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Green ship technology / Ice class vessels / CAD/CAM update / Norway / **January 2011**

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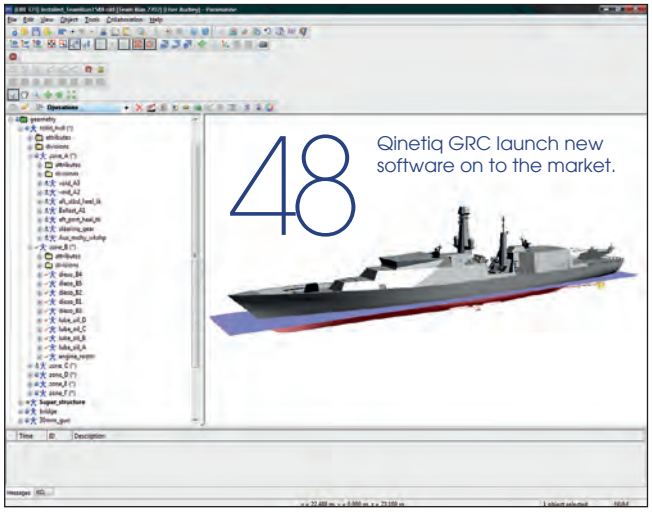

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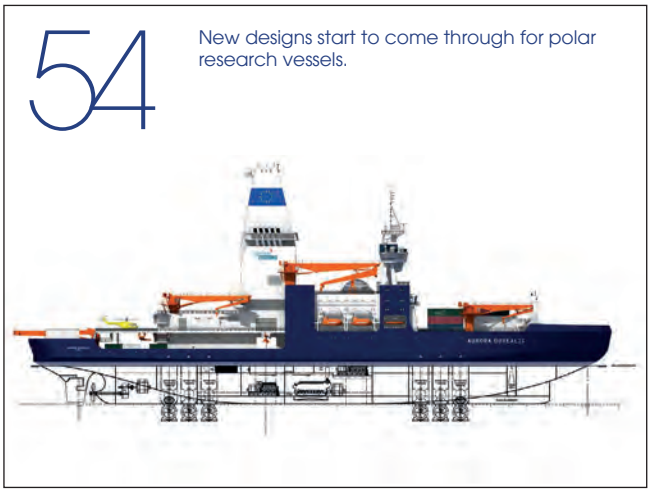

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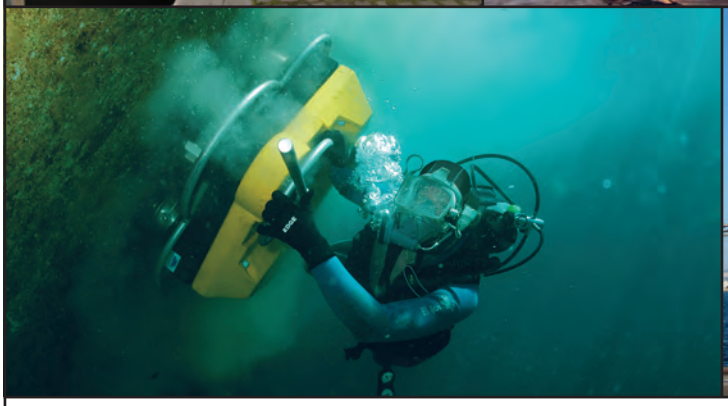
On-line Edition

The Royal Institution of Naval Architects is proud to announce that as of January this year, *Shiprepair and Conversion Technology* journal has gone digital. We are very pleased to inform the maritime industry that each issue will be published online, on the RINA website. Visit www.rina.org.uk/srct and click on the issue cover you wish to view. This means that the entire publication, including all editorials and advertisements in the printed edition, can be seen in digital format and viewed by members, subscribers, and (for a limited time) any other interested individuals worldwide.

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Redefining nuclear power

A Russian nuclear icebreaker heading for the North Pole.

Since the days of the Aldermaston marches, through to the establishment of the Campaign for Nuclear Disarmament (CND) and the Greenham Common demonstrations nuclear power has been regarded as a dirty energy source.

In the public collective psyche (if such a thing exists) the dangers of nuclear energy are many. Long term pollution, secrecy, terrorism, high cost, a threat to the well being of the world. Detractors of nuclear energy point to Windscale in the 1950s, Harrisberg's Three Mile Island in the 1970s and Chernobyl in the Ukraine 25-years ago. All caused pollution that will last many thousands of years, all these accidents had the potential to be considerably worse than they were.

It is with good reason then, that the more cerebral thinkers amongst the ship owning and operating community look at the idea of nuclear shipping with some trepidation. Nuclear power has a perception problem, said Maersk, with no hint of irony.

Supporters of the power source are unfazed by the apparent lack of interest in buying into the nuclear dream. Though undeniably the political landscape has changed since the days of CND and Aldermaston, the designs are certainly better and as some would point out there are some 600 nuclear powered vessels operating safely around the globe today. Some may question just how safe they are, though accidents such as *Kursk* in 2004 are thankfully rare, the question is how will the radioactive material, with a half life far in excess of the vessel that surrounds it be recovered without pollution?

Fourth generation plug & play reactors would be sealed and protected from decay in addition the fissile material is considerably less radioactive than the material used in military hardware. What is more the attractions of nuclear energy such as zero CO_2 emissions, no NOx and SOx, no particulates and refuelling only at drydocking times, and capable of propelling an 8000TEU ship at 30knots, are many.

Such a fuel should be able to give an owner a competitive edge over his or her rivals and Lloyd's Register says that some of the larger companies, such as Shell, Carnival, Cosco and Maersk are seriously considering the nuclear alternative.

Yet even someone that is promoting the benefits of nuclear power in the maritime sector believes that only a small proportion of the world's fleet will ever use the atomic option. Vince Jenkins of Lloyd's Register says the number of nuclear powered commercial ships could "run into the hundreds" rather than the thousands that would be needed to make a serious difference to the amount of emissions that the maritime sector produces annually.

Given that there are some 46,000 ships of above 1000gt operating around the globe today and emitting around 1billion tonnes of CO_2 annually the proportion of greenhouse gases saved even if 999 nuclear vessels were built would be in the marginal bracket.

Estimates also show that the capital costs of a nuclear vessel would be up to three times that of a conventional vessel, which is a large outlay for any company. For Maersk to order some six vessels to operate on the Asia/Europe trade the investment would be a similar cost to ordering 18 conventional container ships, but with only six ships to show for it their flexibility would be considerably reduced.

In addition there are question marks over whether some ports or nations would accept nuclear powered ships and with the ships having to queue to enter port, however fast they are over the water they could well be delayed by the port infrastructure which would considerably hamper the effectiveness of such a ship.

Nuclear power as a strategy for reducing climate change or even the level of greenhouse gas emissions from shipping appears to be an unlikely fuel source. However, few people promoting the use of atomic energy are willing to discuss the element that could surpass all others as a brake on the development of nuclear energy.

In fact the latest designs would see ship operators paying for power by the hour and the power plant itself would belong to Hyperion, the manufacturer. Decommissioning in this instance and the handling of all nuclear waste would then be the responsibility of Hyperion.

Costs for this service are hard to estimate, and certainly BMT Nigel Gee, one of the four partners in the latest quest for marine nuclear energy, believe that "decommissioning is an issue". In BMT's opinion no commercial entity could take the responsibility for storing nuclear waste because that would need a commitment that ran into more than 20,000 years. This is not something that a commercial body could or would write a contract for and as such BMT agree that the cost would necessarily be borne by the taxpayer, in the long run.

It will be intriguing to see which democratic government would like to sell this idea to their electorate. In anticipation of this debate the reader is referred to Wikipedia: "On May 9, 2005 it was announced that THORP [the Thermal Oxide Reprocessing Plant at Sellafield UK] suffered a large leak of a highly radioactive solution, which first started in July 2004. British Nuclear Group's board of inquiry determined that a design error led to the leak, while a complacent culture at the plant delayed detection for nine months."

Plus ça change *NA*

Engines

MAN launches G-type engine

Denmark based MAN Diesel & Turbo has launched its ultra-long stroke G80ME-C engine that will offer reductions in CO_2 of up to 7% compared to conventional engines.

The company reports that design work for the first G-type is already in progress and final drawings for the structure, moving parts and fuel equipment are scheduled to be ready for delivery in mid-2011. The delivery of piping and gallery drawings is scheduled to follow in the second half of 2011, assuming final order confirmation has been received by the end of 2010. In addition the company said other G-type engines of different cylinder diameter will be introduced on demand.

	S80ME-C9	G80ME-C9
Power (kW/cyl)	4510	4450
Engine Speed (r/min)	78	68
Stroke (mm)	3450	3720
MEP (bar)	20	21
Mean Pisto Speed (m/s)	8.97	8.43
Length, 7 cyl. (mm)	12,034	12,500
Dry mass, 7 cyl. (ton)	910	960
SFOC, l, (g/kWh)	168	167

Engine data.

Ole Grøne, senior vice president low-speed sales and promotions, MAN Diesel & Turbo, said: "We have experienced great interest in the G-type engine during extensive consultation with industry partners and are currently working on a variety of projects with shipyards and major shipping lines. As a result, we have reached the conclusion that the introduction of the G-type engine programme is both viable and timely."

He added: "The G-type is an ultra-long-stroke engine and represents the biggest development within our engine portfolio since the successful introduction of the ME electronic engine within the last decade."

Classification

ABS & CCS deepen links

ABS and the China Classification Society (CCS) strengthened their collaborative efforts by entering into a new cooperation agreement late last year in Washington, DC.

The areas of collaboration will include research and development and software development for large and technologically-advanced ships as well as the offshore industry.

The new agreement builds upon the relationship formally established in 1993, when CCS and ABS entered into their original cooperation agreements.

Both class societies will continue to host training and industry seminars in areas of mutual interest including deepwater activities.

In addition ABS has intensified its focus on operations in China with the formation of its Greater China Operating Division, announced in October. The division will have more than 500 employees operating from more than 30 offices across the country and in Hong Kong and Taiwan.

Nuclear Ships

LR group debates nuke rules

A draft of provisional rules for nuclear propulsion in merchant ships was presented by Lloyd's Register (LR) at its Technical Committee meeting late last year; the committee is composed of industry experts.

"We are seeing demand from clients for us to help them in understanding how to manage nuclear power in shipping," said Lloyd's Register's global marine risk advisor Vince Jenkins. "We have expertise and, therefore, we have developed new rules to help the industry. Alongside LNG, fuel cells and renewables, nuclear propulsion is an important future option for reducing CO_2 emissions."

New approaches to environmental protection were presented to the committee and further details of these, and the support that Lloyd's Register is providing to industry, will be available in the near future.

Meanwhile the Board of Trustees has selected Thomas Thune Andersen as the Chairman-elect of the Lloyd's Register Group. He will succeed outgoing chairman David Moorhouse who retired at the end of last year after eleven and a half years.

Mr Andersen, a former Member of the Board for the AP Møller-Maersk Group, will take over at the

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Thomas Thune Andersen appointed LR Chairman.

non-executive helm of Lloyd's Register after almost 25 years in the maritime and energy sectors.

Mr Andersen's previous positions include president and CEO of Maersk Inc., managing director for Maersk Company Ltd, executive vice president of AP Møller - Maersk and president of Maersk Contractors.

Bulk Carriers

Mitsui launches green bulker

Mitsui Engineering & Shipbuilding Co., Ltd. (MES) has developed a new green generation of bulk carriers with the launch of the 66,000dwt ship which it calls the 'neo Supramax 66BC'. MES said the new design will reduce CO_2 emissions by 30%.

Although the 66BC is effectively an enlarged version of the 56,000dwt handymax bulk carrier, the new vessel has seen some major development work with a wide beam (36m) and a shallow draft which is taking into consideration the trade patterns of the 56BCs and the expansion of the Panama Canal, which is expected by 2014.

The neo Supramax 66BC newly developed energy-saving hull form and is larger than 56BC, but even so the new ship is far more fuel efficient than its earlier cousin.

MES said that it has two types of specification of the 66BC, a premium and a standard model. The premium model achieves the reduction of CO_2 emissions by about 21% on a tonne-mile basis. Further reductions CO_2 emissions will be achieved by applying optional software and hardware to vessel operations taking the overall savings to 30%.

LNG

Safety Code link to concept ship

Naval architects Hart, Fenton & Company has unveiled a design of LNG-fuel system. It believes the Aura and its innovative vertical-fuel-system design will comply with international safety codes on gas-ship construction.

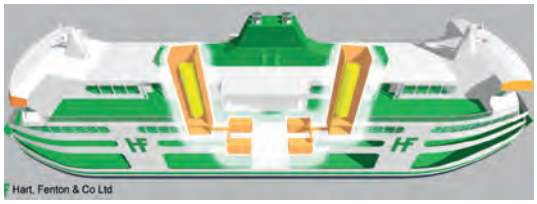
Andy Alderson, deputy managing director of the Portsmouth based subsidiary of Houlder Limited, explains that the Aura incorporates vertically positioned LNG- bunker tanks with one duct leading directly from the engine room to the atmosphere.

In the bulk of the LNG cargo-fuel-system designs produced to date, the cargo tanks are positioned horizontally often under accommodation or passenger areas. This has flagged up concerns as it goes against existing practice and is not allowed within the International Gas Code (IGC), which governs the construction and equipment of ships carrying liquefied gases.

Mr Alderson, who has considerable LNG experience and has been involved in the development of the new International Gas Fuelled (IGF) Code for the past three years, confirms a patent has been applied for and explains the company is in talks with a Classification Society and several shipyards about the design, adding talks are "fairly advanced with one of them".

He goes on: "We have also incorporated the arrangement into other Hart, Fenton & Company designs – predominantly offshore support vessels, ro-ros and ferries as we think this is where the demand will start." The company is also investigating bunker and storage solutions.

Designers Hart, Fenton & Co's double ended ferry with vertical LNG tanks.



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Ancillary equipment

Solar Solve fits GDF *Suez Neptune*

UK-based blind manufacturer Solar Solve has announced that it has recently fitted the diesel-electric LNG re-gasification tanker *GDF Suez Neptune.*

GDF Suez Neptune, was delivered with 45 screens from the SOLASOLV range installed at its navigation bridge windows. The SOLASAFE roller screens were manufactured and supplied by Solar Solve Marine from their South Shields based headquarters and reject up to 91% of the glare, 65% of the heat and 98% of the ultraviolet (UV) radiation from the sun. When in use, they will protect ships personnel from solar radiation and create a more effective and efficient environment in which to work. They are also very effective against glare from ice and snow and retaining heat within the wheelhouse when it is very cold outside.

SolaSolv installs its Solasafe screens onboard *GDF Suez Neptune.*

The Samsung built ship, unusual because diesel-electric propulsion together with re-gasification capabilities make its her almost a rarity, will be operated by Hoegh LNG under long-term charter with GDF Suez. At 283m length overall, 43m breadth and 26m depth, the 70,860dwt tanker's twin 13,200kW motors enable a service speed of 19.5knots.

Contact Solar Solve Marine, Tyne Dock East Side, Port of Tyne, South Shields, NE33 5SQ, UK.
Tel +44 191 454 8595
Fax +44 191 454 8692
www.solasolv.com

Ancillary equipment

Hamworthy cruises into next order

Hamworthy Serck Como has secured a new order for its Multi Stage Flash (MSF) Evaporators, which produces fresh water from seawater to meet World Health Organization (WHO) potable water standards.

MSC Cruises has selected the Hamworthy MSF Evaporator for installation onboard its latest 133,500gt newbuild, which is due to be built at STX France in St Nazaire.

With a capacity for 3274 passengers plus 1600 crew, the ship will be a sister to *Fantasia*, *Splendida*, and the recently ordered *Fantastica*. The contract will see equipment delivered in June 2011.

The latest newbuild will feature two MSF 950-8 units and will be installed close to the ship's diesel engines. Udo Attermeyer, sales director, Hamworthy Serck Como said that that the cruise ship would use the plant to generate both technical water, for use to feed boilers and in the ship's laundry, and potable water.

Drawing on waste energy from the ship's diesel engines, the Hamworthy 'multi-flash' plant solution uses positive pressure to evaporate seawater, producing a distillate meeting WHO standards for potable water that can either be discharged or used as technical water onboard ship as required. It represents the only evaporation principle where heat transfer and evaporation are strictly separated.

Using the system, seawater is first pumped through a cascade of condensers and then a heat exchanger. After heating to a specific temperature (typically 80°C), energy required for evaporation is stored in this stream of hot seawater.

Contact Hamworthy, Fleets Corner, Poole, Dorset, BH17 0JT, UK.
Tel +44 1202 662600
Fax +44 1202 665444
E-mail info@hamworthy.com
www.hamworthy.com

Ancillary equipment

GL approves AMOT

Manufacturer of control and instrumentation for marine rotating machinery AMOT has received the first bearing wear monitoring system type approval according to Germanischer Lloyd's (GL) "Guidelines for Machinery Condition Monitoring".

AMOT's condition monitoring system provides online supervision of crank-train bearings of low-speed diesel engines onboard vessels enabling to detect bearing wear at an early stage. A comprehensive onboard field test demonstrated to GL the reliability of the condition monitoring information provided by the system. The field tests have been conducted in close cooperation with Hapag-Lloyd and MAN Diesel & Turbo.

A significant benefit for shipping companies is the prevention of unnecessary open-up inspections and surveys of crank-train bearings. The dismantling and re-assembling of bearings bear a risk of damage. "Condition monitoring reduces the overall costs of inspection services and optimises maintenance schedules,

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  Andrew Smith, *Global Technology Leader*
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- **Is the current surplus of LNG shipping set to stay? An examination of the supply/demand fundamentals of the fleet**
  Kenneth Wilson, *External Adviser*
  Mitsui OSK Bulk Shipping (Europe)

- **Development of LNG Fuelled Propulsion System for Containerships and Tankers**
  Jung Han Lee, *Vice President*
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reducing the risk of equipment failures or damages," says Dr Jörg Rebel from GL's Strategic Research department.

The type approval certificate is the basis for a survey arrangement for machinery components based on condition monitoring. A condition monitoring system uses various operation parameters or diagnostic results to gain information about the current condition of the monitored equipment. The GL requirements for the survey arrangement and the type approval process for the condition monitoring systems are available in the "Guidelines for Machinery Condition Monitoring", Edition 2008.

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Engines

Scania ups the power

Scania has increased its power generation engine range that is now up-rated with improved step-load performance, increased swept volume and 25% longer service intervals offering customers better operating economy and performance.

The engines can be delivered to customers fitted with a cooling package, making installation faster and easier. The cooling packages are available in three sizes 1.1m^2, 1.3m^2 or 1.5m^2 depending on engine range and cooling needs.

Mikael Lindner, sales director Power Generation Engines said: "The new range of engines have been developed for the specific needs that power generation customers are looking for – high quality, high power– and high step-load capacity, low fuel consumption and good serviceability".

The engine range consists of a 9-, 13- and 16-litre engine for prime power up to 550/607 kVA, 50/60Hz or for standby power up to 636/702 kVA, 50/60Hz. The new power generation engine range meets the Stage IIIA emission legislations with Scania exhaust gas recirculation (EGR).

Key characteristics of the new engine range are: Available with tailor made ready-to-install cooling package, increased bore and stroke, increased swept volume, traditional easy-to-service Scania architecture with individual cylinder heads, waste-gate turbocharger, Scania EGR, no after treatment with additives needed, Scania engine management.

Scania's modular design means that fewer components are needed to build a comprehensive range of engines. This facilitates servicing, parts supply and network training, as well as the setting up of new facilities. Carefully chosen materials and processes ensure high product quality, which also means that the consumption of energy and raw materials will be lower. This leads to lower environmental impact throughout the life cycle of the engine.

Scania launches new engine range to meet stage IIIA emission regulations.

Contact Scania, Scania AB (publ), SE-151 87 Södertälje, Sweden.
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Fax +46 855 38 10 37
www.scania.com

Simulators

BC Ferries gets simulators

Kongsberg Maritime Simulation Inc., the North America arm of Kongsberg Maritime's simulation division has announced it has been awarded a contract by BC Ferries for the supply and installation of three Polaris ship bridge simulation systems to multiple sites in British Columbia, Canada.

Kongsberg Maritime will deliver updated Canadian West Coast area databases featuring 47 detailed terminals owned and operated by BC Ferries. Kongsberg Maritime will also develop 12 new 'own-ship' hydrodynamic models of the BC Ferries fleet.

The BC Ferries contract follows a successful 2010 for Kongsberg Maritime Simulation in Canada, having recently signed new simulator and upgrade contracts with several high profile customers in Canada including the Canadian Coast Guard College (CCGC), the Centre for Marine Simulation (CMS), Marine Campus of the British Columbia Institute of Technology (BCIT) and Lockheed Martin Canada.

Contact Kongsberg Maritime, P.O.Box 483, NO-3601 Kongsberg, Norway.
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"Intra-Asia is already the world's single largest container trade. This will continue over the long term as Asian consumer markets develop. It's not surprising, then, that Asian economies are leading the recovery of international container trade volumes in 2010.

But along with this encouraging outlook comes challenges. More transportation services will be required to support the growth of freight moving within Asia. And freight infrastructure development must be a top priority to prevent a return of supply chain stress in the region.

This will be a crucial discussion at Sea Asia 2011 if the maritime sector is to make the most of its opportunities."

Eng Aik Meng, President, APL
THE ASIAN VOICE IN WORLD SHIPPING: CONTAINER SHIPPING & LOGISTICS conference session panellist

SEA ASIA 2011 CONFERENCE OUTLINE

Tuesday 12 April

Morning
THE ASIAN VOICE IN WORLD SHIPPING: CONTAINER SHIPPING & LOGISTICS

Afternoon
THE ASIAN VOICE IN WORLD SHIPPING: THE MAJOR BULK TRADES

Wednesday 13 April

Morning
LNG ACTIVITIES IN THE FAR EAST

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Smooth operator

In the second and final part of our fouling control paper Hempel A/S experts Diego Meseguer Yebra and Pere Català examine the use of non-toxic, fouling release (FR) technologies.

Anyone who has ever fried an egg can testify to the usefulness of non-stick technology, but in the marine world anti-fouling coatings can save more than just breakfast. Cost savings on coatings that maintain a smooth hull surface can see significant savings on both fuel and emissions.

Non-stick, technology

During the transition from tin-based antifouling products, it was difficult to foresee the commercial success that silicone-based, biocide-free topcoats have experienced in the past few years. In reviews such as that by Yebra et al. (2004), the fouling release technology was just described as a "promising" environmentally friendly option:

- High solid content (i.e. reduced solvent emissions)
- One topcoat required compared to two - three coats for biocide-based anti-fouling coatings. This translates into time-savings in the yards lower solvent emissions and reduced consumption of synthetic materials (lower carbon footprint)
- Completely free of organic biocides and heavy metals (except for trace amounts of catalyst). Hence safer for marine life and reducing toxic waste at dock
- Low hydrodynamic friction with seawater, resulting in reduced emissions of CO_2, SOx, NOx and particulate matter
- No film degradation and no significant leaching of any ingredient into the water column (Finnie and Williams, 2010). In biocide-based paints, the entire formulation is either dissolved or eroded by seawater (i.e. released into the water column).

Source	▲CF%	Remarks
Weinell et al. (2003)	6.1%	Rotary study. Topcoat on smooth PVC
Candries et al., (2003)	3.5;	Rotary study. Full system on smooth PVC
Schultz (2004)	3.0–4.0%	Full system on 304SS. No sandpaper strip
Candries and Atlar (2005)	5.3%	Topcoat on smooth steel. Turbulent boundary layer measurements
Westergaard (2008)	1.4% 5.0%	Towing test. Full system on smooth Al/smooth undercoats Towing test. Full system on Rz_{50} 467µm panels

Table 1. Representative differences in friction coefficient (ΔCF) when comparing clean Fouling Release coatings to self-polishing type ones. Non-fouled silicone topcoats are reported to consistently decrease the drag resistance of a hull compared to eroding-type paints.

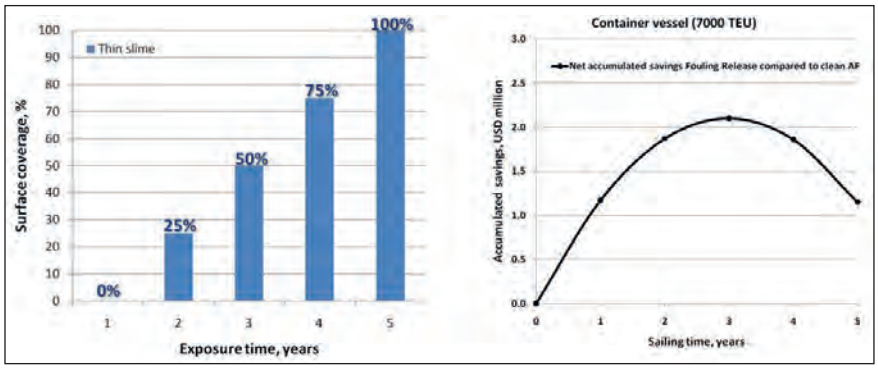

Figure 1: Simulated accumulated fuel savings for a Fouling Release coating vs. a 100% clean self-polishing copolymer paint as a function of progressive fouling settlement on the FR coating (10% self-smoothening is assumed on the SPC: Weinell et al., 2003). Simulations run for a 7000TEU container vessel burning 170tonnes of fuel/day and with an activity of 80% (US$470/tonnes of 380-cst bunker fuel).

Quantifying the above facts, a hypothetical complete conversion to FR coatings would save the environment more than 20million litres of solvent, 70million tonnes of Cu_2O, and six million tonnes of organic biocides annually worldwide[1]. In spite of this compelling profile, a few inherent drawbacks related to the silicone chemistry were believed to jeopardize its commercial success. However, two main factors are responsible for the new reality of this technology. On the one hand, the leap in performance that these technologies have experienced in the past years (see the section below) allowing them to expand to most of the trading fleet while reducing their risk profile and cost.

On the other hand, overwhelming scientific evidence showing that freshly

[1] Assuming sixty million litres per year of antifouling paint. Only topcoats have been taken into consideration. The average dry film thickness of the AF paints is estimated to be 300µm (e.g. two layers of 150µm) compared to 150µm for the FR topcoats.

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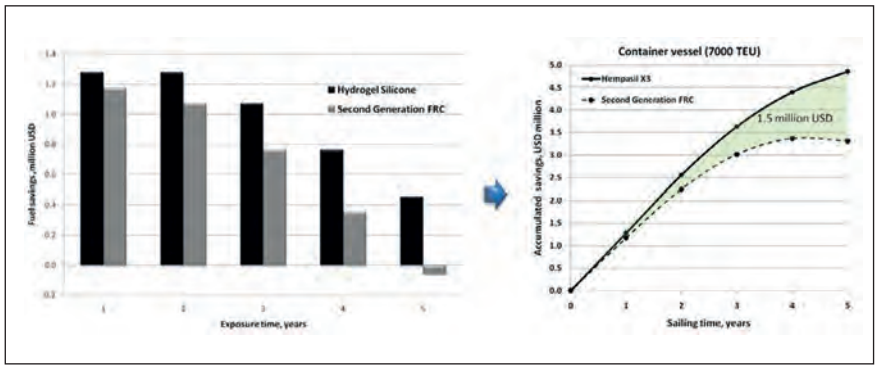

Figure 2: Calculated annual fuel savings (left) and accumulated fuel costs (right) for two Fouling Release coatings vs. a 100% clean self-polishing copolymer paint (10% self-smoothening is assumed on the SPC: Weinell et al., 2003). Simulations run for a 7000TEU container vessel burning 170tonnes fuel/day and with an activity of 80% (US$470/tonne of 380-cst bunker fuel).

applied silicone paints have a significantly lower friction coefficient with seawater compared to conventional anti-fouling paints has been generated in the past few years (Table 1). While tin-free self polishing coatings (SPC) presented a spiky "closed" texture, the silicone topcoat featured a wavy "open" texture with a smaller proportion of short-wavelength roughness (Hellio and Yebra, 2009; Chapter 26). In other words, the smoother surface of silicone coatings results in measurable fuel savings.

The study by Westergaard (2008) for Hempel A/S introduced a new parameter: it is of little practical use to measure drag on smooth panels (e.g. Rz_{50} 30μm), when no less than 100 microns of average hull roughness are typically measured on newly built hulls. The study by Westergaard actually showed that, while the absolute friction resistance increased with the hull roughness, the savings resulting from the use of silicone-based coatings instead of SPC paints were larger on rougher substrates (Rz_{50} 467μm) than it was on smooth plates.

While such studies are of relevance to assess fuel efficiency with clean hulls, the fact is that underwater hulls are rarely 100% clean for the entire service period. Table 1 (see Part I in the November issue) shows the estimated decrease in performance of a containership when its hull coating becomes fouled with different marine organisms. It is now possible to use such data, combined with the measurements by Westergaard (2008), to simulate the fuel consumption of a container vessel coated with different technologies and developing different degrees of fouling.

As a hypothetical example, we compare a self-polishing paint that manages to stay 100% fouling-free (best case scenario) for five years to a FR paint which develops progressive fouling (thin slime). As shown in Figure 1, the fuel savings obtained while the hull is largely free from fouling (first three years) exceed the losses experienced at the end of the drydocking period. In this worst case scenario for a FR coating, the final accumulated savings achieved still exceed US$1million compared to an ideal biocide-based paint.

Figure 2 shows the results of simulating a more realistic fouling scenario for both the second (e.g. incorporating amphiphilic fluoropolymers) and the third (i.e. hydrogel-based) generation of FR coatings (see section below for further details).When compared to the same ideal SP antifouling paint, both technologies yield major fuel savings, with the delayed slime formation on hydrogel-based topcoats translating to about US$1.3 million extra fuel savings compared to non-hydrogel based coatings. According to Thomason (2010), the fact is that currently available FR coatings perform at the level of self-polishing copolymer paints, so Figure 2 (which assumes a 100% clean SPC) is likely to show conservative savings estimates.

Commercial topcoat technologies

Current commercial non-stick FR coatings, all of them based on silicone matrixes, are based on a dual mode of action (Hellio and Yebra, 2009; Chapter 26):

- They prevent the adhesion of fouling organisms by providing a low-friction, ultra-smooth surface on which organisms have great difficulties in adhering
- Once fouling has settled the high polymer chain flexibility characteristic of polydimethylsiloxane (PDMS) polymers result easy the release of attached organisms.

Company	Product name	Special Features
Hempel A/S	Hempasil X3	Above 8 knots. Hydrophobic silicone matrix modified with hydrogels. The documented non-fouling properties of hydrogels are summarized in e.g. the AMBIO-funded Ekblad (2010).
International Paint	Intersleek 900	Above 10 knots. Silicone matrix with amphiphilic fluoropolymer modification.
Chugoku Marine Paints	Bioclean HB	Not known
PPG-Sigma Coatings	SigmaGlide 990	"Pure silicone with improved slime resistance"
Sherwin-Williams	SeaGuard Surface Coat	Above 10 knots. Extra mechanical toughness.
Jotun A/S	SeaLion Repulse	Silicone matrix modified with "nano-springs"

Table 2: Most recent commercially available FR technologies since 2007.

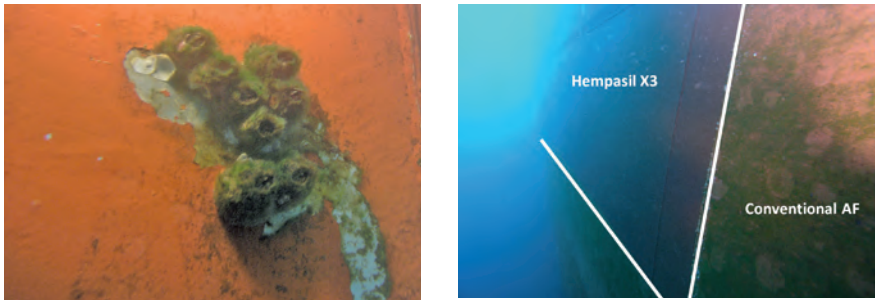

Figure 3: Performance of a hydrogel-modified PDMS topcoat against slime, large size hard fouling and algae growing on inert areas after 10 months sailing in waters with a high fouling pressure (left). Hydrogel Silicone performance against a self-polishing AF on the hull of a bulk carrier sailing around Europe (right).

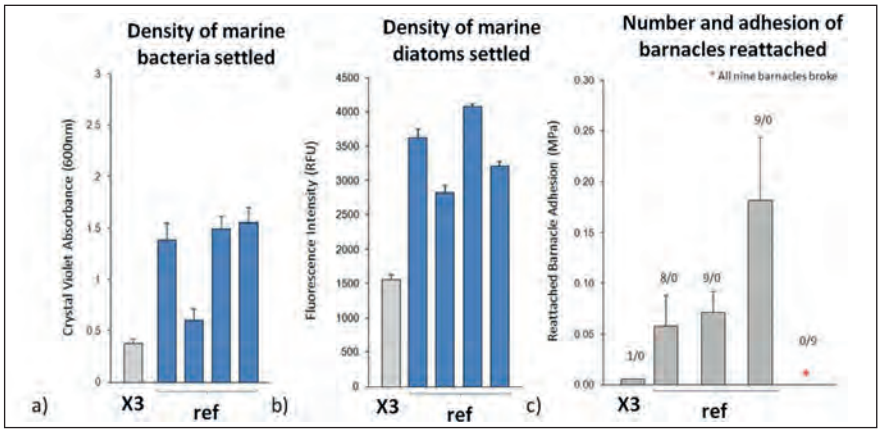

Figure 4: Results obtained from fast screening assays performed on early Hydrogel Silicone commercial coating compared to the standards. a) Settlement of *C. lytica. b)* Settlement of N. incerta. c) 2 week reattached barnacle adhesion test with *B .amphitrite* (measured/broken). The two first reference systems correspond to a commercial pure PDMS-based technology and a commercial PDMS + fluoropolymer technology respectively.

Back at the turn of the 21st century, very few vessels had been applied with silicone-based FR paints. There were three main hurdles at that time for this technology:

- The important R&D investment made by marine paint manufacturers in designing their tin-free antifouling assortment to replace TBT-SPCs
- Few customers were ready to pay the higher cost of the new silicone paints including costs of full blasting
- Concerns with adhesion of silicone topcoats to anticorrosive systems (see Commercial tie coat technologies below).

These topcoats, on the other hand, had issues of staying fouling free so they were only specified for fast moving vessels (e.g. above 15knots or even more) which sailed most of the time (e.g. above 75% activity). While these stringent requirements limited the settlement of macro-foulers such as algae and barnacles, they were not enough to prevent the colonisation of the paint surface by diatomaceous slime or its release during sailing.

As an improvement over hydrophobic PDMS based coatings, the fluoropolymer-modified silicone topcoat Intersleek 900 was the first of a new range of Fouling Release coatings incorporating advanced surface functionalities and allowing its use on vessels down to 10knots. As an extension to Finnie and Williams (2010), Table 2 reviews the most recent commercial products.

As mentioned above, Intersleek 900 was the first commercial product moving away from 100% hydrophobic Fouling Release formulations. Quoting Finnie and Williams (2010), fluoropolymer-modified silicone paints can be described as "amphiphilic network coatings which are designed to provide compositional and topographical heterogeneity with the aim to reduce adhesive interaction with complex marine adhesives". Since it has been widely shown that different organisms prefer different surface energies these coatings alternate between both hydrophilic and low-surface energy hydrophobic domains, aimed at offering a broad spectrum of fouling protection.

The "Hydrogel Silicone" approach used by Hempel rather focuses on protection against diatom and algal spore fouling settlement, the main fouling types affecting "standard" PDMS-based coatings (Hellio and Yebra, 2009; Chapter 26). It is widely acknowledged that hydrophobic domains favour the adhesion of this type of fouling (Finlay et al., 2002), while the glue of diatoms and algal spores cannot displace the water entrapped in the hydrogel surface, hence preventing their settlement (Ekblad, 2010; Rosenhahn et al; 2010). According to Rosenhahn et al. (2010), "the hydration water on OEG (i.e. hydrogel chemistries related to those found in Hempasil X3) is similarly stable as the co-existence of water and ice at lower temperatures".

Just like previous generations of FR paints (Hellio and Yebra, 2009; Chapter 26), the adhesion of barnacles to hydrogel-modified PDMS surfaces is also extremely low. The efficiency of hydrogel-based FR coatings has been demonstrated in laboratory high throughput screening techniques (Hellio and Yebra, 2009; Chapter 15). The results are illustrated in Figure 4. A consistently lower settlement of marine foulers (both soft and hard fouling) on the hydrogel-based coating compared to the references is observed.

These references consisted of two commercial FR coatings (a "pure"-hydrophobic PDMS coating and a fluoropolymer-modified topcoat), one commercial silicone elastomer and one polyurethane coating (negative reference). These results correlate very well to the field performance of this coating technology (Figure 5) and shows that hydrophobic

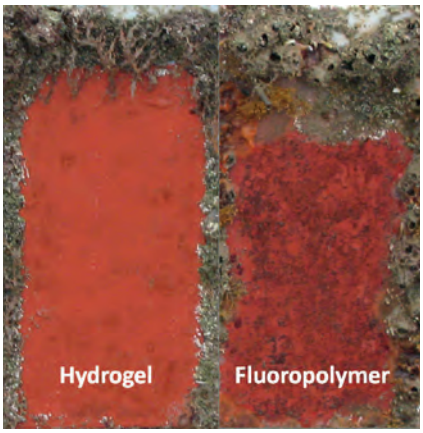

Figure 5: Comparison of fluoropolymer-modified vs. hydrogel modified PDMS-based FR paints (fouling growing from the panel edges should be disregarded). The picture has been taken after 130 weeks of static immersion in the Mediterranean Sea, characterised by strong algal fouling pressure (Hellio and Yebra, 2009; Chapter 16). More examples of performance can be found in Thorlaksen et al. (2009).

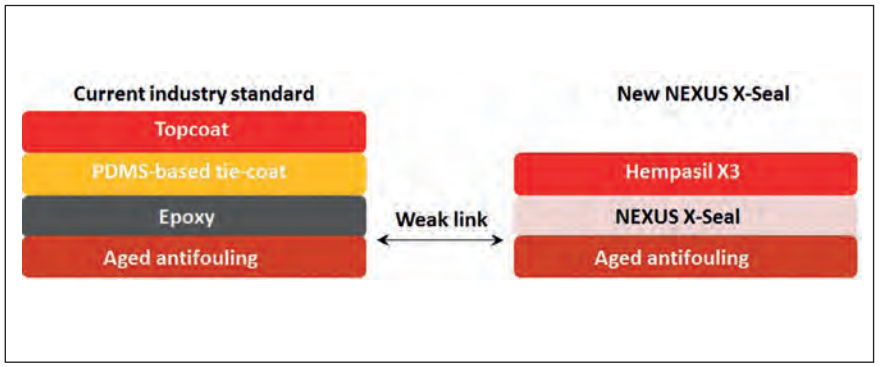

Figure 6: Comparison of traditional specification when converting an antifouling-coated hull to silicone (left) to the new solution using NEXUS X-Seal. Applying epoxy over old AF can cause cohesive failure of the weak topmost layer of the aged antifouling. The latter is unlikely to happen when more compatible and flexible coatings such as NEXUS X-Seal are used.

PDMS coating reinforced with hydrogel moieties overperforms the amphiphilic fluoropolymer approach.

Commercial tie-coat technologies

Until very recently, the application of a FR system on a hull required as the first step the removal of previous paint coats. There is no need to say that the results shown in Figure 4 only have practical relevance if the Fouling Release topcoat is able to maintain its integrity and adhesion to the anticorrosive system throughout the entire dry docking interval. Hence, mastering the tie-coat technology has been a major milestone in the commercial expansion of FR systems. Table 3 summarizes the main tie-coats currently used to bridge epoxy undercoats to FR topcoats.

From Table 3 it can be seen that only one product is not based on the polydimethylsiloxane (i.e. silicone elastomer) chemistry. Compared to silicone elastomer products, NEXUS's patented epoxy-based chemistry provides a very strong chemical adhesion to the epoxy anticorrosive coats (very much like epoxy-epoxy adhesion). In order to safeguard strong adhesion to the silicone topcoat, the epoxy backbone is further modified with highly specific and reactive anchor groups.

Sealing aged antifouling coatings

As an alternative to full blasting, a few marine paint suppliers currently use standard coatings from their assortment to carry out the conversion from antifouling to Fouling Release. Since standard silicone-based tie-coats do not adhere to old antifouling coats, the first step within the industry has been to seal the old antifouling by means of an epoxy coating followed by the standard tie-coat (Table 4 and Figure 6). As elaborated below, using epoxy coatings as "link-coats" poses some risks.

Epoxy coatings are chemically curing (i.e. reacting) systems and, therefore, shrink considerably upon reaction (Figure 7). This creates internal stresses which are likely to cause cohesive detachments of the topmost layer of the aged antifouling, especially if the surface preparation (i.e. washing) has not been done properly. As a solution to this problem, the patent-protected NEXUS X-Seal is formulated as a modification of Hempel's epoxy-silicone tie-coat NEXUS by, among other changes, the addition of physically drying resins in order to maximize its flexibility (Figure 7) and compatibility with AF coats, while maintaining its strong adhesion to silicone topcoats.

Figure 8 compares a full blast scenario to a scenario in which NEXUS X-Seal is used instead. It is obvious from this figure that full blasting operations are very time consuming and constitute a large percentage of the extra time in dock compared to the sealing alternative. Compared to the standard lincoat+tiecoat conversion procedures, NEXUS X-Seal poses a lower cost, as it saves one full coat and reduces time in dock. As shown in Figure 8, using X-Seal brings the dry docking cost to the level of a conventional antifouling.

Touch up and repair of silicone topcoats

One of the drawbacks of silicone-based coatings stated in Yebra et al. (2004) relates to the difficulties in making fresh "non-stick" coating coats stickto old paint systems. Blasting damaged areas results in a transition zone at the edges between the newly exposed steel and the old FR topcoat. This area consists of a range of different substrates, each of them exposed at varying degrees depending on the hydrojetting process. A sample of the above mentioned "transition" areas is shown in Figure 9. When conventional tie-coats are used to repair these areas, their adhesion to these old coatings exposed at the edges of spot repaired areas is clearly insufficient, which may result in detachments as shown in Figure 9 (right).

NEXUS X-Tend is the only tie-coat in the market designed specifically for touch up and repair of silicone vessels. It features excellent adhesion to the broad range of substrates observed in Figure 9. As a

Company	Product name	Special Features
Hempel A/S	Hempasil NEXUS	Three pack mechanically durable epoxy-siloxane tie-coat , specified down to 10 °C
International Paint	Intersleek 737	Three pack, silicone elastomer tie-coat specified down to 0 °C
Chugoku Marine Paints	Bioclean tie coat	One pack silicone elastomer tie-coat specified down to 5 °C
PPG-Sigma Coatings	SigmaGlide 790	Two pack silicone elastomer specified down to 10 °C
Sherwin-Williams	SeaGuard tie coat	Two pack "durable" silicone-based tie-coat specified down to 5 °C
Jotun A/S	SeaLion tie coat	Three pack silicone elastomer tiecoat specified down to 5 °C

Table 3: Tie-coat systems used in combination with the top-coats listed in Table 7.

Company	Product name	Description
Hempel A/S	NEXUS X-Seal Hempasil topcoat	Epoxy-siloxane modified sealer Topcoat
International Paint	Intersleek 717 Intersleek 7180 Intersleek 737 Intersleek topcoat	Epoxy link coat Novel epoxy-modified link coat Tie-coat Top coat
Chugoku Marine Paints	Bioclean sealer Bioclean tie-coat Bioclean HB	Pure epoxy paint Tie-coat Top coat
PPG-Siga Coatings	Unknown	
sherwin-Williams	Unknown	
Jotun A/S	Unknown	

Table 4: Commercial specifications to convert vessels already coated with antifouling into a Fouling Release system without the need for full blasting.

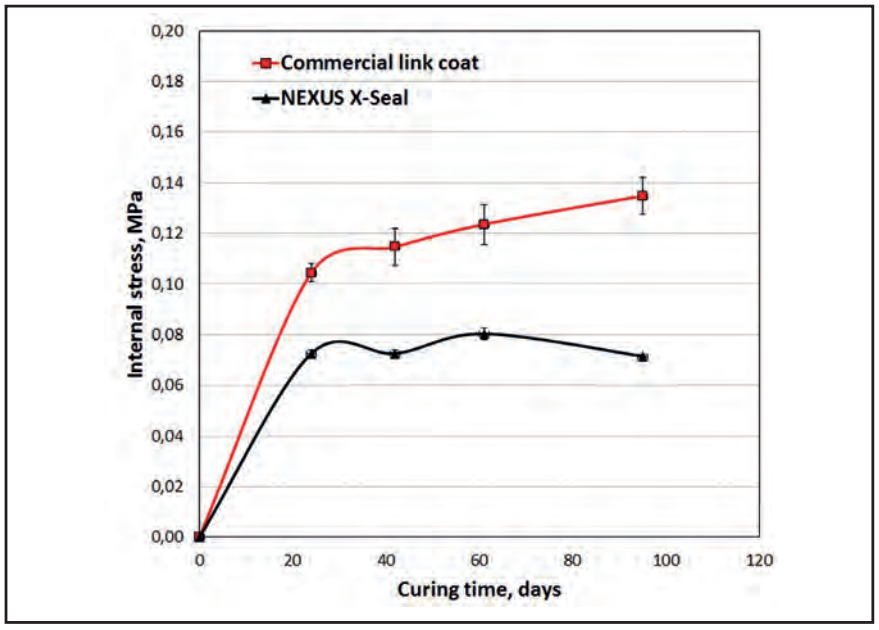

Figure 7: Internal stress build-up upon curing (ASTM D6991-05) showing that NEXUS X-Seal has lower residual stress and, consequently, lower risk of failure, than a commercial epoxy link-coat used to seal aged antifoulings.

result, NEXUS X-Tend provides both faster throughput in dry-dock (fewer steps; Figure 10) and safeguards excellent final adhesion compared to current tie-coats.

The touch-up and repair of Fouling Release vessels can now be accomplished in a few stages and with an excellent final result. As an example, the full repair of a 3500 TEU container vessel has recently been completed in less than 5 days between indocking and flooding partly thanks to NEXUS X-Tend.

A final example of the exceptional surface tolerance of X-Tend is detailed next. Unexpectedly, the boottop area subject to frequent wet-dry cycles has been found to be especially challenging to overcoat. A combination of phenomena, such as e.g. atmospheric contamination and pollution at the seawater surface, causes weak adhesion of the new topcoat, as shown in Figure 11. Applying NEXUS X-Tend is strongly recommended in those intact silicone areas which have a higher risk of being exposed to any sort of surface contamination jeopardizing a safe overcoating.

So what is next?

The evolution of the Fouling Control market in the coming years will be determined, to a large extent, by factors external to the marine business. While it is indeed possible to foresee some general trends, the uncertainty lies on how fast events will develop and to which extent they will impact the market (regional vs. global trends, voluntary vs. mandatory measures, etc.). Some obvious examples are:

- Upcoming and future legislation such as registration schemes for chemical (e.g. REACH) and biocidal (e.g. BPD) products, Volatile Organic Compounds regulations, etc. (see Pereira and Ankjægård, 2009)
- Increasing environmental consciousness (e.g. carbon footprint, ocean pollution, invasive species)
- Economical factors (crude oil price, shift to distillate fuels, price and availability of key raw materials (e.g. metals), etc).

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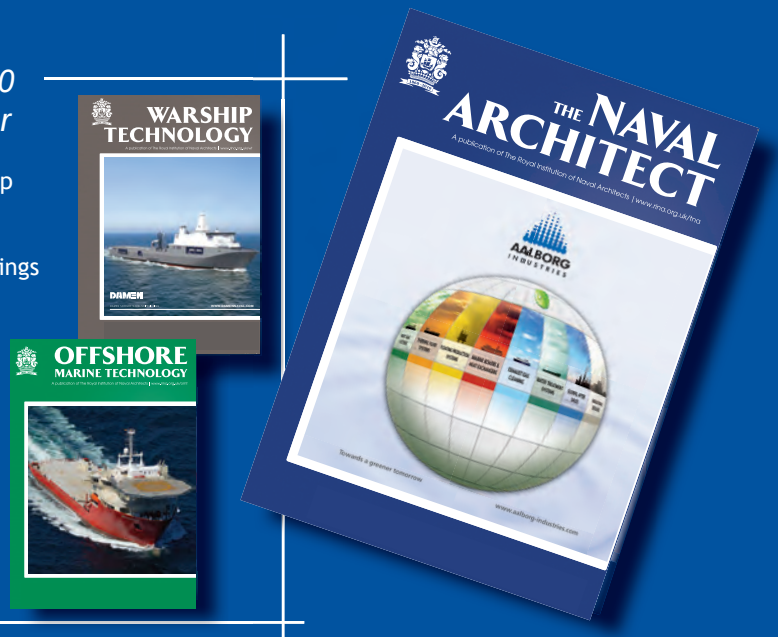

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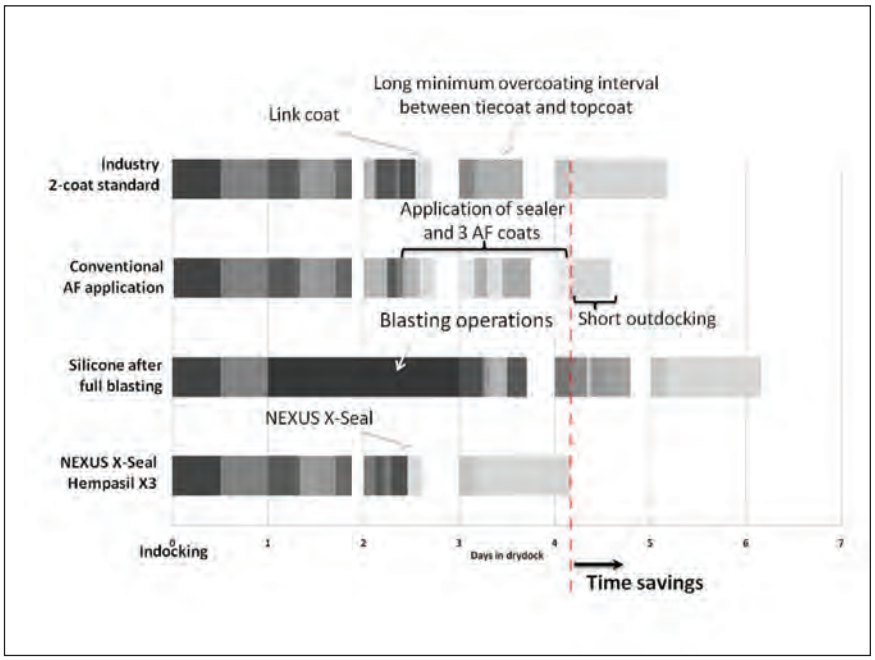

Figure 8: Simulated timelines for a dry docking in which a 10000m^2 hull coated with conventional AF is to be converted to a FR system compared to coatings that are reapplied with a conventional antifouling system (20°C). No painting is assumed to take place during the night time (except for priming after spot blasting). NEXUS X-Seal shows 37% time savings compared to the current full blasting procedures (waiting times depicted as blanks). This is equivalent to roughly two days or US$400,000 using Singapore prices for blasting, washing, paint application and dock rent. It is also one day faster than a re-docking using a linkcoat+tiecoat sealer system. As shown in the graph, a Fouling Release conversion with X-Seal is in level with a conventional antifouling application.

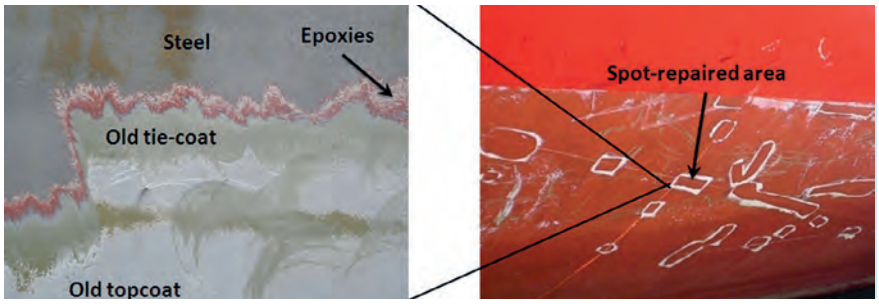

Figure 9: Mixed substrates exposed after hydrojetting of mechanical damage before coating application (left). Final result when conventional tie-coats are used for the touch-up (right) showing deficient adhesion at the transition edges.

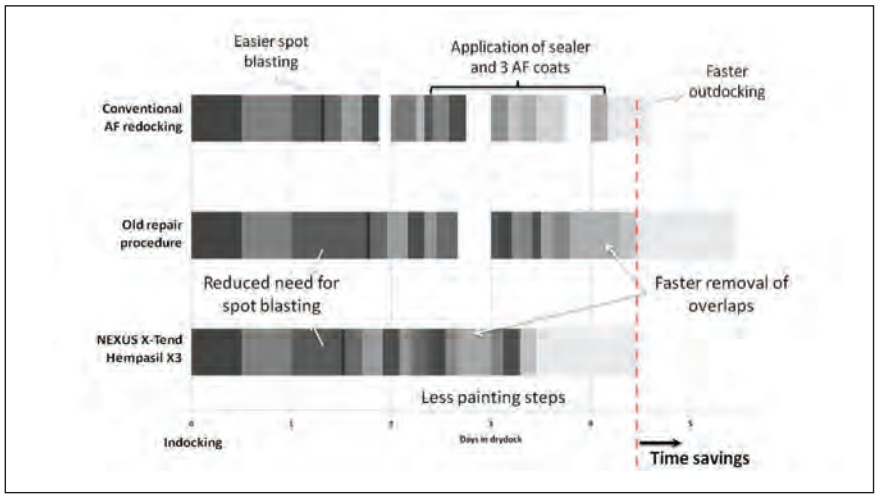

Figure 10: Simulated timelines for a silicone overcoating project at 20°C (10000 m^2 hull; waiting times depicted as blanks). The maintenance tie-coat NEXUS X-Tend is compared to traditional tie-coats such as NEXUS (top) showing an 20% time saving (equivalent to roughly one day or US$100,000 using Singapore prices for blasting, washing, paint application and dock rent). The hull area to be hydrojetted (step 3) is reduced since NEXUS X-Tend is tolerant to well-prepared old epoxy and tie-coats, so only severe damages needs to be repaired. X-Tend brings the docking times down to the level of a conventional AF redocking thanks to the simplified repair steps and the lower number of full coats. The above time comparison has been done following normal working hours and overcoating intervals for the different products.

In the long run, and as the performance of FR products is optimized even further, it is likely that this technology will become the preferred choice both from the economical and environmental points of view. In order to satisfy the more conservative customers unwilling to invest in state-of-the-art coatings, biocide-based products are still expected to stay in the market for many years to come. However, these products will need to continuously reinvent themselves in order to meet tighter legislation, e.g. using lower amounts of efficient yet more environmentally friendly active ingredients, safeguarding low emissions of exhaust gases and preventing the spread of non-indigenous species, etc. The coming years will witness whether marine paint companies will succeed in dramatically improving the environmental profile of their biocide-based products while keeping performance levels similar to that already achieved by the best non-toxic


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Figure 11: Example of the clear beneficial effect of NEXUS X-Tend on the adhesion to aged silicone topcoat in the waterline area.

products and a competitive price structure.

Conclusion

As the shipping industry slowly moves towards higher energy efficiency and lower environmental impact, two technologies are emerging as the preferred choice: the biocide-based Silylated Acrylate technology and the fuel-saving Fouling Release technology. In each of these categories there is a wide range of commercial products already available, as we have summarized in this 2-part review. Within each family, all products are described by similar terminology despite having significantly different formulation parameters. With this background, it is very difficult for a ship owner/manager to know which the most cost-efficient products for their fleet are. As onboard performance monitoring tools become more common and reliable, a larger portion of the market will be able to objectively select their preferred choice of Fouling Control product with subsequent benefits to their fuel bills and the environment.

Silylated Acrylate-based paints base their performance on prolonged antifouling activity, keeping the hull free of macrofouling for longer times than other tin-free technologies (e.g. above 60 months). In this respect, the ship owner/operator should measure almost no decrease in performance due to the antifouling paint throughout the entire dry docking period, with any potential mild fouling compensated for by the self-smoothening of the paint (Weinell, 2003). Biocide-free, FR paints are, on the other hand, more prone to light fouling than biocide-based paints, and are likely to accumulate some slime after long immersion periods, especially if the vessel stays idle for long times and/or its cruising speed is low. As demonstrated by numerous authors, as long as there is a significant portion of the hull which stays fouling free, silicone-based coatings will lead to fuel savings thanks to their well-recognised low friction properties. Hence, the longer a Fouling Release product can delay fouling, the larger the fuel savings. In Figure 4 and Figure 5, we show that not all FR products are equally successful in such a task.

Regarding the magnitude of the potential fuel savings, Figure 1 shows that Fouling Release coatings will lead to fuel savings even in worst case scenario comparisons. State-of-the-art FR formulations show performance levels comparable to that of the best performing biocide-based products for the entire drydocking cycle (e.g. Figure 3), with important savings as a direct consequence. Contrary to the conclusion of Yebra et al. (2004), one can conclude that silicones are already now a commercial reality and that the market is likely to adopt it as customer confidence grows and the products are optimized even further. Year 2010 witnessed the launch of three new tie-coat products facilitating the touch up and repair of silicone vessels and the conversion of antifouling hulls to a Fouling Release system. Two of these products significantly lower the switching costs to this environmentally-friendly technology aiming at lowering the barriers for the technology shift. *NA*

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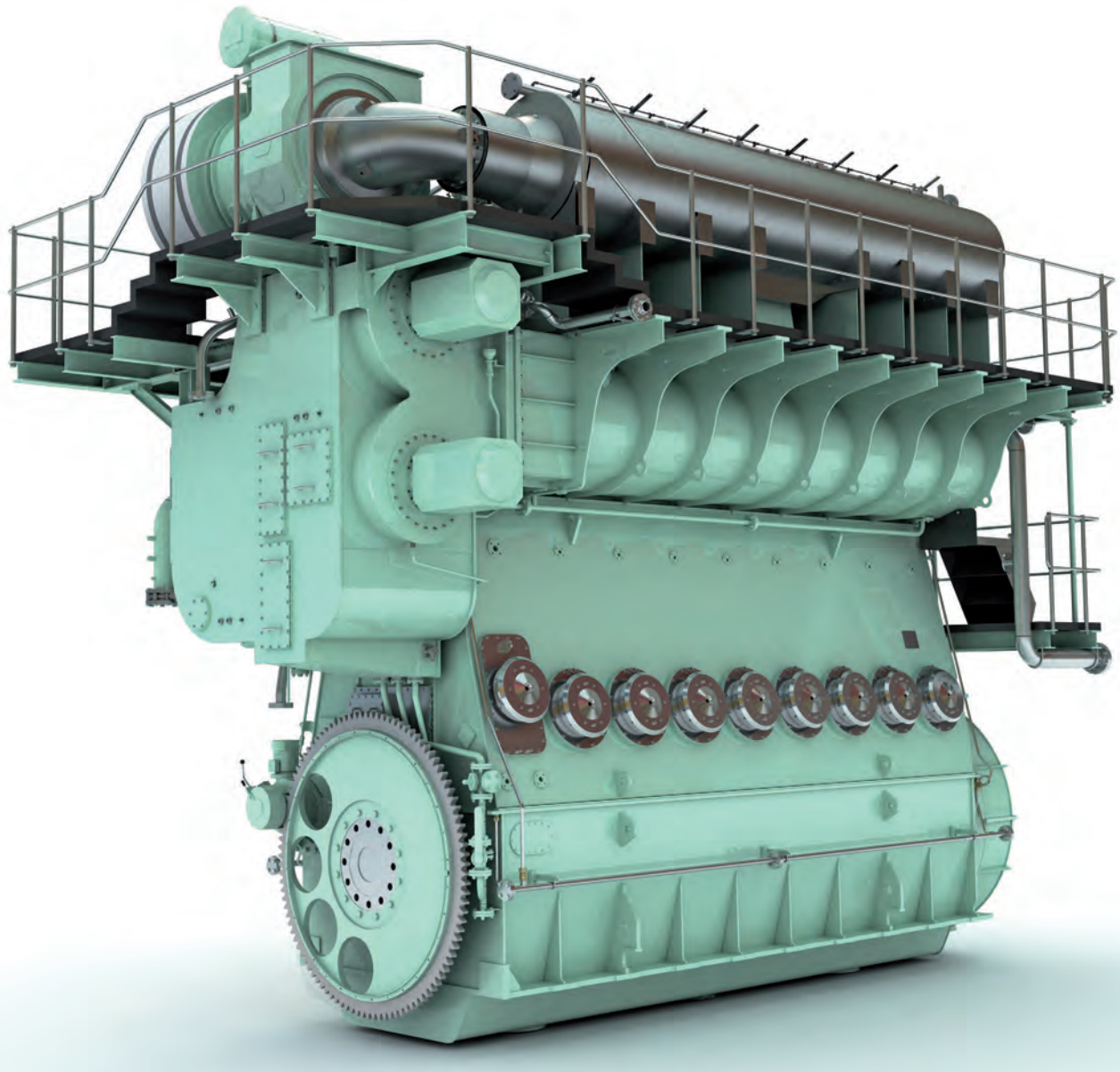

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Deliberation on state aid for yards enters critical phase

The 6 December was the deadline for submissions regarding the European Commission's (EC) consultation paper on the framework of state aid for shipbuilding; paving the way for a decision on what support shipbuilders can expect, when the current agreement expires on 31 December 2011.

Major shipbuilders in Europe, and other interested parties, have had two months to prepare submissions to retain the framework after the deadline and to suggest amendments they would like to see introduced post 2011.

The consultation process is taking place against the backdrop of European shipbuilders' concerns over state aid provided to Asian shipbuilders, Anthony Woolich competition partner at law firm Holman Fenwick Willan points out. "A key concern for the European industry will be that whatever structure emerges will have the effect of having a level playing field with Asia". Other than the concern not to lose subsidies, shipping has moved to Asia to a massive extent in recent years and "this looks like a trend that will continue".

European shipbuilders have recently been raising concerns that Asian yards are beginning to compete in niche areas on which they have concentrated after being out-bid on series ship construction.

However, shipbuilding is still an important industry in the European Union (EU) and the problem it has, Mr Woolich says is: "the European Commission does not like having specific guidelines for specific sectors. That is a real issue. It is not necessarily the end of the story." In EU competition law there is still a block exemption for liner consortia.

"In order to retain the block exemption for liner consortia, the industry had to persuade the Commission that there were specific things about cooperation arrangements in maritime matters that merit having a specific piece of legislation. The question is whether you can make the same case for shipbuilding. The counter-argument is that there are lots of other industries who have moved their activities to Asia at the expense of Europe. "What is special about shipbuilding that it needs to have special rules?"

There are several options going forward, whether to extend the regime, restrict it or dispense with it altogether, Mr Woolich explained. He said he hopes the Commission will look at the issue with an open mind. Commission vice president in charge of competition policy, Joaquín Almunia, has already indicated that this will be the case.

As Commission maritime transport director Fotis Karamitsos pointed out at the London Shipping Law Centre's Cadwallader lecture in November: "We are under the strict obligation to carry out, each time we propose a piece of regulation, a full impact assessment study which shall not analyse only the qualitative effects of what we will finally propose, but shall show a full quantitative analysis. The basic pre-requirement is to have wide consultation with all interested parties."

The other interesting issue Mr Woolich highlighted in relation to the consultation is the "greener ship concept". Holman Fenwick Willan has been advising on this and on concepts for greener ships.

Although, he could not comment on this in detail he said: "The idea that aid should be linked to having greener ships is a very interesting concept, which ties in with other policy objectives". He said he could see that would be "interest and attraction to a lot of people in innovation aid being conditional on the result of the innovation being a greener ship." That concept was, he believed, one possible outcome of the review. The linkage between innovation aid and greener ships was made in the questionnaire put out as part of the consultation process, notably as to whether innovation aid should be retained only if linked to greener ships.

The framework: "provides the rules for the Commission to assess whether state support for shipbuilding is compatible with the EU internal market", a briefing note put out by Holman Fenwick Willan in October explained. The current framework was effective from 1 January 2004 and has been extended twice since then.

Shipbuilding, the note explained, is one of the few sectors still subject to a specific state aid regime which derogates from the general state aid rules: "The explanation being that this derogation is justified by historical features of the industry and certain features of the markets: in particular, shipbuilding is a global market by nature and is recognised as suffering from cyclical over-capacity".

In the framework, definitions of shipbuilding and the different categories of vessel eligible for aid under it are set out. There are specific provisions for innovation aid, regional aid, closure aid, export credits, employment and development aid.

In its industry questionnaire, DG Competition stressed that innovation aid to shipbuilding is "unique and has been justified by the yard industry's short production series, vessel size, value, complexity and the fact that prototypes are generally used commercially," Holman Fenwick Willan explained. Other questions included whether there were projects that could be completed without state aid.

Innovation aid in Germany alone has been estimated to be worth €22 million to the shipbuilding sector this year.

According to Werner Lundt, general managing director of the Hamburg-based German Shipbuilding and Ocean Industries Association (VSM) German yards have been concentrating more on the construction of specialised ships as competition with Far Eastern yards was difficult for standard vessel types.

The move to specialised ship production was easier than might have been expected, he said as German yards have a history in

building specialist vessels, and the German shipbuilding market never concentrated on building long series of vessels to the same specifications.

Reinhard Lueken, secretary general of the Community of European Shipyards' Associations (CESA), said that in CESA's submission, the organisation was, of course, promoting a prolongation of the framework. However, he said CESA believed that the framework should be given a different title. The title 'Framework to state aid for shipbuilding', he believed, seemed to indicate there was state aid to shipbuilding "and that is not actually the case at all". Dr Lueken said: "the level of support to shipbuilding is probably among the lowest if you compared it to other industries".

The difference was that shipbuilding had a separate sector-specific piece of legislation. When compared with the state aid guidelines for maritime transport, he said: "they are much more generous, they provide much more support instruments than the shipbuilding framework. The shipbuilding framework is relatively restrictive."

Dr Lueken said that the first point CESA was making was the title should be: 'Framework for the application of EU state aid rules to the shipbuilding sector' because "that is what it is". The only instrument that has grabbed people's attention is innovation aid, Dr Lueken explained.

Innovation aid is applicable in principle to all other sectors as well "there is a horizontal rule for that". The problem with the horizontal rule, he said, is that it cannot be applied "one to one in shipbuilding". He explained that also under the horizontal rule for prototype developments, the prototype can be sold but the sales revenues must be deducted from the eligible costs, those that are fundable.

For example in the case of a microchip, the cost of development is €1 million you could sell the prototype for say €20 and deduct them from your eligible costs, which would make no difference. In the case of a ship the eligible costs are a fraction of the total ship price. "You sell the ship and then you deduct the revenues from the eligible costs. It is not workable. The fact that we do not have series production and we are always selling our prototypes is one of the main reasons why the horizontal cannot be used and that is the reason why the EU introduced the innovation aid in the shipbuilding framework in the first place." These basic circumstances have not changed therefore Dr Lueken said that he was optimistic that the EU would come to the same conclusion as before.

Dr Lueken said he would expect the responses to be reasonably limited as part of the consultation process and then would do the full impact assessment. He expected to see what was proposed "sometime in the spring". He was optimistic that innovation aid would be prolonged. A number of other proposals have been made, notably on the description of ship types.

One example is those involved in inland navigation. Many of the definitions used are 20 years old, he said and in the case of inland waterway vessels the "global competition has changed". Before there was little competition in building these vessels and this was no longer the case. "In terms of innovation we need a lot on inland navigation vessels. Why should that be excluded?"

Another example is the vessel has to be self-propelled. If you have a non self-propelled vessel for the installation of offshore wind farms, why should it be excluded as it could be a very innovative piece of equipment? Dr Lueken asked. "The definitions in the shipbuilding framework are 20 years' old, or older, and they have never really been looked at. Since this is a more extensive review you can look at the corners that have not been touched for a while and see if they are still appropriate."

CESA also considers there is a lot of scope to support the maritime industry in its endeavours to improve environmental performance. He feels this should be highlighted, so people are made aware that the instrument already exists and they can use it. "One way would be to have some more explicit wording in the shipbuilding framework."

A "strong justification" will be needed if the framework is to be retained, Holman Fenwick Willan says.

"The Commission states that it would like to assess, in particular, to what extent the current innovation aid rules are appropriate for promoting greater efficiency and competitiveness of EU shipyards. It asks whether innovation aid is necessary for the construction of prototypes and whether it should be redirected to the construction of 'greener ships'. Irregular implementation by government and the diversity of shipyard portfolios has meant that the success of innovation aid in the sector has been mixed.

"The need to ensure a level playing field with Asian shipbuilders should also be a prominent consideration." *NA*

The long and the short of green shipping

Essentially the future development of shipping can be split into two parts, the short-term fixes to meet new regulations on existing ships and in the long term designs that will reduce emissions even as shipping demand escalates.

All producers of components and systems are grappling with the problem of making ships more fuel efficient. Maersk itself is engaging with its partners to solve the same problem said the VP of Maersk Marine Technology Bo Cerup-Simonsen.

Maersk's short-to-medium term aim is to reduce emissions from all its vessels by 25% by 2020 and it is building the next generation of ships that are equipped to meet that target and is looking at systems that will curb emissions from its existing fleet.

New vessels will benefit from an optimisation programme that is currently under way to look at every single aspect of ship operation and design and to find a way to reduce the emissions from each system and component. Some 25 projects are currently being evaluated on Maersk vessels. "We are a ship operating company primarily, but we like to find partners that innovate and help them to develop systems," explains Mr Cerup-Simonsen.

In addition in the latest order of sixteen 7500TEU ships from Daewoo Shipbuilding & Marine Engineering (DSME) have been designed using the operational profile of the ships rather than using the "contractual convenience" of a single point in the operational profile of the ship, said Mr Cerup-Simonsen. "No-one has done this before," he said.

"By changing the hull shape we gained 8% on annual fuel consumption, it's been an incredible learning curve for us, it's a huge gain, we all [owners and designers] have to do this in the future," he added.

The 16 ships being built at DSME are destined for the South America/Europe trade and will be known as Sammax vessels. They will be fitted with large propellers and a slow running, long stroke, tanker engine that will have an additional cylinder and then be de-rated by around 10%. This saves 6-8% on fuel costs and with a waste heat recovery system saving a further 10% on the fuel bill the total reduction would be 23% reduction on the fuel bill. Though there is some additional capital costs.

"If you want an absolute reduction in CO_2 emissions from shipping then fuel efficiency will not be enough" said Maersks VP of marine technology, Bo Cerup-Simonsen.

These savings are significant and the reductions in CO_2 will be a benefit to the climate as a whole. However, Mr Cerup-Simonsen admits that most of Maersk's programmes are only a short-term fixes and the Sammax ships themselves, if all ships were designed in a similar way, would not reduce emissions enough to meet the demands being made on the maritime industry when the expected growth in shipping will be 50% within the next 40-50 years.

In the long run "if you want an absolute reduction in CO_2 emissions from shipping then fuel efficiency will not be enough. Slow steaming can go a long way, but over the next 50 years the increase in shipping demand will mean that an absolute reduction of emissions will require more radical solutions."

As a result Maersk is testing new fuels that could meet the conditions necessary to see a significant reduction in greenhouse gas emissions. The company is considering the use of liquefied natural gas (LNG) and is testing a ship operating on bio-fuel, FAME, fatty acid methyl esters.

This bio-fuel is developed from vegetable matter, though Mr Cerup-Simonsen says "we will use only sustainable crops, not corn". However, he admits that FAME "will not solve every problem, it is not necessarily carbon neutral, but it must be grown in a sustainable way and it must be stable".

LNG power is also under consideration, "sulphur is the driver" for this evaluation and the company is looking at its use on vessels operating on trans-continental routes. "The price of LNG compared to low sulphur fuel is the joker in the pack" explains Mr Cerup-Simonsen.

He also admits that the fuel tanks would take up three times more space than a conventionally powered vessel, "but that would have to be factored into the business case" he explains. Another consideration would be whether the ship would be able to take on fuel while it undergoing cargo operations.

"If a ship must spend hours on dedicated bunkering operations then that's a problem" he said.

Much of the marine industry's attention has been understandably turned towards the immediate responses needed to ensure that vessels comply with stringent new regulations. Maersk and others are also continuing to keep one eye on the longer term developments that will be needed to meet future restrictions that are expected to be just as, if not more, challenging. *NA*

Anticipating a Sea Change

Many in the maritime industry want to open a window onto life in 2050 and ask what are the geo-political and socio-economic factors that will drive change and frame the conditions that will drive naval architecture? Del Redvers, head of sustainability at BMT Group, gazes into his crystal ball.

The current global, socio-economic instability is emblematic of the levels of change that world markets are experiencing. The need to pre-empt future trends and changes is key to business planning and major corporations have gone as far as employing futurologists to ensure that they are ahead of the curve.

There are many variables which will shape the world of 2050, the needs of customers and the markets in which they operate. These issues include demographics, climate change, resource availability, political stability and conflict. Companies have always sought greater intelligence on the markets in which they operate. This informs strategic decision making and business planning. However, our ability to see into the future is constrained; the more variables we have to consider, the more restricted our foresight becomes. It seems that a decade into the new millennium and there is greater uncertainty about the business environment than ever before. So taking the time to create a structure which allows the future to be realistically modelled, impacts considered and potential actions evaluated provides greater certainty and confidence. It is easier to tackle the challenges we comprehend than those about which we have no clue.

Among the uncertainties which underpin the global trends likely to have a significant impact on the naval architect, two are of particular interest: Firstly, ecological versus economic development and secondly, globalisation against regionalisation. These axes of uncertainty were developed by BMT drawing the ideas developed by the Intergovernmental Panel on Climate Change (IPCC) Special Report on Emission Scenarios (SRES).

Ecological v Economic Development

What will be the impact of increasing environmental awareness on global economic development? In the ecological versus economic development debate scientific research, clear physical evidence and public awareness are driving legislation. At the national government and international agency level this means expanding legal frameworks for the management of environmental issues and the responsible use of natural resources. This mostly developed-world phenomenon is translating into real change in developing nations. The ideas of technological development and environmental awareness come together in the concept of "leapfrogging" whereby clean technologies are transferred to and indeed pioneered in developing nations allowing them a "green" industrial revolution.

Cities and trade routes are vulnerable to environmental change.

The IPCC define a global behavioural spectrum around environmental awareness. At one end is a goal of living within ecological limits, often expressed in terms of "one planet living". At the other is a continued focus on economic growth almost irrespective of environmental consequence. Whilst these do not necessarily sit at opposite ends of the same spectrum, their juxtaposition on an individual axis neatly frames the attitudinal dilemma.

Globalisation v Regionalisation

The globalisation versus regionalisation axis considers the uncertainty of a more globalised or localised world. Factors such as free trade, political stability and affordable, abundant energy may lead to greater globalisation of markets. Energy security, trade tariffs and protectionism, climatic events and resource scarcity may lead to stronger regionalised or national markets and behaviours. Regionalisation in this context may also refer to the behaviour of large individual national economies, particularly China.

This tension may well underpin many issues of interest to the naval architect including the nature of commercial shipping, transport routes, defence and security and the dominance of global, regional or national legislative bodies.

Technological development

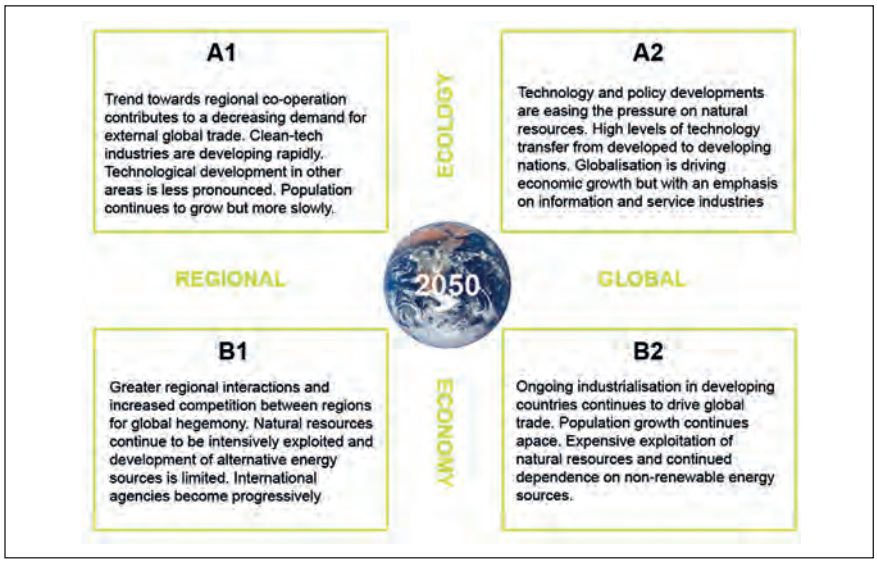
These two axes of uncertainty can provide a basis for differentiating between possible scenarios which could result from prevailing socio-economic and geo-political drivers. An additional dimension of interest is the rate at which new technologies are developed and applied. There has been much debate on the role of technology in addressing some of the most significant challenges we face as a global society. It is commonly discussed in the context of clean technology solutions which allow "business as usual", making the most efficient use of natural resources whilst addressing environmental and social impacts.

Our ability to find technological solutions may be limited by several factors including the scale and urgency of problems faced,

prevailing economic and social conditions and the limits of scientific knowledge.

The two primary axes give rise to four basic scenarios, shown in the following graphic (right).

BMT naval architects took part in a series of workshops to identify the major issues/topics likely to emerge in each of the scenarios and considered how they might impact on their work in the seascape.



The primary axes that give four basic scenarios for change.

Geographical changes

The continued rise of the BRIC economies, particularly China, as well as a number of other developing economies is expected. There are likely to be significant drivers of population migration in the year 2050, including war, famine, sea level rises, water scarcity and economic migration. As the geographical basis of supply and demand in services, goods and resources shifts both the size and types of vessels required might need to dramatically alter.

Climate change, economic development, energy price, food production, cargo types, population distribution, thawing arctic ice, extreme weather events and security will all contribute to changing trade routes. Whilst it is not possible to map future routes with accuracy, it may be possible to pinpoint highly likely developments. Changes in trade routes necessarily impact on port developments, transport infrastructure and modality, vessel design and logistics, while short-sea shipping has also emerged as an important issue.

The geographic basis of supply and demand does not only relate to materials and goods, but also energy. Frontier exploration in the quest to identify and produce new fossil fuel reserves will drive operations into new and evermore physically and politically challenging locations. The same may be true for the development of renewable energy sources, particularly off shore wind.

Efficiencies

By 2050 it is highly likely that there will be even greater pressure for both cost and energy efficiencies. These two issues are deeply interrelated and are well established themes across marine transportation. Specific issues likely to be prevalent in 2050 include increases in the price of energy, particularly liquid fuels and emerging requirements to manage carbon emissions. The spectre of carbon management is expected to drive efficiency measures in the private sector.

Energy efficiency in transportation has long been driven by fuel prices. This of course continues and will be amplified by shortages of traditional fuels. New efficiency measures will become economically viable as the shipping and aviation industries internalise the cost of carbon emissions. In all scenarios, there is a drive for greater energy efficiency. In shipping this will be demonstrated in vessel design, with particular attention on emphasis on propulsion and auxiliary systems and hull optimisation.

The greater gains in efficiency terms in the next 20 years will come from modifications to existing vessels both in operation and through the use of retro-fitted energy saving technologies. Looking ahead to 2050, this is where the naval architects will come into their own – what does the ultra low energy ship look like for 2050. Is it an evolution of current vessel types and designs or starting with the 'clean sheet' of paper and removing the traditional constraints, is it something altogether different? Idealistic perhaps, but a new approach may be required to meet the efficiency targets that will eventually come into force.

Regulation, legislation and accountability

The steady trend in ever tighter environmental (and other) legislation is anticipated and it is felt that scrutiny and public accountability will increase concomitantly, naturally linked to compliance and rising performance standards. The consequences of this trend were generally seen as increased efficiencies, emissions reduction, technological innovation and more carbon trading. It is also felt that better communications and public access to information are drivers in this area. Specific consequences of this might be the development of cleaner bunkers in shipping and investor interrogation of companies in the private sector. Legislation, regulation and accountability are strong drivers of change amongst the shipping community. Compliance related work will proliferate and naval architects with expertise in this area will find themselves in acute demand.

Automation and the control of technology

Automation is expected to play a key role in the lives of naval architects as it increases in sophistication and may even be deployed to control technology. Onboard ships, intelligent machines will be utilised for cargo handling, remote monitoring of vessel performance/safety and energy management systems will be the norm as current technologies open the door to future developments.

A rise in automation and intelligent machinery is predicted in all scenarios, driven by demand for safety, efficiency, productivity and security. Automation and interaction between machinery may also have an important role to play in driving energy efficiencies in freight handling. For the naval architect this heightens the importance of the design and application of automated

systems as well as the provision of readily available, high quality data and information management.

Additionally, to the naval architect's advantage, greater automation and computing power will provide even more power to the designer with developments such as the 'virtual test tank' perhaps being a proven method by this time.

Carbon management

Driven mostly by legislation, the management of carbon emissions is highlighted as a major theme and naval architects across the board felt carbon management will be a major industry in its own right. It is also suggested that likely future growth in carbon markets and offsetting will have ramifications for the shipping industry.

Securing resources and infrastructure

Demand for natural resources is expected to continue to accelerate towards 2050. These resources include minerals, forestry, bio-productive land, fresh water, fossil fuel reserves and renewable energy resources among others. The current robust competition for natural resources throughout Asian, sub-Saharan African and South American supply chains is likely to intensify and where demand outstrips supply conflict may ensue.

Furthermore the reliance on economically critical infrastructure presents many targets for terrorist attack. Piracy, terrorism and conflict will demand ever more sophisticated actions to defend resources and infrastructure. This has consequences for private sector investment in security and the demands placed on national militaries. In considering this naval architects will perhaps have to further focus on vessel security and designs that secure the integrity of the vessel from attacks.

Challenges increase for water management in the face of resource scarcity (Image courtesy of Howard Canning, BMT Group Ltd)

Water scarcity

The likelihood of increased ater scarcity as we move towards 2050 is something on which almost all participants across the workshops agreed. Most felt that it would have serious implications for food production and health, particularly in developing nations. It is felt that this might lead to population displacement and even possible demand for global freshwater transportation or at least large scale ship-borne desalination plants. The ocean going fresh water tanker could well become a reality.

Changes to trade routes

The distribution of supply and demand of energy, natural resources and labour are certain to impact on trade routes. Whilst specific predictions may be difficult, it is felt that changes are inevitable and will impact on port developments, new transport infrastructure, vessel design and logistics.

Frontier exploration

In all scenarios it seems inevitable that over the next decade there will be further frontier exploration and production of fossil fuel reserves. BP estimates that exploration in the Arctic Ocean may discover up to 200bn barrels of oil. The US Geological Survey provides a more conservative, but still very large estimate of 90billionn barrels. Whichever is closest to the fact, the logistics of this exploration activity will require greater supply chain support both in planning and the development of infrastructure. The need for additional icebreakers and tankers suitable for extreme cold weather operation will provide naval architects and shipyards with the opportunity to develop innovative designs to make ice operations safer and more profitable.

Conclusion

While crystal ball gazing is fraught with difficulties, scenario planning can certainly provide an insight into the trends we can expect to encounter in future years. Over the next 40 years we can expect to see continued instability and change on a global scale as we react to the ongoing challenges of socio-economic uncertainty, economic volatility and damage to the environment. Change is a double edged sword and while it brings uncertainty it also provides the opportunity to develop new and innovative technologies that can deliver both social and economic benefits. Are naval architects across the globe ready for the challenge? *NA*

A car caught in a flood and swept away in the raging water as sea levels rise.

Green ships of the future

Almost three years after embarking on an environmentally friendly course, the Green Ship of the Future (GSF) project, a Danish maritime industry initiative, has applied its research and technology to more than 100 ships.

Originally, the aim of Green Ship of the Future was to demonstrate that it was possible to reduce CO_2 emissions from ships by 30%, SOx by 90% and NOx by 90%. Initially, there were four partners, but today there are more than 30 participants with a number of projects targeting three main areas, machinery, propulsion and operations.

The results from the projects were gathered in two so-called 'low emission' studies on an 8000TEU container vessel and a 35,000dwt handysize bulk carrier where the results where accumulated with respect to interdependent interference and compared with an estimate of the extra cost of implementation of the green technologies.

An important criterion for the low-emission studies was the use of available technologies which meant that it was possible to build the ships as specified. The results from the studies showed that, with the new technologies implemented, it was possible to save 7.2 % in CO_2, 79.1 % of SOx emissions and 98.6% of NOx pollution on the handysize bulker and 14 % on CO_2, 90 % on SOx and 80 % on NOx on the 8000TEU container vessel without lowering the speed or changing main parameters of the vessels. So Mission accomplished for NOx and SOx, whereas initiatives are still required to meet the 30% CO_2 target.

Technically speaking

From its beginnings in early 2008 the GSF initiative has evolved into more than 20 projects. Since the low-emission studies were completed, the initiative has focused on testing and verification of the results, spreading information about the results of the studies through conferences and articles and bringing new partners together.

The strategy has been to let the project partners market their projects and let the GSF secretariat together with the network partners – mainly Danish maritime associations – arrange conferences and initiate joint publicity regarding the initiative as a whole.

Christian Schack, general secretary and project partner through the aero- and hydrodynamic consultancy FORCE Technology, explains: "The Green Ship initiative has a technical focus in demonstrating what can practically be done to make ships greener. Therefore, the GSF resources are directed towards supporting the continuous development of the projects as well as trying to attract new relevant projects. As the outcome of the individual projects need to be economically feasible in order to compete with less energy-efficient solutions, the project partners handle the process of communicating the results of their own projects."

An example of the latter is the newly released article from Maersk and MAN Diesel addressing their findings within dual/multi certification with regards to lowering ship speeds. Another is the pump manufacturer DESMI which offers an Energy Check on the basis of the results of their projects.

The future of Green Ship

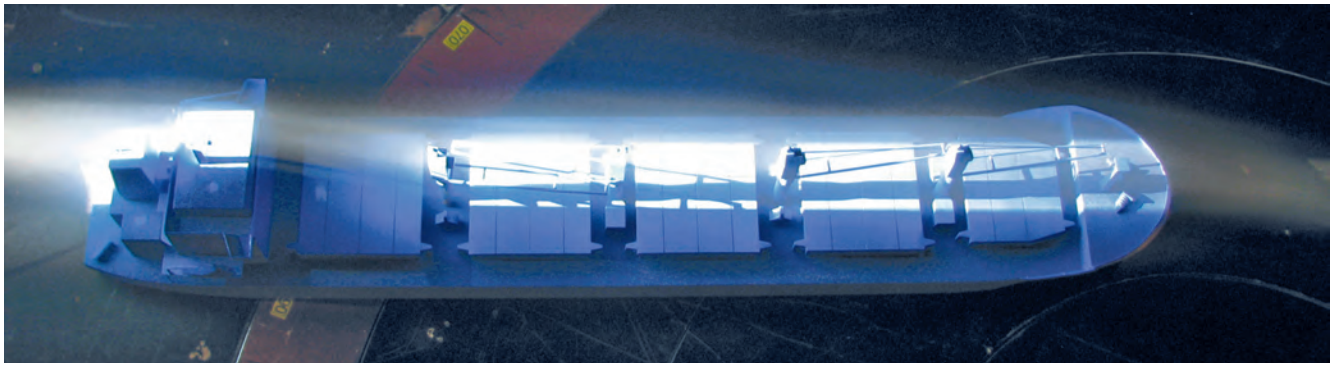
Besides the more extrovert activities, development and innovations have been carried out within the GSF projects. Mr Schack explains: "We have received very positive feedback on our low-emission studies, so we have decided to continue these studies on other ship types. They have proved to be real innovation enablers. In the coming period, we are continuing our effort of bringing companies from all levels of the maritime industry together in cross-disciplinary projects. In 2011 this will be done through two different new studies, where the first is a comparative study regarding the 2015-regulations concerning low sulphur fuel oil within the Emission Control Areas (ECA), the other is an interesting ferry study."

Investigating SOx abatement technologies

The International Maritime Organization's decision to reduce the sulphur level in fuel oil to 0.1% by 2015 or clean the exhaust gas to an equivalent level holds an interesting challenge regarding retrofitting of ships sailing in the ECA.

GSF has formed a new project where a group of companies will work together on comparing various abatement technologies

An illustration of the aerodynamically optimised Seahorse 35 bulk carrier, this version shows how an optimised ship may look in the future.



to fulfil the ECA requirements, i.e. the use of scrubber technology, the use of LNG as fuel and the use low-sulphur fuel/distillate. The objective of the project is to set up practical solutions as well as uncovering the financial aspects regarding installation, operation and maintenance of the three alternatives. The basis for the retrofit project is a newly built 38,500dwt tanker from D/S Norden A/S, and the project partners are expected to deliver results during 2011.

In relation to the new projects as well as the completed low emission studies, the Danish Maritime Fund has played an important role. The original low emission studies were supported financially by the Danish Maritime Fund and since the research and development conducted within the ECA project is considered to be important to the business as a whole, the Danish Maritime Fund has decided to co-finance the project jointly with the partners.

Low-emission study of ferry

Another new initiative is expected to be the low-emission study of a ro-pax ferry. The focus will naturally be on elements within machinery and propulsion, but the plan is also to look at other areas affecting emissions. The study will be performed on an existing ro-pax with an already known operational profile, making it possible to benchmark the emission reductions against existing data. The overall target of the study is to achieve the same numerical goals as with the two previous studies, that is making companies work together on finding ways to reduce CO_2 by 30%, and NOx and SOx by 90%.

Mr Schack said: "In the ferry study, we are initiating new projects concerning HVAC, isolation, windows and lightning, but there might also be projects within looking at how the design of the cargo deck can decrease the loading time in port and thereby help decrease the overall ship speed at sea and still maintain schedules with a reduction of emissions as a result."

New Green Ship projects

Low-emission ship studies cover a wide range of projects. Below, two recently started projects are described. Firstly there is the Advanced CFD calculation on Propeller and Rudder Bulb as a retrofit solution for a ro-pax ferry.

By use of advanced Reynolds averaged navier stokes (RANS) CFD, the flow in the stern region of the vessel is investigated. The flow study is made to optimise the interaction between the propeller, hull and rudder. Based on a complete 3D definition of the propulsion setup, the alignment of the rudder and brackets is checked. Based on the original settings with the propeller geometry included, different rudder bulbs are designed, and the overall performances are evaluated using RANS CFD. Further, a new propeller and hub design will be made and evaluated as well. The project will be conducted by OSK ShipTech, MAN Diesel and Mols-linien.

Reduction of aerodynamic resistance

The second project's aim is to reduce a ship's aerodynamic resistance and thereby reduce the fuel consumption. In this project, the handysize bulk carrier Seahorse 35 from Grontmij|Carl Bro is evaluated. With 7500kW installed power for the main propulsion and specific fuel oil consumption of 165g/kWh, the consumption is approximately 30tonnes of HFO/day or 9000tonnes at an operational profile of 300 sea days – so even a small percentage decrease of fuel consumption will have a noticeable effect on the ship's yearly operational costs. Optimising the areas directly exposed to the wind can predictably reduce the ship's aerodynamic resistance by approximately 30-40%. This gives an overall decrease in fuel consumption of 2-3%. The project will be conducted by Grontmij|Carl Bro and FORCE Technology.

Read more about Green Ship of the Future and the different projects at www.GreenShip.org . *NA*

LR and partners back plug & play nuclear cassette

Three significant players in the maritime market have joined forces with a land-based nuclear power provider to split the atom and crack the CO_2 conundrum that the shipping world is currently grappling with.

Shipping needs an "outpacing strategy" according to Lloyd's Register (LR). That is a strategy which will reduce the amount of CO_2 that is produced throughout the industry at a faster rate than the growth in emissions caused by growth in shipping demand.

Global marine risk advisor Vince Jenkins, part of LR's technical directorate, believes that with the growth in shipping expected to be around 50% by 2050 the growth in CO_2 emissions will be comparable if no mitigation systems are used. Current green technologies, including LNG, reduce greenhouse gases by around 20-25%. If all ships reduced emissions by 25% the net growth in emissions would mean that in order to meet reduction targets the industry would need to further reduce emissions by around another 25-30% overall.

A technology that could achieve this would be, in Vince Jenkins' terminology, an "outpacing technology". Nuclear power is an answer to this greenhouse gas problem and one that a number of owners are considering. Mr Jenkins said that nuclear power could allow an 8000TEU container ship to reach 30knots "no problem" and with refuelling only taking place during dry docking the emission free ship could be realised within five years.

A number of leading companies are said to be interested in the benefits of nuclear fuel, including, Carnival, Shell, Cosco and Maersk. However, Bo Cerup-Simonsen, Maersk's vice president of maritime technology, said that "The perceived risk component [of nuclear power] is a much greater hurdle than the technological component".

Convincing a sceptical public of the benefits of nuclear power on board vessels could be difficult. Even if the public were to be mollified, "Nuclear technology is not ready even if we think it's a possibility," said Mr Cerup-Simonsen.

Nuclear power offers shipping an "outpacing strategy" said Vince Jenkins of Lloyd's Register's technical directorate.

In fact Maersk are correct in that nuclear technology is not ready and it is unlikely that it will ever be a major alternative to conventionally powered ships. As Mr Jenkins admits: "The up front cost [of a nuclear powered ship] means that there won't be thousands of nuclear ships, they will only be bought by a few leading, serious, players who understand the investment, it will not be fly-by-night operators."

With vessel costs "two to three times" the cost of a conventional ship thousands of nuclear powered ships is unlikely, but hundreds of atomic vessels is not a pipedream, said LR. And the class society has joined a group of like minded organisations, BMT Nigel Gee, Enterprises Shipping and Hyperion Power Generation, that will be the driving force for a new generation of nuclear powered vessels operating from around five years time.

Spyros Hirdaris, a senior specialist, Strategic Research Group based at LR's London office, is confident the team will be able to find the technological solutions that will make nuclear powered ships economically viable.

Essentially the new technology is a land-based technology that will be developed by Hyperion and "marinised" for use aboard ships. "The small modular reactor (SMR) will be a fourth generation nuclear reactor that will operate on uranium that has low enrichment, around 22% - that eliminates the threat of a terrorist bomb," explained Mr Hirdaris. Most of the 600 or so nuclear powered vessels, currently operational, operate on pressurised water reactors (PWR) that use uranium that has been enriched to a level of 80% purity.

Vessels designed with the SMR installed will operate without refuelling between drydocking, up to 7.5 years in some cases. The power plant itself will be a steam turbine operated by the SMR, which uses uranium fuel and is cooled by a lead bismuth eutectic. That is lead with an added component that lowers its melting point. Natural convection will cool the core, but will maintain enough heat to keep the coolant molten.

Using this design for a nuclear powered container ship means that while strengthening of the hull structure and protection of the reactor will be necessary the ship will do away with the 18,000m^3 for fuel storage and any other systems necessary for handling fuel on a modern vessel, such as HFO scrubbers for removing SOx emissions.

Although the low enrichment of the uranium fuel will reduce the attractiveness of the vessels to terrorists, other concerns will inform the design of a nuclear powered ship. Mr Jenkins said engines room will be mid-ship to dampen vibration and structures will

need to protect against collisions and groundings.

"If Mark Webber can walk away from a Formula One car after flipping it and crashing at 200mph then I'm sure we can design a ship that can withstand a collision or grounding," said Mr Jenkins.

And if that collision or grounding should result in the vessel being lost the fuel cassette will be in a sealed unit with a sealant that hardens when it comes into contact with water. So if the vessel should sink the core will be sealed preventing leaks into the marine environment until the cassette can be recovered.

Two vessel designs are envisaged by the nuclear partnership, both for suezmax tankers one that will complete its cargo-handling operations outside of port, thereby circumventing any port state control difficulties that could arise from the atomic power plant.

A second design will be modular which would allow the accommodation block and engine room to detach from the cargo holds which would then sail under battery powered podded propulsion for port, leaving the engine room with the nuclear reactor outside of port.

Hyperion will provide the SMR and it will lease the unit to the owner who will then pay for power-by-the-hour in much the same way as Rolls Royce leases its aero engines to owners of aircraft who by the power. Any maintenance and repair work is provided through a contract with the engine manufacturer.

This is a new concept for the maritime industry, but it could well be a crucial point as the decommissioning, including the handling of nuclear waste will all be the responsibility of the power plant owner, Hyperion in this instance. Del Redvers, head of sustainability at BMT Group, admits this cost could be a stumbling block as the responsibility would fall to a privately owned commercial entity which cannot be expected to take on the responsibility for handling radioactive waste for what could amount to thousands of years.

"Inevitably some of that cost will come back onto the taxpayer," he said, but he added that the technology for storing nuclear waste is improving.

Cost is the most potent driver in the development of any new technology and the design of the SMR is no different. Major companies are watching developments because the potential for eliminating CO_2, NOx and SOx emissions from the pollutants that are emitted from the ship during operations.

By leasing the SMR from a power provider the problem of refuelling, storing fuel and handling radioactive waste is passed on to a specialist organisation and is not the responsibility of the ship owner or operator. Nevertheless, the waste will still be generated and will need to be dealt with and as the Mediterranean Shipping Company discovered after the Napoli incident it is the company that has its name on the side of the ship that is the most visible. And as Maersk intimated perception is everything. *NA*

Triality tanker design interests owner

DNV's new tanker design presented to the public in early December in London is a "refreshing" concept said Maersk. The design incorporates a new hull geometry with existing technology that could reduce CO_2 emissions substantially.

In designing the new Triality tanker the DNV team set out to determine what would be the over-riding needs for the future and they concluded, very quickly, that the environmental footprint of the ship was of paramount importance.

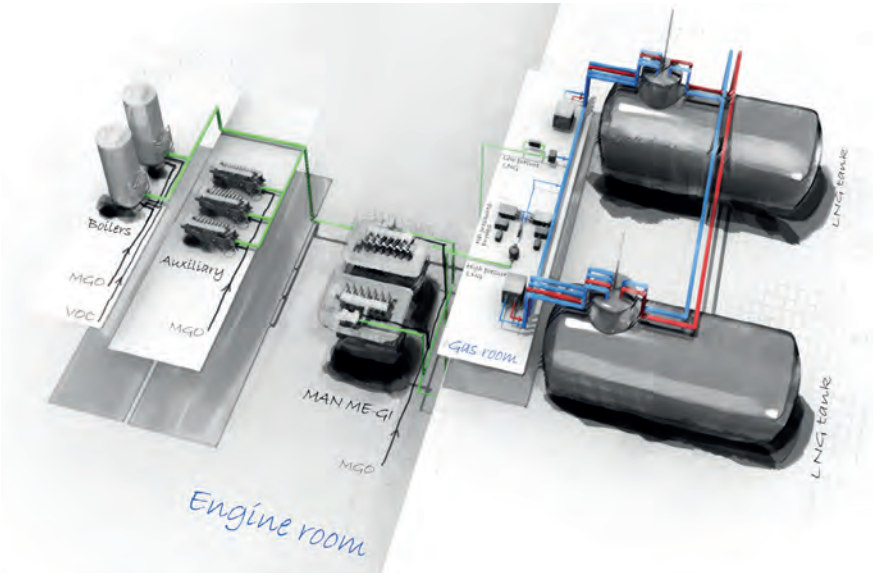
Solutions for reducing emissions needed to be simple, there was to be "no complexity to the ship," explained Torrill Grimstad Osberg, Triality project manager. "We were working with a knife at our throats," she laughed describing the short time scale that was afforded the team to come up with a new concept vessel. In fact the DNV team started work in mid-August and had completed their work in just three months.

With these parameters and the short time scale in mind it was a relatively simple step to decide that the fuel the new ship should use would have to be liquefied natural gas (LNG). It was the only fuel available that would reduce all the key emissions, substantially, including CO_2 by 34%, SOx and particulate matter by 94% and NOx by 82% for the Triality vessel as a whole.

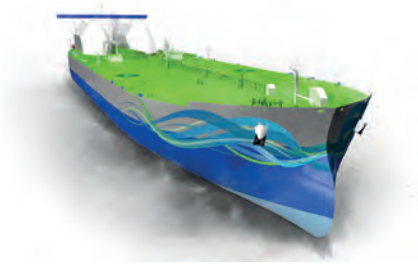
That meant more time could be afforded to the design of the hull which was, said Ms Grimstad Osberg, the most challenging element of the vessel design. The rest of the ship has been fitted with existing technology."

Maersk's manager of the innovations department Gunnyar Bjornsson, who is a naval architect and master mariner and specialises in the use of LNG as a fuel, was impressed by the hull design and the ballast free elements of the concept vessel. "It's a completely different geometry, on an ordinary tanker the cross section is rectangular, with the Triality it is a V-shape, but with a 10m or so flat bottom".

However, with the ship operating at a draft of around 8m aft and 6m at the bow when operating empty there could be issues with stability, agreed Mr Bjornsson, who had also seen DNV's presentation on the Triality vessel. "I couldn't tell about stability without model tests and further calculations, but there would definitely be an issue there, particularly when manoeuvring and in a beam sea." Though he did not consider these design difficulties insurmountable.



Two large deck houses contain the cargo tanks, each of 6750m^3 giving an operational range of 25,000nm.



The 300,000dwt tanker has a 70m beam giving it extra stability in its, ballast free, empty operational mode.

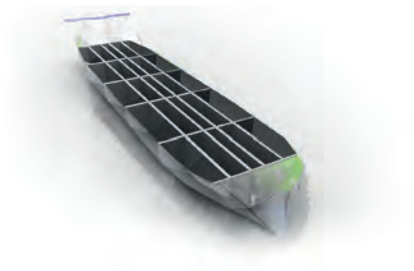
In fact a mitigating factor for the vessel would be its 70m beam, which is 10m wider than the standard VLCC. The vessel has also been made longer at 361m and has a loaded draft of 21.6m. Loading of the vessel, which has its tanks arranged five across, would have to be completed by filling all the centre tanks simultaneously to prevent bending moments.

However, the shallow draft of the vessel when operating empty did create another problem with the propeller. It meant that the team opted for two MAN ME-GI engines with direct drives for two 7m overlapping propellers rather than the standard single 9-10m propeller which would have been too large for the shallow draft vessel.

The two propellers overlap by 1m and give "extra efficiency", said Ms Grimstad Osberg and the cost of two smaller MAN engines compared to a single larger engine "was not great", she added.

A tougher nut to crack, however, has been the dilemma over CO_2 emissions and in this case DNV opted for LNG as the best possible existing technology. Although Ms Grimstad Osberg conceded that LNG is not the only answer to the maritime sector's emissions conundrum she said that the fuel would reduce CO_2 by around 34% while particulates and SOx

Torril Grimstad Osberg delivering DNV's presentation.



New cargo tank divisions eliminate the need for ballast, including during cargo operations.

would be reduced by 94%, NOx by 82% and volatile organic compounds (VOC) by 100%. These figures are all compared to a base vessel which has a 333m length overall, 60m beam and a loaded design draft of 21m.

Although the CO_2 levels would remain high if the ship were built as it was presented, DNV said that if all the ameliorative extras now available to retrofit onto ships to improve their efficiency were added to the Triality it would improve its efficiency, further reducing its CO_2 emissions to around 50% of a standard, comparable, VLCC.

These additional extras would include, air lubrication, waste heat recovery and the propeller and hull appendages that improve hydrodynamic performance.

Triality is already fitted with some innovative systems that would improve its energy efficiency such as using the low temperature of the LNG fuel, which is stored under pressure in two 6750m^3 tanks at -163°C, to cool the ignition temperature of the main engines, reducing NOx emissions and improving efficiency. Low temperature LNG can also be used for re-condensation which recovers VOCs that DNV said will then be used to power auxiliary units such as the air conditioning system and freezers or can be used as fuel along with LNG in the auxiliary boilers.

According to DNV an estimated 500-600tonnes of VOCs are lost in each VLCC voyage, about 0.2% of its cargo. Re-condensation units using the low temperature of the LNG fuel preserve the VOCs to produce auxiliary power.

In addition the vessel is designed to operate without ballast in its cargo free leg, which reduces fuel consumption considerably as well as relieving the owners of the problem of having to buy and operate expensive ballast water cleaners and to train operators to work them.

The LNG fuel system similarly allows the owner to do away with the expensive, and large SOx scrubber systems that are being developed in the light of changes to the acceptable SOx levels emitted by ships as enshrined in MARPOL Annexe VI which stipulates that vessels operating with emission control areas (EMA) will have to pay fines if their SOx emissions exceed 0.1% of current levels.

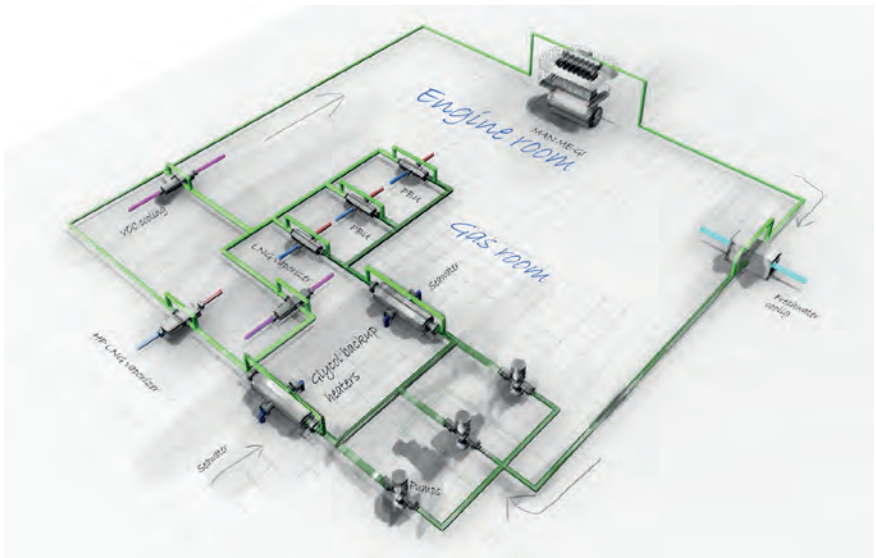
Mr Bjornsson said, "It is refreshing to see some new thoughts and ideas being developed". He was particularly interested in the way that DNV had used the LNG fuel to cool the main engine and to eliminate VOCs. "It is interesting to see just what optimisation can do," he said.

For Maersk's vice president of maritime technology, Bo Cerup-Simonsen, the most pressing issue was the price of LNG and how that would develop when demand increased. "There is a lot of good thinking – a lot of good ideas [in the Triality design], but one of our major concerns is future gas prices," he said, "It is only an attractive solution if the cost of the whole package, that is the total cost of ownership, remains attractive."

In anticipation of this view DNV looked at the expected development of the price of heavy fuel oil (HFO) compared to LNG over the next 20 years as described by the US Energy Information Administration. Their findings reveal that as long as the price of HFO remains at the reference level or at the higher prices the cost savings over a 20 year period for the Triality tanker would be up to US$24 million. If the price of oil is low then the conventional tanker would prevail.

Long term expectations are, however, that the price of mining oil along with increased demand and the costs associated with pollution from conventionally designed vessels will make their operation are far more expensive than the DNV equivalent.

If owners believe that the associated costs of operating the Triality will improve their profitability by reducing their costs then the probability that further development on the Triality will take place are high. And at the moment at least one major owner is making all the right noises. *NA*



Scavenger air cooling may provide an energy efficiency gain of up to 3%.

What future for 3D design

The future of ship design is getting more complex with advanced computer aided design (CAD) and computer aided machinery (CAM) software coming on to the market. Aveva Solutions Stéphane Neuveglise, marine strategy manager explains the benefits of integrated solutions.

Marine projects demand sophisticated design capabilities, with a plethora of data and documents, complex schedules and vast amounts of materials and resources. To make matters worse, these resources are evolving and changing throughout the shipbuilding process as part of a dynamic workflow that demands tight coordination between internal and external parties.

In order to succeed, shipyards need highly developed solutions for generating, coordinating and managing a complex equation of information, materials allocation and resource availability, within contractually agreed schedules and costs. They need a business support system that fully integrates and maintains consistency between all the dimensions of the operation, and throughout the shipbuilding process. They need careful managed and accurate information to create savings in shipbuilding production costs and project schedules, particularly in these economically challenging times.

Mr Neuveglise comments, what is the place of design technology – 2D and 3D, CAD and CAM – within this demanding environment? He asks us to consider, 3D design software, while unrivalled for the purposes of design, cannot, of itself, provide a secure environment for vendors, owners, classification societies and partners to share and collaborate on project information. It cannot provide a vehicle to dynamically interact with existing ship design, production management and design reuse. In short, while it is a design "must have", the reality is that it can't guarantee the right information at the right time, so that shipyards can make the right economic – as well as engineering – decisions.

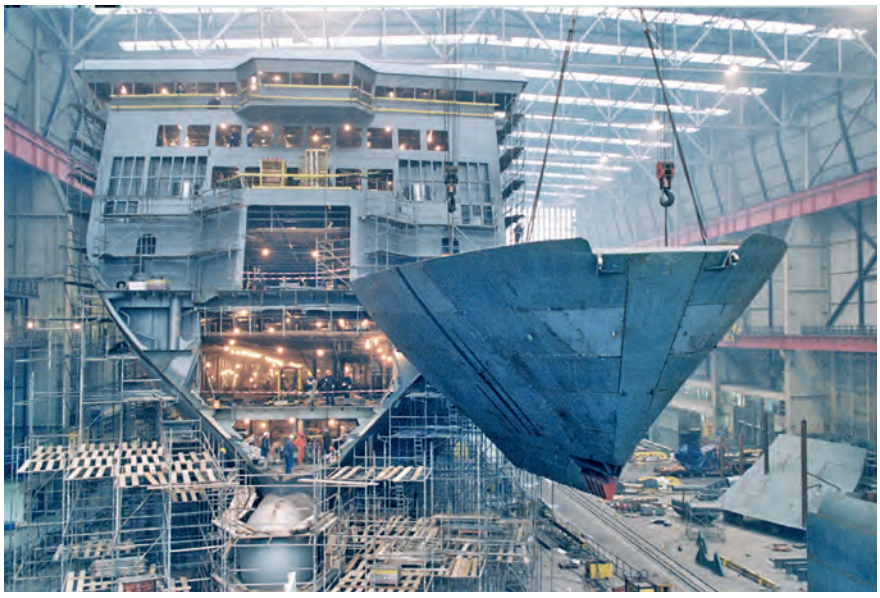
He states that through Aveva's own extensive research through it's customers it has "painted a very convincing picture of the truly effective shipyard, in which 3D design information sits right at the heart of the operation, but only on condition that it is integrated into the wider information management picture."

Aveva's software solution looks at the design process as a whole and is broken down into several separate parts such as the executive management, business and capture of sales, planning and control, engineering and design, procurement and supply chain, stock and logistics, production, customising and delivery; and the extended shipyard.

The reality of the shipyard

Most of the planning and execution of the shipbuilding process is highly dependant on the design of the vessel. While the design and management teams are tasked with engineering all aspects of the ship, they are also responsible for ensuring the relevant engineering; material and production information is optimised and available to support the manufacturing, assembly and commissioning processes. The engineering team must be able to make full reuse of past designs, and rapidly create and validate new designs to maximise the efficiency of the vessel and its production and many other discipline-specific applications in use across the project.

Yet in reality most shipyards employ a wide range of 2D and 3D design applications, from a host of different software suppliers, that provide little or no operational integration, explains Mr Neuveglise. The result of this is a collection of isolated databases that actually lock away the critical design information, making it difficult to share and coordinate. These 'silos' of information also demand a great deal of manual intervention to manage, and, therefore, negatively impacting on project productivity. He adds: "It's design technology gone seriously wrong".



Production: the most complex phase of the project, with the smallest margin for error. Changes and rework resulting from poor upstream coordination can have a massive impact on project schedules.

Work must be allocated to the most cost-effective locations, and work centres added or removed as the project progresses, to use capacity wherever it exists.

An understanding of the design ultimately drives the procurement and supply chain process and so there should be appropriate integration with the design environment. Yet the technologies typically used can actually reduce access to the complete and accurate information set that is vital in the making of key project decisions. Needless to say, these weaknesses can have a cascade effect across the entire project. Incorrect materials and delivery delays jeopardise work order and resource planning, which damages project schedules and impacts on production efficiency, costing time and money.

Integration between design applications and production is also key to the process. A well-managed production infrastructure is characterised by the completion of a vessel that meets all defined quality standards and is delivered on time and within budget. Mismatches between design and production can have a massive impact on project schedules and can make the difference between the design environment and the production environment is, once again, all too often hampered by silos that prevent information from delivering any real benefit.

Global business, global liabilities

One of the most significant changes in the shipbuilding industry over the last two decades has been the specialisation and globalisation of shipyards and suppliers, highlights Mr Neuveglise. As there has been an improvement in product efficiencies and reduced costs, a growing number of major vessel projects rely on them for strategic components and assemblies. The result has been the relentless rise of out-sourcing and the increasing need to establish and maintain effective working relationships with suppliers around the globe.

Likewise, on the design side, the use of subcontracting design companies or agencies has grown impressively. Shipyards have been dealing with global suppliers for decades, but the services, technology and assemblies being provided now demand a much higher degree of integration – right from the design stage. Complete subsystems must be tightly coordinated with key project milestones and technical certifications.

Yet, more often than not, there is no ability to apply the same level of management and overview to extended shipyard activities as is applied to on site activities. The inability to create a fully integrated extended shipyard environment compromises the predictability, efficiency and quality of vessel projects and inadequate integration of design technology is firmly at the root of it, he comments.

Integration is the key

Mr Neuveglise believes that it would be wrong to lay all the blame for inefficient project execution at the design technology door. True, design technology that is not properly integrated into the wider shipbuilding process can be as much a liability as an asset, he highlights. However, the real issue is the effective integration of the valuable design information into all aspects of the shipbuilding process.

Recent activity in the industry has confirmed this, say Aveva Solutions. Aveva has recently acquired a new business, Logimatic MARS, in order to bring more integrated shipbuilding capability to its offering. The Aveva MARS solution that has resulted derives much of its strength from the 3D design ability of the existing Aveva Marine (design) solution, but at the same time it is very much a purpose designed shipbuilding process management system. It optimises the project control, logistics, materials management, resource and production planning processes used by shipyards (as distinct from other manufacturing industries) as is in use in all kinds of shipyard projects, including commercial and naval newbuild, repairs, refits and conversions, outfitting and offshore.

Mr Neuveglise has highlighted that Sedef, a Turkish-based shipyard is currently part of one of these projects. According to Cumhur Kuter, Sedef general manager, this solution has helped in "reducing project cycles and so bringing down our total costs" and has put the shipyard's fortunes "in safe hands".

Sedef integrates with Aveva MARS

Established in 1982, Sedef is situated on the Bay of Tuzla, near Istanbul, the yard has expanded continuously. It has recently completed the production of a new dry dock and added a 500tonne portal crane. Sedef currently employs some 600 workers (roughly 400 in production and 200 in the offices) and nearly 1400 subcontractors.

The company is part of Turkon Holding, one of the largest enterprises in Turkey.

Sedef is a diversified shipbuilder, building practically all types of ships for both naval and commercial clients. Sedef also builds ships for export markets, principally Germany and the Netherlands.

Technological pioneers

Sedef has invested solidly in engineering IT in the past decade and is regarded by many in the Turkish shipbuilding industry as a technological pacesetter. They have, for example, implemented Aveva MARS, as well as Aveva Marine. According to Sedef's chief of IT Department, Serhat Yildirim, such investments are vital for survival in the global shipbuilding industry, where competition is becoming ever fiercer.

Mr Yildirim explains that "... we were among the very first shipyards in Turkey to invest in an IT solution for shipyard materials and production planning..... we felt that this was a necessary step towards becoming a modern, innovative shipyard.... The decision to select Aveva MARS was straightforward, as the application is developed specifically to support shipbuilding processes. Furthermore, Aveva MARS is developed by people with decades of shipbuilding know-how."

Shipyards will always achieve the end product - but the goal is to get there with improved quality, mitigated risk and at reduced costs.

Milestones achieved

Since Sedef Shipyard started using the integrated shipbuilding solution, it has used them to design and build more than 40 vessels of different types, purposes and tonnage. Before, Mr Yildirim calculates that "it took some 600,000 man-hours to build a container ship," whereas with the integrated solution "building an identical ship took only 450,000 man-hours." He continues "Being able to reduce production time by roughly 150,000 hours has considerably improved our financial results."

Building the world's first power plant ship

Another milestone that Sedef has just achieved, using the integrated solution, is the construction of the world's first power plant ship – a project, which has been carried out in close collaboration with other suppliers. Mr Yildirim says: "we are now going on to build another three of these ships. We have been involved in detail design (including hull and piping) and this is a very interesting, groundbreaking project for our yard as, during these hard times for the Turkish shipbuilding industry, we have proven ourselves capable of reorganising and expanding the types of project on which we can work."

Facing future challenges

The integrated solution approach is seen as very important from a business management point of view. Cumhur Kuter agrees that, with an integrated solution approach to shipbuilding, the shipyard is well placed to face the many challenges, which may lie ahead in the industry.

He concludes "…. we have a dedicated and integrated IT environment which, combined with the skills of our employees, has helped us to become a modern and competitive shipyard by reducing project cycles and so bringing down our total costs.... we are in safe hands..." *NA*

Qinetiq GRC introduces latest collaborative solution

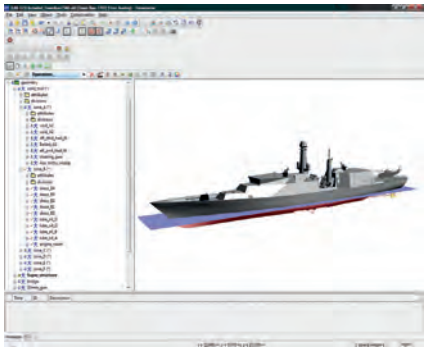
UK-based Qinetiq GRC has recently launched Team Paramarine, its latest in computer aided design (CAD) software, a spin off from the original Paramarine that allows several users to work on one project from different locations.

Team Paramarine was launched alongside the update of Paramarine version 7 at the end of December with new added features that have also been included in the release of Team Paramarine. The latest piece of CAD software from Qinetiq GRC is multi-user friendly and allows a team of people based in different locations to work on a design. The product is a design tool aimed more at shipyards than consultants, highlights Ian Carter, sales manager, Qinetiq GRC.

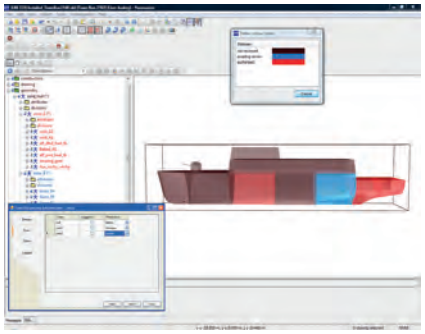
The development of Team Paramarine has come through customer demand, in a world where people need to be able to work together wherever their location. Qinetiq GRC believes that its latest piece of software will cater for larger companies and will eventually see the phase out of the standard Paramarine for this latest CAD software, whilst Paramarine will still be used for smaller clients.

Team Paramarine will incorporate all the latest updates that feature in Paramarine Version 7. The latest version now allows the user to run through checks of a concept design quicker than previously making the design process more efficient, said Qinetiq GRC. Paramarine version 7 has improved reporting capabilities allowing the user to create reports when they need to and to create word documents from these reports. "Paramarine works like excel, you can enter data and if this data needs to be changed, then this automatically transfers through to the document," said Mr Carter.

Adding to the update is the enhanced stability feature, which has had commercial regulations added to it, such as the LY2 regulation for large yachts and passenger vessels. In one particular case the regulation for the Rhine River has been included for the customer. In addition developments to the software have been added to help support Qinetic GRC's onboard products.



The latest development from Qinetiq GRC Team Paramarine.



Team Paramarine will allow more users to work on one design.

The damage stability rules that have been adopted have meant that designs for vessels are now far more complex. However, the impact of the new rules has not just affected ship owners, but also software manufacturers who create the design programmes that need to incorporate the rules into software packages. The development of integrating the rules into software packages has come through software companies working with members of regulatory boards that make the rules.

Mr Carter highlights how the damage stability rules have been incorporated into Qinetiq GRC's Paramarine software: "The implementation of the damage stability into the software has been driven by regulations, with some developers working with the regulators to develop them into the software. They then take the software and try and develop the changes into the software, by way of testing what can be done. Therefore, the regulations get tested (to make sure that they can actually be implemented) before going into a software package."

Mr Carter admits that the inclusion of the damage stability rules into the software "takes it to a level that is hard to understand", adding that the work Qinetic GRC have done with the ministry of defence (MOD) projects, where they have used the rules for different types of damage analysis have been helpful. "It is about maintaining the minimum amount of safety, in the naval area what we see happening is a trade off between the cost of vessel and the damage stability," added Mr Carter.

Furthermore, the software features multi-threaded support or multicore processors which makes running of the software quicker, due to more processors handling the information. With computer hardware getting faster it is a constant need to keep the software up to date with the systems, commented Mr Carter.

In the future Qinetiq GRC is looking to develop it overseas market in Europe and North America. Its current focus is on the European market and to secure contracts in this market. Qinetiq GRC still sees a majority of work coming through Naval based projects, but are hoping it will be able to broaden its scope in the coming year. *NA*

FORAN evolves to next step

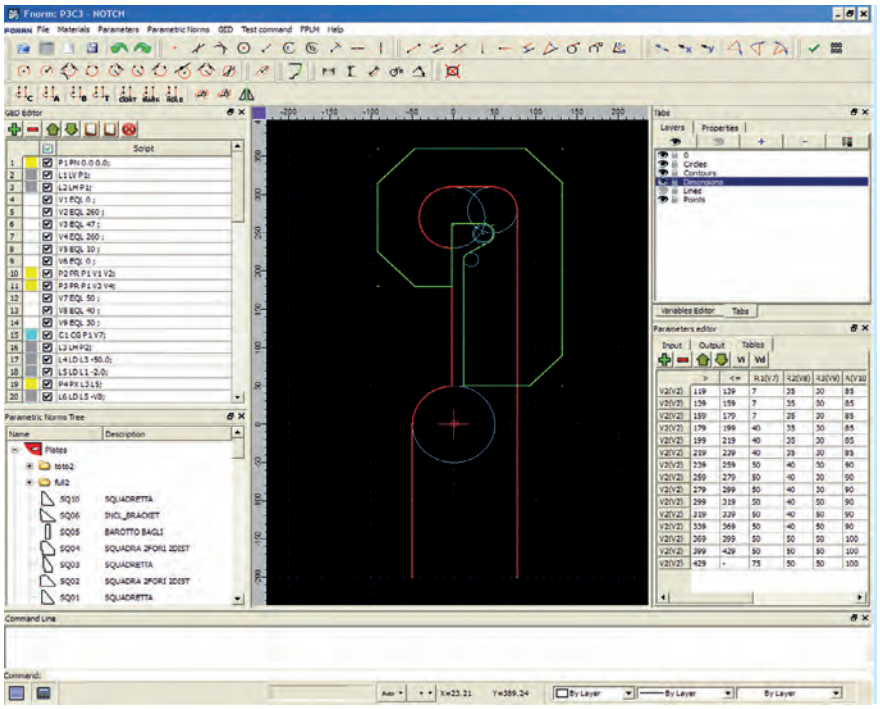
Spanish-based Sener has launched its latest version V70 of its FORAN computer aided design (CAD) software bringing new tools to the user that will create better work flow and definition in 2D and 3D, through its latest general arrangement module.

A major development of the latest version of FORAN V70 is the new general arrangement module (FGA) for spaces and general arrangement definition, both in 2D or 3D environments, with all data stored in the database and being possible to obtain the general arrangement drawing in an efficient way.

Sener has also added an advanced 2D kernel that is based in the QCAD application and is fully compatible with AutoCAD. The kernel, a bridge between applications and the actual data processing that manages the system, is used in the module for norm and standards definition (FNORM) and in the FGA. It will also be used in the future for the definition of electrical and P&I diagrams. Other developments have also been added to the interim product's drawings, the symbolic drawings and the 3D model views, reducing the design time.

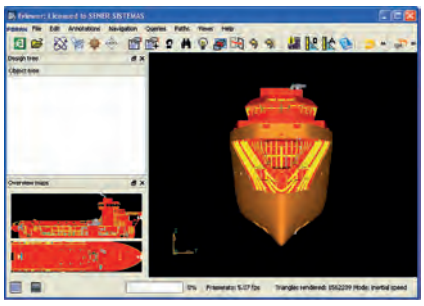
The latest development of the software now supports Unicode characters, which will allow localisation of the system. It will mean that users can now enter text and generate production information in languages using characters such as Chinese, Japanese, Russian and Korean, allowing for a wider use of the software.

Also, a virtual reality module FVIEWER has replaced the VISUAL3D that now allows the user a walk-through experience of the design. The application takes advantage of the latest graphic card capabilities and allows for better management of large amounts of data.



Detail of the new module FNORM.

New FVIEWER, a new visualization module in FORAN.



The module for the probabilistic damage stability calculations (FSUBD) now offers the possibility to consider intermediate stages of flooding, according to SOLAS Chapter II-1, Part B-1, Regulation 7-2, while the automatic assignment of spaces to subzones has also been improved.

A new module FNORM has been developed to replace the previous NORM for the definition of standards of structure, with a new user interface, including multi dock windows, snap points, geometrical restrictions and a layer management. The increase of the lengths of the identifications and descriptions of blocks, materials and geometrical norms, and the hierarchical structure for the definition of the standards and geometrical norms are other new capabilities.

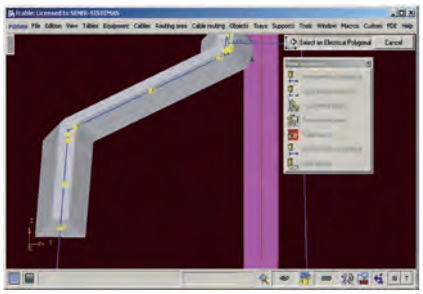
Adding to this, other features have been added to improve the hull structure modelling. As an example, the new modelling algorithm allows corrugated parts to be represented more accurately, thereby, improving the performance of the reading, recalculation and storing operations. New commands to allow an easy graphic checking of the edge preparation of plates and profiles, options for the definition of face bars at any angle with respect to the web supporting it and a modelling algorithm to represent more accurately curved shell and deck plates are other new capabilities.

Regarding profiles and plates nesting, the NEST module in FORAN allows, under global build strategy nesting, the

nesting of identical parts assigned to different interim products and keeps information to recognise each individual part.

FORAN V70 offers a link for the intelligent connection between the model generated in FORAN and the different finite element method (FEM) tools. This application will be improved in futures releases.

Sener has added a new generation of piping design tools to dramatically improve the pipeline routing functionality of the system, with a highly interactive and friendly tool. In addition, there are some other features for a rule and production based design, such as a command for smart splitting of pipe segments based on the standard pipe length defined in the components library, checking utilities to control the spool fabrication restrictions before generating drawings and greater flexibility for the creation of sets of piping elements.



Detail of a non-standard section of a cableway.

Among others, some important characteristics are that auxiliary polygonals are not needed, pipelines are routed dynamically displaying the pipeline solid model and that snap points with significant points of the model are available. Users will benefit with automatic solutions provided by the tool and with the definition of complex layouts in a smart and fast way, says Sener.

The electrical application in FORAN V70 allows the definition of a built-in type of cable duct for special non-standard cross-section cableways. Other improvements are the ability to define conduits with cables inside cable trays and to consider them in the cross-section filling calculations.

The cable routing has also been improved, while the connection of cables and terminal blocks allows the management of cables partially routed. FORAN V70 allows the integration with different PLM Systems, thanks to a neutral solution built with standards based on XML, web services and CORBA. *NA*

HSVA develops the empirical prediction method

Today prediction of resistance and propulsion in ice covered waters is usually carried out by using well established semi empirical methods. Hamburgische Schiffbau-Versuchsanstalt GmbH (HSVA) looks at the development of empiric prediction methods for ice-going ships based on artificial neural networks.

For navigation in level ice, an approach based on certain ship main dimensions as well as hull shape angles and ice properties is used [1]. The total resistance in ice encountered by the ship is split up into components that each include different physical phenomena like initial crushing, breaking, as well as submersion and sliding of ice floes along the hull.

For prediction of resistance and power in the broken channel, the rules calculation according to Finnish-Swedish Administration is used. The same is also applicable for the approach for level ice formulas which include certain hull form and ice perameter. Another similarity is the superposition of single components to determine the total resistance [2].

The disadvantage of these procedures is that the interactions of simultaneous effects are hardly taken into account. Results of model tests and full scale trial on the other hand show high correlation between single parameter influences, for example the dependence of total resistance to ice thickness and ship speed. Another aspect is the validity of the existing methods, which are based on a certain range of ships that are comparable. Since establishing these methods, ice breaking hull shape has been further developed and the number of ships with a conventional hull form operating in ice covered waters has increased.

To offer a prediction including both, a preferable realistic parameter basis and a larger range of validity concerning hull shape and main dimensions, a prediction method based on artificial neural networks (ANN) was developed in scope of a master thesis at Hamburg Ship Model Basin [3]. Neural networks offer the possibility of learning multiple relations of a physical problem without requesting an explicit approach. Assumptions about superposition or interaction of single components or effects are, therefore, unnecessary. The networks are trained on a certain parameter set including both, input and target qualities (resistance, requested delivered power). The training itself is performed with gradient descent methods (see figure 1).

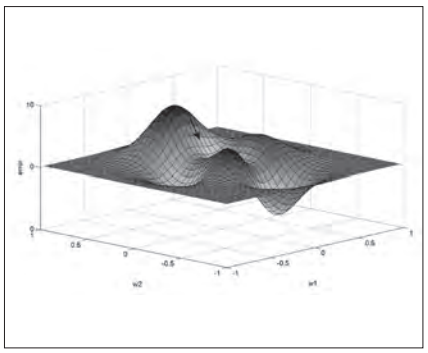


Figure 1: Gradient descent method.

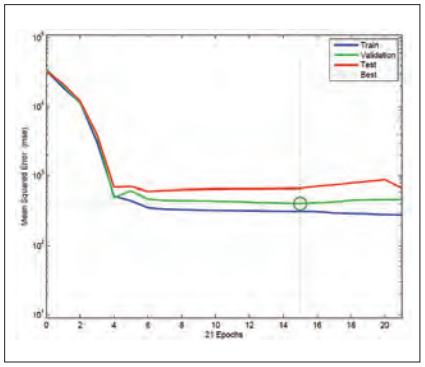


Figure 2 : Error for training and validation.

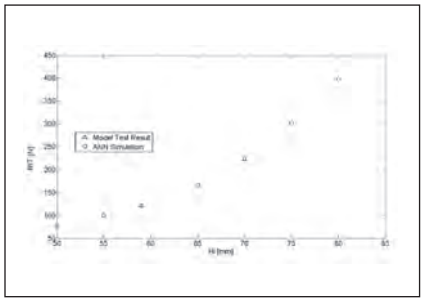


Figure 3: Results of model tests and ANN.

If the training set includes enough information, in a second step, the network should be able to generalise the dependencies to predict the target values by using an unknown input data set.

To avoid the memorisation of presented data during the learning phase, the network has to be validated continuously by using unknown data sets. The optimum training stage is reached, if both training and validation error have reached their maximum (see figure 2).

To enable the networks to learn the relvant parameter relations, data collected during model tests at Hamburg Ship Model Basin were used. The input vector included main ship dimensions, hull shape and ice parameter. The results produced, presenting unknown input vectors to the network showed acceptable accuracy and plausible dependencies.

Besides prediction in the early design stages, the networks may be used to interpolate a parameter range (see figure 3) and can therefore be used to confirm or amend results gained by model tests, as there are usually not enough data to cover each single parameter range. *NA*

References

[1] Lindqvist, G.: *A straight forward method for calculation of ice resistance of ships*, In POAC, June 1989

[2] Riska, Kaj: *Performance of merchant vessels in ice in the Baltic*, Helsinki University of Technology, December 1997

[3] Reimer, Nils: *Develoment of empiric prediction methods for ice going ships*, Hamburg University of Technology, May 2010

Keeping up with demand

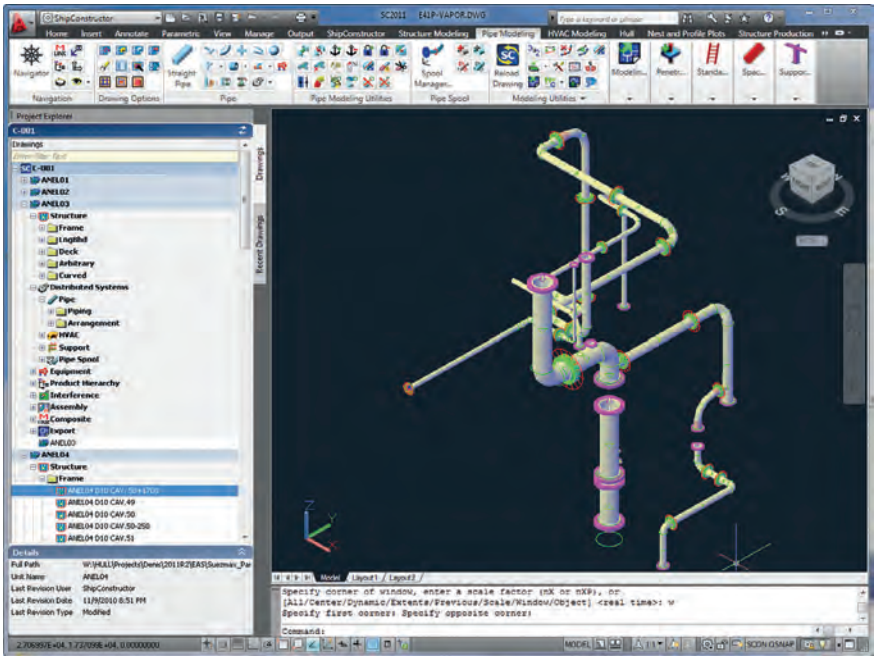
Keeping ahead of the game in design is an important part of keeping a ship design company competitive. Getting quick access to new design tools that come on to the market and having quick turn around times, ensures business flows.

ShipConstructor has released its subscription advantage package that it say's will keep designers and companies at the forefront of the design race. The package will allow existing customers access to new tools before they are released to the general market.

"The package gives customers access to new features and additional features that may never be released in the full version of ShipConstructor giving the subscriber an advantage," said Mark Waldie, PR write/coordinator, ShipConstructor. "The launch of the package is actually the launch of the plan, as yet we are still deciding the other features that will be included," he added.

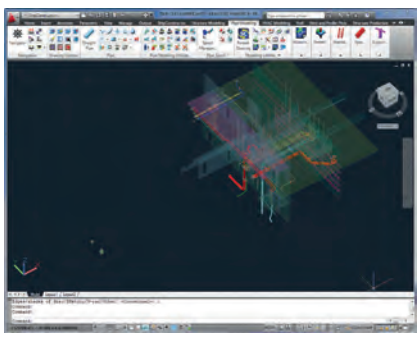
The subscription pack is an add-on to the already existing annual subscription from ShipConstructor that allows customers access to upgrades, maintenance and support. The advantage package gives the customer access to three features, such as part view that will allow the user to any part or portion of a model and viewed in any type of drawing. It will also let the user view only the information that is required when performing a task and therefore, reducing rework that may need to be included into a design. ShipConstructor adds that in contrast to using the current ShipConstructor M-Link technology, this can also greatly increase performance.

The second feature is project explorer, a new feature that will allow easier navigation of a project. Project Explorer will be a new palette allowing users to quickly view, open, and switch between project drawings. Adding to this the package will also include the Auto dimension feature which is intended to speed up dimension detailing in production drawings by using AutoCAD's dimensioning function within the ShipConstructor environment.



Project explorer offers the user quicker and easier navigation to jump between project drawings.

Part view will allow users to view any part or portion in any type of drawing.



"ShipConstructor has based the development of the auto dimensioning feature on AutoCAD from AutoDesk. In auto dimensioning the user can select different points of a steel sheet for example and it will show you the dimensions of those points. This facility in the package will speed up the process for designs, so they do not have to go through each point separately," said Mr Waldie.

"We follow what AutoDesk does as some things that they incorporate into their software is similar to what we have in ours. If they have a good idea in their software then we like to model how we do our on them, as they have show that it works," Mr Waldie added.

Over the next year ShipConstructor is looking to develop the features that it has in the advantage package to be able to offer customers more. The idea behind the added features, are to give customers testers of packages that are condensed versions, which include specific tools that ShipConstructor believes will be of most use to the user. These features may then be expanded into the full ShipConstructor software at a later date.

"We are looking to include a whole lot of other features into the package. We will see what the feedback is like from these three features and if they are popular we will develop them into the regular software," said Mr Waldie.

ShipConstructor will see what feedback it gets from these three features before it launches the expanded programmes into the full version of ShipConstructor software. The company expects that it will be adding new features to the software at regular intervals, the software features will come from customer demand from the feedback that it gets from the regular software and also this new package. *NA*

Fleet modernisation signals new commitment to Polar research

Europe, the USA and South Africa are all in the throes of developing new research vessels as the race to develop the Polar regions hots up. By David Tinsley.

A clutch of new projects, some implemented and a number of others planned, will see a substantial modernisation and development of the polar research and expeditionary vessel fleet over the next five or six years. The various initiatives testify to a renewed commitment by countries to their scientific obligations and long-term strategic objectives as regards the Arctic region and Antarctica. For the maritime industries, these goals translate into design and newbuild contracts of high intensity as regards capital, technology, equipment and man-hour input.

A report issued in November by the Wissenschaftsrat, the highest scientific advisory board for the German federal government, focused on the future development of the German marine research fleet, placing special emphasis on perceived urgent needs as regards Arctic and Antarctic research capacity.

The Wissenschaftsrat has been a key proponent of the European research icebreaker project back in 2006, conceived by Germany as an international endeavour. This had foreseen the construction of the unique *Aurora Borealis*, designed to combine the qualities of a heavy icebreaker, a scientific drilling ship, and a multipurpose research platform capable of operating year-round in all polar waters. Estimated build costs had been around €650 million at 2008 levels, and it had been anticipated that ship construction could start in 2012 with a view to the vessel making her first scientific expedition in 2014.

However, the project has yet to reach the newbuild contract stage, and those timelines could now go back two years or more. The Wissenschaftsrat report referred to the increases in both construction and running costs during the planning phase, and also to the unsettled financing status of the international scheme.

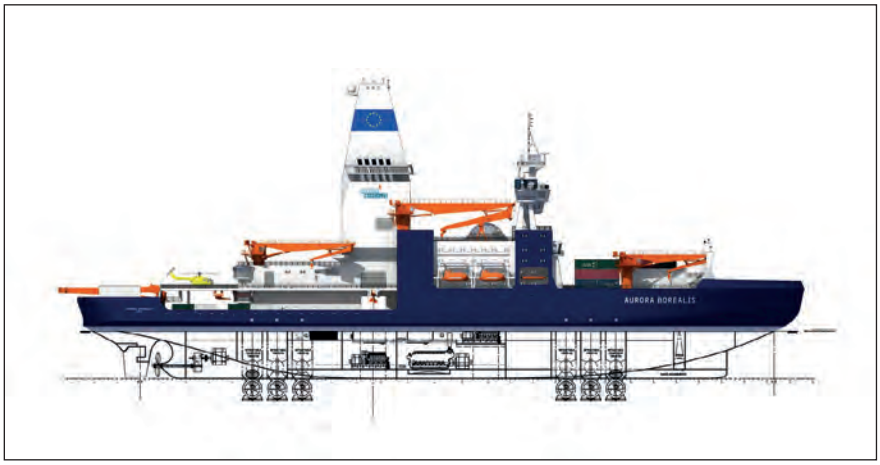
Against this backcloth, the report's authors have suggested a national initiative, whereby Germany should go ahead with the building of a new research icebreaker on its own account. The proposed vessel encapsulates a less ambitious technical capability than the *Aurora Borealis*, but could be brought into operation in 2016, without having to wait for the outcome of the protracted discussions of the *Aurora Borealis* international consortium.

Germany looks to design a new research icebreaker that could be in operation by 2016, encapsulating some features of the *Aurora Borealis*.

The merit of the proposal, it is argued, is that a new German ship would enable key new elements of research to get under way without further delay. Furthermore, by retaining the country's existing polar research vessel *Polarstern* for longer than originally foreseen, there would be an interim, overlap period in which two highly sophisticated vessels would be available to investigate both polar regions simultaneously.

The advocated German newbuild, estimated to cost €450 million, would be significantly less capital-intensive than *Aurora Borealis*, but would employ similar technologies and characteristics of the latter, including year-round operating capability in

Modernising the fleet may not be as costly as expected.



The Royal Institution of Naval Architects

International conference on Design and Operation of Passenger Ships

23rd - 24th February 2011

Second Announcement

The passenger vessel market is emerging from one of the most challenging economic climates and is now showing strong signs of recovery. Vessels are growing not only in size but in complexity as passengers expect a greater level of comfort and greater range of activities on board. Vessels are also now operating in a wider range of areas than ever, polar cruises are particularly becoming more common, these bring their own challenges not only in design but also in terms of vessel fit out and minimising the local environmental impact of vessels.

Changes in regulations have also had a large impact on design, probabilistic rules for damaged stability and new rules for the structural use of composites open up new possibilities but also bring new challenges for all involved in design and manufacture. The introduction of the Energy Efficiency Design Index also places greater restrictions on the design of new vessels.

RINA invites papers from naval architects, class societies, operators, researchers, and builders on all related topics, including:

- All Aspects of Design – Hull, General Arrangement, Interior, Features etc.
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- Powering & Propulsion
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both the Arctic and Antarctic and dynamic positioning in ice-laden waters.

The Wissenschaftsrat's recommendations have been welcomed by the Alfred Wegener Institute in the Helmholtz Association, which operates the 1982-built *Polarstern*. The Institute said that it would submit an application to the Federal Ministry of Education and Research for drawing up documents to prepare for invitations to tender.

Federal German funding had brought the concept of a highly innovative, multi-role research icebreaker for the polar regions, encapsulated in the *Aurora Borealis*, to the technical design stage. Following on from this, an European Union (EU)-sponsored project was set in train in 2008 to create the structures for the ship to be ordered, built and operated under the auspices of the European Research Icebreaker Consortium (ERICON). The Ericon-AB project, as it is known, has 15 partners from 10 countries, coordinated from Strasbourg by the European Science Foundation (ESF). Russian cooperation and involvement was regarded from the outset as particularly important.

The rationale for public funding was that the *Aurora Borealis* would enable Europe to undertake international research expeditions into the Arctic Ocean and the Antarctic continental shelf throughout the year, providing a hitherto unmatched capability to allow European polar scientists to study some of the ecosystem and climatic issues that will become ever-more pressing in the coming decades.

At approximately 65,000tonnes displacement and just under 200m in length overall, *Aurora Borealis* was foreseen with a diesel-electric plant of 94MW and three ice-reinforced, fixed pitch propellers absorbing 27MW apiece, enabling unassisted ice navigation and manoeuvring. The unique incorporation of a deepwater drilling rig would enable samples to be extracted from the ocean floor at a penetration of up to 1000m in water depths of between 100m and 5000m at some of the most inhospitable locations on the planet. Model tests carried out in the ice tanks of the Hamburg Ship Model Basin (HSVA) and the Aker Arctic Research Centre in Finland demonstrate that the vessel's technical design would permit dynamic-positioning in ice cover potentially as thick as 2.5m.

Currently, experts assigned to the ERICON project are understood to be working on a business plan encompassing various financial participation models for the partners in the research consortium. A final decision as to the building of the benchmark-setting *Aurora Borealis* is now anticipated in early 2012. It seems unlikely that the vessel would be ready for service before 2016.

As one of the original signatories to the Antarctic Treaty, South Africa maintains modern and sophisticated research facilities in Antarctica, and now has a new, multi-role ship under construction to support and extend its polar scientific platform. Entrusted by the country's Department of Environmental Affairs to the Rauma yard of STX Finland, the 134m vessel will become the crucial logistical component of the South African National Antarctic Programme.

Due for delivery in the first half of 2012, the €116 million build project constitutes one of the largest-ever civil trade agreements between South Africa and Finnish industry.

The diesel-electric newbuild will not only be used to carry scientists and research equipment for the National Antarctic Programme, but will also serve as a resupply ship, icebreaker and expedition vessel, with the capability to spend months at sea in the role of a mobile laboratory. Futhermore, the ship will be equipped to keep a continuous record of weather data for meteorological institutions around the world. Expeditions will take place during the Antarctic summer, between November and March. Over the remainder of the year, the vessel's duties will include relief of stations in the Antarctic islands. Accommodation will be provided for a crew of 45 plus some 100 researchers or passengers.

Vessel operation has been assigned to the South African company Smit Amandla Marine, and crew will be trained at the Wartsila Land and Sea academy in Turku.

The power and propulsion plant will be based on four main gensets driven by six-cylinder models of the Wartsila 32-series medium-speed engine design. Electrotechnical specialist Converteam has been contracted to deliver a transformerless power solution, including two 4.5MW propulsion motors supplied by PWM MV7000-type converters.

By way of the multi-drive architecture, the propulsion converters will also feed energy to the tunnel thruster motors. Benefits of the technology include improved efficiency and availability of the propulsion train, lower overall maintenance costs, and space and weight savings, with a correspondingly reduced footprint.

Meanwhile, a new research vessel project under way in Wisconsin will help serve USA long-term objectives related to its Arctic national interest. A long-espoused need for an advanced research ship conceived and equipped to operate in the ice-laden waters of Alaska and the polar regions, offering substantially greater capability than an earlier, sold vessel, has been acted upon through the order for the 260ft (87m) *Sikuliaq*.

Designed by The Glosten Associates, the Seattle-based marine technical consultancy, with reference to science mission requirements developed by the University-National Oceanographic Laboratory System community, *Sikuliaq* has been laid down by Marinette Marine Corporation, and is expected to be ready to undertake her first scientific deployment in 2014. The vessel's contractual owner is the National Science Foundation, although it will be operated by the University of Alaska Fairbanks as part of the USA academic research fleet, and homeported at the university's Seward Marine Center. It will be used by scientists in the USA and from among the international oceanographic community.

The requisite ice strengthening will be incorporated to allow *Sikuliaq* to work safely in moderate seasonal ice, operating over a longer period than formerly possible in the northern Pacific, the Gulf of Alaska, and the Bering, Chukchi and Beaufort Seas. The ship will have the capability to break ice up to 2.5ft (0.75m) thick.

Sikuliaq will allow researchers to collect sediment samples directly from the sea floor, host remotely operated vehicles (ROVs), use a flexible suite of winches to raise and lower scientific equipment, and conduct surveys throughout the water column and sea bottom using special instrumentation. The vessel will also be equipped to transmit real-time information during expeditions directly to classrooms anywhere. A low underwater radiated noise signature has been stipulated so as to conduct marine mammal and fisheries work to best effect. ***NA***

The Royal Institution of Naval Architects

WARSHIP 2011: NAVAL SUBMARINES and UUVs

29 - 30 June 2011, London, UK.

First Notice & Call for Papers

Warships 2011 will be the 31st in the successful Warship series of conferences organised by the Royal Institution of Naval Architects, and the tenth to cover the topic of 'Naval Submarines'.

Submarines are among the most complex of engineering products, comparable in complexity with aerospace projects such as the space shuttle. To design, manufacture and support them in service requires a sophisticated industrial base and the willingness to incur the long term cost of ownership.

Submarines used by the world's major navies have evolved for 'blue water' warfare, in a period when cost was effectively secondary to capability. In this arena, the submarines themselves and their supporting industrial base are well developed, to the point where further change to their overall architecture is limited to incremental or evolutionary development. This situation is now being challenged, both by the desire to reduce the cost of ownership and in response to changing military threats. Submarines are now required to accommodate roles which may change substantially during their service lives, and to undergo continuous updating while minimising the time spent in refit and hence unavailable for service. These changes affect the submarine throughout its lifecycle and the design not only of the submarine but the organisations involved with it.

Warships 2011 will also, for the first time, include the rapidly growing new field of military Unmanned Underwater Vehicles (UUVs), which have an expanding role and are increasing in both complexity and capability.

RINA invites papers on all aspects of the design, construction and operation of Naval Submarines and UUVs, including the following topics:

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- Affordable, available and adaptive submarines.
- Management of submarine design information and maintenance of design intent.
- Design and construction
- UUV specific: construction, design, operation
- Novel materials; their underwater application.
- External installation of weapon delivery systems, towed sensors and communications systems.
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Trading places

By adopting a bold, but circumspect, approach to the technical design of a new generation of Arctic containerised vessels, Russian metals producer MMC Norilsk Nickel is now reaping the benefits with a strengthened export market reach and competitiveness, writes David Tinsley.

Built to ARC-7 ice class standard, and incorporating diesel-electric power and podded propulsion, the 14,500dwt *Norilskiy Nickel* series was conceived from the outset to provide for largely unassisted year-round Arctic operation. While aiming to bring heightened transport capability and efficiency to bear on the main route to foreign markets through the western section of the Northern Sea Route, the group also sought to ensure that its investment would provide for navigation on the even more challenging eastern section. Direct shipments from the group's facilities at Dudinka, on the River Yenisey, might thereby be made to eastern Asian ports through the Arctic passage.

Sovcomflot's 70,000dwt Arctic shuttle tanker *Vasily Dinkov* loading crude oil from the Varandey fixed offshore terminal in the Pechora Sea.

The initial emphasis with what is now a fleet of five sisters was on conveying products from Dudinka westbound to Murmansk for transhipment, with the transport pattern including a gradually increasing number of direct sailings to the north west Continent. While direct voyages to foreign ports, sailing westbound through the Arctic seaway, have indeed steadily grown, the company achieved a new milestone in September 2010 when one of the ships, *Monchegorsk*, left Murmansk for her first full eastward transit of the Northern Sea Route. The ship put in to Dudinka to load, and then proceeded via the East Siberian Sea and Cape Dezhnev to Busan and Shanghai.

Given the attributes of the vessel type involved, based on Aker Arctic design technology, MMC Nickel believes that it can tap the potential offered by using the eastern part of the Northern Sea Route to serve markets in China, South Korea and elsewhere in Asia on a direct basis. The trip from Dudinka to Shanghai can be made in around 19/20 days, as opposed to a duration of some 60/65 days with routings through European ports and the Suez Canal. On her return voyage from Shanghai to Dudinka, the Monchegorsk transported materials and supplies for the group's production plants as well as consumer goods for the residents of the Norilsk Industrial Region.

Although affording scope for other cargoes, MMC's bespoke vessels use container-dimensioned pallets to carry pre-rolled nickel plates on flats or frames of standard size, loaded in up to 650 containers of a design specific to the company but similar to conventional 20ft units. Recently, the producer received the first batch of a new, higher capacity design of container that will be conveyed by the Norilskiy Nickel series.

The new ISO-ICX units are 1280cm in height, twice that of standard boxes, and offer a gross capacity of 30.5tonnes. Plans foresee 1500 of these containers being in service during 2011, for consignments of metals to the commodity markets as well as for return flows of process materials and supplies to the Norilsk Industrial Region.

Aker Finnyards, as it was then, delivered first-of-class Norilskiy Nickel, while the four subsequent vessels were entrusted to Aker Ostsee at Warnemuende, now Nordic Yards, where a new Arctic tanker derivative of the class was laid down in November 2010. Ordered by MMC *Norilsk Nickel* to supply fuel and lubricants to Dudinka and elsewhere in Russia's Far North, and to backhaul condensate from the Taimyr pensinsula to continental Europe, the 18,500dwt *Enisey* will encapsulate the container vessels' key performance attributes.

With construction to ARC7 ice standard, and applying the double-acting concept based on a 13MW Azipod electric propulsion unit and special aft ship form, she will be capable of independent navigation stern-first through ice fields up to 1.5m in thickness.

German project cargo specialist Beluga

Shipping's 2009 accomplishment in sailing two of its vessels from Korea to Rotterdam via Russia's Northern Sea Route attracted considerable attention, as the first-ever complete transit by non-Russian commercial ships.

However, Russian and earlier Soviet experience in this regard goes back many decades.

Last summer, a new chapter in this sphere of endeavour was written, when an Aframax tanker operated by Sovcomflot undertook a laden voyage from Murmansk to China, using the whole course of the Northern Sea Route.

With an escort of Russian nuclear icebreakers, the 115,000dwt *SCF Baltica* covered the 2500 nautical miles between Murmansk and Pevek ahead of schedule in 11 days, before proceeding with its 70,000tonnes condensate cargo to Ningbo, south of Shanghai. The vessel's Northern Sea Route transit took it through the Barents Sea, north of Cape Zhelaniya on Novaya Zemlya island, the Vilkitskiy Strait, the Taimyr ice field, the Sannikov Strait, Laptev Sea and the ice-covered East Siberian Sea.

In addition, the brief Arctic summer saw the landmark voyage of the 43,700dwt *Nordic Barents*, transporting 41,000tonnes of Norwegian iron ore to China via the Northern Sea Route, the first foreign-flag bulker to use the seaway as a transit trade lane.

Russian-controlled shipping has gained an entirely new dimension through the construction of two classes of diesel-electric shuttle tanker tailored to respective developments in the country's Arctic waters. The *Vasily Dinkov* series of three 70,000dwt tankers delivered by Samsung Heavy Industries to Sovcomflot has implemented the world's first Arctic oil shuttle export system, undertaking shipments from the Varandey offshore terminal, a fixed structure in the Pechora Sea.

The facility is fed from wells in the Timan-Pechora region of northern Russia, and the crude oil is transferred to Murmansk for transhipment, or carried direct to foreign markets using the new breed of purpose-designed vessels. *Vasily Dinkov* and her two consorts embody the double-acting principle conceived by Aker Arctic Technology. They have been designed with the capability to maintain independent operation year-round on the Northern Sea Route, without the need for icebreaker assistance, creating the basis for an efficient, constant and high-productivity crude oil offtake pattern in the Arctic. The charterer is field developer Naryanmarneftegaz, a joint venture between Lukoil-ConocoPhillips.

The second new class of diesel-electric Arctic shuttle tanker made its debut in 2010 with the delivery of the 70,000dwt *Mikhail Ulyanov* from Admiralty Shipyards, followed by sistership *Kiril Lavrov*. The pair is intended to become the mainstay of the traffic from the Prirazlomnoye platform in the Pechora Sea, starting in 2011.

Aker Arctic Technology provided the basic hull design to the St Petersburg yard. Employing twin podded propulsion units and an aft form optimised for icebreaking by running astern, the vessels meet owning group Sovcomflot's requirements as regards independent navigation in most ice conditions with the requisite high level of manoeuvrability.

Operation has been assigned to SCF-Unicom on 25-year timecharters agreed between Sovcomflot and Sevmorneftegaz, now Gazprom Dobycha Shelf. Crude will be shipped from Prirazlomnoye to a floating storage and offloading(FSO) unit off Murmansk, or direct to refineries in northern Europe or elsewhere.

Shipping is crucial to the support of Canadian mining operations within and just outside the Arctic Circle, and to the delivery of supplies to remote northern and eastern Canadian communities. Montreal-based Fednav's pioneering role and involvement in ice-going bulk cargo transportation has been consolidated in recent years, including the introduction of the 31,500dwt bulker *Umiak I* to serve a year-round shipment contract bringing nickel concentrates out of the harsh environs of northern Labrador.

An envisaged new Canadian Arctic export traffic arises from a plan by Baffinland Iron Mines Corporation to mine iron ore on Baffin Island, in Nunavut Territory. This has led to sample shipments being lifted by Fednav bulkers to European steelmakers, and to design studies for a fleet of polar class ore carriers of up to 190,000dwt carrying capacity. The Mary River project is reported to contain the world's largest undeveloped deposits of high-grade iron ore, and Baffinland is looking eventually to an export volume of 18million tonnes annually for at least 25 years, with Europe potentially being the primary destination. *NA*

Fednav group's 32,000dwt icebreaking bulker *Umiak I*, used to transport nickel concentrates from the Voisey's Bay mine in northeast Labrador, seen in Anaktalak Bay (Photo courtesy of Voisey's Bay Nickel Company).

New generation ice breakers set to service Artic offshore industry

Russia has taken positive measures to modernise and extend its icebreaker capacity. The turning point was the commissioning in 2007 of the long-delayed nuclear icebreaker, *50 Let Pobedy (50 Years of Victory)*. Two diesel-electric icebreakers have followed from the same domestic source, Baltiyskiy Zavod. David Tinsley reports.

Russia's *50 Let Pobedy*, the world's most powerful nuclear icebreaker.

Technical work has been initiated on a programme aimed at bringing a new generation of nuclear icebreakers into service, originally envisaged from 2015 onwards. In addition, further commitments to diesel-electric newbuilds are in prospect.

Fleet strategy is closely allied with the fundamental, long-term economic importance attached by Russia to vast hydrocarbon and mineral reserves in its most environmentally inhospitable regions. While the rise in commercial shipping activity generated by Russian overseas trade through the Baltic and the country's Arctic waters is primarily energy-related, existing Arctic metallurgical and other northernmost industrial endeavours and the associated communities, generate significant traffic demand. Attention is also focused on the potential of Russia's Northern Sea Route to serve as a shorter conduit for traffic between Europe and the Far East.

During 2009, winter shipping in the Gulf of Finland benefited from two new Russian diesel-electric icebreakers, the 10,000tonnes displacement sisters *Moskva* and *Sankt-Petersburg*. Contracted from Baltiyskiy Zavod by the Russian state-owned company Rosmorport, the design employed confers multifunctional qualities, whereby the key task of providing icebreaking escort to large tankers is complemented by rescue and salvage capabilities. A key role, permeating the design parameters and performance criteria, is that of supporting tanker traffic serving the eastern Baltic port of Primorsk.

Moskva had the distinction of being the first icebreaker powered by a diesel-electric plant to have been built in Russia for 34 years. During the intervening period, all Russia's non-nuclear icebreakers were sourced from abroad, mainly from Finnish yards.

The entry into service of *50 Let Pobedy* has been a boon to Russia's means of ensuring year-round navigation in its western Arctic region, while providing the scope for duty throughout the Northern Sea Route. The vessel is equipped with a pair of 75,000shp steam turbogenerators feeding power to three fixed pitch propellers.

Design work implemented on a new multipurpose nuclear icebreaker class has been shaped by the requirement to support convoys and render individual vessel assistance in the Russian Arctic seaways, with the added capability for operating in relatively shallow areas of the Yenisey River and Gulf of Ob. Design projects undertaken by Russian institutes have included a 110MW nuclear icebreaker that could potentially facilitate complete transits of the Northern Sea Route, from Europe and northwestern Russia into the Pacific, by tankers of up to 150,000dwt.

Meanwhile, Russia's planned new 25MW diesel-electric polar icebreaker is the first project in which Aker Arctic's Hybrid DAS system has been nominated as the propulsion solution. It has been determined that a hybrid arrangement employing a centreline, fixed pitch propeller, flanked by a pair of Azipod azimuth podded propulsors, incorporating fixed-pitch propellers, would best suit operational power needs and the requisite flexibility in Arctic conditions. The Hybrid DAS concept has been patented by the Finnish technology specialist.

More than a decade on from the unveiling of the innovative, oblique icebreaker concept, the unique vessel design could find first form as a consequence of a Russo-Finnish agreement. The memorandum of cooperation signed by Sovcomflot and Rosmorport with Aker Arctic Technology, STX Finland and Southeast Trading reflects Russian aims of modernising and strengthening its fleet of vessels dedicated to support operations such as ice escort, ship towage, search and rescue, and spill control. It has opened the way to a pilot project to design and construct a spill combat and salvage icebreaker, using the oblique icebreaker as the basis for the technical project.

The intention is to deploy the envisaged vessel, which has yet to be ordered, in the Gulf of Finland. However, the parties have expressed optimism as to the longer-term potential for applying the concept to a larger programme of icebreaking special-purpose vessels serving Russian terminals and fairways in the Baltic, Barents Sea and Sea of Okhotsk.

Conceived by Aker Arctic's predecessor, Masa Arctic Research Centre(MARC), as an

efficient means by which a single icebreaker could clear wider channels in ice for beamier tankers, the oblique design is asymmetrically triangular in form, with a wider stern. Both ends of the vessel are designed for icebreaking, while the widest channel cut can be made by operating sideways, at an angle of some 50degs.

To confer the necessarily high manoeuvrability and ice-forcing properties, Azipod units are located in each of the three 'corners' of the triangular hull, one at the bow and two at the stern. The arrangements afford flexibility in serving different requirements and conditions, such that working a relatively narrow channel through thin ice can be fulfilled by navigating bow first, with better performance in thicker ice being achieved by running stern first. Deployment in oblique operating mode would achieve the widest channel clearance. Tank tests with the original design proposal had indicated suitability for operating in ice up to 1.2m thick.

The oblique icebreaker foreseen under the pact between the Russian and Finnish organisations is tentatively envisaged with three azimuthing propulsors of 7.5MW in total, and at approximately 1450dwt, to accommodate the requisite technological equipment and machinery.

The development of Russian Arctic oil exports from a major new outlet in the Barents Sea, the Varandey terminal, spurred investment by Lukoil in two versatile, diesel-electric icebreakers. Constructed in each case by Keppel Singmarine, the 4400gt *Toboy* was designed as a multipurpose icebreaking supply vessel, able to force ice up to 1.5m in thickness, and the 7300gt *Varandey* is classed as a multipurpose icebreaker/tug, which can break ice of 1.7m.

The ice-resistant *Varandey* fixed offshore terminal, serving wells in the Timan-Pechora region of northern Russia, is also the interface for Sovcomflot's new, Samsung-built generation of 70,000dwt diesel-electric shuttle tankers of the *Vasily Dinkov* class.

Distinct from the mainstream duties of icebreakers in clearing main navigational channels and towing, assisting and escorting ships at sea and in port and terminal approaches, smaller ice management vessels have been developed. A primary role of these icebreakers is to protect offshore structures and offshore production vessels from ice impact, and also to protect ships from ice damage while lying at berths or moored to offshore structures or loading buoys, as well as ensuring access to those facilities.

Such icebreakers or icebreaking tugs have the capability and manoeuvrability to minimise impact risks by reducing the size of floes in the target area, and to push and tow pieces of drifting ice. A number of new ice management icebreaker projects are under development for oil companies and specialist operators. *NA*

Kongsberg develops "Green" engine room simulator

Shipping is taking steps to be more efficient and environmental in its operation, but with this has come new technologies that crew will need to learn to use. Kongsberg has met this challenge through the development of its latest simulator for a green engine-room.

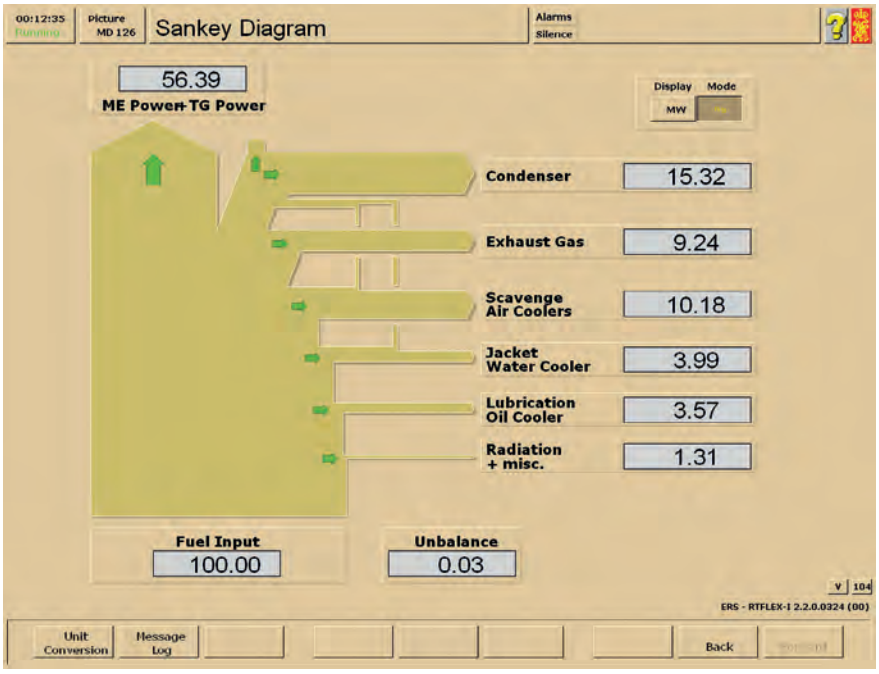
Drawing down on previous experience, Kongsberg has developed a simulator, the Kongsberg Green Ship Engine Room Simulator (ERS), that is aimed at training cadets and crew who need to develop skills in engine room operation. The simulator is not just for the operation of the engine, but incorporates the entire technical plant, giving a training experience for a whole scenario.

The simulator has been based on a Wärsilä 12RT-flex 82C low-speed common-rail engine, built for a panamax container ship of 4800TEU with a reefer capacity of 800FEU. The scenario for the simulated ship model is based on a modern green ship, one that is financed and operated by a ship owner that is keen to keep an environmentally sounds vessel that is fuel efficient and has low emissions.

The simulated vessel has an operating speed of 26knots with the propulsion machinery adapted for all ambient temperature conditions, ranging from arctic (-40ºC) to tropical (45ºC), allowing new trading routes. Kongsberg says that the new ERS model is able to offer a realistic training for the above conditions. The simulator also includes a sankey diagram, a flow diagram to show the proportion of flow of energy, making it easier for training crew to visualise the energy efficiency of the engine room plant.

"We have a huge library of technical parts that we have used in the development of the simulator. The simulator is based on technology that we have used before and has also been developed with Wärtsilä and its RT-flex engine that we have used for this simulator," said Leif Pentti Halvorsen, product manager - engine room simulators in Kongsberg Maritime, simulation & training department, Kongsberg Maritime.

"Although many Kongsberg Maritime ERS models offer green ship functionality, the RT-flex model features the most comprehensive fuel efficiency and emission reduction that we have developed so far," explains Mr Halvorsen. "Our increased focus on green ship simulation comes from the higher interest from environmentally conscious owners, who will be using more efficient engines like the Wärtsilä 12RT-flex in the future," he added.



The sankey diagram that will enable crew to see the energy efficiency of the vessel.

Instead of the usual mechanically-controlled fuel injection pumps and exhaust valve drives of Wärtsilä RTA engines, the RT-flex82C has an electrically-controlled common-rail system, meaning that the engine room operation differs from that of other vessels, so there is a requirement for specialist training on this system.

The latest ERS model simulates the Wärtsilä engine control room system (WECS) which triggers the elctro-hydraulic rail valves for the respective functions, in addition to simulating other technical aspects including, waste heat and thermal oil tank heating systems. The model also simulates a selective catalytic reduction (SCR) exhaust converter, cutting NOx emissions by about 90%.

Training for crew that need to update their skills for this type of engine room operation can take between three days to a week, if they are looking for an intensive course. Whereas, students will have access throughout their term time to the simulator. Mr Halvorsen highlights: "The training that crew and students will get, means they gain more knowledge through the simulator, more than real life experience, as it will be able to simulate different scenarios in a safe environment first."

To date Kongsberg Maritime has sold to STC Rotterdam and Bodin Videregående Skole og Maritime Fagskole in Norway. Kongsberg is expecting to see sales grow as the demand for trained crew for green vessels increases. *NA*

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Höegh gets ahead of the LNG market

Recent moves towards the fuel of the future has brought liquefied natural gas (LNG) to the forefront, but Höegh LNG saw the fuel's potential before this recent surge and has already started to develop a fleet of vessels and is following the market development closely.

The development of shuttle and regasification vessels started back in 2001, where Höegh realised the market potential and future for this type of technology. Since then Höegh LNG has been expanding from shuttle and regasification vessels (SRV) into floating storage and regasification units (FRSUs) and deep water port projects, where the company now has licenses in place for deep water ports in the UK and USA. Further, Höegh has also developed its own LNG FPSO.

"The SRV development, and investment, is one piece in the LNG value chain, and through the development over the past years we are now in a position to offer services within the whole LNG value chain," said Rune E. Karlsen, Project Manager - Project Execution, Höegh LNG AS.

Höegh LNG has received delivery of its second SRV *GDF Suez Cape Ann* in June last year, which will join the first of the series *GDF Suez Neptune* that was delivered in 2009, both constructed at Samsung Heavy Industries. The vessels are on long term charter to GDF Suez and are fully capable of world wide operation both as a conventional LNG carrier, and as an SRV and also FSRU mode and can also operate in cold climates.

"The SRV is part of Höegh LNG's overall strategy, and we are of the opinion that being innovative brings added value to the LNG industry," comments Mr Karlsen.

Höegh LNG believes the SRVs bring the LNG market offshore and so eliminating the need for onshore terminals. The vessels operate in the Neptune deep water port terminal offshore Boston, in masachusetts bay, USA. Operating in this area requires compliance with rigorous environmental requirements, amongst the strictest in the world, highlights Mr Karlsen. To operate in this environment the SRVs are equipped with submerged turret loading system (STL). The STL system enables the SRVs to deliver natural gas directly into a consumer grid.

The vessels have electric propulsion with dual fuel power generators with high fuel efficiency. When operating on gas, the CO_2 as well as NOx emissions are reduced, and the emissions of SOx and particulate matter (PM) are taken out. The generators are fitted with selective catalytic reduction units (SCRs) reducing the NOx emission even more – down to 0.2g/kWh. By comparison, the current International Maritime Organization (IMO) requirement for the same sized engines is 13g/kWh. The power generators also have oxidation catalyst reducing the CO emissions to below 0.165g/kWh. The regasification boiler, producing steam for the closed loop regasification, have low NOx burners, and in addition they are both fitted with SCR's reducing the NOx emissions significantly, states Mr Karlsen.

In addition, the regasification process is in closed loop, i.e. it is no intake of seawater and, therefore, no risk of marine life being taken into the process system and no discharge of cold seawater affecting the marine life. The seawater used for cooling of the engines is re-circulated in the ballast tanks of the vessel. This eliminates the risk of marine life being sucked into the engine cooling system, and also eliminates the discharge of used cooling water.

GDF Suez Cape Ann and *GDF Suez Neptune* meets DNV's COMFORT class, resulting in low noise and vibration onboard; improving the working conditions onboard, reducing the risk of fatigue related accidents impacting the environment. The low noise and vibration also reduces the impact on marine life, in particular marine mammals. The vessels have dynamic positioning (DP Class I) contributing

TECHNICAL PARTICULARS

GDF Suez Neptune/Cape Ann

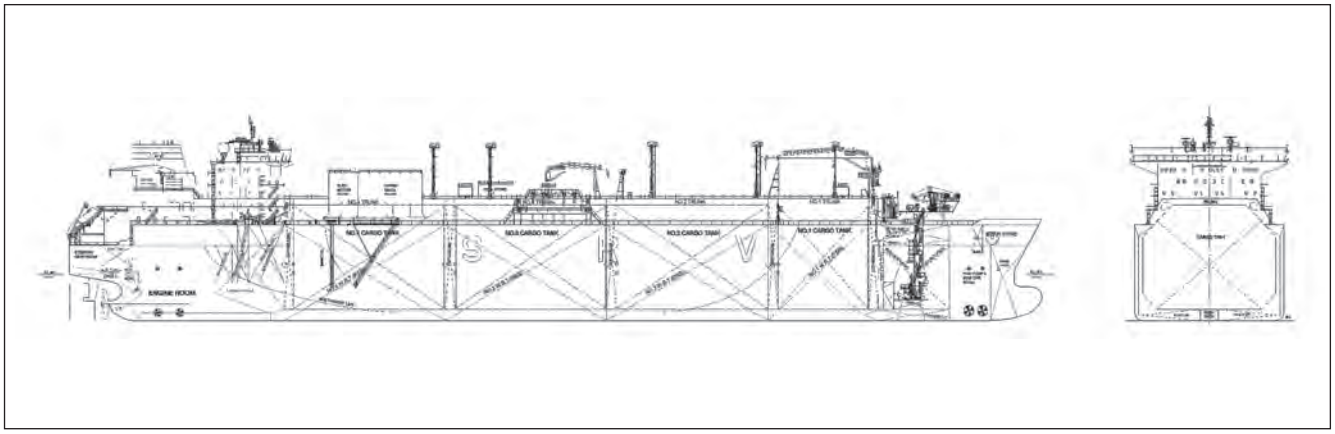
Length oa:	283m
Breadth moulded:	43.4m
Design draft:	11.4m
Deadweight (design):	70,800dwt
Cargo capacity:	145,000m^3
Propulsion:	Singlescrew with twin propulsion motors, powered by four dual-fuel diesel electric generators
Propulsion system output:	26.150kW /88rpm
Service knots:	19.5knots
Main engines:	Wärtsilä
Electric motors/drive:	ABB
Gas combustion unit:	Hamworthy combustion
LNG cargo pumps:	Shinko
Cargo heater/vaporiser:	Cryostar
Inert gas generator:	SMIT
Nitrogen generator:	Air generator
Regasification plant:	Hamworthy
Gas production pumps:	Nikkiso
Custody transfer system:	Kongsberg
Automation:	Kongsberg
Propeller:	MMG
Bow thrusters:	Brunvoll
Stern thrusters:	Brunvoll
Shipbuilder:	Samasung Heavy Industries
Ship owner:	Höegh LNG and MOL
Ship operator:	Höegh LNG
Technical manager:	Höegh LNG
Flag:	NIS
Year built:	GDF Suez Neptune 2009 GDF Suez Cape Anne 2010
Containment system:	Mark III-super reinforced
Class:	DNV
Intended sphere of operations:	World wide trade

further to operational safety and reducing the risk of accidents impacting the environment.

Both vessels have CLEAN notation from the class society, DNV, and also have the Green Passport from the same society, covering all environmental issues throughout the vessel's lifecycle from construction to recycling.

"Höegh LNG's aim is to grow our presence in the overall LNG market including upstream, midstream and downstream," comments Mr Karlsen about the future developments of the Höegh fleet. To date Höegh LNG has received two SRV's and an LNG carrier *STX Frontier* that was delivered from Hajin Heavy Industries at the same time as *GDF Suez Cape Ann*. The vessel is on charter with Repsol for a 33 month term. *NA*

GA Plan for the *GDF Suez Cape Ann*.



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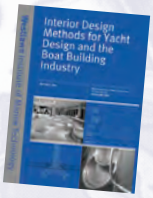

By Lisa C. Hix Ref: IDMYD

In a first-time release to industry and the general public, the Westlawn Institute of Marine Technology announced in April 2009 this textbook was now available for purchase. Specifically prepared as a textbook for Westlawn's intensive Yacht & Boat Design Program, and also used as the text for Westlawn's continuing education course in boat interior design this book provides detailed technical information not available from any other source. Heavily illustrated, with numerous line drawings and photos on nearly every page, this textbook will answer almost any question a designer, builder, surveyor, crewmember, or serious boater may have about the accommodations and arrangements required for safe, comfortable, and efficient crew and passenger spaces. Though focused on boats (vessels under 200 feet or 60 meters), the information is equally valuable for commercial vessels of all sizes.

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By Fred Walker FRINA Ref: SAS

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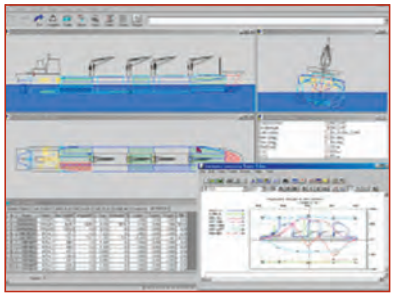

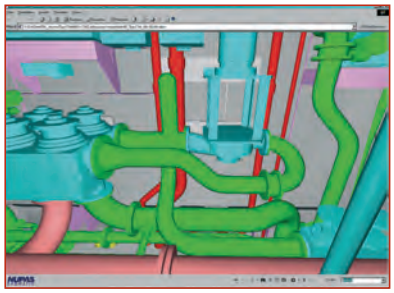

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The conference will cover the full range of topics related to computer applications, including separate programs, integrated systems, knowledge management, simulation and virtual reality applications, for:

- Early design, including concept design, tendering, initial design, general arrangement, cost and work estimation, hull form, hydrodynamic analysis and basic structural design, risk based design.
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- Parts manufacturing and assembly, including prefabrication, shop automation, robotics, assembly and accuracy control.
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- Management of shipbuilding projects, including planning, work-flow analysis, PDM and ERP applications Management of co-operative working between different actors in shipbuilding projects, e.g. shipyards and equipment and systems manufacturers.
- Commissioning, inspection and maintenance, including life-cycle maintenance, life-cycle cost management, environmental cost management, parts and systems reliability, inspection standards and risk management inspection standards, risk management and security.
- Skills management, knowledge transfer and other human resource issues.
- Innovation, innovation management and innovation impact assessment, including new materials and eco design including new materials, green ships and eco design.

Papers are invited on the topics to be covered by the conference. Such papers should focus on advances made in information and communication technology with respect to methods, tools, standards and organisational adaptations in the different application sectors of the shipbuilding industry. Where appropriate, papers should also describe the potential impact of the innovation described to productivity improvements.

The conference will attract a large international audience and provide a forum and means of professional development for all parties interested in computer applications in shipbuilding. Key dates and up to date information will be displayed on the website at:

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