will further reduce maintenance costs because it has no rotating parts. It also has the ability to handle combustion under conditions with high excess air and/or high inert gas content.

"We often see that new technology has a very slow adoption rate in our industry, which makes sense because safety is the number one concern. However, new technology should not be confused with 'unsafe'," Jespersen states. "Using electronic igniters on gas burners is often questioned, but Alfa Laval has been using these on our traditional gas burners for years – and these have a proven safety record. We see the same holding true for combustion and the GCU."

"Despite using a principle which differs from the traditional burners used on our boilers, for instance, the flame is maintained across variable loads," he adds. "Shipowners sometimes forget that the objective of the combustion on a GCU

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Second Announcement

The global maritime industry faces many challenges as it seeks to recover from the financial crisis which has affected all sectors of the industry, whilst at the same time, responding to the continuing demands of operators, regulators and society for greater efficiency, safety and the protection of the environment. This response will require innovative thinking from all sectors of the maritime industry, and particularly those involved in ship design and construction.

The third International Conference on Ship & Offshore Technology - India 2013 will take "Technological Innovation in Shipbuilding" as its theme, and will bring together members of the international maritime industry to present and discuss the latest developments in the ship design and construction process which will provide the improvements in productivity and cost-competitiveness necessary to respond to the demand for lower cost of ownership and greater environmental sensitivity. Papers are invited on the following topics:

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Harsh realities

Dear Sir

I felt that your editorial treatment of LR's Global Marine Trends to 2030 was a little harsh. As an experienced forecaster, the first thing that I teach masters students about the subject is that the only thing you can be certain about in relation to a forecast is that it will be wrong. This is the underlying truth about forecasts but it doesn't mean that forecasting is a waste of time. The issue is how wrong will it be and this depends on a wide range of factors, not least the length of the forecast period. Most commercially available forecasts address only the short term for this reason but there is a place for a more long term speculative look-ahead as presented by LR. Another good example is BP's "Energy Outlook 2030", which provides scenarios to guide thinking in the energy sectors. In the case of the Global Marine Trends document, Mr Sadler clearly states in the foreword: "We share this publicly to encourage a broader understanding of global issues that affect the marine industry and their impact in the form of scenarios, but not projections". As such I believe that it is a useful summary of the issues facing the industry and possible consequences, as intended by its authors.

Reading the editorial I was put in mind of a famous quotation from Henry Ford, who wrote in the Chicago Tribune on 25th May 1916 "History is more or less bunk". What Henry Ford certainly did not mean by this statement is that we cannot learn or use the lessons of the past. What he did mean is that you can not necessarily predict the future by extrapolation of the past. The example Henry Ford gave was that at the end of the 19th Century market research would have predicted the need for "a better horse" to improve transportation, because extrapolation could not predict the invention of the motor car (although scenario writing arguably could have done). Forecasting on the basis of extrapolation tends to lead to 'hockey-stick' shaped forecasts that are of limited use and certainly of questionable value beyond the short term. But, identification of the big issues and trends is undoubtedly of value and has a point.

"The example Henry Ford gave was that at the end of the 19th Century market research would have predicted the need for "a better horse" to improve transportation"

As part of research into shipbuilding competitiveness I have recently read a chapter titled "The future of the ship", from the book *Shipbuilding*, published by Hardy and Tyrrell in 1964. The chapter confidently asserts that the future was about the design of liner and tramp ships and that shipbuilders rarely get the opportunity to build more than eight sister ships because of the idiosyncratic nature of trades. The significant issues missed in these assertions were, rather obviously, the imminent invention of containerisation, the standardisation of vessels into series of hundreds and the pace of the shift from the economy and trade of empires to globalisation. But, the chapter also got much right, including the increasing size of vessels and the specialisation of dry and wet bulk carriers. A more recent example of a major shift that extrapolation certainly missed was the increasing importance of the transportation of LNG and the development of a fleet sector that twenty years ago was a small niche with little opportunity for shipbuilders or shipowners.

The Global Marine Trends publication I believe identifies major factors that are shaping our industry that we need to take into account. It will be interesting to look back on this in a decade's time to see what future changes will render it wrong and how much it got right.

Paul Stott
Senior Lecturer
School of Marine Science and Technology
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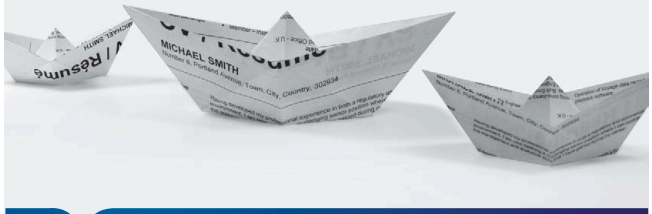

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