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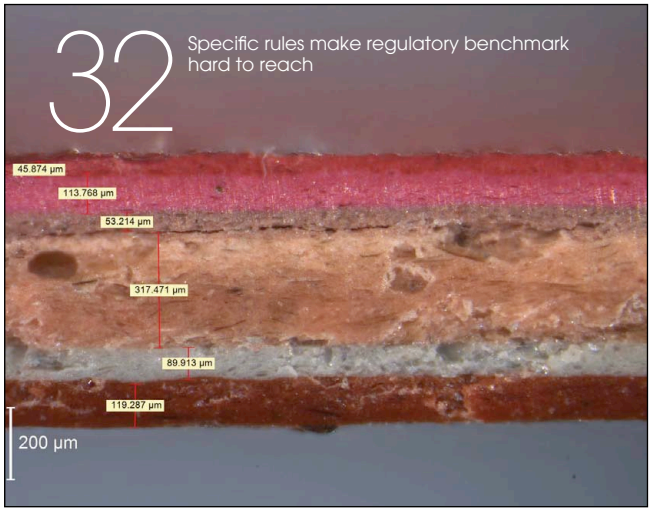

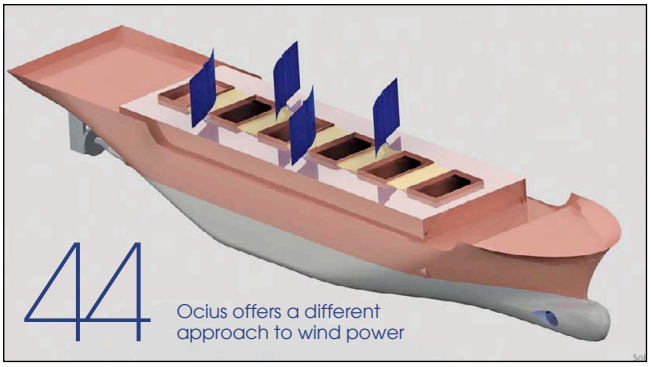

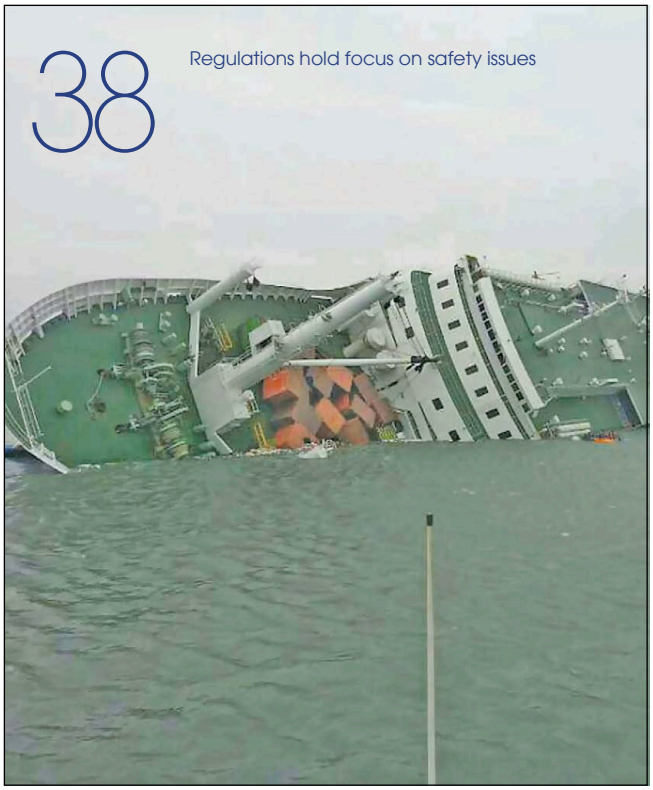

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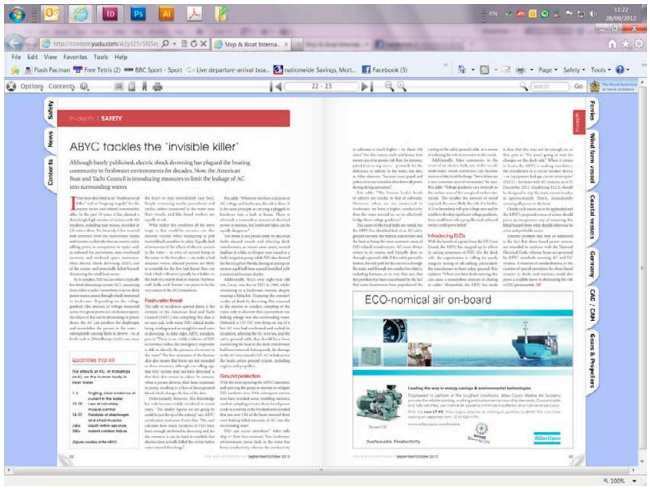

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Swanland loss raises LSA questions

Regulations governing the use of immersion suits with lifejackets are not as stringent as the rules for lifejackets alone says the MAIB

Amid the recriminations and anger at the loss of six seafarers following the cracking and subsequent sinking of the 2,000dwt *Swanland*, a Dutch built general cargo vessel operated by Torbulk Limited out of Grimsby was the issue surrounding life-saving appliances (LSA), which may also have contributed to the deaths of some of the crew.

Inquests into the deaths of six of the eight, Russian crew aboard *Swanland* in November 2011 began last month, but the report into the accident by the UK's Marine Accident Investigation Bureau (MAIB) was concluded last June. There is little to cheer the maritime industry in this report.

Maintenance failures, poor systems and a failure to recognise the heavy stresses on the structure of the vessel with its limestone cargo, loaded in a single pile in the central hold all contributed to the loss of the vessel according to the MAIB report.

However, included in this report were some trials on lifesaving equipment, which should be a cause for concern for those regulating the industry and for those building, monitoring and operating vessels.

Concerns were voiced by the Maritime and Coastguard Agency (MCA) regarding the compatibility of some immersion suits when used with lifejackets and the MAIB conducted 'wet trials' of the available immersion suits and life-jackets found on *Swanland*. Those trials "indicated that the combination [the Aquavel Mk2/UK life-jacket worn in conjunction with the Autoflug KS1 immersion suit] met the applicable performance requirements detailed in the LSA Code. In particular, the subject was able to turn from 'face-down' to 'face-up' within 5 seconds and the subject's mouth was kept over 120mm from the water."

Worryingly, however, the MAIB noted that the: "performance requirements for immersion suits, including immersion suits worn in conjunction with lifejackets are less onerous than the performance requirements for lifejackets alone with respect to self-righting. Whereas a lifejacket must be able to right a subject within five seconds, no corresponding requirement exists for immersion suit/lifejacket combinations. Therefore, any person wearing an immersion suit, or an immersion suit with a lifejacket, who is unconscious and 'face-down' in the water would possibly remain in that position and drown."

The Autoflug KS1 immersion suit and the lifejacket did not produce any self-righting moment, but with some effort the wearer did manage to turn face-up in the water within five seconds. And once face-up the subject's mouth was kept clear of the water by 135mm. The lifejacket remained in position and did not harm the subject, says the report.

In addition the MAIB point out that vessel abandonment rarely takes place in ideal conditions; it is often dark and stormy with the vessel rolling and pitching making even simple tasks far more complex.

In the trials on the different immersions suits and combinations of lifesaving equipment the MAIB found that manual dexterity was also a significant problem. Trials showed that picking up an 8mm pencil while wearing Parkway Imperial MQ254 and the Autoflug KS1 immersion suits, both of which were found aboard *Swanland*, was very difficult.

The MAIB says: "During the trials, the wearer experienced no difficulty with either of the suits when picking up and securing an 8mm rope around his waist with a double overhand knot.

However, he could only pick up an 8mm pencil from a flat surface by using two hands. Although this task became less difficult when a larger diameter pencil was used, two hands were still generally required. Once the pencil had been lifted from the flat surface, the wearer had no difficulty in writing his name."

Clearly the wearer may have some difficulty in performing finer movements such as using the search and rescue transponder while wearing the immersion suit.

"It is therefore critical to crew survival that, wherever possible, the LSA provided is easy to use and it functions as expected. It is clear from this accident [*Swanland*] that, in order to achieve these requirements, demonstrating compliance with SOLAS and the LSA Code alone is not always sufficient," says the MAIB.

In conclusion the MAIB says that a crew's difficulty in operating key safety equipment and the possible confusion caused by the use of two different types of immersion suit along with the differences in the performance requirements between lifejackets and immersion suits "make a case for the adoption of a goal-based standard for life-saving appliances compelling." *NA*

Safety

Union calls for action as *Swanland* inquest starts

The RMT seamen's union has called for swift action from the maritime industry as the inquest into the deaths of six Russian sailors lost in the 2011 sinking of the general cargo vessel *Swanland* opened in May.

Carrying limestone the vessel structure failed in an Irish Sea storm, off the coast of Gwynedd, Wales, in November 2011. Apart from the criticisms by the UK's Marine Accident Investigation Bureau (MAIB) of the maintenance of the vessel, in its investigation into the accident the report also highlights failures in safety equipment such as life vests.

View looking forward from wheelhouse on *Swanland*. annotated to show approximate area of initial damage

RMT Acting General Secretary Mick Cash said: "This rusting death trap of a vessel had been flagged out to the Cook Islands, although based in Grimsby and sailing out of Wales, and had been allowed to dodge the most basic of safety and maintenance regimes. The seafarers onboard never stood a chance. Their lives were lost in the name of profit and greed."

Criticisms of the Aquavel Mk 2/UK life jacket by the MAIB included the failure to prevent the male part of the securing buckle from sliding off the end of the securing strap and the fact that regulations around the use of life jackets used with immersion suits being "less onerous" for life jackets used alone.

CSR-H

BV aids rules application

Bureau Veritas (BV) says it has completed a series of "consequence assessments" with all the major Asian shipyards in an effort to expedite the implementation of the Harmonised Common Structural Rules (CSR-H).

The International Association of Classification Societies (IACS) agreed the harmonised rules in an effort to ensure that vessel designs meet minimum environmental and safety standards.

BV says: "The assessments of current yard designs were made using BV's fully adapted suites of user-friendly software for structural analysis, MARS2000 and VeriSTAR Hull."

Christophe Chauviere, head of the development department for Bureau Veritas' Marine and Offshore division, says as BV was involved in the development of the CSR-H it was able to readily adapt its software.

"As our software tools are not class-specific and many yards already use our tools we were able to help them check out their designs and adjust them to be ready for the entry into force on 1 July 2015," explained Chauviere.

MARS2000 is BV's tool for 2D prescriptive requirements assessment. It is free of charge and allows quick assessments of designs against the new harmonised rules. BV whas invested heavily in training across its network to ensure local offices can support yards wherever they are, says the company.

MARS 2000 delivers assessment of global yielding, ultimate and residual strength criteria, local scantling minimums including yielding and buckling of strakes, longitudinal and transverse stiffeners for cross sections and bulkheads, fatigue calculations of connections between longitudinal stiffeners and primary structure, assessment of the side frames and grab loads for bulk carriers and assessment of the primary supporting members ring for oil tankers.

VeriSTAR Hull is the BV's three dimensional analysis tool which uses finite element calculations. The software is conforms with the latest version of CSR-H including new requirements concerning buckling, aft most - foremost cargo hold assessment and fatigue check.

LNG power

Arctech and ABB break the ice

Designed by Arctech Helsinki Shipyard the Finnish Transport Agency's latest icebreaker will be furnished with a 6MW Azipod unit at the bow and two stern mounted 6.5MW units designed and built by ABB.

Set to be delivered in 2016 the vessel, which is designed for Baltic Sea operations will have a dual fuel power plant and is claimed to be the first icebreaker to operate on LNG as a fuel.

The Azipod propulsion system was developed in close cooperation between ABB and the Helsinki

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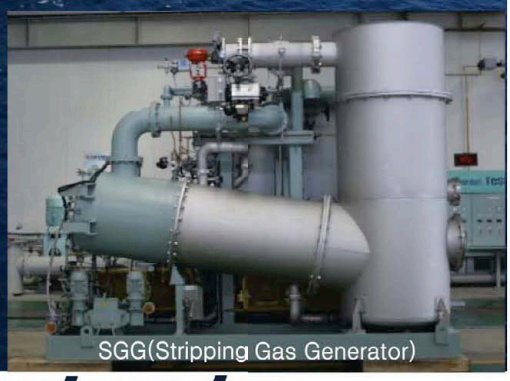

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Azipod technology has been selected for use on the Finnish Transport Agency's dual fuel icebreaker currently under construction at the Arctech Helsinki Shipyard

shipyard combining the two companies of electro-technical expertise with the shipbuilding experience of the yard.

The €123 million (US$168.5 million) icebreaker, part funded by the EU, ordered by the FTA will feature the industry's most advanced technology and it has been designed for operations in the most demanding icebreaking conditions in the Baltic Sea.

The icebreaker will be able to perform oil spill response operations and emergency towing under demanding conditions at open sea both in winter and summer, and will therefore operate all year round to ensure safe seaborne transports in the Baltic Sea. The icebreaker will be powered by both diesel and LNG.

Air lubrication

New ID for DK

As its air lubrication technology development approaches its latest commercial phase, DK Group has announced that the company and its product will be re-branded.

The company is now known as Silverstream Technologies (Silverstream), while the air lubrication system is now known as the Silverstream Air Lubrication Technology (SALT).

SALT reduces friction between the water and the vessel's hull, reducing both fuel and associated emissions by up to 10%, says the company. It is the only proven air lubrication technology that can be installed on newbuild vessels, as well as being retrofitted in just 14 days, Silverstream claims.

CEO Noah Silberschmidt concluded: "Over the past year, Silverstream has been working with leading industry partners, including classification societies to further refine our technology and we are looking forward to announcing what we anticipate will be the first of many landmark commercial developments in the coming weeks."

Coatings

Credits where credits are due

AkzoNobel claims its subsidiary International paint and the Gold Standard Foundation have launched the first maritime carbon credit earnings scheme.

Monitored by the Gold Standard Foundation International will offer to share, with ship operators, the carbon credits accrued through the switch to biocide free coatings, such as the paint company's Intersleek coating, from standard biocidal coatings.

The system will work by agreeing a base fuel cost structure for a vessel that is then coated with the new biocide free paint and any savings in fuel costs will be generated as carbon credits to be shared with the paint company.

"Certification by The Gold Standard for the first of its kind, peer-reviewed methodology will allow ships to generate carbon credits, thus income, for the CO_2 emission reductions they achieve," says the company, adding: "Using a 'results based finance' approach, carbon credits are awarded annually, based on vessel data that is collected, analysed and for Intersleek, administered by International and submitted to The Gold Standard Foundation for validation. To ensure rigour and transparency, the fuel savings that are generated are verified by independent UN accredited auditors. Once the carbon credits are issued to International they can be sold at market price and the revenue shared with customers."

According to International the company spent two years developing the methodology for the carbon credit sharing scheme which it says is a "significant landmark for sustainability within international shipping". *NA*

Corrections

In *Significant Ships 2013* there were some inaccuracies. In the *Cape Green* entry (Page 28) eFuture was developed solely by IHI Marine United and JMU was the sole optimiser of the Nakashima manufactured propeller, while the total number of sister ships on order was undisclosed and the daily fuel consumption is less than 50t/day. *Kaimon Maru* (page 62) was built by JMU. In the *Shoyoh* entry (page 94) the length should read 234.5m. The *Significant Ships* editorial team would like to apologise for these errors.

In the April issue of *The Naval Architect* in the story headlined Conoship innovates for further efficiencies, the development of the O-foil was wrongly indicated as a development of Conoship. The O-foil is an invention of the company 'Ofoil'. We would like to apologise to Ofoil and Conoship for this error.


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Environmental Casualty Area – the new ECA

Moving to low sulphur fuels in emission control areas from 1 January 2015 presents many challenges for owners and operators and has now claimed a casualty in the form of DFDS' historic passenger ferry route between Harwich and Esbjerg, *writes Sandra Speares*.

The need to switch from heavy fuel oil to 0.1% sulphur, when transiting the North Sea ECA, has provided the final nail in the coffin for the DFDS service, which has been running since 1875 and will close on 29 September.

DFDS' historic passenger ferry route between Harwich and Esbjerg has been struggling for a long time, the company says, and it has worked hard to cut costs on the route to make it more competitive. Among other tactics, the route was changed into a combined freight and passenger service, the number of crew onboard was reduced, slow steaming was introduced to save fuel, the number of departures was decreased and centralised sales tried to increase passenger numbers with aggressive marketing.

"Unfortunately we haven't been able to reduce costs enough to enable the route to bear the very high additional costs of around £2 million (US$3.3 million) a year," says DFDS, CEO, Niels Smedegaard. "This is what the new environmental law and the requirement to use low sulphur oil will cost based on current oil prices from 1 January 2015.

The Esbjerg to Immingham freight route "will also be hit by the substantial extra costs as a result of the new sulphur rules. We therefore need to keep a tight focus on costs to prevent the transfer of freight to road transport that will otherwise become a consequence of the new sulphur rules," Smedegaard added.

In a paper delivered at the Scottish Transport Applications & Research conference in Glasgow last year, authors Chris Rowland and Chris Wright of MDS Transmodal, pointed out that marine gas oil was substantially more expensive than HFO, and while moves to use LNG were being considered the infrastructure so far is not there to deal with it.

Their paper stated that: "ships that operate on longer crossings across the North Sea will incur higher fuel costs per unit carried because the units are carried over a longer distance and any investments required in the ship (in scrubber technology, for example) have to be recouped from customers over a fewer number of units carried per annum". Fitting scrubbers on ferries is in some cases not a viable economic alternative in any case.

The closure is just one of the consequences of the move to low sulphur in ECAs from next year. Other concerns have been raised over the refining process for low sulphur fuels, which is expected to result in an increase in cat fines, which could cause severe engine damage. There are also concerns that when changing from heavy fuel oil to sulphur when transiting the ECA there could be fuel contamination leading to damage to fuel injection systems. Lubricity of low sulphur fuels is also an issue.

"ships that operate on longer crossings across the North Sea will incur higher fuel costs per unit carried"

Coastguard reports have highlighted the care that must be taken by ships' engineers when changing from one fuel to another in order to avoid a loss of propulsion. The specifications of heavy fuel oil and low sulphur gasoil vary widely. For example, HFO has to be heated to around 130°C to inject it properly while low sulphur marine gas oil only needs to be heated to room temperature.

Fuel quality has also become a major issue raising concerns about whether equipment onboard needs to be overhauled at shorter intervals than those specified by the engine manufacturer.

This has led to the development of fuel treatment products which aim to address some of the issues and concerns. Wilhelmsen Ships Service's new fuel oil treatment system has been designed to help shipowners maintain vessel performance and engine efficiency even when slow steaming or burning low sulphur fuel.

The product is designed to offset the effects of changes to the refining process for the marine market which have resulted in deteriorating quality, coupled with performance issues due to slow steaming.

Aderco is another company that has been developing fuel treatment products which it says will help with the lubricity issues surrounding the use of low sulphur marine gasoil as well as the potential contamination problems when switching from one fuel to another. *NA*

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Environmental

EGR boiler from Alfa Laval

Alfa Laval is cooperating with MAN Diesel & Turbo to develop an EGR boiler, which could potentially add major energy benefits and ensure emission compliance, the company claims.

The companies say that in the EGR process, around 30% of the exhaust gas is directed back into the engine, which reduces the combustion temperature and thereby the production of NOx. This also reduces waste heat recovery by 30%, since only 70% of the gas reaches the traditional exhaust gas boiler after the turbocharger. The remaining heat energy is dissipated in the EGR scrubbing process.

Combining Alfa Laval's Aalborg XW-HPX pressurised EGR boiler with a traditional installation could extend the operating range for waste heat recovery, enabling fuel savings through even slower steaming

By including a boiler in the process the company says that the heat can then be recovered from the EGR circuit, and the availability of service steam would be unchanged from today and could potentially bring more energy savings.

The Aalborg XW-HPX pressurised EGR boiler, is planned for launch in 2015 and is scheduled for test installation aboard *Maersk Cardiff* late this summer. Developed by MAN Diesel & Turbo, the EGR process already uses Alfa Laval's PureNOx, which provides the cleaning for the scrubber water.

Supported by the Danish Energy-Technological Development and Demonstration Programme (EUDP), the project continues the close partnership between MAN Diesel & Turbo, Alfa Laval, A.P. Moller-Maersk and Aalborg University. Testing of the Aalborg XW-HPX aboard the *Maersk Cardiff* will begin in the second half of 2014.

www.alfalaval.com

Cargo handling

Craning to new heights

Huisman has launched its latest patented crane, the rope luffing knuckle boom crane. The latest active heave compensated (AHC) crane type combines the benefits of a normal rope luffing crane and a traditional knuckle boom crane, the company says, by offering a high lifting height and a large capacity at outreach.

The cranes feature a main hoist system, a patented anti-twist device, and an electric drive system. The capacities of the cranes range from 400tonnes up to 1,200tonnes and up to 5,000m water depth. The first crane of this type, a 900tonnes rope luffing knuckle boom crane for Subsea 7's *Seven Arctic*, is scheduled for delivery in 2016.

www.huisman.com

CAD/CAM

SOLIDWORKS latest Inspection application

Dassault Systèmes has announced its latest Solidworks Inspection application is now available, which completely automates the creation of inspection documents, the company highlights. Users are given multiple ways to automatically enter values directly into an inspection report, which in addition to reducing the time needed to create the reports, will also help eliminate errors and inconsistencies that come from entering data by hand.

With the Solidworks Inspection application, companies will be able to quickly re-use existing design data and content to create highly accurate inspection reports, such as AS91002 or PPAP forms, helping to accelerate the time to regulatory approval.

Solidworks Inspection consists of a stand-alone application and a Solidworks add-in that enables users to leverage their legacy data, regardless of whether they are Solidworks files, PDFs or TIFFs.

www.3DS.com

Ancillary equipment

Faster than light OS3

Prüftechnik has announced the launch of its OS3 sensor which the company claims to be a faster and more efficient sensor for laser shaft alignment.

The full redesign of the Optalign sensor's internal components has seen Prüftechnik include even more technology into the device. With a faster CPU, OS3 can take up to 10 times more measurement points during shaft rotation. The high definition (HD) position sensitive device (PSD) and precision

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inclinometer using micro-electrical-mechanical systems (MEMS) technology make the measurement process more powerful than ever, the company says.

The Optalign also has reduced energy consumption meaning it can run for longer, though the sensor's battery status always gives a useful indication. The ambient light compensation allows measurements even in direct sunlight.

www.pruftechnik.com

Accommodation & interiors

Estillon gets onboard

Estillon has announced that it will be supplying two cruise ships, *Quantum of the Seas* and *Anthem of the Seas*, both of which will be making their maiden voyages in 2015, with its Fenix Base underlay.

This year, Estillon will supply 60,000m² of Fenix Base for installation on these two cruise ships being built for Royal Caribbean International. The underlay is made of a composite polyurethane foam, which the company says is what distinguishes its material from other IMO-rated underlays on the market.

www.estillion.com

Cargo handling

Post-Panamax orders roll in for TTS

TTS Group ASA has, through its subsidiary TTS Marine AB in Gothenburg, signed two separate contracts with Hyundai Heavy Industries (HHI) in South Korea with a total value of NOK118 million (US$20 million).

The contracts will see the delivery of cargo access equipment for two post-Panamax car carriers under construction, as well as an increased scope of supply for an existing contract with the Hyundai Group. All deliveries will be completed during 2015.

The contracts were signed only a few weeks after TTS Group ASA announced the delivery of four ship-sets of cargo access equipment to four post-Panamax car carriers, with a total value of NOK209 million (US$35 million).

www.tts-group.com

Propulsion

Hebe moves to Hatlapa

MacGregor, part of Cargotec, has presented its latest addition to its Hatlapa product range; the steering control system, Hebe. It will be offered as an integrated part of the company's Hatlapa range of steering gear solutions and its inclusion will deliver operational and equipment compatibility benefits for customers.

Hebe main steering control systems are designed for operation from nominal 24V DC or 110/230/440V AC power supply and are suitable for virtually all SOLAS vessel types and high speed craft. The company also adds that due to its modular design the Hebe series will give customers a more flexible approach for single and multiple rudder options and can also be integrated with Azimuthing steering pods.

The Hatlapa steering gear portfolio comprises four-cylinder ram-type steering gear up to 8,893kNm, two-cylinder ram-type steering gear up to 950kNm, rotary vane-type steering gear up to 1,100kNm, twin-rudder steering gear, compact piston type steering gear and rudder carriers.

www.hatlapa.de

Ancillary equipment

Remote monitoring from Finning Marine

Finning Marine (Finning) has introduced a remote diagnostic tool, alongside two Tier III propulsion engines, the Cat C18 ACERT and Cat C32 ACERT, as well as the new Cat C7.1 generator set.

Available for all electronic engine applications, the remote monitoring tool can be used on commercial and recreational vessels, as well as for tracking power generation performance.

The information, which can be viewed on internet-enabled computers, smartphones or tablet devices, can be used to optimise fleet efficiency, monitor the global positioning of assets and alert engineers to alarm conditions occurring with power or other critical safety systems.

Data points monitored include: total fuel used (by shift/day/week/month), average fuel burn rate, oil pressure, coolant temperature, engine load, intake manifold temperature, speed, heading and many other factors.

www.finning.co.uk

Ancillary equipment

Grundfos extends MAGNA3 range

Grundfos has extended its MAGNA3 range, which now offers an extra 25 models. The company has said that with the further options in the range it can now support light, medium and large commercial

Grundfos extends its MAGNA3 range

heating, air conditioning and cooling systems, domestic water systems, ground-source heat pump systems and solar heating systems.

The MAGNA3 comes with an installation wizard, which has been designed for easy and intuitive installation. The installation wizard also has a high-resolution colour display and once the pump is turned on, the Assist software guides the installer through set-up. With many integral features including AUTOADAPT that helps optimise energy usage in conjunction with the FLOWADAPT and FLOWLIMIT control features that allow a maximum flow limit to be set, which means the pump continuously monitors the system.

Grundfos has also developed the innovative Grundfos GO control software, which can be used on a smart phone or iPod Touch, allowing the user to monitor, set and control MAGNA3 as well as other Grundfos e-pumps.

www.grundfos.com

Ancillary equipment

Cargo Care pads out

Cargo Care has launched a low wear hatch cover bearing pad, that the company has said will save money on fitting, on wear and on man-hours for ship operators who find they can no longer postpone essential maintenance tasks on vessels.

In coming years a lot of the traditionally fitted Bronze-Teflon type hatch cover bearing pads will need to be changed, the company explains. Hatch cover support pads are an important part to transfer the vertical forces of the hatch cover into the coaming structure of a vessel. Not replacing the support pads in time can cause an increase of these forces into the coaming structure, which can cause severe damage to the coaming and hatch cover.

The UltraPad features a locking pin to speed up mounting and is offered in multiple sizes to fit different makes of hatch cover, which also simplifies maintenance and replaces traditional Bronze Teflon type support pads; at 30 - 40% of the cost, and in a fraction of the time, the company says.

One of the main features of the UltraPad is the set of prefabricated grooves of variable depth positioned on areas where the pads wear down most, making detecting wear on the pads speedy and accurate.

www.cargocaresolutions.com

The UltraPad is aimed at saving shipowners maintenance costs

Propulsion

Schottel heads inland

The German-based propulsion provider has announced that it will be supplying about 40 European river cruise vessels with its SCHOTTEL propulsion concept that uses four Schottel Twin Propellers, STP 200.

The concept, the company said, was specifically designed for river cruise ships with advantages such as low-noise, shallow draught, increased overall efficiency and energy efficient operation. By splitting the propulsion units from the conventional two to four Twin Propellers, it will reduce the draught of the ship to approximately 1.60m and will allow the ships sail more smoothly even in shallow waters, it said.

The concept involves highly elastic mounting of the STP, which will effectively dampen the pressure impulses induced by the blades. The reduced diameter, of 1,050mm, of the propellers also allows a good clearance between the propellers and the hull and results in a low structure-borne noise level. In addition, one or two SCHOTTEL SPJ 82 RD Pump Jets serve as additional drives in the bow.

Currently, the propulsion concept is available in both a diesel-direct and diesel-electric versions with four mechanical STP 200 propellers, as well as with four electric Schottel SCD 200 Combi Drives. The Schottel propulsion portfolio for river cruise ships also includes a variety of individually tailored concepts for different river cruise providers. These range from the traditional concept with two Schottel Twin propellers to river cruise vessels operating with Schottel Pump Jets as main propulsion units.

www.schottel.de

www.rolls-royce.com

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Bulbous bow refits – the industry catches on

Formal optimisation can be applied to selected portions of ships as well as complete hulls. This makes bulbous bow refits an attractive option, particularly for slow steaming container ships. Carsten Hahn and Volker Bertram, DNV GL Maritime Advisory, describe how to make annual fuel savings of 10% on a boxship

Fuel efficiency is bound to stay the dominant topic in shipping for years to come. It is well known that hull optimisation is one of the most important levers for fuel efficiency in newbuildings. However, the re-design and refit of bulbous bows is often not considered at all for ships in service. This oversight is understandable as the achievable savings were frequently underestimated even by experts. *Hochkirch and Bertram (2009)* showed for the first time that attractive payback times of less than a year might be possible for bulbous bow refits.

While obtainable fuel savings are significantly larger for complete hull optimisations, optimisation of the bulbous bow region alone still offers very attractive potential fuel efficiency gains, especially for high-powered large containerships which now operate frequently in off-design conditions (slow steaming).

State-of-the-art optimisation for a realistic operational profile rather than a single design point opens the door to significant further fuel savings, also for refits. This has been demonstrated in many projects by DNV GL Maritime Advisory (formerly known as FutureShip). The company performed 16 bow refit projects in 2013, and nine already in the first quarter of 2014. Word is spreading in the industry that we have a winner here.

Employed tools

The results of any optimisation project depend on the software tools employed and on the skill and experience of the project engineers. Many so-called hull optimisation projects fall short of what the best in the field can achieve. The reasons are manifold, *Hochkirch and Bertram (2012)*:

- False labelling: Simple improvement e.g. guided by CFD (computational fluid dynamics) analyses is called "optimisation"
- Wrong choice of optimisation objectives or methods: Rather than yearly fuel consumption, a single design point is chosen; or only the resistance is minimised rather than the required power; or instead of a high-fidelity CFD code a simpler software is employed introducing errors in the hydrodynamic assessment of variants
- Restricted form variation: The investigated form variations depend on the fundamental (parametric) model. Unfortunate set-up of the parametric model may then prevent finding superior designs. Good parametric modelling requires considerable experience.

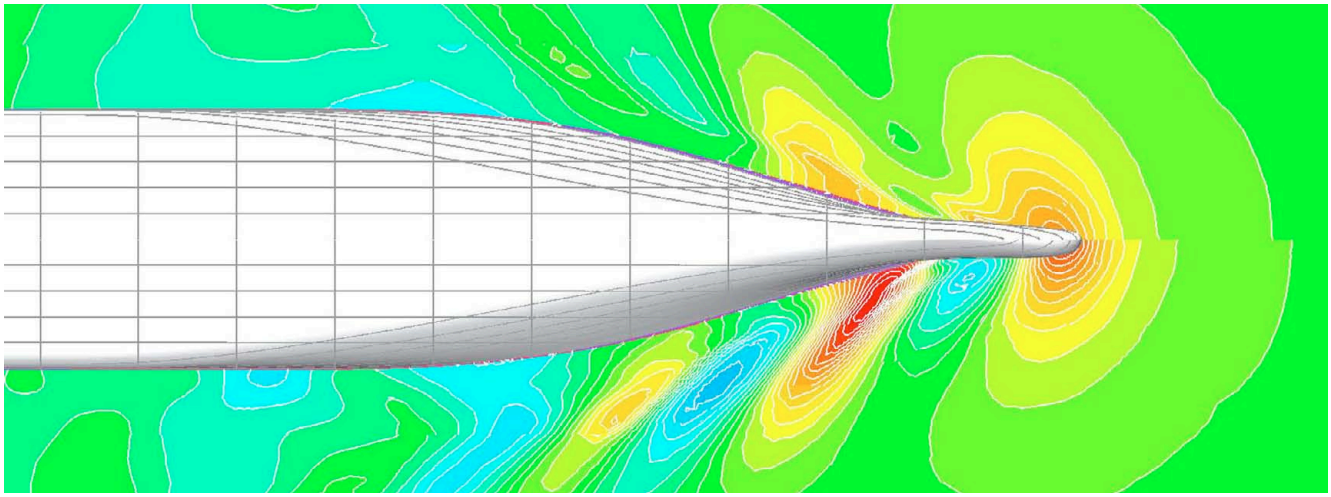
DNV GL maritime advisory employs a range of state-of-the-art tools in its optimisation projects:

- FRIENDSHIP Framework for parametric hull modelling
- FS-Flow – Fully nonlinear wave resistance code based on potential flow theory
- FINE/Marine as high-fidelity viscous CFD code
- FS-Equilibrium for hydrostatic analysis (as required for constraints in ship stability)
- FS-Optimiser – toolkit for design space exploration and optimisation offering a variety of optimisation algorithms.

Case study – a 12,000TEU ship

The owner realised the opportunities of a bulbous bow refit for his fleet of 12,000TEU container ships. The task was then to find the best solution for the owner's current operational profile. The shipowner supplied records of actual operational data for the ship for a whole year. The database of speeds and

CFD wave pattern: original hull (bottom) and optimised refit (top)

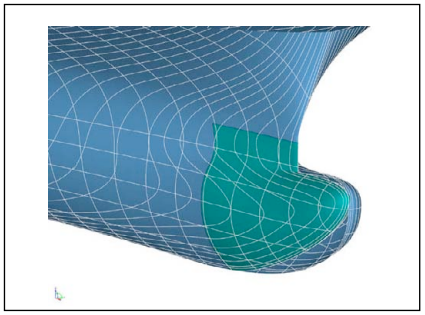


drafts was condensed to six representative clusters of speed-draft combinations with associated weights, ranging between 10% and 25%. The objective was then to reduce the combined fuel consumption for these six operational states, considering their time share in yearly operation.

A parametric model was set up for the bow section, employing 28 free parameters. The high number of parameters ensured that a vast number of possible bow shapes could be created. A harmonious fit with the rest of the hull was imposed by suitable constraints on the hull-bow intersection. Some 7,500 bow variants were investigated. The optimisation achieved substantial improvements for all considered operational conditions, yielding expected yearly fuel savings of 10% for the actual operational profile.

These savings are higher than for typical bow-only optimisation projects (4-5%), but not uniquely so. As for full hull optimisation projects, the numerical results have been validated many times against "numerical sea trials" (high-fidelity CFD simulations for full-scale ship) and model tests with good agreement. They can thus be considered as reliable.

Depending on size of fleet, employed repair yard and assumed fuel oil price, there are variations in payback times, but all realistic scenarios show payback times between two and eight months, making refits with optimised bows a good business decision by anybody's standards.



Original hull (port) and optimised refit (starboard)

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A jolly series for Messina

As part of its fleet expansion plan Ignazio Messina shipping company ordered two series of eco-efficient multipurpose container ro-ro vessels from two shipyards in Korea, the second series is due for delivery later this year

With the pressure on shipowners to meet with environmental regulations, whilst still having vessels that are commercially viable, Messina, with its newest vessels aims at meeting these targets.

The second series, the Jolly Titanio class, will see four vessels that are currently under construction at STX Offshore & Shipbuilding, Korea, scheduled to be delivered between September 2014 and March 2015. These vessels are in addition to the previous four vessels of the Jolly Diamante class that was constructed at Daewoo Shipbuilding & Marine Engineering (DSME), Korea and delivered between December 2011 and March 2013.

The main feature of the ships' design is flexibility; the vessels have not been designed for a specific route, but to allow the ships to cater for all worldwide routes, this includes new routes recently opened by the company, such as its North Europe routes. The company says that the design takes in Ignazio Messina's traditional markets and routes, the design required more attention in specific areas; for instance, needing more DWT, and an increased beam which has been selected instead of an increase to the draught, in order to take into account specific characteristics of some African ports.

The vessels have been designed for heavy cargoes and project cargoes, the ramp can bear loads of up to 350tonnes and there is an area in the main garage able to accommodate a height of 7m. The in-take/out-take of the ship is served by a wide stern ramp (12m of clear way) and a wide stern door (27m of clear way), no elevators or movable ramps are applied, the architecture and the design allow operations independently on the main garage, and above (main and upper decks) and below it (twin and hold deck). This is to speed-up loading and unloading operations without using shore facilities, which can be used when the opportunity to operate on open decks is available.

Jolly Diamante from the first series of ro-ro ships for Messina

A spokesperson from Messina adds: "As ro-ro vessels they don't have any special cargo handling system, the most impressive system, from the loading/unloading point of view is the jumbo-ramp at the stern, which is one of the biggest and most powerful ever built in the world."

The vessels are equipped with a controllable pitch propeller, which allow the vessels to be operated at different speeds and loading conditions, with the possibility to optimise the propulsion chain efficiency; a shaft generator in-line with the propeller shaft, frequency controlled, is able to supply all the electric power necessary during normal sailing and also during manoeuvring, the necessity to use diesel generators is minimised.

The electric plant has been designed, with two physically separate bus-bars, one for ship services and another one for the side thrusters (the vessels are equipped with bow and stern thrusters), and with the four diesel generators able to be connected independently to each bus bar, this eliminates the risk of black-out during manoeuvring when the power demand coming from side thrusters can be very high with very fast variations.

Messina also adds that from the environmental impact point of view these vessels have many features. The vessels are equipped with a Water Ballast Management System (UV based), bringing them in-line with forth coming rules, they are also equipped with an Alternative Maritime Power system (Cold Ironing) so they are able to receive electric power from shore when berthed in ports equipped with these facilities and, last but not least, they are among the first vessels in the world equipped with Exhaust Gas Cleaning Systems (scrubbers) for SOx.

The company says that the Jolly Diamante class is the first commercial vessel series equipped with scrubbers (for auxiliaries diesel generators and boiler) and the Jolly Titanio class will continue along this path with significant improvements, with all

TECHNICAL PARTICULARS

Jolly Diamante/Jolly Titanio class

Length oa:	239/240m
Breadth:	37.5m
Depth:	19.95m
Deadweight	45,200/45,000dwt
Lanes:	6,030/6,065m
TEU:	2,920/2,889

the exhaust coming from the main engine, diesel generators and auxiliary boiler will be passed through the scrubber, with an hybrid-system able to operate both in closed and open loops.

Adding to the vessels' efficiency, the ships are also fitted with a DSME pre-swirl stator device, which is a set of fins placed in front of the propeller with the purpose of optimising the wake, with a mean power saving of around 4% observed at model tests, the company says. The main engine has been equipped with a Variable Geometry Turbo charger, able to improve the efficiency of the engine at low and intermediate loading, with an expected saving of around 4%.

In the light of the specific characteristics of this project, RINa says that it has established, based on the general rule approach, specific criteria for the structural verifications of the hull structures, in particular for concerns regarding the fatigue analyses of some important structural elements, such as the connections between ro-ro and container areas, the double bottom connection with side structures and the side frames and the structures associated with cargo operations.

The anti-pollution characteristics of these ships are certified by RINa with the assignment of the GREEN PLUS notation, which has entailed a detailed analysis of all their "environmentally friendly" capabilities.

In addition to Messina's order, Grimaldi has been following suit with an order that it placed with Hyundai Mipo Dockyard (HMD) for a further six 31,300dwt vessels that will be delivered in 2014/15, Grimaldi had a previous 15 vessels delivered between 2010-2012. Grimaldi has also set its sights on opening up opportunities across the globe with an expanded fleet and greater flexibility in its operations.

One of the main features that Grimaldi highlights about its vessels is the ballast water treatment system (BWMS) and space allocated for scrubbers, further adding green credentials to its fleet portfolio. The Ballast Water Treatment Plant which will be installed onboard its vessels is the OceanGuard BWMS, developed by Headway Technology Co., Ltd. together with Harbin Engineering University.

A Test Report for a Corrosion Contrast Experiment for Water Treated by the equipment under test (EUT) Unit, of OceanGuard BWMS to Different Materials and Coatings has been carried out. Grimaldi says that based on the long-term testing, the effects of two test waters on Q235 steel, SS304 and coating materials are the same, indicating that the treated seawater will not change the corrosion rules in the natural seawater for the materials above; and for butyl rubber, the effects of treated seawater on its properties are less than that of natural seawater.

Besides the BWMS, the new vessels are equipped with common rail main engines, which will help reduce CO_2 emissions, so it is possible to maintain a low level of smoke, minimum power for the vessel's designed speed, and lower consumption, the company adds. *NA*

The Royal Institution of Naval Architects

Marine Heavy Transport & Lift IV

29-30 October 2014, London, UK

Call for Papers

The marine heavy transport and lift sector has enjoyed a buoyant and growing market due to the boom in offshore renewables and large project cargo work. The rapidly growing Wind Farm sector in particular has increased the number of offshore project requiring transportation, installation or removal of a wide range of structures and modules. The project cargo transport market has been growing, particularly power generation and refineries work in US, South America, Africa, India, Pakistan and China.

As the structures and cargo become bigger and heavier and destinations seemingly more difficult to access the market is looking for more and better equipped vessels. There are also increasing safety and greater environmental concerns for all aspects of marine operations. The new generation of heavy lift vessels designs are responding to the demand for higher lifting capacity and larger outreach. There are also an increasing number of new designs concepts aimed at servicing this increasing demand in the marine heavy transport and lift industry.

This conference, the Fourth in the series from RINA, aims to bring together naval architects, operators, project engineers, warranty surveyors and designers to examine the various design and operational issues associated with this industry. Papers are invited on all related topics including the following:

- Current design and operational experience
- Float over and float off; offshore discharge
- Station keeping
- Propulsion system redundant
- Ballast control, stability and stress monitoring
- Weather routing
- Design criteria for short trip scenarios
- Extreme cribbing loads
- Risk management

Selected papers may be published in the Transactions of the Royal Institution of Naval Architects

http://www.rina.org.uk/marineheavylift2014

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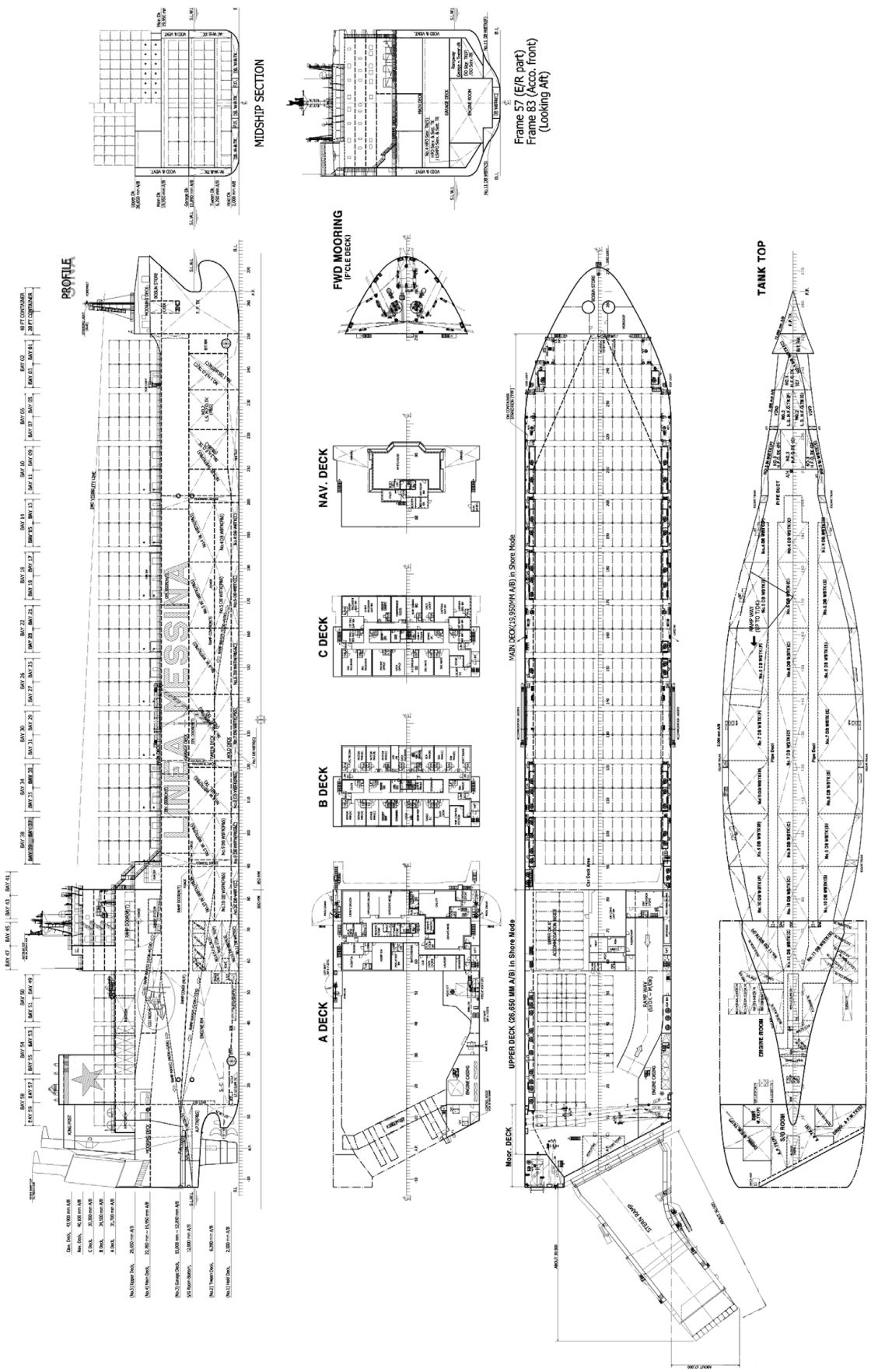
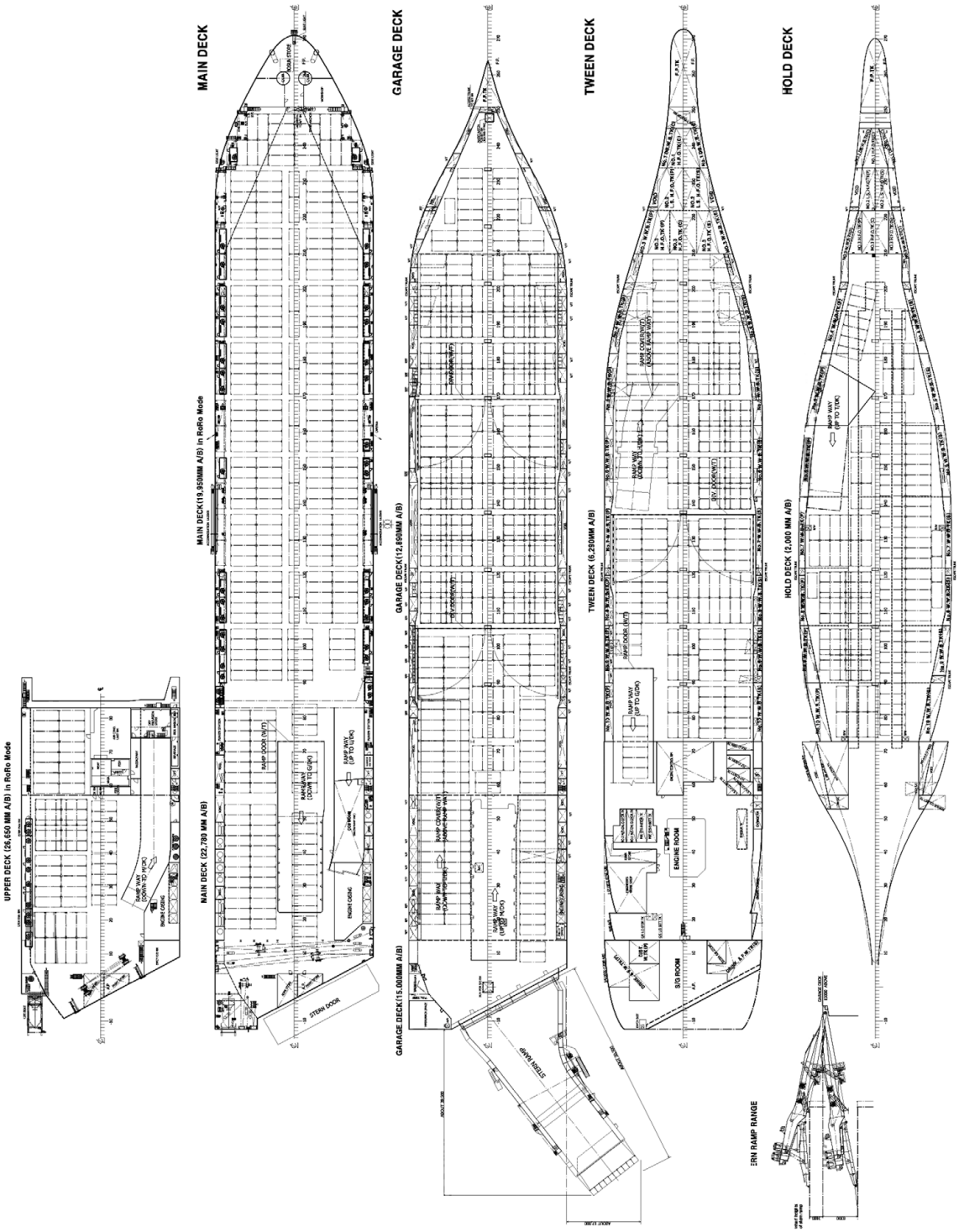
GA plan of Messina 45,200dwt ro-ro




UPPER DECK (26,650 MM A/B) in RoRo Mode
MAIN DECK
MAIN DECK(19,950MM A/B) in RoRo Mode
MAIN DECK (22,700 MM A/B)
GARAGE DECK
GARAGE DECK(12,850MM A/B)
GARAGE DECK(15,000MM A/B)
TWEEN DECK
TWEEN DECK (6,200MM A/B)
HOLD DECK
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Industry upgrade strategies for three Chinese provinces

Fujian, Shandong and Guangxi provinces have tailored their forward planning strategies to the needs of key shipbuilding enterprises, 'killer products' and market opportunities in their territories to speed up the structural adjustment, transformation and upgrading of the regional shipbuilding industry. Liu Ying reports

In the second half of 2013, China's State Council issued the "Implementation Plans for Accelerating the Structural Adjustment and Promoting the Transformation and Upgrading of the Shipbuilding Industry (2013-2015)".

Fujian, Shandong and Guangxi provinces have launched related documents since then, detailing the adjustment plans and development goals of the shipbuilding industry in 2013-2015 in order to realise the spirit of the implementation plans.

A closer look at those documents will reveal that the three provinces have designed unique strategies to strengthen and upgrade their shipbuilding sectors and to promote the development of new ship models based on several factors including key shipbuilding enterprises, what they call 'killer products' and potential market opportunities in their territories.

Qingdao Beihai Shipbuilding Heavy Industries Co Ltd

Fujian supports key enterprises

Fujian province has resolved to support its key shipbuilding enterprises, so as to strictly control the total shipbuilding capacity and realise an industry transformation and upgrade. The province will rely on companies such as Fujian Mawei Shipbuilding Ltd, Fujian Southeast Shipyard, Xiamen Shipbuilding Industry Co Ltd, Fujian Funing Shipbuilding Industry Co Ltd, Baima Shipyard, Fujian Changxing Shipbuilding Industry Co Ltd and Fujian Huisman Steel Manufacturing Co Ltd to optimise resource allocation and maximise production capacity.

Fujian encouraged key shipbuilding enterprises to form strategic alliances with upper and lower stream companies, such as steel companies and shipping firms, as well as to cooperate with state-owned and Taiwan enterprises. The provincial government also encouraged mergers and acquisitions between shipbuilders to help utilise resources within the sector. Fujian Shipbuilding Industry Group Corp was likely to cooperate with or merge with shipbuilders such as Fujian Huadong Shipyard Co Ltd, Fujian Crown Ocean Shipbuilding Industry Co Ltd, and Huahai Shipping Enterprises Ltd.

At the same time, Fujian encouraged mid- to small-sized shipyards to re-focus on different market segments such as shiprepair, ship breaking, steel structure processing, hull block manufacturing, pipe processing and iron outfitting production, etc. The provincial government would guide the ship accessories and intermediate products manufacturers to speed up their professionalisation and restructuring processes. Fujian hoped to form a dual-stream development model that contains intermediate products production and ship assembly.

Shandong to build innovative platforms

Innovation will be the highlight of the transformation and upgrade of the shipbuilding industry in Shandong province. The provincial government emphasised the benefits of in-house design and innovation in major projects, as well as creating synergies between the industry, the education sector and R&D institutes.

The province has been building different platforms for innovation. For example, the government has supported the setting up of China International Marine Containers (CIMC)'s offshore research institute, China Shipbuilding Industry Corporation (CSIC)'s Marine Equipment Research Institute in Qingdao, Shandong Ship Technology Research Institute Ship Design Co Ltd, Shandong Sino-Ukraine Specialised Ship Research and Design Institute, Penglai Zhongbai Jinglu Ship Industry Co Ltd's Long Distance Fishing Fleet Construction Technology Demonstration Center etc.

The provincial government also planned to establish different industry standards to match its R&D efforts.

To promote innovation, Shandong has strengthened its talent pool through attracting overseas R&D groups and industry experts to come to the province, as well as utilising research resources from abroad to help local enterprises build their own overseas research centres. Besides, the provincial government also planned to leverage on the cooperation between enterprises, higher education institutes and research institutes to build new state-level or provincial-level laboratories, engineering research centres and enterprises technology centres hoping to lay a foundation for R&D of ships, offshore equipment, luxury cruise ships and ship accessories.

To achieve the structural reform of the industry, Shandong will promote merger and acquisition activity between shipbuilders to nurture internationally-competitive, sizeable shipbuilders and offshore equipment manufacturers. The province will encourage mid to small-sized yards to shift to ship repairing, producing intermediate products or even expand into other non-ship product markets.

Guangxi seizes transformation opportunities

The provincial government of Guangxi thought that the province should seize opportunities arising from the structural reform of the shipbuilding industry to focus on high calibre-technology with market potential. Therefore, Guangxi has been supportive towards the setting up of China State Shipbuilding Corporation (CSSC)'s large-scale offshore construction and maintenance base in Qinzhou and Guangxi Haisente Heavy Industries Co Ltd's offshore equipment construction project in Fangchenggang. Guangxi would focus on the building of specialised vessels, offshore equipment, and the development of specialised systems and facilities for offshore equipment. The province also aimed to achieve coordinated development between shipbuilding, offshore equipment construction and accessories manufacturing.

At the same time, Guangxi would integrate mid- and small-sized shipyards along the Xijiang to form larger, more competitive enterprises; and adjust the business structure of mid- and small-sized shipyards to shift to the production of intermediate products such as ship repair, ship breaking and other non-ship products, etc.

R&D Initiatives

On the product development front, Fujian province plans to strengthen the development of technologies for building

energy-saving and safe ships according to the latest international conventions and standards. The province will also upgrade the existing models of mainstream ship types, specialised vessels and offshore supply vessels that it offers.

The province will start to upgrade the existing designs of ro-ro vessels, offshore supply vessels, mid- and small-sized tankers, bulk carriers and containerships. It will also strengthen its R&D efforts on ro-ro vessels with capacity for over 6,000 cars, 4,000-6,000TEU boxships, offshore supply vessels and ro-pax vessels that are suitable for operations on the Taiwan Strait. In addition the province will also improve its R&D capability and construction technology for the development of a high-tech long distance fishing fleet, especially fish processing vessels and factory trawlers. The province also planned to raise administration and law enforcement standards, as well as improve the design of public service vessels.

Through the above strategies, Fujian province aimed to develop at least four ship products, which are designed and branded locally, in the following categories: offshore supply vessels, large-scale ro-ro vessels, luxury cruise ships, mid-sized LNG carriers, etc.

Shandong shipyards have traditionally been strong in building fishing and ro-pax ships, in future, the province will promote R&D of the three mainstream ship types while at the same time upgrade its existing models for large luxury cruise ships and long distance fishing ships. The province will follow the state's strategy to build green specialised vessels, long distance fishing vessels, fiberglass fishing ships and public service vessels that comply with the latest international conventions and standards.

Apart from commercial vessels, cruise ships and yachts are likely to become Shandong's 'killer products'. The province will expedite the development of the construction of yachts and cruise vessels and will build a production base for yachts and core components. The goal is to acquire the capability to design and build well-known international brands of luxury cruise ships, yachts, passenger boats, public service vessels and leisure fishing boats. Shandong also plans to enter the yacht services and cruise tourism service sectors, making them core industries in the province.

Guangxi goes populist

Guangxi's strategy to upgrade its shipbuilding industry is to seize the opportunities brought by the state's policy to boost the economy in the Zhujiang-Xijiang area, the rapid development of the shipping industry in the pan-Beibuwan district and the replacement of obsolete fleets in the region; as well as to develop products that are most sought-after in the market. Apart from the three mainstream ship types, Guangxi will develop ship models that are suitable for operating in the Xijiang water system; high performance, energy-saving fishing vessels. The province would leverage on the advantages of its core shipbuilders to develop law enforcement vessels, public service vessels, integrated offshore supply and emergency vessels.

Moreover, Guangxi planned to improve its ship repairing capability and further expand into the shiprepair market and raise the province's market share in that area.

Marching into the deep ocean

Fujian shipbuilders have already established a reputation in the international offshore supply vessel market. Building on this foundation, the province hoped to turn itself into a national offshore equipment production base and increase the proportion of the production value of offshore equipment to the total shipbuilding production value to 30% from the existing 20%.

Fujian was striving to achieve a breakthrough in core technologies for offshore equipment construction. The province will focus on the development of electricity supply vessels, geophysical survey vessels, heavy-lift pipe-laying vessels, diving support vessels, offshore wind turbine installation vessels, high-end specialised offshore vessels and LNG carriers. Fujian's targets are to produce at least 80 offshore vessels that bear the province's brand annually and raise its share in the international market to at least 20% by the end of 2015.

Besides offshore supply vessels, Fujian will enhance its innovative capability and strengthen its R&D efforts on offshore drilling rig modules. Its goal is to be able to build medium-sized jack-up, semi-submersible drilling rigs and to convert large-scale offshore storage tanks.

Meanwhile, Shandong has drawn up an equally ambitious blueprint for its development in the offshore vessel market. The province aims to build a comprehensive system for the construction and R&D of offshore equipment, and to reach the highest international standard for deepwater drilling rig construction and development.

The province will focus on a 400-feet jack-up drilling rig project. Through this project, the province hopes to obtain the know-how of the assembly process, steel materials development, accessory and component manufacturing and the construction and testing of rigs; and to gradually set up a modern shipbuilding model.

Guangxi hopes to leverage its own geographical advantages to expand in the offshore vessel market with the help from other provinces in terms of human resources, technology, facilities and capital.

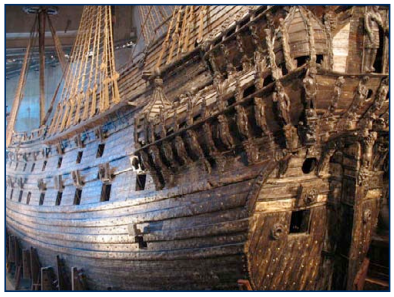
The province has signed several cooperation agreements with CSSC, including the "Strategic cooperation framework agreement" and the "CSSC Qinzhou large-scale offshore construction and maintenance base project agreement". Apart from the cooperation with CSSC, the province has also attracted Guangxi Haisente Heavy Industries Co Ltd to carry out its offshore equipment and vessel construction project in Fangchenggang.

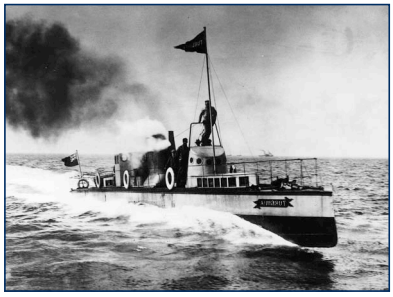
Through those two projects, Guangxi will commence its research on oil and gas drilling rigs, oil and gas storage tanks and various offshore vessels such as sea exploration vessels, supply vessels, towing vessels, crane vessels, salvage ships, cable laying ships and pipe-laying vessels. Guangxi will encourage key enterprises and research institutes to set up professional units to nurture the design, system integration and assembly capability for offshore engineering equipment. *NA*

The Royal Institution of Naval Architects

Historic Ships

25-26 November 2014, London, UK





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The problem with meeting paint specifications

Over recent years, developments in the way coatings are specified have resulted in a situation that can make it impossible to meet a paint specification, as currently laid out in Technical Data Sheets. Dr Raouf Kattan of Safinah Ltd and John Fletcher of Elcometer Ltd report

There has always been a problem in terms of meeting paint specification because of the subjective nature of some of the assessments, for example a visual assessment of steel surface cleanliness, rust and mill scale removal, dust and profile height when using a surface comparator.

It is well known that the appearance of a steel substrate can change considerably depending on the nature of the abrasive blast medium used, thereby making an assessment of surface cleanliness particularly subjective.

Up until 2008 strong demand for ships and attractive charter rates encouraged owners to accept ships from yards as quickly as possible. Many of the Chinese yards and some of the second tier South Korean yards were established during this early 21st century boom period and developed systems and processes in line with what owners were willing to accept to get the vessels into the market as quickly as possible to benefit from the favourable market conditions. Now that the market is less attractive owners are generally applying more stringent approval procedures than during the boom period.

In addition the advent of the IMO Performance Standard for Protective Coatings (IMO PSPC) has seen an increased focus on coatings for all areas of the vessel, particularly for ballast tanks. In particular the PSPC introduced the concept of a minimum Dry Film Thickness (DFT) based on the 90:10 rule.

This rule states that 90% of all thickness measurements must be greater than, or equal to Nominal Dry Film Thickness (NDFT) and the remaining 10% of measurements must be 0.9 x NDFT or above.

If the coating process cannot achieve the specified DFT then to some extent the coating system performance through-life may be compromised. Any such reduction in performance could manifest itself in many ways, for example an increased chance of corrosion for a low DFT and increased chance of cracking for a high DFT or an increase in time to service (for a cargo hold coating) or solvent entrapment.

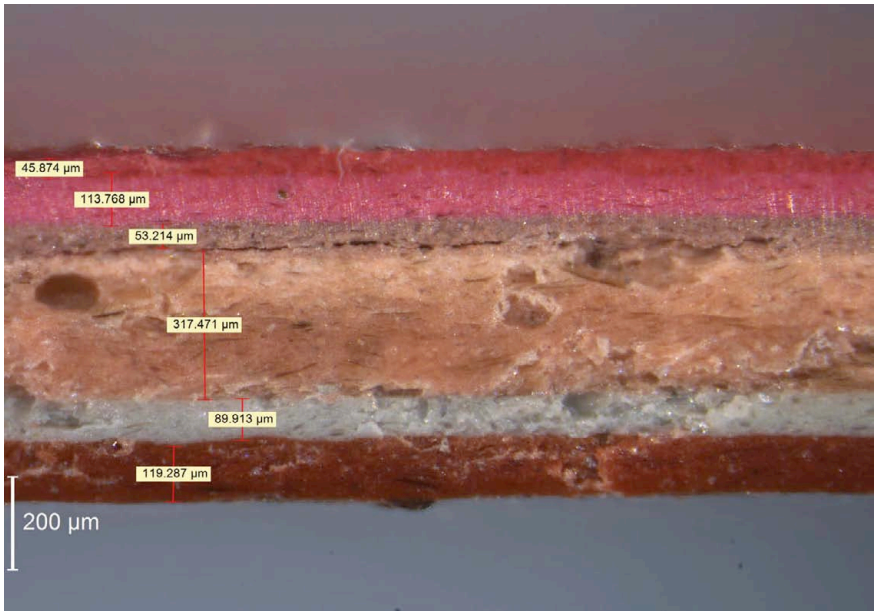


Figure 1: DFT and scheme

One of the key elements of any paint specification is the required DFT for individual coats for the system as a whole. The figures introduced into the specification are usually taken from the Technical Data Sheet (TDS) for the product being used. The TDS normally provides a value or a range of values e.g. 125µm or 125-150µm and usually refers to a single coat. For example, if a scheme is 2 x 125µm, then the Specified DFT is 250µm.

The specification

In considering a typical specification required by the IMO PSPC for water ballast tanks for the majority of areas (rather than repairs and erection joints):
Surface preparation: Sa 2.5 (Note: This is a requirement for mill scale and rust removal and does not cover the profile).

Paint Scheme: Multi-coat system to an NDFT of 320µm with up to two stripe coats.

In most cases this is interpreted as 2 x 160µm and one stripe coat.

Requirement:
Minimum DFT: defined by the 90:10 rule
Maximum DFT: in accordance with manufacturer's recommendations.

In general, there is also wording in the PSPC that indicates that the coating is to be applied in accordance with manufacturer's recommendations.

This may seem fairly straight forward, as may a specification for the underwater hull such as:

The scheme specified:

2x Epoxy anti-corrosive	250µm
1x Modified epoxy	100µm
3 x Self-polishing anti-fouling	390µm
Total scheme DFT	740µm

Table 1: sampling requirements of key standards. Source: R A Francis

	SSPC PA2	ISO 19840	PSPC
Approximate number of spot measurements for more complex areas >100 square metres	5 for each 100 square metres	10 for each 100 square metres	1 for each square metre
Number of spot measurements for 300,000 square metres	15,000	30,000	300,000
Number of gauge readings for 300,000 square metres	45,000	30,000	300,000

The fact that reality can vary considerably from the specification can be seen in figure 1 below for the above specification:

The scheme as applied	
2x Epoxy anti-corrosive	209µm
1x Modified epoxy	317µm
3 x Self-polishing anti-fouling	213µm
Total scheme DFT	739µm

If the scheme applied was assessed based on two inspections:

- Surface cleanliness and
- Final DFT

Then the scheme would likely be accepted (if these were the only hold points), despite the low epoxy anti-corrosive and self-polishing anti-fouling layer thicknesses.

Keeping in mind that many major commercial shipyard procedures now only afford owners' representatives the opportunity to assess cleanliness, and final DFT as a standard procedure then there is considerable opportunity for the as applied system to bare little or no relation to the specified scheme. Combined with a lack of as applied records (even with the presence of a coating technical file as required by the PSPC) this results in problems when assessing the causes of a failure.

This deviation from the scheme specified, in many instances, will result in a reduction of the performance of the total scheme in service, the degree of which can vary considerably depending on the type of product.

Standards

Of course, one of the first problems faced in determining the achieved DFT of a coating application is to determine how many readings should be taken to get a good overall view of the structure in question.

Francis provided a very good analysis of the needs of the various key standards, see table 1:

Table 2 also from Francis shows how the various standards require the readings to be taken and their minimum DFT requirements.

Francis also went on to show how the number of readings can influence the overall results as shown in Figure 2.

Standard	No of readings for spot measure-ment	Minimum required average reading	Minimum individual reading allowed	Number of readings below average allowed
SSPC PA2	3	Specified DFT	0.8 x Specified DFT	Not stated
ISO 19840	1	Specified DFT	0.8 x Specified DFT	<20% of readings
PSPC	Not stated	Not stated	0.9 x Specified DFT	<10% of readings

Table 2: Number of readings and minimum values – Source R A Francis

This shows that while the likely mean DFT readings for coating specified at 85µm may be approximated by a relatively few readings the minimum and maximum values (more so the maximum rather than the minimum) are influenced considerably by the number of readings.

Guidelines

Of course the immediate reply is that there are guidelines and standards. The most critical ones are those recommendations that the manufacture makes. Often the key document used is the TDS.

The TDS used with the guidelines is rarely provided to field personnel or referred to unless a problem arises when the user is then referred to some statement within them (a typical one for cargo hold coatings would be the time period before loading a first cargo of coal – rarely on the data sheet or the specification but can be found in other guideline documents).

This raises the issue of the true purpose of the TDS and exactly what information should be included in it; for example many anti-corrosive paints would be specified for non-cargo hold use and hence the time to load a first cargo of coal is not relevant to such specifications.

The net result would be an increase in the number of data sheets required or the length of the data sheet, or at least a requirement to identify clearly some reference to a system

guideline document in a prominent position (i.e. this data sheet should be read in conjunction with a marine systems guideline).

Technical data sheets

The DFT provided on the data sheet generally takes into account a number of things including:

- The DFT value at which the performance of the product is optimised (although the paint supplier will of course test a range of thicknesses in an attempt to reflect practical conditions)
- The DFT allocated to a specific product for a specific use will also take into consideration what competitors offer for coatings for that use. If there is considerable deviation then there could be increased costs (higher DFT) or lower cost (lower DFT)
- The minimum value at which the coating will coalesce if applied by airless spray.
- Other commercial or practical considerations.

The TDS often gives a DFT value or sometimes a range, typical terms used for the given DFT on major paint supplier data sheets are:

- Typical thickness
- Recommended DFT
- Film thickness
- Indicated film thickness
- Recommended systems DFT (with a minimum and maximum)

What is interesting is that none of these terms match the "nominal DFT" term as used in the IMO PSPC.

However, for more general use it is also not unusual that the specification can deviate from the DFT as set out in the TDS.

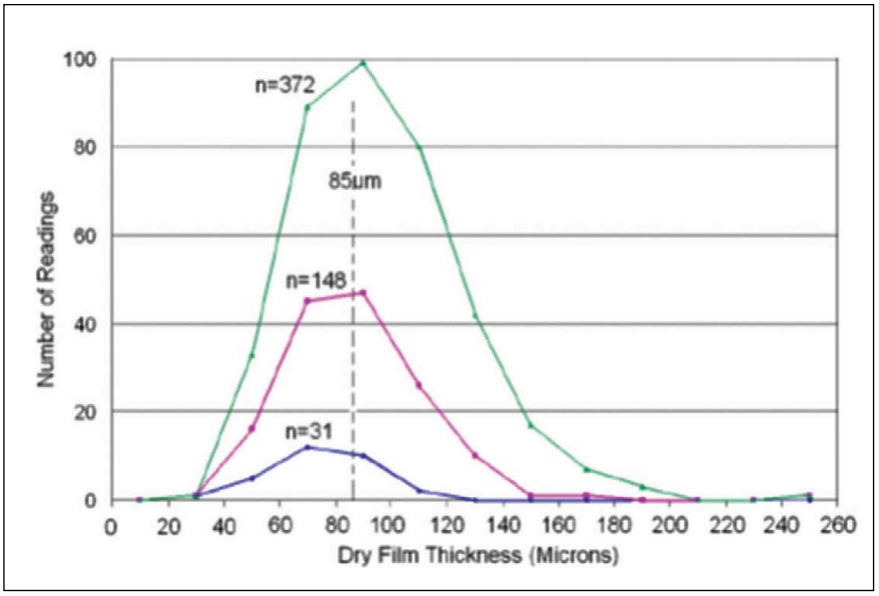
For example in cargo holds for bulk carriers, a typical system may be 2 x 150µm DFT and the TDS may give a range for the DFT of 125-150µm, while for the ballast hold of a bulk carrier the specification itself may give 3 x 100µm. Thus a DFT is specified that would appear to be below the minimum value given on the TDS.

It is clear from the content of the data sheets that the data sheets themselves are advisory and often they carry a legal disclaimer at the end indicating that the values given on them are based on laboratory testing that may be updated based on practical experiences.

What is not clear at all is the role of the DFT indicated. Is it a minimum, a nominal, an average or what? What does typical mean? If it is a recommended DFT how will performance of the coating change if the application deviates from the recommended value? What does any range given mean, is it a maximum/minimum or simply some guideline values?

These ambiguities are often unresolved in the paint company guidelines for the use of the TDS or application. This can leave the end users with difficulties in the event of a subsequent failure (of course from a cynical point of view one could argue that providing relatively vague data in this matter may suit the paint supplier as it makes subsequent claims in the event of a failure harder to assess).

Figure 2: Impact of total number of readings on assessment of DFT achieved – Source R A Francis



Guidelines/ Recommendation sheets

On examining the recommendation sheets, most paint suppliers suggest that good practice the maximum DFT should not be more than twice that which is specified (per coat and for the whole scheme) with an increased allowance in limited areas (complex structural areas).

It is noted that in absence of any recommendations from the paint suppliers ISO standards refer to a value of three times the specified DFT (for anti-corrosion paints), while it is well known that for Korean yards maximum DFT values are often specified as high as 2,000µm for ballast tank coatings (which is at considerable odds to the recommended guidelines for good practice). While this may be convenient for the production capability of the yard, how does that affect the performance of the coating system when the nominal DFT is 320µm?

There would seem to be merit for the paint suppliers to carefully review the content and detail of both data sheets and their recommendation sheets to capture the current practical issues in particular with respect to DFT.

What is the specified DFT?

When the paint specification only gives a value that says 2 x 160µm, what is this specified value? Is it the minimum, the mean, the mode or the maximum?

It would seem that most people would interpret this figure to be a "nominal" or an "average (mean)" value i.e. it is not an exact number to be hit and it is understood that there will be a variation with a good practice limits set by the guidelines and recommendations (typically at twice the specified DFT) and a minimum set either by the physical ability of the paint film to coalesce or the adoption of a minimum rule such as the IMO 90:10 rule. However, the authors have come across inspectors (shipyard, owners and paint companies) that often consider it as a minimum value.

The nominal DFT may not match any DFT reading of the scheme applied. The nominal DFT may correspond to an aggregate over many readings.

Impact of minimum and maximum values

The Practical impact of the minimum and maximum values needs to be understood. First of all a number of samples of coating inspections have been taken to get an understanding of what is generally practically achievable.

Control of DFT is dependent on many factors, such as worker skill, equipment, access considerations and the complexity of the structure to be coated.

Performance is best on a flat surface while more complex surfaces will tend to increase the range. The size of the area to be coated will also have an influence.

Data presented by Francis 2013, indicated that, for small areas, the readings on a nominal DFT of 85µm for a single coat of inorganic zinc silicate would give a range of 240µm with a minimum of about 20µm and maximum of about 260µm.

In simple terms, the closer the Standard deviation value is to the mean value (the higher the ratio) the greater the spread of the curve. Hence the more likely you will get over or under application as the process is not well controlled for a number of reasons, such as:

- Weather/wind conditions
- Worker skill
- Equipment capability/maintenance
- Roughness of the surface to be coated

This would indicate a process that is not well controlled, results in excessive over application of coatings, which can penalise a yard in a number of ways:

- Increased cost of paint and thinners/cleaners
- Increased application time
- Increased curing/drying time
- Increased emissions
- Increased waste
- Delay to build schedule
- Increase in utilisation of facilities

In more complex areas Safinah research has shown these results for Cargo holds gave a mean of: 0.19 for the ratio of standard deviation to the mean.

Specified DFT:	250µm
Average DFT:	649µm
Standard Deviation:	133µm
Process capability to 3σ	250 - 1048µm

The process for cargo holds does show a greater variability (higher Standard Deviation) than that for the outside shell, the ratio of mean to standard deviation is about the same (0.18 to 0.19).

The reason for this is relatively simple. The outer hull scheme typically comprises four or more coats of paints as compared to two coats in the cargo hold. The variability in the DFT of each coat is additive, meaning the more coats of paint applied the greater the variability that will be contained.

These results for Ballast Tanks, which are also generally two coat schemes and are more complex areas, should therefore offer a better comparison to the cargo holds.

These give a mean of 0.26 for the ratio of standard deviation to the mean.

Specified DFT:	320µm
Average DFT:	602µm
Standard Deviation:	162µm
Process capability to 3σ	116 –1088µm

As a result ballast tanks, despite having only two coats of paint, as with the cargo holds both the standard deviation and the ratio are considerably higher as a result.

This would imply that design complexity has a much greater influence on the variability of the coating process rather than the number of coats.

This would also imply that to maximise the probability of a good coating application, both the design complexity and the number of coats should be minimised, but that the simplification of design would offer the greater benefits.

In practice, the problem is aggravated further because not all the coating work in one location will be carried out by the same team, In fact there may be more than one team working on each area and the skill/ability and equipment as well as local conditions may vary considerably.

Impact on a coating scheme

Consider a specification of 2 x 160µm as required by the IMO PSPC and as shown on most paint supplier data sheets. In this case the value on the TDS is not the "nominal value" which the authors have interpreted as a target value or the mean/average.

Maximum DFT

Good practice from Paint Company guidelines would mean that the maximum DFT applied should be twice the specified DFT for each coat and for the total scheme. These would give a maximum scheme of 2 x 320µm.

Minimum DFT

While applying the 90:10 rule or the 80:20 rule would give minimum values of:
90:10 rule - 2 x 144µm or 288µm total:
80:20 rule – 2 x 128µm or a 256µm total.

The standard deviation for water ballast tank application has been derived at 162µm. Thus, if the minimum acceptable value is 288µm as per the IMO PSPC, then three standard deviations would provide a mean of 774µm [given by: 288 + 3(162)µm] and the maximum value that could be expected would be 1260µm [given by 774 + 3(162)µm].

The mean that is likely to be achieved will itself exceed the recommended guideline of most paint suppliers, which is set at twice the specified DFT (640µm in this case) and also surpasses the triple value in ISO 12904.
To achieve the required specification:

- Minimum 288µm
- Maximum 640µm

Then the standard deviation would have to be 58.7µm or about 36% of that being achieved in the field based on the Safinah data.

The problem of a high achieved DFT is compounded even further, in that if during the inspection areas of low DFT are identified e.g. an area of 250µm is identified, then if it is touched up by airless spray, it will not be bought up to 288µm or 320µm, but likely by an additional 160µm to 410µm, compounding the over application problem. If the coating is applied by brush an additional 80µm could be added. Therefore any application of "build" coats to achieve the minimum DFT is likely to increase the mean DFT and push the scheme further out of the recommended guidelines provided.

Practical distribution

In practice, however, the applied DFT data does not result in a normal distribution, but a skewed distribution. An actual set of data from a ballast tank is presented in Figure 3.

This WBT coating was specified according to IMO PSPC and thus should have a nominal DFT of 320µm. The analysis of the

data revealed was:

Total number of readings:	566
Minimum DFT:	272µm
Maximum DFT:	1326µm
Range:	1100µm
Mean:	611µm
Standard deviation:	not relevant (not a normal distribution)
Mode:	564.5µm

Given that the recommended practice would give a maximum of 640µm then 193 (34%) of the readings taken in this sample exceeded the maximum, while very few readings were below the minimum, this despite the mean and the mode being below the 640µm maximum.

Thus the actual distribution of the DFT readings will be greater than the expected specified values, in particular the actual distribution will tend to skew toward higher DFT values and this is aggravated by the use of a minimum DFT rule.

As soon as a minimum rule is introduced then the mean DFT achieved will end up being considerably higher than the specified DFT. This combined with a complex space, results in the mean DFT being close to or greater than the twice DFT maximum as provided in paint company guidelines. This can make the specification impossible to achieve in a practical environment.

Conclusions

The variability of the coating process, the number of coats of paint, the complexity of the surface and the use of a minimum DFT rule, result in a mean DFT far greater than that specified and a non-normal distribution. The shift in the mean can be close to or exceed the twice DFT maximum value that paint companies generally recommend as good practice. This shift is further aggravated by repair and touch up work and of course the ever present request by owners for a final cosmetic coat.

Clearly, it is easier for a shipyard to apply more paint to make up for low DFT than to remove paint in the event of excessive DFT. While it is important to achieve a certain minimum DFT for the coating to perform, there is a real danger that the use of minimum DFT rules will lead to higher than expected DFT readings and this can also lead to a drop in performance or even failure of the coatings.

The problem for the yard is that the application of this extra paint not only increases the man-hours and cost of coating the area, but also extends over-coating and drying times as well as increasing Volatile Organic Compounds emissions.

For the owner the problem faced is that the DFT provided may be in excess of that recommended by the paint supplier as good practice and the impact (if any) of the excessive DFT on the performance of the coating may not be well understood.

The reality is therefore that unless current coating application techniques are improved, then the range of readings that will be obtained in practice for any given specification will depend on:

- The number of coats
- The structural design complexity
- The skill of the applicator
- The condition of the equipment used

Paint suppliers would be prudent to test their products at expected DFT's that may be achieved in the field and provide data on the TDS for the elevated thickness expected.

Implications for Paint Specification

What should be taken away from this study is that the way that coatings are currently specified is inadequate and how the DFT is provided on the TDS can be quite misleading.

It is recommended that the TDS should simply contain a maximum and minimum value for DFT rather than some individual ambiguous value. This would leave each paint supplier to determine the DFT range over which their products will provide the claimed performance. Of course this would add some complications, in that drying time, curing time and other data that may be affected by DFT (such as time to service) will need to reflect the range that is provided. *NA*

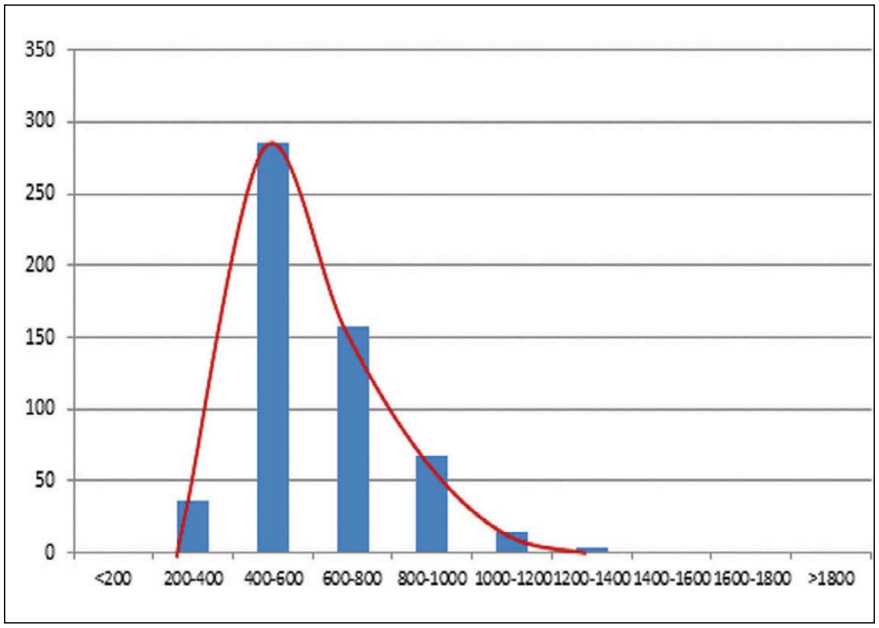


Figure 3: Actual set of data from a ballast tank

The Royal Institution of Naval Architects

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7 - 9th October 2014

Dr Kenneth W FISHER, FRINA

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Intense regulatory regime still driving design

Safety and the environment are just two of the topics that will dominate the regulatory agenda this year, writes Sandra Speares. The Korean government has recently announced a complete overhaul of its regulatory requirements following the *Sewol* tragedy in April

Renewed concerns on passenger safety were already high on the agenda for IMO deliberations this year following the grounding of *Costa Concordia* in January 2012 with the loss of 32 lives.

Following the tragic events of April, which saw the loss of about 300 people in the *Sewol* sinking, many questions are bound to be asked, not only about evacuation procedures and what happened on the day, but also about whether local regulations which allow coastal ferries to be equipped with life rafts, rather than lifeboats – a difference from international regulations which do not - should continue to be applied.

It is too soon to speculate on what might have caused the disaster. The accident has focused the industry's mind on evacuation procedures, which had to take into account not only the emotional state of the passengers – many of whom were children - but, also the options available to the master given the dangers of evacuation by sea into liferafts.

In any investigation, there is also bound to be concentration on whether a steering gear failure might have resulted in a massive list as well as on reports of the vessel being overloaded.

Speculation ahead of the facts will not help the families of victims or the members of the crew but, it is hoped that the South Korean authorities will deliver a robust and comprehensive report which helps to ensure that the right lessons are learned from this accident.

The first of January 2014 saw the entry into force of a number of amendments to both SOLAS and MARPOL, as well as the 1988 Load Lines Protocol.

Amendments to SOLAS included the introduction of a mandatory requirement for new passenger ships

IMO Secretary-General Koji Sekimizu speaking at last year's symsosium. Ship safety has again came into focus following the *Sewol* accident

for either onboard stability computers or shore-based support, for the purpose of providing operational information to the master for safe return to port after a flooding casualty. Other changes include operational testing of free-fall lifeboat release systems shall be performed either by free-fall launch with only the operating crew onboard or by a simulated launching.

Changes were made to SOLAS chapter V to add new rules on ships' manning requiring administrations to establish minimum safe manning levels, as well as a prohibition on the blending of bulk liquid cargoes during a sea voyage. There were also moves to make mandatory the international code on the enhanced programme of inspections during surveys of bulk carriers and oil tankers.

The US Caribbean Sea Emission Control Area also came into effect on 1 January 2014, bringing in stricter controls on emissions of sulphur oxide (SOx), nitrogen oxide (NOx) and particulate matter for ships trading in certain waters adjacent to the coasts of Puerto Rico and the United States Virgin Islands.

There are now three designated ECAs: the US Caribbean Sea ECA and the North American ECA and the sulphur oxide ECAs in the Baltic Sea and the North Sea. More ECAs are expected to follow in due course.

There have also been amendments to regulation 47 of the 1988 Protocol to the International Convention on Load Lines (LL), 1966 to shift the Winter Seasonal Zone off the southern tip of Africa further southward by 50 miles.

Changes to MARPOL Annex VI effective from 1 January 2015, will have considerable ramifications for ships entering emission control areas, and industry concerns have been raised over the effect the change to 0.1% low sulphur fuel when entering an ECA might have on ships' systems.

They point to the fact that low sulphur fuels have gone through a different refining process which increases the risk of cat fines, which can cause serious engine damage and raises fuel incompatibility issues resulting from residues of heavy fuel oil mixing with low sulphur fuel. The low lubricity of the fuel, it is feared, may cause pump failures.

The Marine Environment Protection Committee meeting in April saw the adoption of amendments to the MARPOL Convention to set a date for the implementation of Tier III standards within emission control areas (ECAs) and to make the IMO Member State Audit Scheme mandatory; reviewed environmental provisions in the draft Polar Code and associated draft amendments to make the Code mandatory.

The MEPC adopted amendments to MARPOL Annex VI, regulation 13, on Nitrogen Oxides (NOx), concerning the date for the implementation of Tier III standards within ECAs.

The amendments provide for the Tier III NOx standards to be applied to a marine diesel engine that is installed on a ship constructed on or after 1 January 2016 and which operates in the North American ECA, or the US Caribbean Sea ECA that are designated for the control of NOx emissions.

In addition, the Tier III requirements will apply to installed marine diesel engines when operated in other emission control areas which might be designated in the future for Tier III NOx control. Tier III will apply to ships constructed on or after the date of adoption by the MEPC of such an emission control area, or a later date as may be specified in the amendment designating the NOx Tier III ECA.

There has been some discussion about putting back the Tier III requirements by five years for all existing emission control areas rather than bringing them into force in 2016. However, the MEPC agreement means that they can be in force in the US from that date within the IMO framework as the regulations already exist in US law. The implementation of Tier III requirements in other ECAs will follow a separate timeframe depending the date of making an application to form, for example, a Baltic NECA.

NOx control requirements apply to installed marine diesel engines of over 130kW output power, and different tiers of control apply based on the ship construction date. Outside emission control areas designated for NOx control, Tier II controls, required for marine diesel engines installed on ships constructed on or after 1 January 2011, apply.

"In the meantime, the shipping industry cannot recommend that further member states ratify the BWM Convention until confidence building measures on resolving implementation concerns have been set in place"

Amendments to MARPOL Annex I, the Code for the Construction and Equipment of Ships carrying dangerous chemicals in bulk (BCH Code) were also adopted at MEPC as were amendments to the International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code) on mandatory carriage requirements for a stability instrument for oil tankers and chemical tankers, which are expected to enter into force on 1 January 2016.

There were also amendments to MARPOL Annex VI concerning the extension of the application of the Energy Efficiency Design Index (EEDI) to LNG carriers, ro-ro car carriers, ro-ro cargo ships, ro-ro passenger ships and cruise passenger ships with non-conventional propulsion and to exempt ships not propelled by mechanical means and independently operating cargo ships with ice-breaking capability, expected to enter into force on 1 September 2015.

A correspondence group was established, to finalise the draft MARPOL amendments and the environmental requirements contained in the draft Polar Code for consideration at the next MEPC meeting in October.

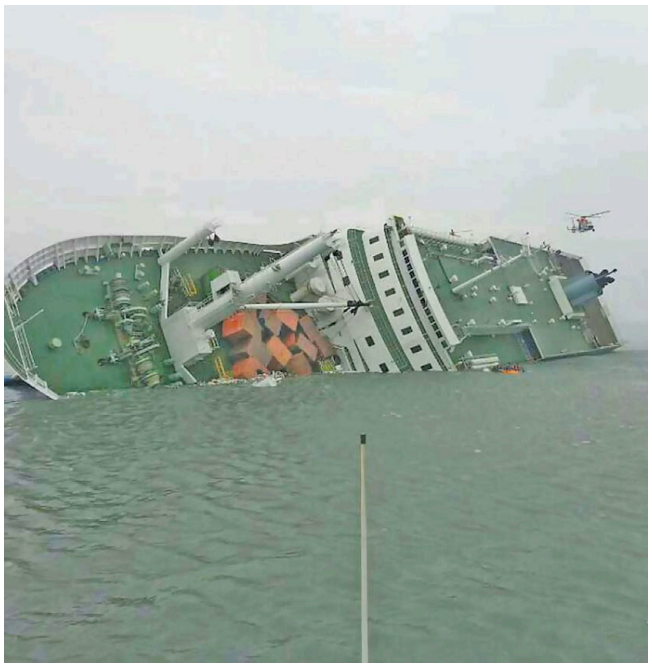
The draft Polar Code covers the full range of design, construction, equipment, operational, training, search and rescue and environmental protection matters relevant to ships operating in the inhospitable waters surrounding the two poles. Environmental provisions include requirements covering prevention of oil pollution, prevention of pollution from noxious liquid substances from ships; prevention of pollution by sewage from ships, and prevention of pollution by discharge of garbage from ships.

The MEPC discussed various submissions relating to proposals to establish a framework for the collection and reporting of data on the fuel consumption of ships. It agreed to establish a correspondence group, to consider the development of a data collection system for ships, including identification of the core elements of such a system.

It also adopted amendments to the NOx Technical Code, 2008, concerning the use of dual-fuel engines.

MEPC has adopted the 2014 Guidelines in respect of the information to be submitted by an administration to the organisation covering the certification of an approved method as required under regulation 13.7.1 of MARPOL Annex VI (relating to marine diesel engines installed on a ship constructed prior to 1 January 2000) and the 2014 Guidelines on the approved method process, which apply to new approved methods notified to IMO only.

The MEPC also approved draft amendments to MARPOL Annex



Sewol highlights need for better safety and regulations

VI regarding engines solely fuelled by gaseous fuels, to clarify that such engines should also be covered by the Annex VI NOx regulations, with a view to adoption at MEPC 67.

The MEPC adopted the 2014 standard specification for shipboard incinerators, which covers the design, manufacture, performance, operation and testing of incinerators intended to incinerate garbage and other shipboard wastes generated during the ship's normal service. The specification applies to incinerator plants with capacities up to 4,000kW per unit.

David Patraiko, director of training, Nautical Institute, explains how crew need to adapt to ECDIS

The review of whether or not there will be enough low sulphur fuel to meet requirements when the global cap of 0.5% comes into force in 2020, was once again on the agenda for discussion at MEPC. The timing of the review on the availability of compliant fuel oil to meet the requirements set out in the new rules has been a subject for much debate. It was agreed that a correspondence group be established to develop the methodology to determine the availability of fuel oil to comply with the fuel oil standard set out in regulation 14.1.3 of MARPOL Annex VI.

The group would provide a progress report to MEPC 67 in October this year, with a view to the Committee adopting the terms of reference of the study at MEPC 68 in 2015. The group is to be chaired by the US who some sceptics suggest is not in favour of any advance of the review date from 2018.

Depending on the outcome of the review as to the availability of compliant fuel oil, the 2020 global cap deadline could be deferred to 1 January 2025. Many observers suggest that while meeting the low sulphur fuel requirements coming into force in 2015 may not be a problem, leaving the review as late as 2018 may not leave refineries enough time to meet the 2020 deadline.

As far as the Ballast Water Management Convention is concerned, 38 governments have signed up; representing 30.38% of the world's merchant fleet tonnage 35% is needed to meet entry into force requirements.

Trade associations including BIMCO and the International Chamber of Shipping have again raised concerns about the need to address implementation problems ahead of the entry into force. "In the meantime, the shipping industry cannot recommend that further member states ratify the BWM Convention until confidence building measures on resolving implementation concerns have been set in place," the associations said in a joint statement recently.

Meanwhile the progressive roll out of the installation of Electronic Chart Display and Information Systems (ECDIS) hits its next deadline on 1 July 2014, when cargo ships other than tankers of between 3,000gt and 10,000gt constructed on or after 1 July 2014 will need to have ECDIS fitted.

The same deadline applies to passenger ships of 500ft and upwards constructed before July 2012, with ECDIS having to be fitted not later than the first survey on or after 1 July 2014.

The next deadline will be in July 2015 when tankers of 3,000gt and upwards, constructed before 1 July 2012, need an ECDIS system fitted not later than the first survey on or after 1 July 2015.

While concerns have been expressed about the costs of fitting the system, not least at a time when owners and operators have to fit other expensive pieces of equipment to meet environmental regulations on emissions or ballast water treatment, one of the major challenges will be training.

Nautical Institute director of training David Patraiko, recently stressed the need for an "ECDIS mindset". As ships change hands, or crew members move from one vessel to another, they may be operating a new type of ECDIS system and therefore training is vital. There have also been concerns raised that some ECDIS manufacturers are providing too much functionality to ECDIS and they argue front of bridge ECDIS should be a pure navigational function with other issues like bunker costs and availability being handled by the back of bridge system. *NA*

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Call for Papers

RINA Marine Design 2014 will provide a forum for reporting and discussing the design practice and technical issues associated with aesthetic design. The full spectrum of marine design from small craft to super yachts, including commercial and specialist vessels, will be examined.

An exhibition celebrating the 30th year of boat design at Coventry University will be opened at the end of the conference, which will include a virtual 3D exhibition of Coventry University students' design work. This will show the breadth of capability within the department of Industrial Design including automotive, transport and boat design.

The conference will present technical papers on a number of aspects of aesthetic marine design, including:

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- ***Sustainability in construction*** (including one-off construction and series production issues, facility design, materials, joining technologies, reconstructions and rebuilds of historic craft, results of simulation).
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- ***Implementation of regulations*** in the design process (including international, national, and regional regulatory frameworks, classification, codes of practice, rating rules).
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Bestobell focuses on the future

Duncan Gaskin, sales manager for Bestobell Valves, a specialist manufacturer of cryogenic globe and check valves for LNG ships, discusses how safety issues are now becoming apparent with the latest revisions to the ICG code

Bestobell adapts for the LNG market

Concerns that safety standards for valves used in LNG systems could be below the safety standard required, is causing concern for valve manufactures and could prove to be a dangerous liability for shipowners, who operate these vessels with substandard parts.

The International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC) code explicitly requires components of valves to be able to withstand a temperature of 925°C. This has been adopted into the interim IGF guidelines. However, there is already evidence that cryogenic valves using PTFE or PCTFE seals, with a melting point of below 400°C are being used in LNG fuel systems.

This is worrying from a safety point of view, as the valves installed in a fuel system need to keep their integrity at all costs or the engine could lose its fuel source and be left drifting at sea, potentially endangering crew and cargo.

The IGC Code first adopted in 1983 provides an international standard for the safe carriage by sea of liquefied gases (and other substances listed in the Code) in bulk by prescribing the design and construction standards of ships carrying these cargoes and the equipment they are entitled to transport.

The Code is currently being revised following a comprehensive five year review, which has taken into account the latest advances in technology and reflects new applications for LNG within the marine sector. The revised version is expected to be adopted by the IMO in 2014, offering an improved regulatory framework.

One of the most important requirements of the IGC code is that LNG cryogenic valves are "firesafe". The IGC code explicitly states that "Material having a melting point below 925°C should not be used for piping outside the gas tanks". Piping also includes the valves. To meet this requirement and enhance the safety of valves when used in marine applications, Bestobell engineers have designed an 'all metal' valve. This means that if any valve is exposed to a fire onboard a ship, the valve integrity is maintained and there is no leakage of gas through the seat of the valve which could cause a fire to escalate.

Over the past couple of years there has been a steady increase in demand for small scale LNGC's, up to 30,000m^3, but this is set to increase rapidly, as countries look to ship LNG around coasts from major receiving terminals to more regional terminals on short transits.

The smaller LNGC use designs for ships with Type A, Type B and Type C cargo tanks. Type A, are unpressurised tanks, Type B are semi-pressurised and Type C are fully pressurised tanks. Each tank design will require a different specification of valve to cope with the range of pressures and class societies will require a higher level of valve integrity as the pressure increases.

Bestobell recently carried out a Failure Mode Effects Analysis (FMEA), for GL (now DNV GL) to prove the integrity of the first valve on the pipe of a Type C tank. Class 150 and Class 300 globe and check valves will be required by the customer to handle different pipeline pressure and the size range will be reduced from DN15 – DN200. Actuated valves will remain the hydraulic type. All valves will still be supplied under the overall requirements of the IGC code.

The larger LNGC's have more challenging requirements, as the vast majority of ships are built with "membrane" type cargo tanks, or Type A tanks, which are prism- shaped. The valve requirements from shipyards using this tank design are well established, requiring Class 150 manual and actuated (hydraulic) LNG cryogenic globe and check valves with size range DN15-DN300.

Another development in marine LNG transport/storage is the increase in countries using floating storage regasification units (FSRUs) instead of land-based receiving terminals.

The advantage of FSRUs is that they are cheaper and quicker to build, as they do not have to meet stringent land-based planning requirements. They also offer more flexibility (as they can be moved), compared to land based terminals. An FSRU is basically an LNG carrier with a regasification system onboard. Bestobell supplies valves to many FSRUs, for example in partnership with Wärtsilä Oil and Gas (formerly Hamworthy), to manufacture manual and actuated (pneumatic) Class 150 to Class 1500, LNG cryogenic globe and check valves for their regasification systems. Sizes range from DN15 –DN100.

The development of the large scale use of LNG as a marine fuel is apparently under way; there are now approximately

50 plus vessels currently sailing that run on LNG exclusively or as a dual fuel. This is set to change in the next five-10 years as shipowners either build new vessels or convert exiting vessels to LNG fuel. LNG offers significant cost savings over existing marine fuels and significant reductions in pollutants that will allow ships to comply with ever toughening environmental laws.

In response to the increase in the use of LNG and other new fuels, the IMO is drafting the International Code of Safety for Ships Using Gases or Other Low-Flash Point Fuels (IGF Code) to create a set of standards similar to the IGC Code, but for fuel systems. Currently, there are interim guidelines that essentially follow the requirements of the IGC code, but the lack of definite rules and inexperience of LNG fuel applications has seen the adoption of sub-standard cryogenic valves for fuel systems. The full IGF code is likely to be approved at the IMO in 2015.

The fuels of the future are boosting parts manufacturers' business as the need for specific equipment increases

A more recent development has been the publication of the OGP Draft 118683 guidelines for bunkering of LNG to ships. The guidelines were drafted by the International Association of Oil and Gas Producers (OGP) and International Organization for Standardization (ISO), and aim to give ship operators and LNG bunker providers safety guidelines on the bunkering of LNG. They are not formal IMO regulations at this stage, but may well form the basis of more legally binding regulations in the future.

Without doubt, the LNG transport sector is set to undergo a rapid period of growth and will lead to diversification in how LNG will be transported and used.

Therefore, the marine industry more than ever needs strong regulation to ensure the near impeccable safety record of transporting and using LNG for transport at sea is maintained where LNG is used in new applications. *NA*

Steeling an edge

Harnessing the power of the wind to achieve both fuel savings and reduction in emissions has been the focus for Australian-based Ocius

Ocius has been developing its steel sail, the Ocius Lotus wing, that has the potential to achieve 20-40% in fuel savings, the company claims. The sails have been developed along with NASA technology to provide a new motion concept, what the company calls motor sailing, by throttling back on the vessels power and using sails to assist in the propulsion of the vessel.

Although putting sails on ships is not a new concept, Robert Dane, chief executive officer, Ocius, explains how he believes that Ocius has something different to offer: "The sails have been developed around stability, visibility and cargo handling. The steel sails also have the option to fold down on to the cargo hatch covers of a bulk carrier, so not taking up any cargo room."

Dane explains that compared to other sail solutions on the market, which either need energy to drive them, take up valuable cargo space, are hugely expensive or obstruct vision and cargo handling cranes, the Ocius solution has taken this onboard with a sail that it claims is relatively cheap to manufacture, doesn't take up excess cargo space and has all controls and joins placed at the bottom of the sail for easy access.

Further to this Ocius has also been looking into solar technology applied to the sails, which it originally developed for smaller vessels. The outcome Dane highlighted was that this type of technology would not yield enough return for larger vessels. "If you did put solar on the sails you would double your cost and only get a 3% payback," he says.

Dane further adds that the future of solar technology on ships still needs further development due to the complexity and cost of it. He, however, points out that: "In 10-20 years' time when nanotechnology can be sprayed on, then it may be possible."

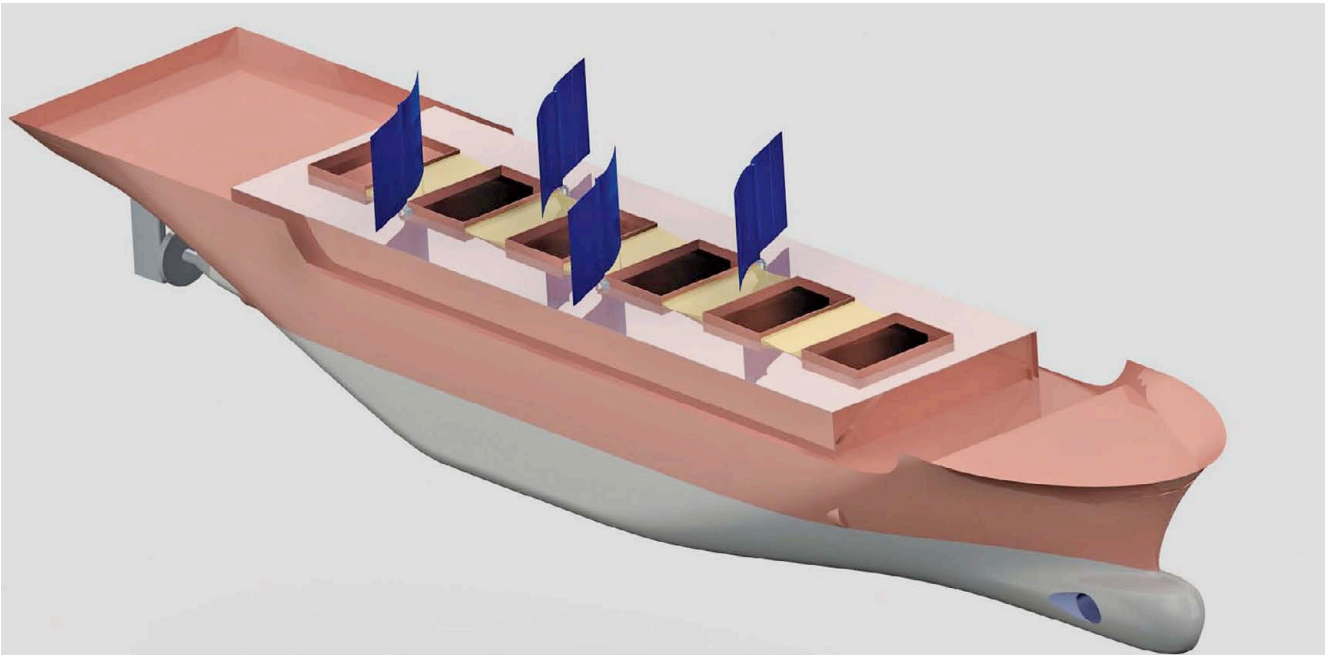
The steel sail project has focused on the bulk carrier market, as there are many of these vessels on the market and they are suitable in the first instance for the application of the sails. "We would like to look at retrofits to start with, as we are looking at real GA plans of vessels at the moment. We are looking at vessels that have an ideal sailing speed of between 12-18knots," he adds.

OCIUS Lotus Wing Solar Sails under construction at Afai Shipyard Guangzhou, China

Ocius has run a study for a Capesize vessel doing consecutive voyages from Japan/Cape Lambert/Japan with an initial cost of four sails for the vessel at AUD$3.2 million (US$3 million); the company has claimed the payback would be a year for this type of vessel.

Dane says that the company is still looking for a partner to apply this technology to their vessels, in order to get real feedback of the sails' performance and adds that the company is working towards this happening in 2015. *NA*

Ocius looks at wind power to drive down shipowners' costs



Improving the numbers

DNV has recently launched its latest optimisation service that will help shipowners make the most out of optimisation

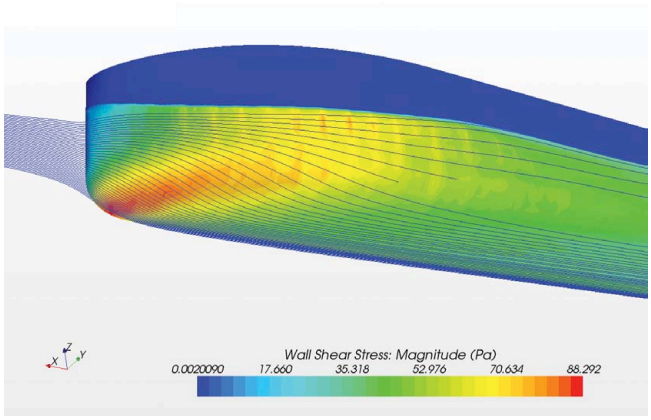
The Build2Design package that was recently launched by DNV GL and trialled on the Green Dolphin 38, has been achieving better than expected results the company claims.

Michael Aasland, business director bulk carriers, DNV GL, notes that the results that they are seeing may seem small, but it is the resulting savings with only a limited effort which makes the service attractive to shipowners and yards.

On the Green Dolphin 38 design a conservative estimate has shown that a saving of 2% can be achieved, which equates to 80tonnes of fuel/year and a saving of US$50,000/year. Corresponding figures for a typical Capesize bulk carrier are 200tonnes of fuel/year and a saving of US$120,000/year.

The Green Dolphin 38 design optimisation focused both on hull resistance and on power plant operation, along with other perimeters using CFD calculations to create the maximum impact on fuel efficiency. Aasland says that the calculations showed savings of 25% (compared to the EEDI index). The Green Dolphin 38 design work focused on achieving the best possible design, while Build2Design takes it one step further, focusing on achieving the best possible ship based on the decided design.

Michael Aasland, business director bulk carriers, DNV GL highlights just how CFD optimisation is changing



Build2Design looks at optimising hull forms and is calculated on design specific instead of ship specific criteria

DNV GL undertook a sensitivity analysis of over twenty parameters and considered both the complexity of addressing a particular parameter and the impact on fuel consumption of each parameter. Aasland adds that the project results show the perimeters and explains that: "There is different optimisation for different hull forms, this is design specific not ship specific."

One of the factors that DNV GL considers in the Build2Design service is the bilge keel; optimisation of this alone has given savings of 0.7% (adjusted from 0,5% in the initial calculations) the company has said. The bilge keel is used to reduce the roll motion of a vessel, but it is not taken into account when hull resistance is calculated using CFD or during model testing. The positioning of the bilge keel is not given by any rules or regulations and each yard has its own methods and procedures.

"It has been acknowledged that the bilge keel influences water flow around the hull, so it should be placed in a way that has minimum negative influence. If the bilge keel is purely aligned based on flow parameters at design draught, it can be misaligned for scantling and ballast draught, impacting on efficiency. However, the location and angle of the bilge keel can be adjusted relatively easily and thus improve the fuel efficiency." says Aasland.

Aasland explains that we are now seeing a new approach to optimisation from how it has been carried out in the past, where previously the design influences the build, now DNV GL want to look at how the build influences the design. "What has been done in the past has been focused on the theoretical hull form and CFD, very little focus has been on what has been done at the shipyard, which is perceived that it just replicates from the design. This we are addressing with the Build2Design service," he says.

But, the question still lies with how reliable optimisation alone will be going into the future and will there be gaps in the data that could create more problems? Aasland says: "No, as long as the CFD is done according to limitations of CFD." DNV GL is also undertaking a study comparing CFD, tank testing, sea trials and operation to see the limitations of each test procedure.

The Build2Design service provides the technical analysis needed to highlight focus areas. It then defines an appropriate set of acceptance criteria to ensure the finished vessel meets design specification expectations. The areas of attention and their acceptance criteria are defined specifically for each design as the hydrodynamic characteristics of every design are different. *NA*

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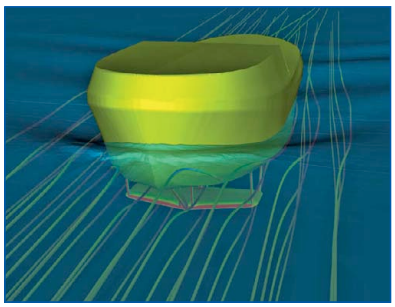

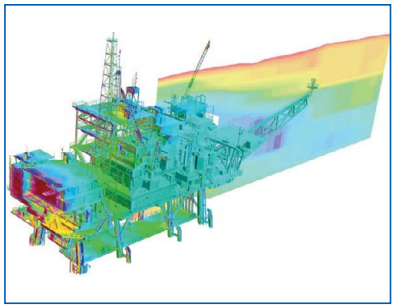

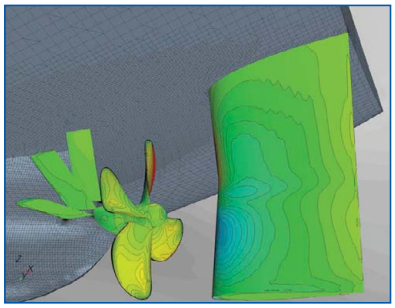

Second Notice

Marine hydrodynamics deals with flow around marine vehicles, such as surface ships, submarines, AUVs and ROVs, and offshore structures, both fixed and floating ones. Some of the important topics are marine vehicle resistance and propulsion, controllability, wave loads, wave induced motions, and energy and ecology considerations. Correct understanding and application of hydrodynamics on marine vehicles and structures are vital in their design and operation.

Computational methods in marine hydrodynamic problems are applied to solve a wide range of maritime applications. Significant progress has been made over the recent past towards the development of the 'numerical towing tank' and 'virtual basin or cavitation tunnel'. Research and development work is still ongoing to enhance their stability, accuracy, computational speed and its integration into the overall design process. While the computational hydrodynamics can provide important insights into physical flow characteristics and offers an economic way to investigate a range of design options, it may still lack the accuracy to match results obtained in real-life experiments. This obviously points to the fact that the computational methods do not replace the experiments completely. The development of non-invasive flow measurement and visualization techniques such as particle image velocimetry (PIV) has resulted in better understanding and quantifying the complex hydrodynamic behavior such as wake in ship propeller region, flow around appendages and vortex shedding from risers

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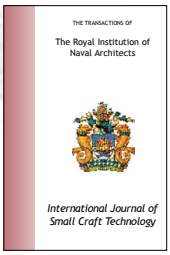

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