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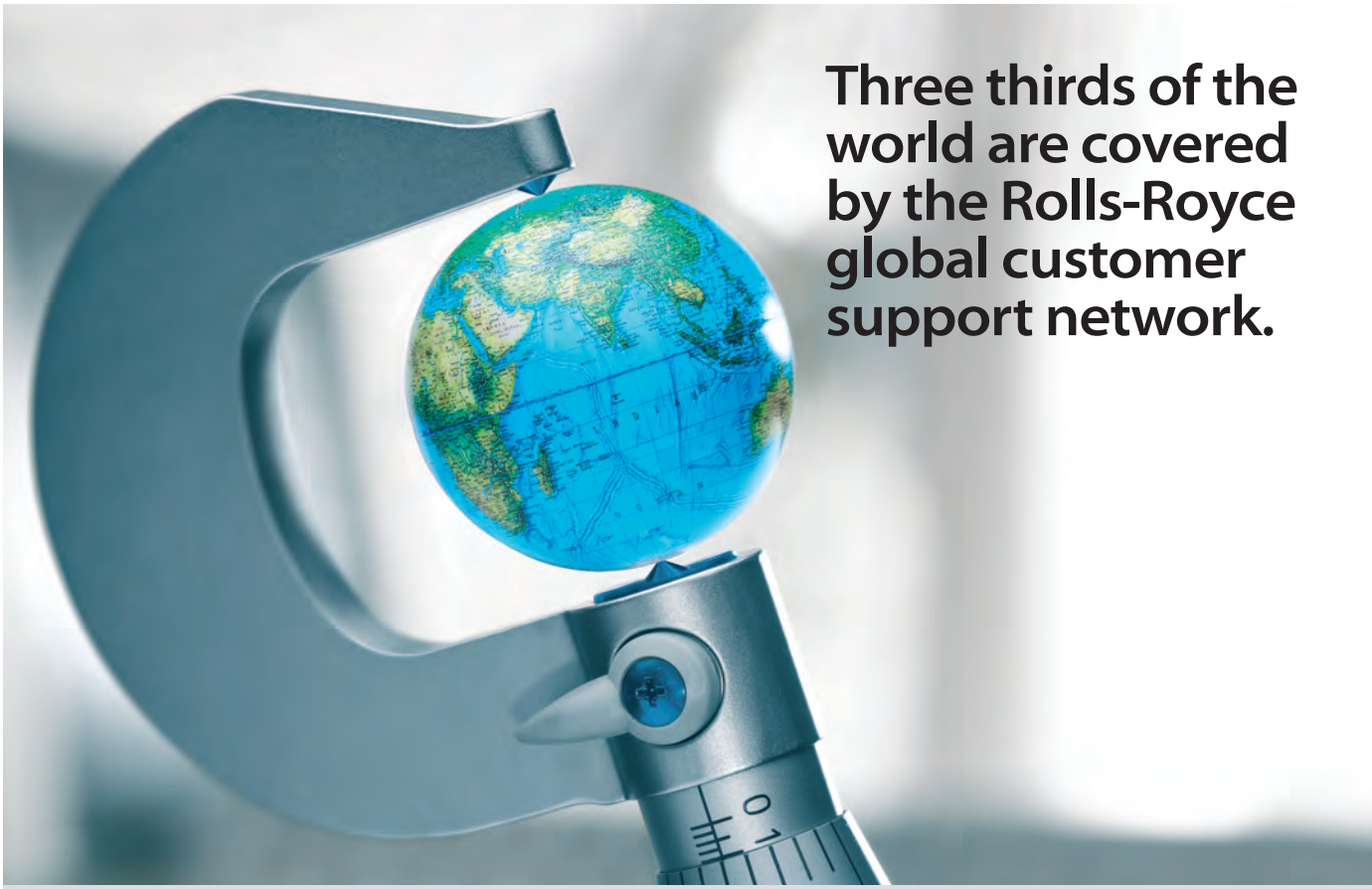

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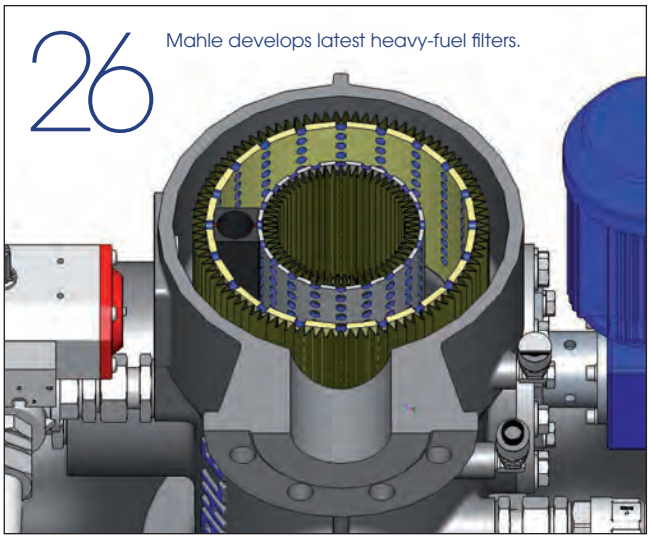


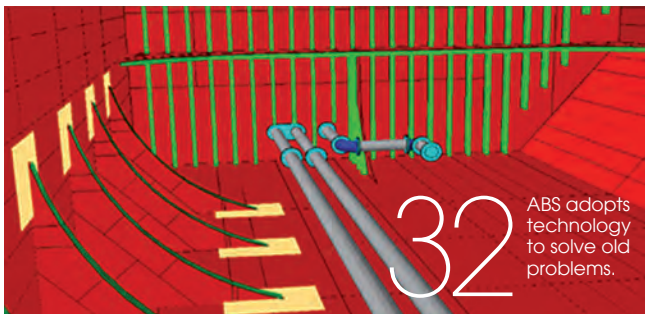


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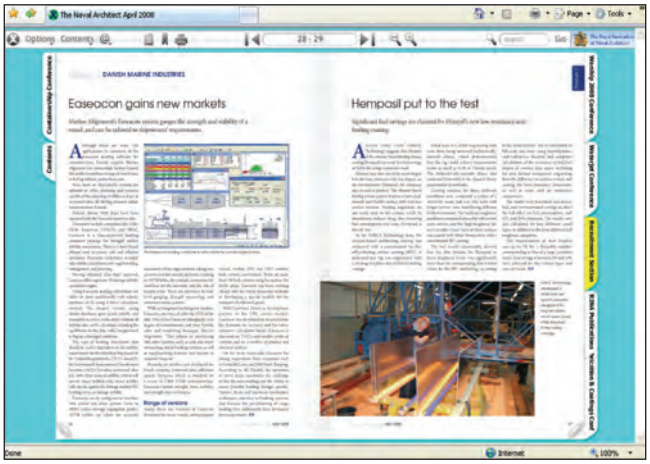

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# Regulatory slip or blip?

**By July bunkering could be an illegal operation in certain parts of the world with certain fuels, but the ships using the new low sulphur fuels are finding that necessary modifications could be difficult to make.**

Lawmakers are criminalising shipowners by adopting legislation without being certain that those that must abide by the rules have the time to comply with those rules. Enforcing the use of low sulphur fuels is an excellent idea, though as many operators will confirm they would prefer a global regulation rather than the hotchpotch that has been adopted.

Scandinavia, the European Union (EU) and the USA have either adopted regulations or will adopt regulations that will require owners to use fuels with only 0.1% sulphur, while MARPOL Annex VI will require the use of fuel with a 1% sulphur content from July this year and a third layer allows fuels with 3.5% sulphur.

Bunker associations and shipowners' associations have, however, pointed out that boilers need to be adapted in order for vessels to be able to safely use the low sulphur fuel. Modifying the fleet takes time and regulators must allow owners the time to make those changes.

Regulators have been warned, not least by Det Norske Veritas, that the low sulphur fuels' low viscosity and acidity along with its poor combustion properties will lead to an increase in the clogging of engines, lowering efficiency, and therefore emitting more greenhouse gases, and increasing catalytic fines. All this from just a reduction to 1.5% sulphur content and that is not to mention that some marine diesel and gas oils have a flashpoint that takes them outside the accepted International Maritime Organization (IMO) requirements.

Intertanko has warned that fuel pumps will need to be modified as existing pumps are not designed to operate with the viscosities of low sulphur fuels and that could mean leaks. The tanker owners' association also warns that the segregation of fuels will mean that ships, whose tank design has not changed in more than a quarter of a century will need more tanks in which the different types of bunkers can be stored.

Parallel fuel systems could also be needed to cater for the different fuels, said Intertanko, with crew needing to be trained in using the new systems. All this and still there is the question of whether there are enough repair facilities to make the comparatively simple modifications to all the vessels that will be affected before the July deadline. And of course there are the costs which in a global economic crisis that has hit shipping harder than most industry sectors, where owners have seen incomes plummet; there is a need to restrict costs not to raise them still further.

The International Bunker Industry Association (IBIA) said that the European Commission is aware of the potential dangers and pitfalls that low sulphur fuels will bring.

The Commission has apparently recommended that the relevant maritime authorities within member states should allow some flexibility for a certain period where planned modifications are agreed, but not yet implemented.

However, IBIA's view is that following the introduction of the new regulations "all non compliant vessels are at risk" means that owners could find themselves in breach of the regulations and advises owners to check with individual ports before arrival.

Moves toward more stringent regulation are not new. The IMO has never been under more pressure, however, to reduce the pollution from ships and shipping as an industry. That pressure is leading some to look at ways in ship operators can improve the way they manage their fleets.

With societies compelling the industry to regulate more in ever more stringent ways comes the added pressure of scrutiny from outside the industry. Often this is seen as an unwelcome intrusion by those within the maritime industry. However, it is this pressure that when applied drives change and this should not be regarded with derision, but should be embraced. The old ways are not necessarily the best.

ABS is looking to move with the tide. It is encouraging owners to take, in their words, "a more holistic" approach to ship management. An integrated consisting inspection data, classification survey information, regulatory requirements, maintenance and repair requirements and dry dock planning all into a single system could well help owners to manage the increasing burden of regulation and by adopting a course of actions that are effectively preventative in nature, rather than reactive, could see reduced costs as a by-product of their endeavours. *NA*

Bunkers

# Jiskoot cuts bunker costs

Jiskoot says its automated blending system will cut the cost of supplying bunkers by US$10/tonne and improve the quality of the fuel by giving suppliers the ability to blend fuel "on demand".

The company said that blending "a wide range of high quality bunker fuels to within 1% of the ISO 8217 viscosity specification, the system's cost savings are achieved through enhanced measurement and control to reduced distillate 'giveaway'."

Configuration of the blenders can be managed to measure density and sulphur content allowing suppliers to guarantee that fuel will meet MARPOL regulations.

Engines

# The gas MAN is coming

MAN Diesel and Daewoo Shipbuilding and Marine Engineering (DSME) signed an agreement in mid-February that will see the companies jointly develop the high-pressure cryogenic gas-supply system designed by DSME for installation with MAN B&W ME-GI engines.

The visit of the Korean delegation ended with a tour of MAN Diesel's test facilities.

MAN's ME-GI is a gas injection dual fuel low speed diesel engine that can burn any ratio of fuel oil and gas, allowing the ship operator the flexibility to choose the fuel depending on availability and cost.

MAN Diesel said it had: "decided to make a full-scale demonstration and performance verification test of the GI principle for all kinds of marine applications on its 4T50ME-X R+D test engine, which will be rebuilt as a 4T50ME-GI engine ready to operate on natural gas by end-2010."

The deal will see the two partners agree a schedule for the development and installation of the cryogenic system on a test engine in Copenhagen and will then be developed for general use on MAN B&W ME-GI engines. Eventually the system will become an integral part of the fuel supply system where it is applicable, said the companies.

Ballast Water

# Ballast water break through

A Ballast Water Management System (BWMS) designed by OceanSaver was the first system to be contracted for inclusion on deep sea vessels. In late January the OceanSaver signed a deal with Hyundai Heavy Industries to provide its BWMS for the three VLCCs of 317,000dwt each. The ships are being built for the Oman Shipping Company.

The deal is something of a breakthrough for the industry as the deal confirms that the BWMS can and must meet regulatory deadlines for their introduction, said the company.

OceanSaver's system will treat some 6000m$^3$ ballast water per hour and has been type-approved by DNV.

"During the development of the technology, comprehensive and independent corrosion and coating impact studies has been carried out, both in laboratories and under real-life onboard conditions. These confirm reduced corrosion and coating weathering rates. The OceanSaver BWMS have demonstrated compliance with the intentions of the IMO Performance Standard for Protective Coatings (PSPC)," said the company in a statement.

OceanSaver estimates the BWMS market to grow to around US$30billion between 2010 and 2020 and it is positioning itself to take a "significant" market share within the tanker, LNG and chemical and product tanker market sectors, and particularly in the larger tonnage sectors which it estimates it can capture 20% of the total vessels by numbers, 40% by value amounting to around US$12billion in total.

The International Maritime Organization (IMO) Convention on BWMS is expected to be ratified by 2011 in most regions while the USA will ratify the convention by 2012, with IMO compliance necessary from 2012.

Personnel

# New MD for Stone Marine

The techinical director at Stone Marine Propulsion, Lyn Bodger, has been promoted to managing director, following the recent retirement of Dr. Graham Patience.

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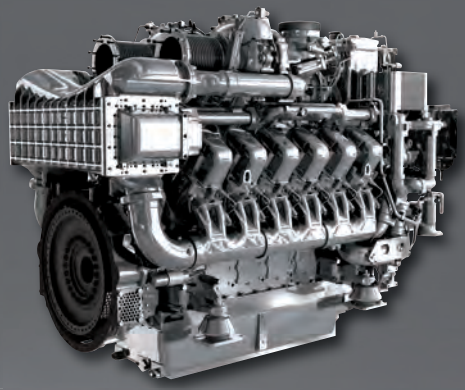

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Mr Bodger joined the company in 1979, when the company was called Stone Manganese Marine, as a surveyor after an eight year career at sea.

He then became a designer at Stone Marine and worked his way through the ranks as project engineer and then technical manager, before being promoted to technical director in 2006.

Following his appointment Mr Bodger said: "As a company we will continue to develop our technical capabilities and marketing strengths in all aspects of ship propulsion, paying immediate attention to our economy propellers."

Tankers

# Inert systems are go

Hamworthy Moss AS has signed contracts to deliver 10 shipboard inert gas systems, to be installed on a series of crude oil and product tankers being built in China's Waigaoqiao Shipyard.

The company has won orders specifying Hamworthy Moss Flue Gas Systems for four 316,000dwt crude oil tankers due delivery between June 2010 and August 2011 to Nanjing Changjiang Oil Transportation Corp (NCOTC). This latest contract means that Hamworthy's inert gas systems have been installed on board 23 tankers delivered to NCOTC since 1997.

In addition Hamworthy secured contracts to supply Moss Mult-Inert™ systems for six 316,000dwt crude oil and product tankers to be delivered by Waigaoqiao Shipyard to Singaporean ship owner Ocean Tankers between June 2010 and October 2011.

These ships will feature inert gas systems offering a capacity of 18,750m$^3$/h each, 100% inert gas blowers, deck water seals, and P/V Breakers. The deliveries will bring the number of inert gas systems delivered by Hamworthy Moss to Ocean Tankers ships to 45.

Geir Hellum, managing director of Hamworthy Moss said: "These sophisticated systems have been designed to enable Ocean Tankers the choice to handle or store surplus product, in line with the demanding trading patterns of the ships.

Mr Hellum added that Hamworthy's new, full-size test inert gas generator, installed at the Moss test shop late last year, represented a vital piece of equipment in speeding up innovation in the company's design process.

The test facility will allow the company to design and test new components in a shorter time improving the delivery to customers, said the company.

These latest orders bring to 48 the number of tankers built at Waigaoqiao Shipyard that have installed Hamworthy inert gas systems.

Cruise

# Cruise prototypes planned

USA cruise operator Carnival and Italian cruise ship specialist Fincantieri have reached an outline agreement to build two prototype cruise vessels. The agreement will be turned into a definitive contract once financing and other conditions have been agreed.

The two vessels, due for delivery in 2013 and 2014 will be 139,000gt and will have a passenger capacity of 3600 people, they will be the largest vessels in the Princess Cruises fleet.

An artist's impression of the prototype ships.

Giuseppe Bono, chief executive officer of Fincantieri, said: "Since these are prototypes we hope that in the years to come they will be followed by a substantial number of ships of the same 'family'.

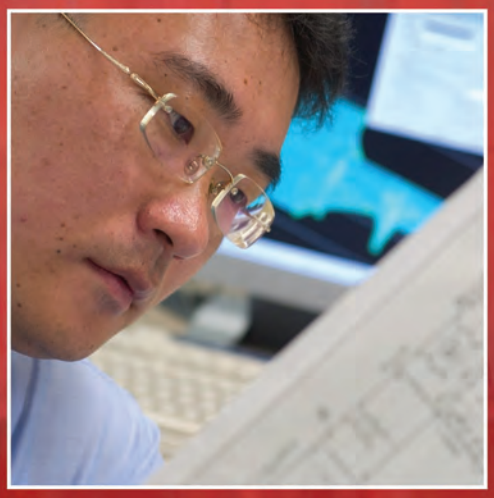
Fincantieri has built 52 cruise ships since 1990, of which 48 have been for different Carnival Group brands. Without taking into consideration this latest order, Fincantieri will build a further 11 vessels between now and 2012, of which seven are for the Carnival Group.

## Correction

In last month's the story entitled *IMO takes action on damage stability* we said that the International Maritime Organisation (IMO) had established a working group and that the UK delegation will lead a correspondence group on damage stability for chemical tankers. This is incorrect.

The Sub-Committee agreed that it would be beneficial to develop guidelines in order to enhance the ability of all concerned to verify the damage stability of their vessels, they decided that the guidelines would be in two parts (design and operational). The Sub-Committee invited member governments and international organisations to submit proposals on the design and operational guidelines for tankers at the next session.

*The Naval Architect* apologises for any embarrassment this error may have caused.



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Lifesaving

# Fassmer and Nadiro in Cooperation

Danish company Nadiro A/S and German company Fr. Fassmer GmbH & Co KG has signed a cooperation agreement enabling customers to order Fassmer lifeboats with Nadiro's Drop-In-Ball and a full launching system including a protecting container around the lifeboat, which combines the Nadiro and Fassmer products.

Fassmer already offers complete systems with their own Duplex Release Hook which is also in conformity with the new regulations like DE 52 conventional hooks, however Fassmer sales manager Norbert Kotte, considers the agreement vital in capturing potential changes in the market: "We expect to see changes in the industry due to new safety regulations and general demand for increased safety from seafarers. Even though we are very content with our current product portfolio, we always strive towards getting better and meeting new customer needs. If the Drop-In-Ball is the future, we want to be in the game from the beginning."

**Contact** Fr. Fassmer GmbH & Co. KG, Industriestr. 2 D-27804 Berne/Motzen, Germany
**Tel** +494406 942-0
**Fax** +494406 942100,
**E-Mail** info@fassmer.de
**www**.fassmer.de

Ancillary equipment

# Wiper Solve Marine offers new range

Recently formed Wiper Solve Marine has announced that its latest products have reached the end of the first phase development and test stages. They are now available to the marine industry as items of marine equipment that naval architects and specifiers for newbuild projects.

The latest product range from Wiper Solve Marine consists of; WIPASOLV Straightline Wiper (SLW), the main features of which are its quietness, variable 6-speed control, economical power consumption and safe low voltage with retained power together with other inbuilt features that enable safer and easier installation. They are available with single or twin arms and internal or external drive motors.

The WIPASOLV Pantograph Wiper benefits from a fully enclosed twin drive system with smooth simple harmonic motion for a long life and a fully sealed mechanism with lubricated bearings that renders them virtually maintenance free in service. The compact design allows for more powerful wipers all with variable 5-speed control.

A WIPASOLV Clearview Screen (CVS) that is an industry standard type of spinning glass disc and very robust and reliable. CONTROLASOLV CANbus Control System, a whole new concept that is claimed to be both visionary and unique in its application for the marine industry. It is a highly intelligent but quite small device that will control the wipers, washers, heaters, speed of wipe and synchronisation of wipers. It can also be programmed to control other items of equipment that would benefit by being controlled from the arm of the Captain's Chair or any other place controllers are located. Motorised anti glare roller sunscreens are one good example of additional equipment.

**Contact** Wiper Solve Marine, Unit 3A Tyne Dock East Side, Port of Tyne, South Shields, Tyne & Wear, NE33 5SQ, UK.
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Engines

# Ferry company orders MAN Engines

Bohai Ferry Co., Ltd. has ordered four MAN 16V32/40CD propulsion plants to power two passenger vessels to supplement its fleet. The four-stroke engines will be built at MAN Diesel's production centre in Augsburg, Germany, and will operate at 750rpm, providing a total of 16MW of installed power for the 2300P/2500LM RoPax vessels.

The ferries will be built at Huanghai Shipbuilding Co. Ltd., in RongCheng City, Shandong Province, and the order includes an option for two other vessels.

Bohai Ferry Co., Ltd. has also ordered twin-screw, controllable pitch propeller (CPP) propulsion systems from Alpha, suitable for ice class B. The MAN Diesel scope of supply includes two single-stage reduction gearboxes from Renk for each vessel. Delivery of the

Illustration of ro-pax vessel for which MAN will supply propulsion plants.

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propulsion systems is expected to take place in the first half of 2011.

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**Tel** +49 821 3220
**Fax** +49 821 3223382
**E-mail** mandiesel-de@mandiesel.com
**www**.manbw.com

Lifesaving

## Cosalt Premiers on *Queen Elizabeth*

Cunard's new £365 million *Queen Elizabeth*, will be launched with an inventory of 5500 Cosalt Premier Lifejackets when the ship sets sail on its maiden voyage in October 2010. The order is the second contract Cosalt has won to supply Cunard with Premier lifejackets this year. An order for 7500 units has already been placed to equip Cunard's new cruise liner *Azura*.

*Queen Elizabeth* is 294m long and is designed to accommodate just over 2000 passengers. The vessel is being built by Fincantieri at their Monfalcone shipyard near Trieste and will be the third new ocean liner launched by Cunard in the past six years, joining sister ship *Queen Victoria* and *Queen Mary 2*.

Fully approved to MCA/UK SOLAS standards, the Premier features a single quick release buckle, high intensity SOLAS Grade reflective tape and a whistle with lanyard. It is designed for persons with little or no experience of wearing a lifejacket. The Premier can be fitted with a tamper proof light and is also available with a spray hood for extra protection.

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Engines

## China orders first Wärtsilä RT-flex35

Wärtsilä has received the first order for its new Wärtsilä RT-flex35 two-stroke engine. The Wärtsilä licensee, Yichang Marine Diesel Engine Co. (YMD), manufacturing low-speed marine engines in China, has signed a contract with Ningbo Donghai Shipping Co. Ltd to deliver five Wärtsilä RT-flex35 engines for a series of five chemical tankers.

"Among low-speed engines with smaller bores, the biggest advantages of Wärtsilä RT-flex35 are its low fuel consumption and its compliance with environmental regulations, both of which fully meet our customer's expectations. Operational flexibility and the improved fuel efficiency offered by the RT-flex35 engine were important considerations when YMD decided to offer this engine type," says Andrew Stump, Sales Director, two-stroke engines, Wärtsilä in China. "Wärtsilä will continue to provide support during the project implementation process to ensure the highest levels of quality and on-time delivery," Mr Stump continues.

The 17,000dwt chemical tankers will be built by the Ningbo Shipyard Group in the province of Fujian, China. The ship owner is Ningbo Donghai Shipping Co. who will operate the ships in international trade between the Far East, the Middle East and Europe. The contract signed in January with Ningbo Donghai Shipping Co. is the first order for Wärtsilä RT-flex35 engines.

Delivery of the first engine is scheduled for August 2011. The scope of the contract includes five 6-cylinder Wärtsilä RT-flex35 common rail diesel engines with a power output of 5220kW (7099bhp).

**Contact** Wärtsilä Corporation, John Stenbergin ranta 2, P.O. Box 196, FI-00531 Helsinki, Finland.
**Tel** +358 10 709 0000
**Fax** +358 10 709 5700
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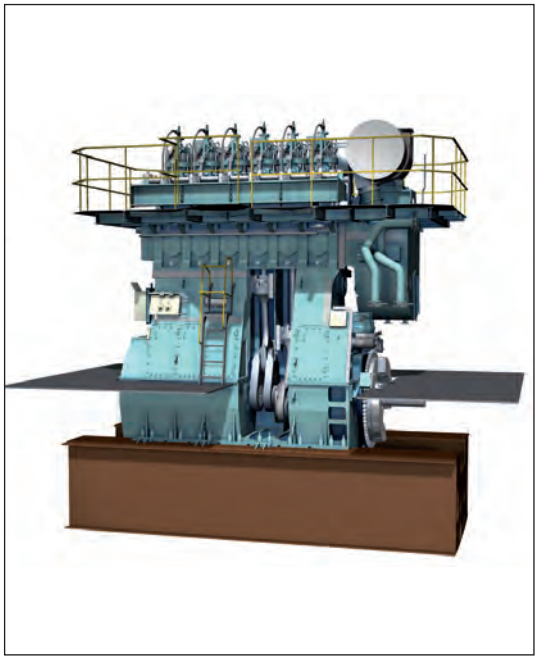
The 6-cylinder RT-flex35 engine with simple platform arrangement.



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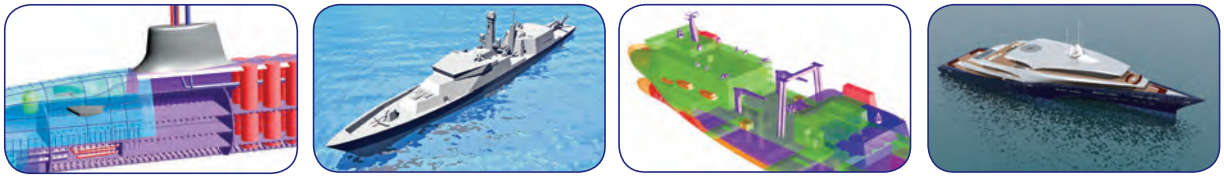

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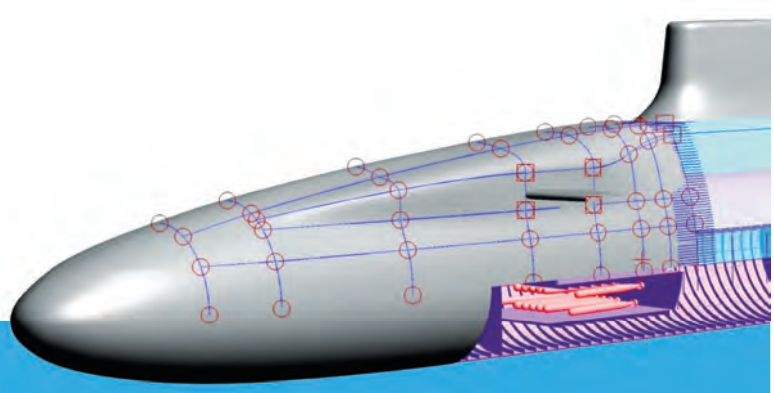

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# Ship design goes multidisciplinary

The MARSTRUCT five-year series of conferences is aimed at advancing the field of marine structures. Nicolas Besnard, Principia, and Fabian Pécot, Sirehna (both of Nantes, France) and Philippe Rigo, ANAST-ULG (Liege, Belgium) report on developments ahead of the March conference in Lisbon.

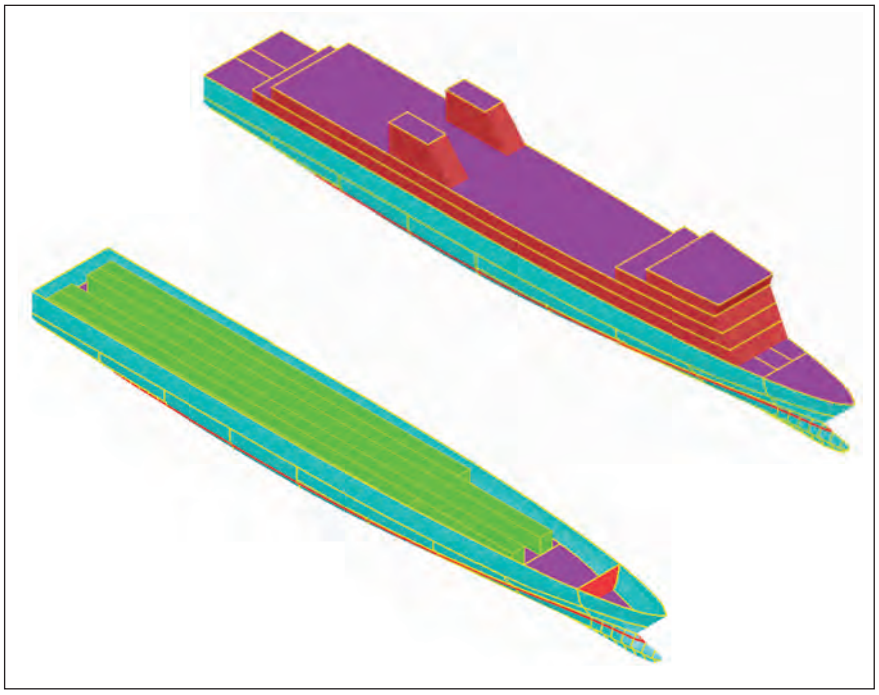
In the frame of the European funded project MARSTRUCT, a joint study was performed to define an innovative methodology for ship design, highlighting the possibilities offered by well-tried optimisation techniques. The methodology was validated on a realistic study case: specifications were defined for a fast ferry, and a first design was defined. The methodology was then applied to improve the design.

MARSTRUCT is a European Network of Excellence on marine structures, and is part of the Sixth Framework Programme (FP6). The objective of the project is to create a European network of researchers, working in cooperation on shared research topics. A large range of topics are addressed: simulation and testing of different structure behaviours (ultimate strength, collision and grounding, corrosion, etc.), hydrodynamic loads, etc. The present study took place in the frame of a work package devoted to identifying and improving methodologies and tools for design.

The methodology consists in a two-level and multidisciplinary optimisation. The first level (global level) consists in modifying the ship's overall dimensions to reach a global objective. The second level (local level) allows defining the successive designs locally, optimising inner properties of each global iteration.

The methodology is based on an iterative process built around three tools operated in interaction. AVPRO, naval architecture software, is used to generate the ship model at each step of the global optimisation and to assess the model (evaluation of hydrostatic properties, ship weight, hull stability, hull resistance, etc.). LBR5, a tool for ship structural calculation and optimisation is used to define and optimise the midship section of each global iteration design according to Rule constraints, with an objective of least weight. modeFRONTIER, the optimisation environment, coordinates the tools and performs the global optimisation.

Figure 1: Views of the initial design of the fast ferry.



## AVPRO

AVPRO is a naval architecture tool developed by Principia. Based on a parametric model, AVPRO allows the defining of a 3D model of the ship with a minimum amount of data, in order to comply with the short duration of early design. The model includes the ship surfaces (hull(s), decks, bulkheads and superstructures), areas, capacities and equipments.

Thanks to precise surface and volume calculation on the 3D model, a precise weight evaluation is performed on the model, including structure, capacities, areas and equipments. Hydrostatic calculations can also be performed, and include static equilibrium, intact and damaged stability, flooding calculations. The results can be exported through XML files. The XML format is a convenient format to connect several tools to each others.

## LBR5

LBR5 is a structural analysis and optimisation tool developed by ANAST-University of Liege, specifically oriented towards the conceptual and early design stages. LBR5 allows performing a 3D structural analysis of a portion of the structure (usually located in the mid-ship region), and a scantling optimisation of the structural elements (plate thickness, size and spacing of the longitudinal and transversal members), based on different objective functions, as higher inertia, less weight and/or lower cost.

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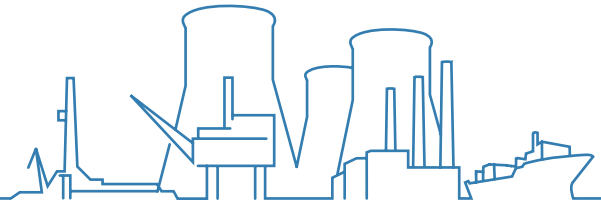

The elastic analysis of the entire structure is based on the analytical formulations of the behaviour of stiffened panels. This analytical approach allows short computation times, and is suitable for the integration within an optimisation process.

The optimisation module is based on the mathematical optimisation algorithm CONLIN. The user can impose constraints to the model: technical constraints (upper and lower bounds of the design variables), geometrical constraints (such as stiffener aspect ratios), and structural constraints (allowable stresses and deflexions, safety coefficient regarding buckling, etc.). LBR5 also includes a cost module which allows the direct calculation of the construction cost, taking into account the unit costs of raw materials and labour costs.

## modeFRONTIER

AVPRO and LBR5 are embedded in the optimisation environment modeFRONTIER which coordinates the tools and performs the global optimisation on the ship model.

modeFRONTIER is a general purpose optimal design tool developed by ESTECO, which is able to deal with multidisciplinary problems. It is a state-of-the-art PIDO tool (Process Integration and Design Optimisation) that offers a large number of functionalities in terms of process integration, design optimisation and post-processing analyses.

## Study case

In order to demonstrate the possibilities offered by the two-level and multidisciplinary optimisation, a fast ferry was chosen as the study case.

A ROPAX design was initiated with AVPRO, with the following specifications:

- a garage capacity of 400m (trucks)
- one full length garage deck
- cruise speed: 30knots
- propulsion ensured by two gas turbine generators and two pods.

The resulting ship is 150m long, 7500dwt ship, illustrated in figure 1.

The hull resistance is an obvious objective to minimise for a fast ferry. This is a very sensitive parameter, as reducing the resistance directly leads to a reduction of fuel consumption, allowing reduction of the fuel tank capacity. It can also allow selecting smaller propulsion installations, less expensive and of reduced weight. So the global objective of the optimisation is to minimize the hull resistance at the cruise speed of 30knots.

The main requirement for the ferry is a minimum garage length of 400m. This requirement will be set as a restriction for the optimisation. Other restrictions will ensure the feasibility of the ship design. First, the balance of the ship will be assessed to check that the volume of the generated hull is sufficient to accommodate the weight of the structure, equipments, garage and other areas. Secondly, some basic hydrostatic stability requirements will be checked on the intact stability curve, so that the generated hull geometry complies with International Maritime Organisation (IMO) requirements.

The weight is a highly significant parameter on fast ships.

Table 1. Results of the optimisation of the fast ferry

| | Initial design | Optimised design |
|---|---|---|
| Length L (m) | 150 | 152 |
| Ratio L/B | 7.5 | 8.1 |
| Beam B (m) | 20 | 18.8 |
| Ratio B/T | 4 | 4.4 |
| Draught T (m) | 5 | 4.3 |
| Parking length (m) | 440 | 421 |
| Propulsion power at 30 knots (kW) | 21 400 | 16 700 |

The structural weight on its own can represent about half of the total weight of a ship. To address the structural weight efficiently, a local optimisation is defined to generate for each design iteration a weight-optimised structure, complying with Rule strength requirements. For each design iteration the structure is generated, analysed and optimised on the basis of the midship section; the thickness of the decks, longitudinal bulkheads and hull shell, as well as longitudinal stiffeners are addressed by the optimisation, with a least weight objective. The Bureau Veritas Steel Ships rules are considered, concerning the hull girder loads, the minimum strength and maximum allowed stress levels.

The resulting optimisation problem is a two-level and multidisciplinary optimisation problem. The first level (global level) consists in modifying the ship model overall dimensions to reach a global objective of minimal hull resistance, keeping a specified minimum garage length, and considering some feasibility restrictions. The following design variables are selected for the global level optimisation: waterline length, waterline beam and draught. The second level optimisation (local level) allows defining the successive structural designs, optimising structural weight properties of each iteration of the global level, and complying with standard strength Rules. The local design variables are the scantlings of the midship section (plate thickness and stiffener dimensions and spacing).

The optimisation process is initiated with a population of designs generated by modeFRONTIER randomly distributed in the whole design space. Then, the different steps of the optimisation are the following. First AVPRO is launched by modeFRONTIER, reads the model file and generates the geometry of the 3D model. Then, the midship section and hull girder loads are exported to LBR5. LBR5 analyses and optimises the structure of the model according to predefined Rule requirements (local optimisation), and returns the results to AVPRO. AVPRO can now compute the total weight of the ship, perform hydrostatic calculations (balance check, stability). The available garage length is also measured on the 3D model, and the hull resistance is assessed using an analytical Holtrop

method. All these results are exported by AVPRO to modeFRONTIER, which at last performs the global optimisation based on these results, using a genetic algorithm.

## Results of the two-level optimisation

The results obtained for the initial design and the final optimised design are given in table 1. The optimisation leads to a gain of 22% on the required propulsive power, keeping the vehicle capacity above the minimum requirement, and complying with the stability requirements. The table also points out that the design variables are modified with a slight decrease of beam (6%), and a larger decrease of draught (14%), whereas the length remains almost unchanged (1% increase).

Length and beam directly affect the garage capacity: basically the beam is adjusted to accommodate the 3.10m wide vehicle lanes, and the length is adjusted to obtain the correct garage length. The initial design proved to be quite close to the optimal garage arrangement, so only small length and width variations were observed.

The draught has a great impact on the displacement, and consequently on the hull resistance. So the optimisation process led to decreasing the draught as much as possible, keeping the hull volume sufficient to carry the ship weight, and respecting the stability criteria. The optimisation led to an important reduction of the displacement (21%). Actually, the initial design presented weight margins that were too large and were reduced by the optimisation process. Furthermore, the structural weight optimisations, led at each iteration of the global optimisation, resulted in a significant reduction of the structural weight.

## Conclusion

The validity and feasibility of such an approach coupling different tools (general purpose optimal design tool, a structure dedicated optimisation tool and a naval architecture tool) have been demonstrated. The interoperability of these tools was made possible thanks to the ability of the general purpose optimal design tool to manage multi-purpose problems with different tools, and efficient input and output facilities. In particular the study highlighted the importance of universal input and output capabilities for tools connected together through an optimisation environment, and in this respect the XML format proved to be very efficient. *NA*

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## Web links

MARSTRUCT: http://www.mar.ist.utl.pt/marstruct

PRINCIPIA: http://www.principia.fr/eng

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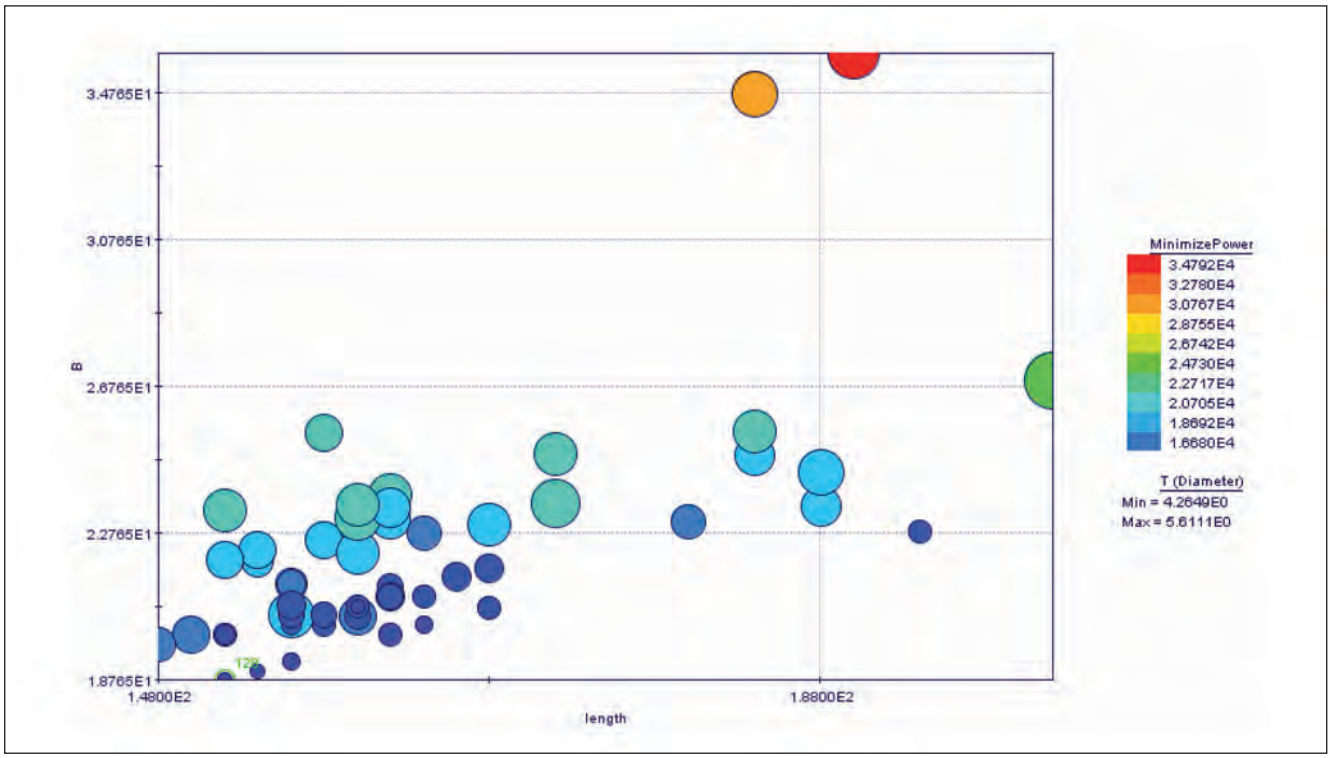
Figure 2. Feasible designs in a length vs. breadth diagram. Diameter of circles represents draught and colour represents power.



# Low sulphur bunkers fuels boiler modification concerns

From 1 January, 2010 all ships are required to use low sulphur fuel while in EU ports. According to the International Bunker Industry Association (IBIA), there has been a certain amount of confusion surrounding the implementation of EU Directive 2005/33/EC, writes Sandra Speares.

New regulations introduced by the European Union (EU) on emissions have been the subject of much discussion, not least from the point of view of the risks of switching to low sulphur fuels during operations.

While the new rules say that ships in EU ports must not use marine fuels with a sulphur content of more than 0.1% by mass, IBIA has warned that the deadline has not been put back *even though there are* "potential safety risks associated with the switchover on ships with unmodified boilers".

According to IBIA chief executive Ian Adams, ships are not exempted by virtue of the risk of switching to low sulphur fuels because no boiler modifications have been made. He adds that there is no automatic dispensation for those ships that have made arrangements to make modifications, but have not yet carried them out.

Mr Adams says that while the European Commission (EC) is aware of the potential dangers associated with switching to low sulphur fuels while in port and has recommended a degree of flexibility by member states on enforcement for a transitional phase in cases where plans for boiler modification are in place, the directive is nonetheless in force and "all non compliant vessels are at risk".

The association is advising that operators check with a port ahead of entry to establish what control measures may be taken while the ship is berthed.

With the introduction of low sulphur fuel regulations in the EU and North America, many question marks have been raised.

In its paper on low sulphur fuels, class society Det Norske Veritas (DNV) raises a number of challenges relating to low viscosity, acidity, poor ignition or combustion properties which can lead to increased clogging of the engine, and the increase of catalytic fines resulting from the introduction of a 1.5% sulphur cap on heavy fuel oil grades which is progressively being reduced.

Ian Adams, IBIA chief executive officer.

Dragos Rauta technical director at Intertanko.

In addition DNV Petroleum Services data suggests that some low sulphur marine gas oil and marine diesel oil fuels have a flashpoint below 60°C and are, therefore, outside International Maritime Organization (IMO) requirements.

The class society says the risks of switching between HFO and low sulphur distillate is considered higher than that HFO and low sulphur HFO.

Independent tanker owners' organisation, Intertanko, has been closely involved in discussions over the directive since 2003, according to technical director Dragos Rauta.

While he says there is nothing wrong with using motor gasoil or distillates in diesel engines, there would need to be

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some modification to fuel pumps because gasoil has less viscosity and has certain properties for which existing pumps are not designed. There needs to be a process that will ensure against leakage.

Technically the matter is simple, he says, but the issue is one of the volume of ships visiting EU ports, not to mention the costs involved.

How easy it will be to make the modifications will depend on the ship as those that have been built with the forthcoming introduction of MARPOL Annex VI in mind will find the transition smoother.

The big challenge is the human element, because of the need to switch fuels on board, Mr Rauta says. While installations could safety run both fuels, to switch between them, parallel systems may need to be tailored to the type of fuel being used.

With the introduction of the MARPOL Annex VI requirement for a maximum of 1% sulphur in July, coupled with the new EU rules, and the proposed North American Emissions Control Area set to be introduced in 2012 - which will cap sulphur at 0.1% - ships will need to carry significant supplies of low sulphur fuels, Mr Rauta explains.

This raises the issue of storage capacity, which will need to be adapted. Unfortunately, he says, most of the ships in service, including recently built ships, have a design and fuel storage capacity which has not changed significantly over the last 30 years.

To accommodate the new fuels, more tanks will be needed and better segregation between those tanks, he says.

If no parallel systems are installed to cater for the different types of fuel, then the same pipes will be used to pump fuel to the engine and the process of switching between fuels has to begin hours before entering the emissions control area.

On traditional ships the tank containing the high sulphur fuel would be drained down before pumping in the low sulphur fuel. Some further hours would be needed to ensure that the high sulphur fuel was drained from the engine, Mr Rauta explains.

The switching process could take anything between four or five hours and two days, depending on the ship, he says.

Some larger tankers have retrofitted storage capacity in order to bypass using this common system, he says. This would make the switch much easier. Ships with sufficient storage capacity have subdivided tanks to make them smaller and therefore capable of carrying different types of fuel.

Bearing in mind the new 0.1% limit in the EU, coupled to a 1% limit under MARPOL Annex VI amendments, ships could potentially have to carry three different fuel grades, one for deep sea, one for the North Sea or Baltic emissions control area and one for EU ports.

> "DNV Petroleum Services data suggests that some low sulphur marine gas oil and marine diesel oil fuels have a flashpoint below 60°C and are, therefore, outside International Maritime Organization requirements"

Lubricants also need to change as a result of the new emissions regime.

Leading oil major Total has been just one of the companies seeking to provide products which will enable the shipping industry to reduce its carbon footprint.

Total Lubmarine has been developing a range of biodegradable products for the shipping industry to address the issue not only of spillages onboard but also the demands of the new low emissions regime.

The company stresses that new cylinder oils are needed not only to address the risk of failures resulting from the mismatch of different Boron nitrate (*BN)* lubricants, but also to reduce the amount of crew training needed and onboard procedures required to match different lubricants to different heavy oils. There is also a potential risk of damage when using high BN lubricants over a long period with low sulphur fuels.

Total Lubmarine believes that its product Talusia Universal solves the problem. While two stroke engines until now have required different lubricants to match the sulphur content of the fuel being used, Talusia Universal can be used with fuels with varying sulphur contents.

The company says the lubricant solves not only the potential dangers of a mismatch between high BN and low BN cylinder oils. It also says it offers cost benefits in terms of procurement and additional crew training.

Such crew training is a key element in the process. As DNV points out in its guidance: "it is highly recommended, especially for vessels that do not perform fuel changeovers on a regular basis, to practice such a changeover as well as manoeuvring trials before entering restricted waters.

Intertanko was involved in technical discussions last year held by the European Maritime Safety Agency to discuss with engine manufacturers and boiler makers the risks associated with switching.

The majority of tankers coming to EU ports come to discharge, Mr Rauta explains. Most use steam, instead of electrical power to pump the cargo ashore. The steam is created by boilers which in turn have to be heated. The boilers are also the source of energy for other onboard installations.

"If you have cargo onboard a tanker which has to be kept heated, your boilers will have to run during the transportation." There is a risk therefore associated with switching fuels into a hot system, Mr Rauta says. The question is what can be done to manage that risk.

Following concerns raised in Brussels, the EC's DG Environment commissioned a study to identify the risks and hazards for different types of ship and establish what needed to be done operationally

and what physical upgrades had to be made.

Intertanko, together with the Oil Companies International Marine Forum (OCIMF) have published a booklet that provides a checklist of those items that should be part of the risk assessment and hazard identification process for boiler systems on oil tankers when switching to, or operating with low sulphur fuels.

There has been an avalanche of discussions with boiler makers which resulted in different responses. While in the 1980s ships used to switch between different grades of fuel this practice has gone into abeyance and crew members are no longer familiar with the process. Now, this process has become mandatory.

It is a question of experience, Mr Rauta says. He estimates that there were between 6000 and 8000 tanker calls in EU ports each year, the majority for discharge. In the current blame environment in the possibilities for injuries or deaths caused by explosions are very real. "If you have one, that's it".

It was decided to have discussions involving all the parties, he says. The owner, he continues, has the responsibility to ask the question on safety issues but does not have the expertise to modify installations.

In addition a classification society will have to vet the installation for safety and provide a certificate. By the time the EU rules came into force on 1 January, the majority of tankers were not ready, Mr Rauta says.

In its analysis of those steps that need to be taken, DNV specifies that all modifications need to comply with the low sulphur requirements will need to be reported to class.

These would include piping system modifications, assurances that the engine's NOx certified emissions were in line with the engine's technical file. Detailed information of changeover procedures from one fuel to another would also have to be available.

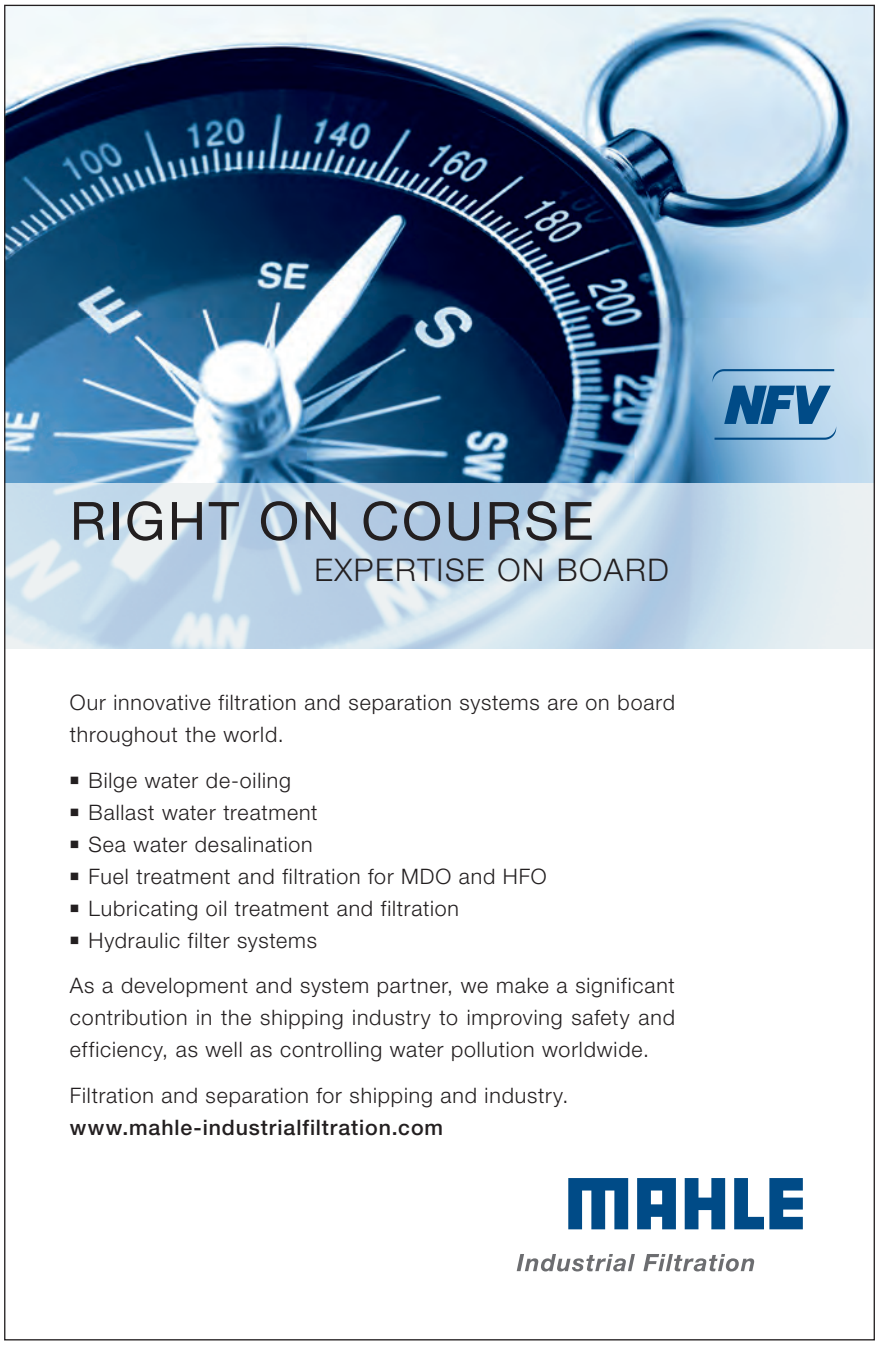
The class society has warned that the risks of incompatibility between heavy fuel oils and high sulphur distillates are considered greater than with mixing HFO and low sulphur fuels.

EU member states are responsible for enforcement, and given the delay in putting in place new installations, member states would have to decide whether they were prepared to accept undertakings and documentation showing work was scheduled.

Some countries have already introduced the changes in their national legislation in order to be prepared for their entry into force in 2010. Mr Rauta said he had not heard of any ships being fined so far for non compliance. There is a high degree of awareness of the issue and Mr Rauta feels that the risk element is being taken very seriously by operators.

The argument in favour of distillate fuels revolved about the perceived inefficiency of operating systems with two different types of fuel.

The cost of upgrades Mr Rauta estimates at being between €30,000 and €150,000/ship. The different in price would depend on how well prepared the ship was for the use of both fuels. The highest price would include a state of the art system with full segregation, he says



and would be in excess of what would be needed to manage the risk. These prices would cover boilers and pumps and perhaps retrofitting bunker tanks.

Significant amounts of low sulphur fuels would be needed coming from the Atlantic, for example and going through the Channel and the North Sea and Baltic Sea emissions control areas.

Much will depend on bunker prices when considering whether to take the maximum amount of low sulphur fuel so as to cross the emissions control area and enter an EU port with a maximum sulphur content of 0.1%.

Shipping is the only means of transportation where it is required to carry different fuels.

Intertanko has raised concerns in the past that fuel quality might result in main engine failures. According to Mr Rauta the association has heard from members with problems resulting from heavy fuel oil contaminated with chemical waste.

There have also been problems with distillate fuels, but these have been rare. He believes that there should have been much stricter control over the quality of fuels used. ISO Quality standards are often not enforced, he says Standards can be "as strict as you wish, but nobody enforces them."

There is no obligation on owners to take samples to see whether ISO standards are being complied with, he says. A ship may have a complete blackout due to poor quality fuel, he says, and while everyone is aware of this possibility, including regulators, nothing has been done about it. "At Intertanko, we will not stop the campaign until we see a system that controls the fuels," he says. "We need some government control".

There have been engine problems with low sulphur fuels, he continues. The low sulphur fuels are produced by blending with components that reduce the sulphur content. The blending element should contain very little sulphur and the blending components can become incompatible in a few months. "Some become incompatible much faster than others".

This means that if the fuel is kept onboard for too long it could become incompatible because the fuel begins to separate. Concerns remain over the so-called "cutter stocks" being used.

Looking at data provided by the refining industry, Mr Rauta says, the refineries are becoming more and more efficient because of environmental requirements.

Amounts of residues are diminishing and have been doing so since 1973, he explains.

To make residual fuels, the quality of what it is blended with is more important to reduce viscosity. With refineries becoming more efficient, he believes residual fuels will become more and more expensive to produce.

Engine manufacturers have been doing a very good job in reducing energy consumption, he says and consumption is 20-25% less than before, he says. Hull and propeller design are just two ways of reducing fuel consumption.

There are some contradictory elements in terms of emissions expectations, Mr Rauta says.

As far as Nitrogen Oxide emissions are concerned, stricter Tier 2 will come into force in 2011 and Tier 3 in 2016.

The process by which NOx is to be reduced will lead to an increase in fuel consumption, he says. Ships of the future will need to comply with the Energy Efficiency Design Index and also with NOx emissions targets – what is referred to as the "NOx dilemma". NOx's warming potential is 35% greater than $CO_2$.

Mr Rauta expresses concern that there is a "total lack of control" since mandatory regulations were put in force for bunkers. The regulatory framework for shipping puts the emphasis on the ship to comply, he explains.

Then there followed scandals with oily water separators, he says. "For 20 years, ships were equipped with lousy systems which did not fit."

"The more we go ahead with environmental legislation, particularly SOx, NOx and greenhouse gases you put the onus on the shipowner for things that are outside his control. You can't have efficient enforcement if the means of enforcement is port state control in Rotterdam detaining a ship buying bunker fuel in Singapore. Where the sample could show the ship's bunkers exceed the regulatory maximum. You can penalise the ship, which in the tanker business has extremely serious consequences with charterers.

"It is not to say that owners should stop taking bunker fuel tests, but the laboratories doing the testing have not delegated authority from government."

He stresses that the environmental benefits of putting the regulatory measures in place need to be measurable from the start.

"Should shipping do better, definitely yes, *no matter the issue of climate change*. Why should you run with more fuel and more emissions than strictly necessary?"

Scrubbing technology is obviously one solution to the problem, and firms like Krystallon have been trialling their products on ships to provide an abatement technology alternative to low sulphur fuels.

The Krystallon scrubbing system and continuous emissions monitoring enables ships to reduce sulphur emissions, without the need to make fuel changes or modification to engine designs.

Those developing such technology had an early boost this year from the USA Environmental Protection Agency, who had originally specified that only fuel with 0.1% sulphur content or less would be allowed to be used within the forthcoming North American emissions control zone. This would have placed pressures on ships, particularly cruise ships that are homeported in the USA and usually buy their bunkers there.

The EPA has now said that abatement technology that achieves the same result is acceptable, which brings the USA stance closer in line with that advocated by the IMO. DNV approved a certificate for the first ship fitted with an exhaust gas cleaning system capable of compliance with the SOx Emission Control Areas in September last year. The scrubbing system was fitted to the exhaust pipe of an auxiliary engine on Neste Oil Shipping's product tanker *Suula*. The project took two years to complete and arose from a collaboration between Neste, DNV, Wartsila, Aker Yard and Metso Power. ***NA***

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# Mahle rises to the HFO filtration challenge

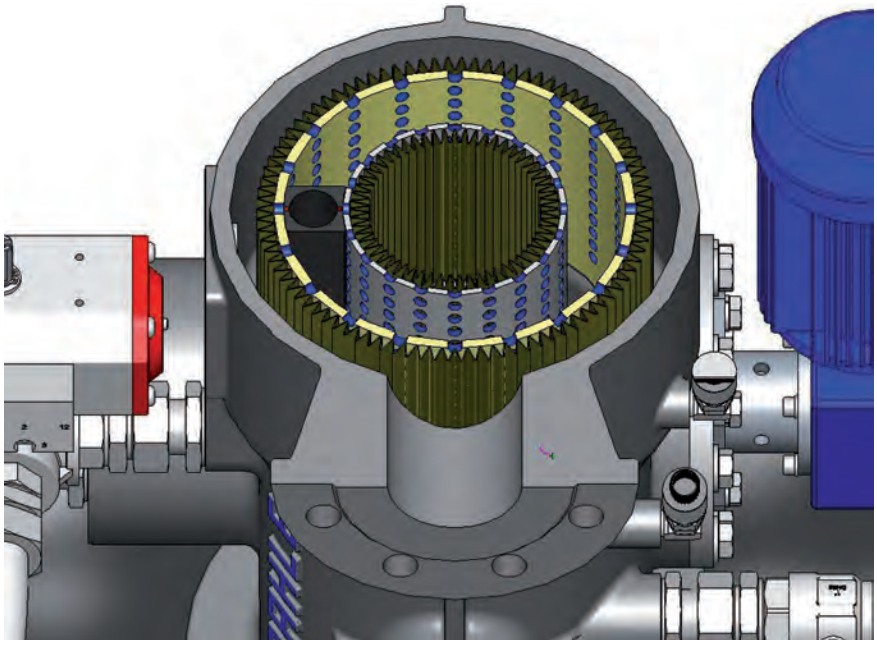
Mahle Industriefiltration GmbH says that it has developed heavy-fuel filters that are effectively self-cleaning and that do not suffer from pressure drops in the system.

In a challenging climate for heavy-fuel filtration with ever tighter environmental protection regulations and increasingly complex and highly sensitive components in modern drive units, the demands on filtration are greater than ever before.

The prerequisites for the required reliability are excellent manufacturing quality and materials that meet the heavy-duty expectations in daily use. Piston engines are the classic drive unit for continuously operating systems, such as on ships and in power plants.

In order to ensure smooth operation and maximum service life of the diesel engine, fuel purity is an important requirement. High-performance filter systems have become an indispensable part of these modern units. The filters protect highly sensitive components by ensuring compliance with the required purity, even under varying conditions.

Proven Mahle filter technology provides for exceptionally low-maintenance and failure-free filtration. Spare parts are minimised in favour of efficient performance and economic efficiency. In addition, the direct positioning of the rinsing nozzle ensures highly efficient cleaning while using the lowest rinsing volumes possible.



Duplex filter inlet for the AKO COM plus.

## High-performance filters in action

The filtration of fuel, particularly in applications with heavy oil (DMC), places maximum demands on cleaning and throughput. The newly developed filter type AKO COM plus, which is based on a proven rinsing nozzle concept, allows the filters to be cleaned using a controlled process without pressure drops.

This new filter type can be used for the cleaning of all types of fuels, from heavy oil and high-viscosity fluids to middle distillates and biodiesel— even at temperatures above 150°C. Due to the intelligent filter control, the self-cleaning and discharge of separated solids into the sediment tank have no influence on the filtration process and do not affect throughput or operating pressure. In this way, AKO COM plus ensures a consistently high-performance capability of the drive unit.

## Function of the AKO COM plus

At operating temperatures, the heavy fuel is pumped into the filter, which as a standard feature and is trace-heated. Now with an optimised fluidity, the heavy fuel flows to the filter insert, which features a compact design, either as a single or concentric duplex insert.

Contained particles and catfines are deposited on the outside of the inner filter or on the inside surface of the outer filter. The duplex filter insert (Fig. 1) consists of two special stainless-steel wire-mesh cylinders ranging between 48µm and 10µm, based on the absolute fineness required by the customer. The standard series already accommodates volume flows between 0.6m³/h and 63m³/h.

The intelligent filter control automatically performs the self-cleaning operation based on a defined differential pressure or time interval. Relay switching values and analogue signals for monitoring the heavy-fuel filters from a remote control room are standard. For backflushing, a defined amount of temperature-controlled rinsing fluid is stored in the clean side of the compensator. This process requires no external pressure source.

During the backflush procedure, filtered fluid flows at a high rate through a specific section of the filter fabric, opposite of the filtration direction. The dirt particles deposited on the fabric are entrained and suctioned into the dirt side of the compensator via the rinsing nozzle. As a result, the rinsing process for the entire filter surface takes only a few seconds, and

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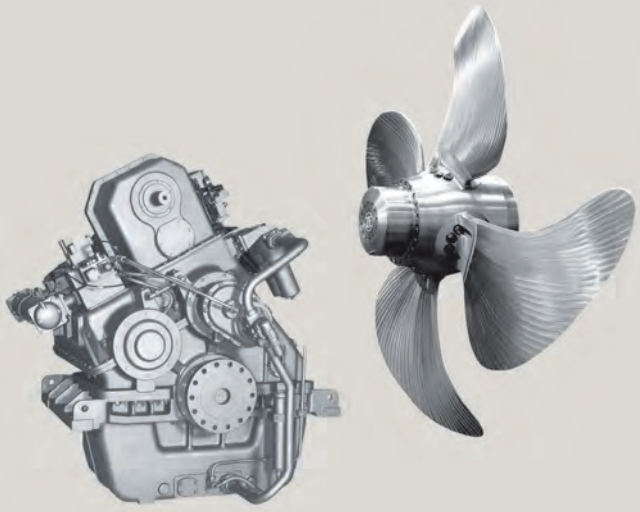

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The AKO COM plus filter system.

the backflushing with its tempered own medium eliminates viscosity changes of the filtered medium.

The dirt side of the compensator is subsequently discharged into the sediment tank and, at the same time, the clean side of the compensator is filled with filtered and tempered medium. Comprehensive tests in internal and external, independent laboratories and institutes verified the function even with heavy fuel of poor quality. And what is more—it was verified that in the event of failure or maintenance of the separators used for fuel conditioning, the AKO COM plus can assume the tasks of complete cleaning of the heavy oil for extended periods, without impeding quality and performance.

In this event, however, it is recommended for economic reasons to limit filtration to a maximum of 24 hours if excessive contamination is present. In exceptional cases, the filter can even be started at the bunker's temperature and used at higher resistance. All AKO COM plus components are extremely robust and heat-resistant, making it possible to use the filter on heavy-fuel modules both in the "cold" and "warm" range. The high operational reliability of the heavy-fuel filter ensures a consistently high quality of the medium to be filtered, even under varying conditions.

## Conclusion

In the future, the quality of heavy fuels will deteriorate even further, while the performance and environmental requirements will steadily rise. Consequently, heavy-fuel processing, which includes filtration, is gaining increasing importance. The smooth continuous operation of internal combustion engines must be ensured with reliable, low-maintenance, and unmonitored technology. Only filters that guarantee a defined purity level of the heavy fuel and retain solid matter in the system, without incurring interruptions or pressure losses, can contribute to a sustainable increase in the service life of engines, the reduction of operating costs, and the compliance with environmental protection guidelines. *NA*

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# NMRI outlines emission control plans

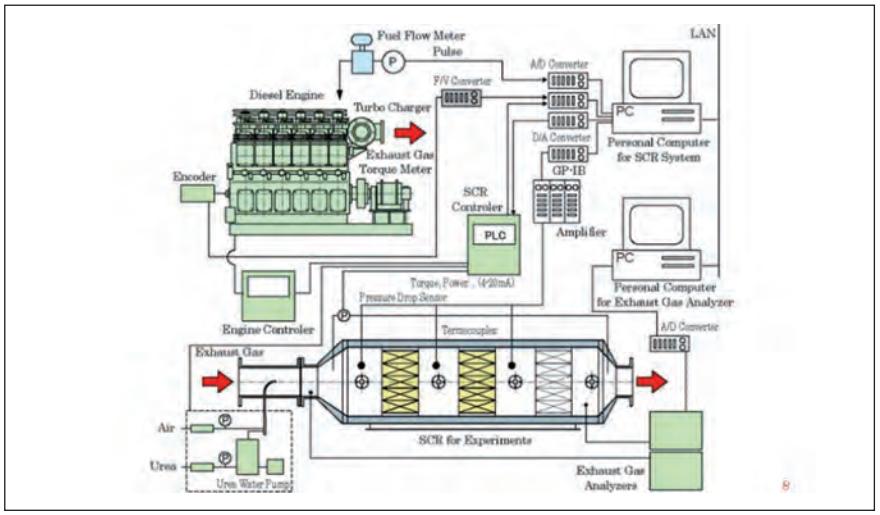
Japan's National Maritime Research Institute (NMRI) tested its Selective Catalytic Reduction System NOx scrubber and Circulating Fluidized Bed heat conversion energy saver. In a seminar in London last month Dr Tetsuya Senda, director for research at NMRI, presented the institute's findings.

Finding methods of reducing the emissions of greenhouse gases from ships has become critical for the industry as regulation on pollution edges closer and penalties for failing to meet those regulations will substantially add to owners' operating costs.

In Japan the development of the Selective Catalytic Reduction System (SCRS) that uses a urea solution to neutralise NOx emissions from ships and the Circulating Fluidized Bed (CFB) heat recovery system are further evidence of the innovative ways that the industry is using to achieve a reduction in its greenhouse gas emissions.

In the SCRS exhaust gases pass through a titanium and vanadium catalyst and the chamber is injected with the urea that reacts with the exhaust splitting the molecules into nitrogen and water. This system was initially tested with ammonia and it showed positive results.

The system must either operate at around 400°C or in a sulphur free environment otherwise as the temperature falls away the ammonia molecules will progressively fail to degrade the NOx into the benign gases, however, if the fuel is sulphur free, then the catalyst will work even at 200°C. The decline in temperature and the subsequent progressive failure of the ammonia to react is known as ammonia slip.




The engine and SCR system fitted, pc's are also included to analyse the SCR operation.

In the initial tests the NOx conversion rates were at around 100% at 400°C, but these results fell to 80% when the temperatures fell to 240°C, causing the ammonia slip. Even so the smaller figure would still satisfy the Tier 3 requirements of the International Maritime Organization's MARPOL Annex VI regulation, which is due to be enforced from 2016.

Using ammonia in the laboratory and bench tests for the SCRS were fine, but as Dr Senda points out that ammonia has a high toxicity and owners are reluctant to sanction the use of such a chemical onboard a vessel and so

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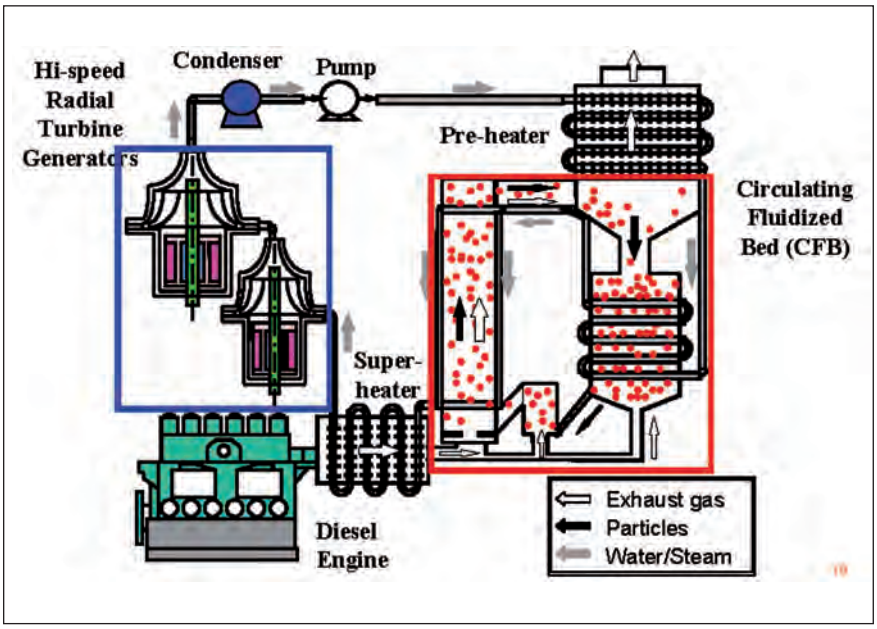



The CFB system connected to engine and radial turbine generators.

urea was substituted for testing aboard a vessel.

When the SCRS fitted to a 7800dwt cement carrier *Pacific Seagull* the urea presented an alternative problem. After more than 1300 hours of operations the injection nozzle, used for introducing the urea, was blocked through the build up of cyanuric acid deposits. A redesign of the nozzle improved the operation and a third design optimised the injection pattern, reducing the build up of cyanuric acid and reducing the distance between the catalyst and the injection system making the whole more compact.

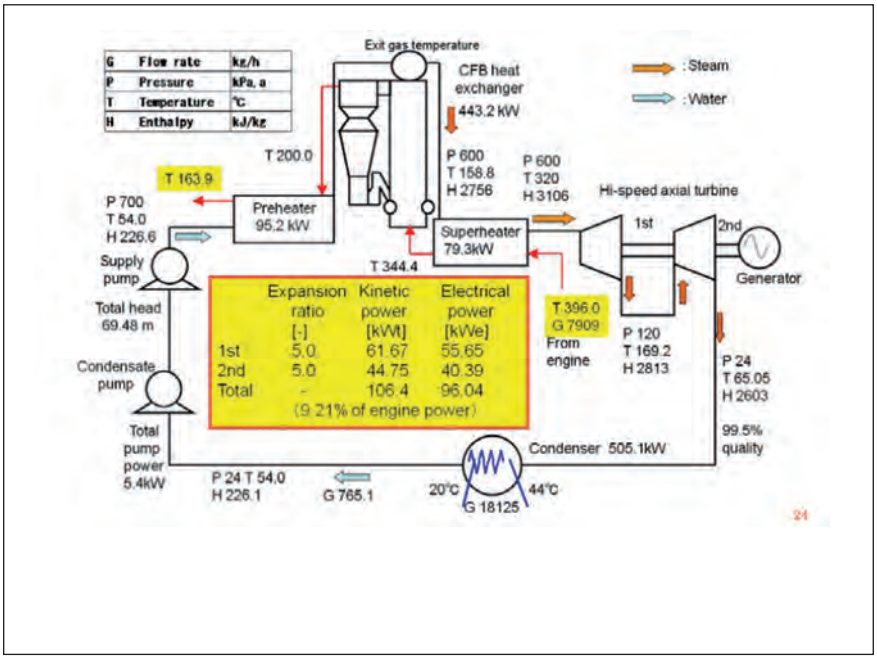
Dr Senda pointed out the most successful results for the SCRS occurred when the system was operated with ammonia that neutralised the NOx emissions. The system was not as efficient when the urea solution was used onboard the *Pacific Seagull*. However, the more compact system resolved the issues with cyanuric acid and urea and now the system is equally effective with both chemicals.

A separate system that Dr Senda included in his seminar was a heat recovery engine attachment known as the Circulating Fluidized Bed (CFB) that recovers heat from exhaust gas which is as low temperature as 250 to 400°C to generate additional power with steam turbines..

The CFB is a multi-stage heat transfer system that also removes any sulphur dioxide gas and reduces $CO_2$ emissions. Effectively thermal recovery is achieved by a heat exchange system that uses steam that is piped through CFB, external to the pipes, but inside the CFB, exhaust gas passes through the CFB before it moves onto the SCRS where the ammonia targets the NOx molecules.

Any sulphur is removed from the exhaust when the gas is passed through calcium based desulphurisation granules within the CFB. Effectively the system recovers 9.21% in engine power, reducing the $CO_2$ levels from the vessel.

Dr Senda said: "In this system rolling is an advantage because it increases the heat transfer rate."




Total performance estimation for the CFB.

However, Dr Senda said that while this system is feasible for four-stroke engines there are still "some practical problems to overcome, there is still the need for some development". One problem could be that the steam CFB system is too large to be practical for smaller ships and will only be useable on vessels with enough engine room space.

Even so the most efficient method of fuel conservation is through heat recovery from the exhaust system, said Dr Senda. Analysis of tests revealed that through the use of the CFB system a more than 9% saving on engine power was observed while calcium desulphurisation granules had seen an 80% improvement in sulphur emissions.

In analysing the test results they appear to be extremely encouraging for future implementation on board operational vessels. Whether environmental or economic dynamics move the goal posts shifting requirements again, however, remains to be seen. *NA*

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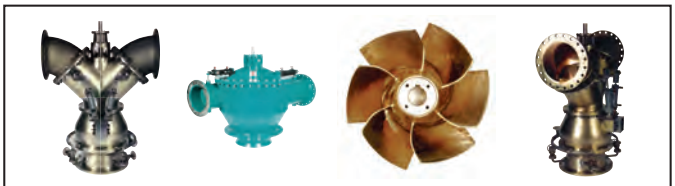

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# Technology offers a new approach to traditional problems

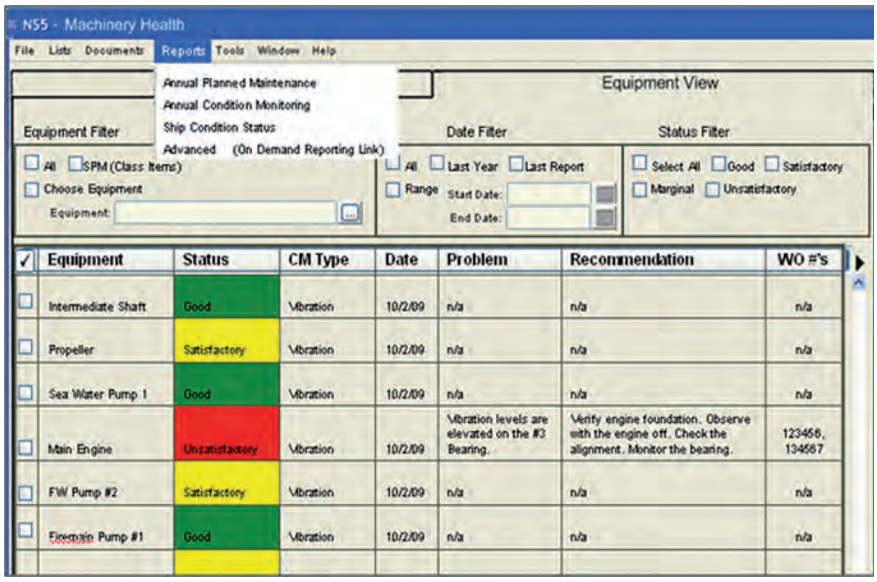
ABS believes that social, economic and regulatory imperatives are forcing class societies to take a holistic approach to maintaining the integrity of ships and keeping the world's fleet from polluting the environment.

As tanker owners look ahead to what promises to be a difficult year for earnings, they face an additional challenge that has not manifested itself in such clear terms in previous downturns.

That challenge is change, but it is change driven from two primary sources: increased regulation and the continuing evolution of technology.

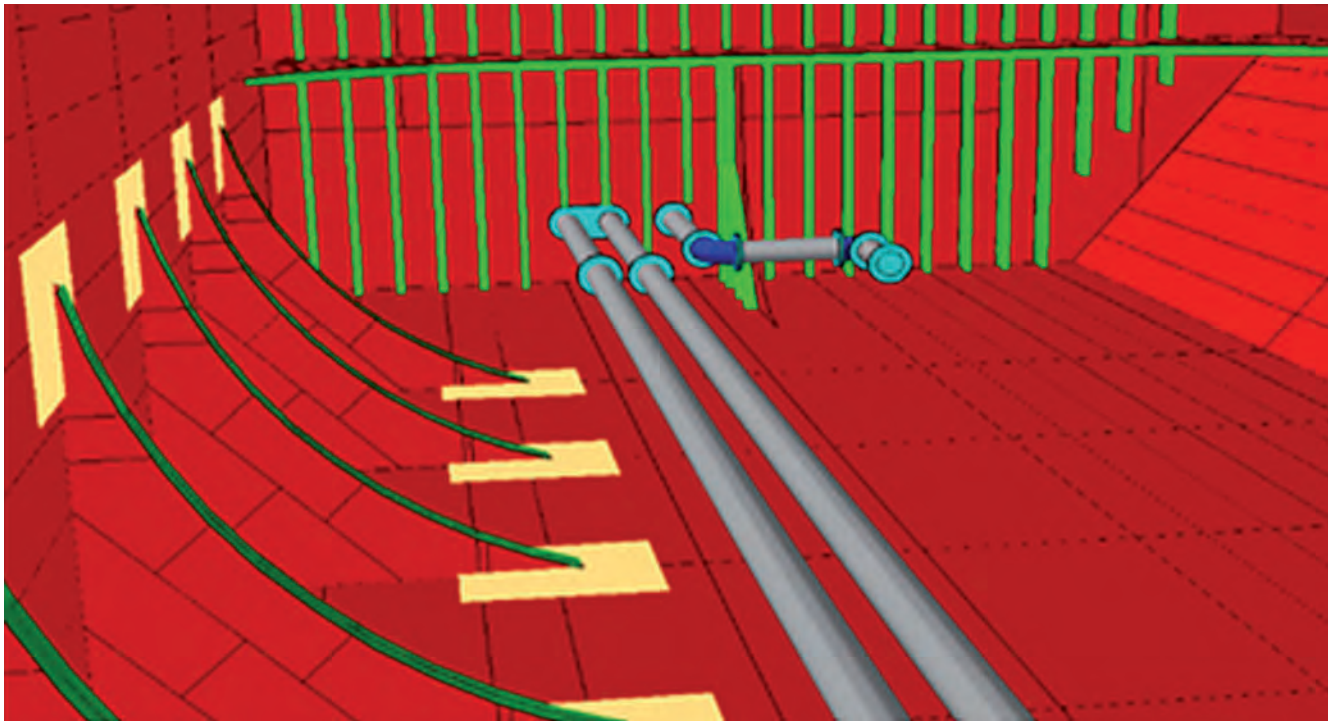
As an industry, shipping must find a way to respond to regulatory developments such as reducing airborne and carbon emissions and managing ballast water. At the same time, improved technology, in particular the development of more integrated computer systems, offers an opportunity to be proactive in identifying areas for improvement.

Of course technology opens up all sorts of possibilities for shipping and




The ABS NS5 Hull Inspection Programme module uses a simple 'traffic light' system tied to set inspection criteria to grade the status of equipment in operation.

ABS NS5 uses computer modelling within the Hull Inspection Programme module to give users a 3-D view of equipment in machinery and cargo spaces.



classification to develop new ways of addressing traditional issues associated with the operation and maintenance of tankers.

But technology is also an enabler that can help meet the twin demands converge. If the industry can grasp that opportunity then it can not only react to the imposition of regulations, but also improve routines and practices and in so doing demonstrate to regulators that it can work proactively to set standards and perhaps even exceed them.

Monitoring the condition of hull structure is one key example of how the tanker owners can use the technical tools now available to not only improve their understanding of the condition of their fleet, but to use that information to better manage their maintenance and repair strategies.

Such tools will be vital in the current market for the opportunity to help plan efficiently and manage costs. But they also serve the goal identified above – to move from the merely reactive to proactive compliance and quality routines.

Regulatory, societal and commercial pressures are steadily pushing the shipping industry towards a more holistic interpretation and application of quality management measures and safety standards. The tanker operator is facing an increasingly complex and more intrusive regulatory framework in which environmental issues are taking a much more prominent role.

These impellers can be broken into a number of elements that have a particular impact.

There is a much greater emphasis on life cycle management as this can help the forward thinking operator to maximise his economic and commercial models and minimise business interruption.

The operator is subject to far greater third party scrutiny than ever before, whether from Port States, increased third-party vetting or the need to conform to Tanker Management and Self-Assessment (TMSA) standards and audits.

All stakeholders – producers, charterers and shipowners are subject to much more comprehensive and stringent enterprise risk management requirements. And of course, the current and projected economic environment remains a concern.

All of these elements demand a new approach. As a class society, ABS firmly believes that the adoption of information technology can greatly facilitate how the industry addresses these demands.

The vision of integrated shipboard maintenance systems has been around the industry for many years. Simplified versions which take a broad and often compartmentalised approach to storing data have been available for some time. Some of the more advanced owners and

larger shipmanagement companies have developed their own proprietary systems.

But still, the proportion of owners using advanced fleet management software to assist with the operation of their ships remains the minority.

The ABS approach is of an integrated system which brings onboard inspection data, classification survey information, regulatory requirements and findings, maintenance and repair strategies and dry dock planning into a single system.

Just as importantly, this system is not restricted to the ship or the office but is replicated between the two and, if necessary across the fleet. Using such a system, the chief engineer and chief officer onboard the ship can establish daily work plans at the same time that the superintendent is using the same data set to identify trends across the fleet, between sister ships and to develop cost effective maintenance strategies.

The genesis of such integrated systems can be traced back to the early 1990s when class began moving from prescriptive rules to a dynamically-based approach to assess the design of tankers and other ship types. This was intended to improve evaluation of initial designs and required the development of an electronic model of the ship that captured the individual structural components and identified the high stress areas within the structure.

From around the same time, the shipping industry began to experience a significant increase in safety and quality performance assessment and monitoring. That brought with it the recognition of the need to move towards a more holistic management and maintenance approach, one which more specifically addresses the lifecycle condition of the vessel, from initial design to recycling.

The information collected can be used to demonstrate compliance - to the class society, to Flag and Port State, to vetting inspectors and ISM and TMSA auditors. It can be used to build performance records, to more accurately predict performance, and to more efficiently plan for routine dry dockings and repairs.

The information also brings the application of risk-based methodologies into the day to day decision making process.

This last point is perhaps the most important when looking to the future. Risk-based inspections and reliability-centred maintenance are two terms that will receive greater and greater prominence in the future.

For example, why should elements within a ship be subject to a calendar-based periodic survey or inspection regime that bears no relation to their actual in-service performance? If a piece of machinery, properly maintained, has a failure profile of 10,000 hours of service, why should class require it to be opened up for survey after 4000 hours?

Using that information as the basis for onboard inspection and maintenance and sharing the results with the class society means we are already moving from a system of periodic class surveys to one that is more audit based, one that more properly accounts for known failure profiles. This approach is more efficient, promotes greater safety and should be less intrusive and costly for the responsible operator.

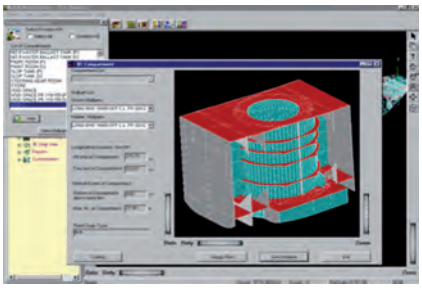
During 2009, ABS began offering to place its Hull Inspection Programmeme (HIP), together with the Maintenance and Repair module of its ABS Nautical Systems (ABS NS) fleet management programmeme, on every newbuilding delivered into ABS class from 1 January 2009 forward.

In developing the hull inspection programme, ABS started from the premise that it should help superintendents and crew focus their inspection efforts on structurally critical areas.

It provides a unified method of identifying potential problem areas, conducting examinations, grading the hull structure and recording defects. It also helps with the creation of repair and dry-dock specifications, the detection of anomalies and maintenance trends across a fleet, and offers a more efficient use of inspection results to satisfy inspecting stakeholders.

The programme considers specific areas known to be critical, based on vessel type and class historical data, including:

- design-related strength and fatigue critical locations identified during design and construction phase
- critical areas within the hull, based on unique structural details
- how to assess the overall integrity of the structure.



During 2009, ABS began offering the Hull Inspection Programme and Maintenance and Repair module of its ABS NS5 management programme on every newbuilding delivered into ABS class from January 1, 2009.

ABS uses the International Association of Classification Societies (IACS), International Maritime Organisation (IMO) and Tanker Structure Co-Operative Forum (TSCF) standards as the basis for these ratings, while coating and corrosion rating is based on IACS and ABS Rules. Grading of criteria is numerical based on increasing severity and uses a simple 'traffic light' system tied to set inspection criteria.

Much of this is standard in a comprehensive maintenance programme but what takes the process to a new level is the ability to direct the inspector – whether a ship's officer or superintendent – to look at structurally-critical areas. The identification of these areas is based not just on in-service experience but the ship-specific engineering analyses, including finite element analysis, that are undertaken by ABS in establishing the inspection scheme for each ship entered into the programme.

The key to an effective hull inspection and maintenance management system is that it brings together data from class and onboard maintenance programmes. This is a natural outgrowth of the ISM management system approach and ABS considers it an integral part of the responsible tanker operator's TMSA programme and an auditable element in the SIRE assessments.

ABS believes that this is the future. It is already here for forward-looking owners and ABS expects that integrity management programmes used with shipmanagement systems that enable data to be collected and integrated onboard and ashore will become the norm within a relatively short time frame. *NA*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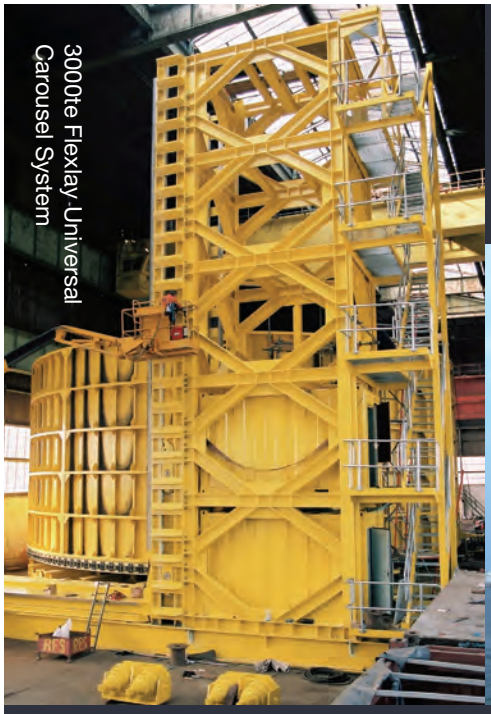


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# New rules for VOCs

New mandatory requirements set to come into force in July will mean crude oil carriers will need to develop a plan for dealing with volatile organic compounds, writes Sandra Speares.

New rules governing the handling of volatile organic compounds (VOCs) are part of the revised MARPOL Annex VI which covers air pollution from ships. The VOC Management Plan will need to be approved either by a recognised organisation or a class society. The purpose of the VOC management plan is to ensure that tankers prevent or minimise VOC emissions as much as possible. Parties regulating tankers for VOC emissions have to submit a notification to the International Maritime Organization (IMO), including information on the size of tankers to be controlled, the cargoes requiring vapour emission control systems and the effective date of the controls.

Independent tanker owners' organisation Intertanko and class society Det Norske Veritas (DNV) issued joint guidance to help members develop management plans for their tankers.

The guidance is in two parts, the first of which deals with the content of the management plan and the second which will need to be filled in by member companies and submitted to class for approval.

An appendix to Part B includes a suggested Non Methane VOC emissions calculation standard form. A spread sheet for this is available to members on the Intertanko website (www.intertanko.com).

VOCs for tankers are more environmentally dangerous than $CO_2$.

At industry level many systems were developed to minimise and contain VOCs, according to Dragos Rauta technical director at Intertanko.

The systems development of such systems arose after the Norwegian government put in place rules requiring those involved in North Sea activities to reduce their VOC emissions by 72%.

All tankers operating in the North Sea have to have systems in place. At issue is how long valves can be opened to limit the pressure building in the tanks during transportation.

What Intertanko observed in tests on 35 tankers was that when the valves were opened there was a fast drop in pressure in the first 10 minutes after opening and then a continuous linear drop in pressure thereafter.

By implementing efficient operational methods, VOC emissions could be reduced by 60-80%. New systems have now been developed by which, on measuring the pressure, a valve automatically opens and closes when the pressure variation becomes linear.

There are more sophisticated systems used in loading. One such system has been developed by tanker company Knutsen who designed a new loading system in such a way as to eliminate the vapours when the cargo is piped onboard. The design is simple and keeps the pressure constant between the shore tank and the ship's tanks then there is no huge development of vapours.

Tankers have been required to have vapour recovery lines for loading which means the vapour returns to the terminal, however very few terminals have facilities for handling it. Knutsen's KVOC system aims to prevent VOCs being emitted from oil during loading and transit from tankers. The company estimates that its system will eliminate vapour release from the cargo during loading by up to 90%.

All this has been developed because a deadline on VOCs had to be met, Mr Rauta says. "The tanker sector is pretty good at going ahead and doing things." *NA*

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# SAM Electronics updates bridge system

SAM Electronics announced that its latest integrated bridge system has a new generation vessel control system that combines navigation, automation and control functions into one, in its latest development the NACOS Platinum.

The latest development has been jointly developed with associate companies Lyngsø Marine of Denmark and L-3 Valmarine of Norway, the series will provide a complete range of functionality for vessels of all types and sizes while ensuring unprecedented levels of usability and scalability.

The entire Platinum series is based on identical components and a common network. The series will support a complete portfolio of Radarpilot, Ecdispilot, Trackpilot and Conning functions in addition to those for Alarm, Monitoring and Control, Propulsion Control and Power Management as well as other requirements.

A combination of networked architecture and use of modular components will give the system unrivalled levels of system scalability, say SAM Electronics. Based on a new platform concept, solutions will be able to extend from a small alarm system or a stand-alone Electronic Chart and Display System (ECDIS) to very large, complex configurations for highly advanced vessels such as cruise ships. Any system can be easily expanded, upgraded or modified to provide increased functionality. The system also has a new IP radar which, by direct connection to a ship's own IP network, will allow for complete radar images to be accessible from any workstation. Similarly, ECDIS displays can be made available for viewing in an engine control room, the Captain's office or any other ship area.

A key concept of the NACOS Platinum series is that all products have been developed observing User Centred Design principles. Avery ambitious collaborative design process by SAM Electronics has resulted in the development of a Human Machine Interface (HMI) which is consistent across the full range of products. The results in systems have shown ultra-efficient and ease of operation by providing overviews and simplicity of operation, enabling crews to concentrate on managing ships safely without any undue distraction or stress.

SAM Electronics has said that other advantages of the Platinum series, with its system-wide use of standardised hardware and software components include; significantly improved quality and reliability of performance. Similarly, maintenance requirements are greatly simplified with a much-reduced requirement for spare parts, while continuity of operation is assured by extensive self-monitoring facilities supported by online diagnostics.

SAM Electronics has already received a first order for NACOS Platinum systems with its L-3 Marine Systems Korea subsidiary having been commissioned to supply 10 units for a series of 45,000dwt chemical carriers under construction by SLS Shipbuilding of Korea for delivery to Arab Chemical Carriers (UACC) of Dubai in 2011-12. *NA*

NACOS Platinum the latest in bridge system developments from SAM Electronics.

# Kongsberg at the helm of *Oasis of Seas*

Royal Caribbean Cruise Lines (RCCL) *Oasis of the Seas* made a splash when it entered service at the end of 2009, with latest critical navigation, manoeuvring and automation functions from Kongsberg maritime control systems.

Royal Caribbean International (RCI) commissioned Kongsberg to install its complete cruise control onboard the *Oasis of the Seas* that would enable the largest cruise ship in the world, to date, the ability to move around small ports. The extensive design and installation project, which is a realisation of Kongsberg Maritime's 'The full picture' ethos was undertaken in close collaboration with RCI at the STX yard in Turku, Finland.

The Complete cruise control system is the driving concept behind the Kongsberg Maritime installation onboard *Oasis of the Seas*, which at its heart features a complex bridge control system. With six Wärtsilä diesel electric engines delivering close to 100MW of power to four large 5MW bow thrusters and three 20MW azipods supplied by ABB Marine, *Oasis of the Seas* has a unique and powerful propulsion system. The challenge of controlling all of that power from the bridge, in order to safely and efficiently move *Oasis of the Seas* was given to Kongsberg Maritime, when it was contracted to supply the propulsion control system and dynamic positioning (DP2), in addition to power management, machinery automation and HVAC automation systems.

Captain Bill Wright, senior vice president of Royal Caribbean International, and captain of the *Oasis of the Seas* believes that many different components home come together to make the system meet RCCL's requirements for such a large vessel: "*Oasis of the Seas* has about 15,000m$^2$ of sail area, so manoeuvring the vessel in and out of small or busy ports in challenging wind and sea conditions requires a powerful and dynamic propulsion control system. We worked closely with Kongsberg maritime to ensure we got the right bridge control system and functionalities in the software solution to match our needs."

Captain Wright was also involved in the fine tuning the KONGSBERG DP system by suggesting some software refinements to ensure the redundant DP system was optimised of the *Oasis of the Seas*. "There were some functions we didn't need and others we wanted;, and with Kongberg's help, we ended up with a system which meets our requirements. In fact, there are elements to the DP system onboard the *Oasis of the Seas* which I am confident would be of interest to the offshore industry," comments Captain Wright.

Konsberg has installed its complete cruise control onboard *Oasis of the Seas.*

> "There were some functions we didn't need and others we wanted, and with Kongberg's help, we ended up with a system which meets our requirements"

According to Rolf Taxt, Kongsberg's Maritime's project manager (Integrated Control Systems) the company places a high value on the input delivered by RCI personnel. "*Oasis of the Seas* is among the largest, most challenging projects we've ever worked on, and it is a credit to RCI's personnel and the yard that everything has gone smoothly. In addition to customising the DP software and bridge control systems, RCI wanted wide-screen monitors, which allows us to make available more information on screen for bridge officers. Following this, we are now able to offer the same widescreen solution to other customers."

The collaboration between Kongsberg Maritime and RCI continues apace as *Oasis of the Seas* enters 2010; with the installation of a similar cruise control system onboard her sister ship, *Allure of the Seas*, which is due to be delivered later this year. ***NA***

# Thrane & Thrane extend its reach

Wired Ocean, a marine broadband solution has been awarded official status of a Thrane & Thrane accredited solution.

The accreditation will see Wired Ocean widen its scope of internet usage onboard vessels after extensive testing of the solution, which confirmed that Wired Ocean S-Box and service is compatible with SAILOR fleetbroadband and Fleet terminals, and also a forthcoming line of SAILOR SAT TV anennas.

"Although our services are already used onboard many SAILOR fitted vessels we are delighted that Thrane & Thrane has officially recognised Wired Ocean's ability to significantly improve the performance and affordability of onboard internet," says Victor Barendse, managing director, Wired Ocean. "Combining Wired Ocean's S-Box with SAILOR Fleetbroadband and SAILOR SAT TV provides ships with cost-effective broadband, in addition to the voice, data and television services available through the SAILOR equipment."


Thrane & Thrane accredits Wired Ocean's S-Box.

Wired Ocean has collaborated with Thrane & Thrane to provide a higher level of integration and improved management of the broadband connection when the Wired Ocean service is used with the SAILOR family of FleetBroadband terminals.

"We have tested Wired Ocean extensively and were impressed with the benefits it could bring to users of SAILOR equipment. Installation was fast and very easy, and the testing period has ensured that the Wired Ocean and SAILOR solutions work together seamlessly," comments Mads Ebbesen, product line manager, Satellite TV, Thrane & Thrane. *NA*


- The MarineSTAR Manoeuvring System provides high accuracy position, course and speed - both in the forward direction and athwartships.
- MarineSTAR assists manoeuvring in restricted waters and confined port areas. Quay distance calculation aids berthing of large vessels.
- MarineSTAR can be integrated within ships bridge systems to provide stable accurate, position course and speed data. This is especially valuable to ships using electronic charting.

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# Marlink introduces latest broadband packages

Marlink has announced that it has introduced an extensive range of FleetBroadband Bundles, which can be purchased with its two and three year price plans.

The latest bundles will enable customers to lease equipment from a choice of three different vendors, as well as purchase broadband time for data and voice, all at fixed monthly cost. Customers purchasing the bundles can take advantage of low prices for equipment and airtime with predictable communications costs.

"The launch of our new FleetBroadband Bundles is part of our ongoing commitment to provide exceptional flexibility and value to maritime satellite communications customers worldwide. FleetBroadband provides customers with high quality connectivity at sea and costs that are dependent upon usage. However, some ship operators prefer fixed charges to ensure predictability. Our new FleetBroadband bundles have been designed to help customers regulate communications costs, as they will be able to purchase an amount of airtime and data at a fixed cost. In addition, the FleetBroadband equipment is included in the monthly bundle price, which means that customers won't have to make heavy instruments in hardware," comments Tore Morten Olsen, CEO, Marlink.

Providing both MSS on-demand services and its own VSAT solutions Sealink and Wavecall to a broad range of customers, Marlink says that it is a one-stop-shop for maritime satellite communications, offering high quality of service and exceptional flexibility. Customers of the new FleetBroadband bundles will be able to choose from a range of competitive priced packages as well as hardware from Thrane & Thrane, AddValue or JCR, to meet their own satellite communications requirements. *NA*

# Sperry Marine launches latest CIBS system

Sperry Marine has launched its latest compact integrated bridge system (CIBS) on to the market.

The latest compact integrated bridge system from Sperry Marine has been designed to improve situational awareness and ship efficiency whilst reducing installation costs.

The new CIBS design has been based on Sperry Marine's VisionMaster FT technology, and utilises the company's proprietary TotalWatch multifunctional displays, allowing the user to customise display screens to meet operational requirements. The system uses high resolution Widescreen display consoles, which will proved a 25% larger viewing area than standard screens. Standard operating modes will include conning information display, radar only, chart radar and international Maritime Organization (IMO)-compliant electronic chart display information system with Sperry Marine's optional iview 3D picture for underwater contours and hazards.

The CIBS is fully type approved to meet applicable international regulatory requirements. The standard VisionMaster FT CIBS package includes the three-node console/display units and steering stand, as well as all necessary subsystems and sensors, including gyrocompass, speed log, echosounder, automatic identification system, voyage data recorder, GPS, steering controls and self-tuning adaptive autopilot.

"Smaller footprint and standarised equipment packaging will reduce the cost of acquisition and installation for ship owners and shipyards"

"Smaller footprint and standarised equipment packaging will reduce the cost of acquisition and installation for ship owners and shipyards," says J. Nolasco DaCunha, vice president of Northrop Grumman Sperry Marine. "The scalable system srchitecture means that the CIBS can be easily expanded with field upgrades to add new features and functions, including Sperry Marine's next generation performance-based navigation capabilities for improved ship efficiency through greater ship-shore integratation," he adds. *NA*

# The Royal Institution of Naval Architects

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# Iridium unveils latest transceiver

Iridium is set to launch its latest satellite data transceiver that will provide global two-way data links for remote tracking and monitoring devices.

The Iridium 9602 is a full-duplex short-burst data (SBD) transceiver and is designed embedded applications in the remote asset tracking and monitoring solutions market. The product, the culmination of a two-year R&D programme, has completed prototype testing. Iridium expects to begin commercial deliveries in June this year.

The latest Iridium 9602 short-burst data transceiver will provide global two-way data links for remote tracking, monitoring and messaging applications.

"The smaller, lower-cost Iridium 9602 will serve as the data communication engine for a wide range of portable tracking and monitoring devices, leveraging Iridium's global coverage and low-latency, two-way data links," said Don Thoma, executive vice president for marketing at Iridium. "Our service partners are already testing prototypes in their Iridium 9602-based solutions for applications such as tracking soldiers and military vehicles in the field, telemetry from unattended sensors, fleet management, enterprise logistics and supply-chain visibility, as well as personal two-way navigation and mapping devices."

"The matchbox-sized Iridium 9602 is 69% smaller, 74% lighter and considerably less expensive than the first-generation Iridium 9601 SBD modem, which we designed the Iridium 9602 to replace," said Mr Thoma. "The very small form factor and low power consumption will offer greater flexibility to value-added manufacturers (VAM) and resellers (VAR) embedding the Iridium 9602 into their products."

"The smaller, lower-cost Iridium 9602 will serve as the data communication engine for a wide range of portable tracking and monitoring devices"

"The Iridium 9602 focuses on highest overall value of price and performance offering global, real-time service combined with new lower pricing," said Patrick Shay, vice president, data services, Iridium. "The Iridium 9602 is the highest value in the industry."

A unique feature of the Iridium 9602 is its built-in GPS input/output ports which will permit system integrators to interface with an external GPS receiver, using a single dual-mode L-Band antenna for GPS and Iridium SBD, saving the cost of an antenna in their applications.

The small size of the new Iridium 9602 short-burst data transceiver will enable system integrators to embed the unit in a wide range of small, portable satellite tracking, monitoring and messaging solutions, say Iridium.

The duplex data links provided by the Iridium 9602 will permit two-way communications to and from the remote devices, allowing users to reprogram the unit, adjust its reporting intervals and send on-demand queries for specific data updates. It will also enable first responders and search-and-rescue authorities to respond to emergency distress signals from personal location and tracking devices.

"Prototype evaluations from Iridium's service partners have been positive," Mr Thoma said. "More than 90 companies are working on plans to embed the Iridium 9602 in their next-generation products," he added. *NA*

## SevenC's adds more to its software

**SevenC's GmbH has announced that it has updated its electronic navigational charts (ENC) Tools Software Suite, with the addition of three new software tools; ENC Encryptor, ENC Permit Generator, and ENC Contour Generator.**

**ENC Encryptor in combination with ENC Permit Generator will allow organisations that produce S57 electronic navigational charts to encrypt and sign chart data by preventing unauthorised copying of data. In addition, there will be control over user data access and the users will be able to verify the source of their electronic charts. ENC Contour Generator is a software plug-in module for the SevenCs ENC Designer application. ENC designer is used by hydrographic authorities, port authorities, and others to produce S57 navigational charts and the ENC Contour Generator which, will allow them to automatically generate chart contours at defined intervals from xyz depth data (i.e. cluster of depth points defined by geographic coordinates and a depth value).**

**One of the key features of the ENC Contour Generator is its ability to consider the scale of the final chart to control the degree of contour generalisation. The generalisation process also integrates "safe side" directional contour modification.**

# Ship simulators in The Netherlands: Present and Future

Ship simulators have over the years become a very technological advanced piece of equipment and today gives crew members an experience as close to reality as possible. In The Netherlands STC B.V has been a part of this development, Jacob Pinkster highlights the developments being made in The Netherlands.

## Introduction

A Full Mission Bridge (FMB) simulator consists of a ship's bridge, a mathematical model of the ship in question, visual models showing the ship as viewed from within the bridge and her environment (i.e. harbour, waterway and open sea area if so required). Computer programs are of prime importance for a ship simulator and handle the calculations regarding ship's speed, course and motion under given environmental conditions such as wind, currents and waves. The action of any other external forces present such as tug boat forces be it from pulling (i.e. tow line) or pushing (tug boat bow), mooring line forces or anchor line forces are also taken into account.

There are a number of FMB simulators in The Netherlands and these may be found at research and training institutes and education facilities as well as marine companies. STC B.V., a full subsidiary of the STC Group, has an extensive and modern ship simulator centre at their Wilheminakade facilities in Rotterdam. Besides the ship simulators there are also a number of Dynamic positioning simulators as well as VTS systems at the Wilhelminakade location which may be used for education, training and research purposes. All FMB's can be coupled together to simulate a marine project consisting of a number of vessels working together in a virtual world. Important hereby is the possibility to include the human factor (i.e. the bridge team) within such simulations.

Training courses are STCW compliant and Dutch Shipping Inspectorate certified. The simulator centre and her simulators are DNV certified. Research projects are either privately initiated at the request of shipowners, oil companies, marine pilot associations or are a part of an EU projects, etc.

At the head office of the STC Group there are also a number of simulators used for education and training purposes which include amongst others engine room simulator, cutter dredging simulator, container crane simulator.

Figure 1. A modern 360deg view Full Mission Bridge Simulator of STC B.V., located in Wilhelminakade in Rotterdam.

## Use of ship simulators

Nowadays ship simulators are used for a various number of purposes such as:

a) Basic training of ships bridge crew in the art of navigation, ship handling and manoeuvring (Training simulator)
b) Training of ships bridge crew to work together as a team (Bridge Resource Management Course)
c) Training of DP operators (basic course and advanced course)
d) Assessment of bridge crew for functional suitability (career advancement)
e) Forensic (Incident) Investigation (what were the true course of events leading up to an incident)
f) Nautical study regarding suitability of proposed harbour/waterway configuration
g) Installation of large offshore constructions in an oil field
h) Pilot exemption courses
i) Upgrading of sea time
j) Contingency training
k) Combination of one or more of the above

A ship simulation project may consist of one or more ship simulators connected together in one virtual environment. A basic training course for ship cadet officers for example may consist of one ship simulator alone whereas the intricate installation of large offshore construction (FPSO) in an existing oil field may require four or more interactive simulators (one for the FPSO

and one for each tug boat involved). Each simulator bridge has its own bridge crew for a given project which could consist of a captain, mate and helmsman. In the event of an FPSO installation then there should also be a blind simulator where the tow master monitors and guides the complete installation process. Especially in projects where more than one simulator is involved, inter ship communication is a subject that commands great attention for obvious reasons as miscommunication in such projects in real life may cause large and expensive damages to men, ships and the environment. Recently, a number of such FPSO tow out and installation projects have successfully been carried out at our simulator centre at the Wilhelminakade in Rotterdam. One of these FPSO projects has been described in detail by Hao Jun et al. [1]. According to Hao Jun et al., it is expected that model tests and virtual simulation will play a more important role in FPSO positioning and hookup operations as well as offshore installation of SEMIs, SPARs, TLPs, etc in deep water and ultra deep water.

Figure 1 shows a modern, well equipped, 360deg view Full Mission Bridge Simulator of STC B.V. at their Wilhelminakade simulator park in Rotterdam, The Netherlands.

New dynamic positioning simulators at STC B.V.

## Future ship simulators

In the future, the next generation of ship simulators will be capable of:

a) Accommodating more ship types, including those yet to be built (therefore straight from the designers digital drawing board)
b) Producing more elaborate ship models yielding a higher degree of realism regarding ship performance under a wider range of circumstances such as heavy lift ships, pipelaying vessels, anchor handling vessels, fast vessels, etc.)
c) Multibody ship simulations (i.e. ships sailing alongside each other such as ship lightering operations, ship supplying, etc.)
d) Reducing required sea time through adequate simulation training
e) Integration of more aids to navigation (AIS, ECDIS, pilot, laptop)
f) Depth view in visuals due to stereoscopic projection

Technique is a procedure used to accomplish a specific activity or task and technology is the study of or a collection of techniques. Ship simulators are full of technique and technology, all required so that one may successfully execute, for example, ship manoeuvres while entering a harbour, and going to a berth. Skill, the ability to carry out a task, for example, manoeuvring of a ship to entering a harbour. can be acquired through practice on a simulator. A result of many a simulation is often the technique which should be applied to be able to accomplish a specific activity or task, i.e. enter a harbour, berth the vessel, which type and size of tugboat is necessary?, etc.

Simulators generally evolve due to technology pull often initiated from the marine industry itself. New technologies have become more viable for application in modern simulators due to the large leaps in computer technology. A good example of this is 6 dof motion technology which can now be implemented properly and was not feasible in the past due to the heavy calculation load on the computer system. With this improved vessel motion, a ship's behaviour in a seaway can be simulated to such a degree that weather routing can be applied which results in a safer vessel passage whereby, for example, forces on container lashings may be an important constraint.

In short, a lot has been done in the field of ship simulators in the past and there are still plenty of interesting challenges for simulator development to be met in the future. *NA*

## Reference

1. Model Test vs. Virtual Simulation of a VLCC Class of FPSO Hookup
Hao Jun et al. Journal of Marine Science and Application. Volume 8, Number 2, Pages 137-143. Publisher Harbin Engineering University.

## Author

Jakob Pinkster
Head R&D, STC Group, The Netherlands.

Jakob Pinkster graduated in Naval Architecture (TU Delft), has almost 30 years experience in commercial ship design including fast vessel design as well as teaching ship design and ship hydromechanics.
He has worked for shipowners, shipyards, Delft University and in marine consulting. Now he holds the position of Head R&D at STC Group Rotterdam, The Netherlands
Present projects:
Simulator projects (merchant marine, offshore and inland waterway related)
Improvement and expansion mathematical models for simulators.

# Turkish yards freeze orderbook

Workers have been laid off in crisis hit shipbuilding industry where few yards, if any, have managed to come through the economic crisis unscathed. Those yards still building ships are mainly surviving on domestic or Turkish Navy orders.

Shipbuilding in Turkey has perhaps suffered more than most as the economic crisis swept like a tsunami over the global ship construction industry. Buoyed by the high demand from foreign, mainly European, owners for new chemical tankers in the 3000dwt to 10,000dwt range the collapse of demand has forced yards to idle.

Effectively many yards have shut down their operations by laying off a substantial proportion of their yard staff; these were mainly sub-contractors making the workforce a flexible entity, according to one yard source. Administration staff have been retained in an effort to win orders.

This effective shipyard hibernation has seen employment levels in the yards plummet from their high points in 2008, according to Ali Düzgit, a naval architect and marine engineer for Düzgit Ship Construction AS.

"Turkish shipbuilding employed 30,000 workers in 2008, by the second half of 2009 that had fallen to just 50% of the 2008 levels and in the first quarter of 2010 staffing had fallen by between 70 and 80% of 2008 levels," he said.

Though an alternative source, close to the Turkish yards, put this figure at the lower level of 60% as yards retained a proportion of yard workers to carry out ship repair contracts, to which many of the Turkish yards are now said to be turning.

Effectively the source said that there had been few new export orders for small to medium sized chemical tankers, the mainstay of the Turkish yards for several years, and cancellations of orders have left the industry bereft of work.

As the crisis bit deeper into the economy finance dried up and many orders were cancelled and all speculative building that the Turkish yards had previously engaged in ended. Shipyards owned by ship operators that had vessels that were near completion

continued to build the ships and if there was no buyer they have operated the vessels themselves.

This option was not open to yards that do not have a ship operator linked to the company and the investment remains tied up in the asset that they cannot sell. Any ships being built that were not nearing completion have been mothballed. "The Turks have put a freeze on the orderbook. They acted very promptly putting a freeze on new investment in September 2008," as the crisis hit, said the yard source.

He added that if this freeze on newbuildings was to last a few months then there would be no problems, but any longer than that then difficulties could appear, not only for the yards that have finance invested in half-built vessels, but also for their suppliers who have not been paid. "There are too many orders in the pipeline and the yards cannot get rid of them," said the source.

However, few if any yards are in danger of going bankrupt as Mr Düzgit points out: "If by closed down you mean that there is a padlock on the gate, then this has not happened, but most around 70% of Turkish yards only have administrators working there," he said. "Those yards with repair facilities are still working," he added.

This view was endorsed by Mustafa Insel, the head of the executive committee for class society Turk Loydu. "There are not many ships being ordered from abroad, but there are some orders for domestic ferries and naval ships," said Mr Insel, he added that "the shipyards [in Turkey] will survive, they are used to these kinds of crises, they won't go bankrupt".

The *Naftocement XVIII* shortly after its launch.

In fact the yard source also agreed that yards were unlikely to go bankrupt, mainly because they have flexible workforces, mainly subcontractors, who can easily be laid off, while other yards have found some solace in ship repair work, managing to retain about a fifth of the yard workforce. In addition much of the investment in Turkish yards is came from the owners directly, little of the investment is to foreign banks any borrowing was from domestic banks and the yards and banks are looking to reach an accommodation over the debts.

Mr Insel pointed out that while Sehla yard in Tuzla has not had any orders they have not gone bankrupt, they have laid off workers and looked to expand any local work with the staff that remain.

A similar situation has occurred at the Düzgit yard where Mr Düzgit concedes that there are no new orders for foreign owned vessels. "We are now working with the [Turkish] navy building patrol vessels and landing platforms and we are working with a UK-based design office to develop offshore support vessels and survey support vessels," said Mr Düzgit. He added that the company were also working with a Danish company on an oil recovery and sludge tanker and a bunkering ship design for the European market.

Mr Insel believes that if the shipbuilding market picks up at the end of this year, as it is expected to by many in the industry, then that upturn will "be reflected in the Turkish yards". For the moment with the limited orders that are around the yards will need to maintain capacity so that they are in a position to respond when the upturn comes.

For some yards that will mean just idling while others are still completing a backlog of orders keeping the yards operational, for example the Selah yard delivered the *Naftocement XVIII* in December last year, the biggest vessel of its type built in the Mediterranean.

*Naftocement XVIII* is classed by RINa and includes the Italian Society's Clean Sea and Clean Air notations certifying the vessel as environmentally friendly. *Naftocement XVIII* is the third vessel designed by Cosnav Engineering SRL for the Greek Shipowner Naftotrade Shipping and Commercial SA.

Meanwhile Italian shipowner Ciane Spa has purchased a second double-hull bunker tanker from the Çiçek Shipyard. In May 2009, Çiçek delivered the first of a series of four 3100dwt IMO II chemical tankers the *Chem Flower*. The ships were being built for Çiçek's sister company White Tulip Shipping, but now Ciane has stepped in again to acquire the *Chem Rose*, which has been renamed, *Brezzamare*. The ship was handed over to Ciane in early February.

The Beşiktaş Shipyard has signed an agreement with the Italian company Gas and Heat for four 3800tonne LPG tankers, originally ordered by Vafias of Greece for delivery early last year. The Greek company cancelled the order following delays, but now the quartet have been bought by the Italian company based in Livorno. The first of the ships is due for delivery in the first half of this year.

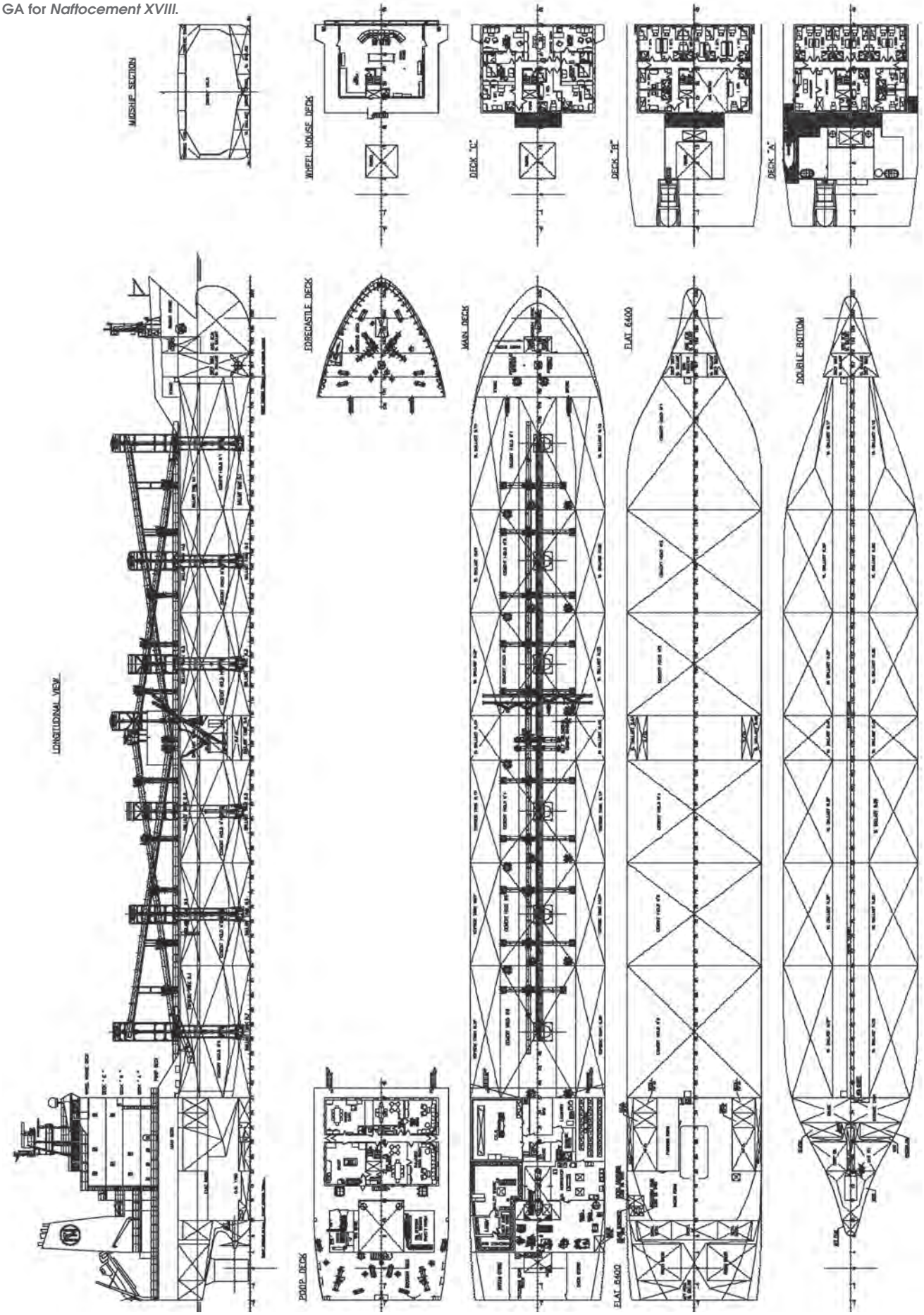
Besiktas has also won a US$200million order for 10 chemical and product tankers of 7100tonnes for delivery to the Istanbul-based Palmali Shipping between the 2011 and September 2013. *NA*

TECHNICAL PARTICULARS

***Naftocement XVIII***

| | |
|---|---|
| Length, oa | 156.52m |
| Length, bp | 145.30m |
| Breadth, moulded | 20.60m |
| Depth moulded, main deck | 10.70m |
| Draught | |
| design | 8.0m |
| scantling | 8.2m |
| Deadweight | 15,500dwt |
| Speed, service | 14.0knots at 90%MCR |
| Cargo capacity | 14350m$^3$ |
| Bunkers | |
| Heavy Oil | 771.5m$^3$ |
| Diesel Oil | 135.0 m$^3$ |
| Water Ballast | 6939.7m$^3$ |

GA for *Naftocement XVIII*.



# New for old? ISO debates revamp of noise standard

The ISO 6954:2000 noise and vibration standard will be brought up to date following the latest review. Marco Biot, associate professor in ship structural design, and Francesco De Lorenzo Fincantieri's head of noise and vibration, analyse how changes in the standard will effect existing quality levels.

In the last few years the theoretical and practical approach given to the ISO standard 6954:1984, which is regarded as a milestone for a reliable assessment of comfort onboard ships, has been abruptly changed by the issuing of the final draft of the 2000 version. That version's framework is highly questionable, at least from the point of view of shipbuilders and ship owners.

On the other hand, an enhancement of the old 1984 standard could not be postponed, since such a version has been accepted for years despite a general lack of satisfaction with the standard.

As matters stand, it is taken for granted that in order to look at how to overcome the present impasse a review process of new ISO 6954 standard cannot be avoided. The main issue is that an updated and in-depth study regarding the effects of vibrations on passengers comfort onboard of ships does not exist. It is in this context that the ISO technical committees have started to work on a reviewed standard that should be included as part 5 of the new standard ISO 20283 covering the whole range of vibration on ships.

## Accepting the old standard

The main feature of ISO 6954:1984 is that, for the purpose of assessment, each excitation frequency of a vibration spectrum is considered to give a separate contribution in terms of human perception of comfort. The admissible vibration level for each excitation frequency is expressed as maximum 0-peak value (Figure. 1). The approach was validated by a lot of measurements made onboard ships during several years and after statistical analysis of the behaviour of the people onboard. The statement: "Adverse comments not probable" which marks the area below the lower limit curve in Fig. 1 is very effective

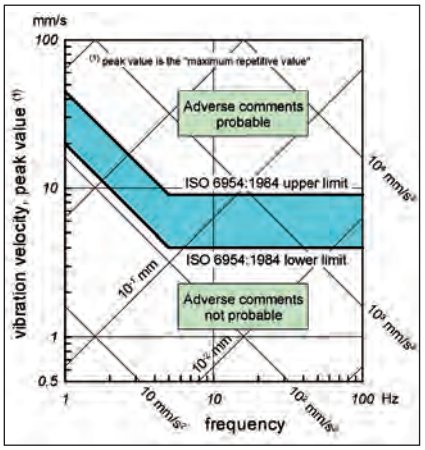



Figure. 1: The ISO 6954:1984 vibration limits.

in defining a basic level of comfort. Higher comfort levels may be set by lowering the limit curve. This is why the old ISO standard gained general acceptance for the evaluation of shipboard vibrations with regard to human exposure.

## Handling real comfort

Clearly, limits to vibrations in the accommodation area of a ship should guarantee an optimal comfort level. Unfortunately, there is a lack of information about the human perception of vibrations, at least as far as shipboard habitability is concerned. Exhaustive research in close cooperation between ship vibration experts and psychologists should be carried out. Up to that time, the best rule is to act in accordance with the experience gained by shipyard and owners. Other opinions have a relative value.

In order to shed some light on people's perception of vibration an investigation was performed using a practical approach [1]. The applied procedure consisted of gathering, processing, and analysing passengers' judgements in order to correlate the comfort perceived by passengers (the real comfort) and the objective quality of the offered comfort, measurable by means of physical parameters.

In the case here presented, a number of judgements were collected and classified on the basis of the different sources of disturbance related to noise and vibration (Figure. 2), as they are considered the comfort attributes with the greatest influence on the perception of well-being by passengers.

Since analysed data refers to a modern cruise ship involved in routine voyages, the results here presented are indicative of the level of comfort onboard of cruise ships of the latest generation. The main conclusion of the analysis is that no claims have been registered in relation to the vibration phenomena, that proves the ability of designers in dealing with this phenomena, even if they set comfort design just on velocity levels in mm/s peak at any single frequency.

## Against the use of a frequency-weighted limit

The new ISO approach based on an "integrated weighted" overall level expressed in mm/s root mean square is apparently valid as it considers the human perception of vibration as a whole. On the other hand, a global value which can synthesise all the vibration effects on human perceptions is not completely convincing when the energy of the vibration spectrum is mostly concentrated on a narrow band, since a vibration spectrum is not perceived by the body as a whole, but by any part of the body as a single part. The analogy with the concept of dB(A) in the noise field is very attractive, but to argue from an analogy may lead to false conclusions.

Another question is the starting point of ISO 6954:2000, which in our opinion –

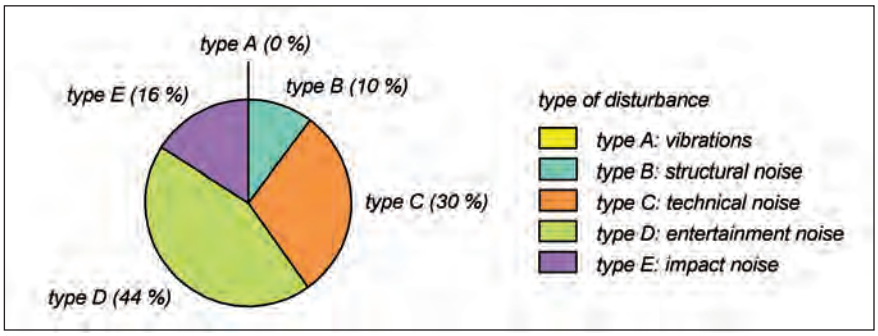



Figure. 2: Different influence of the sources of disturbance.

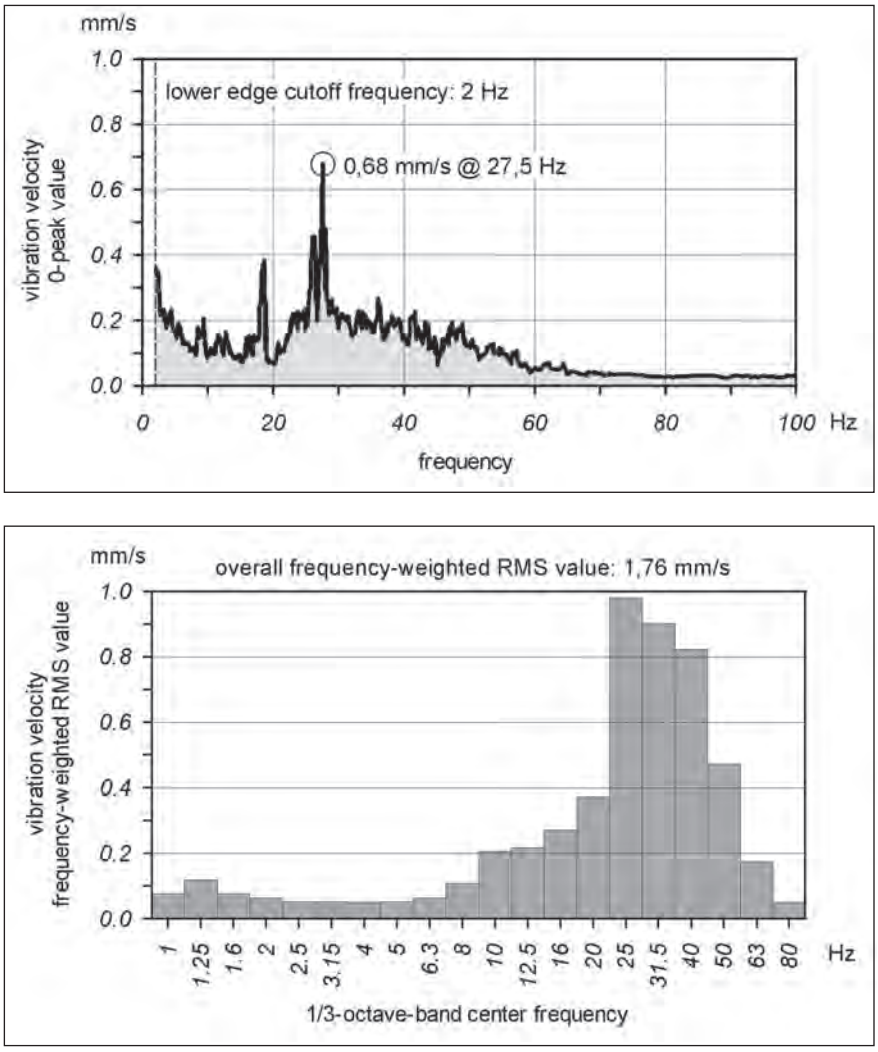



Figure. 3: Spectrum with a small broadband response (cruise ship, passenger cabin).

an opinion shared by many experts, is not strictly correct. In effect, the new standard is based on the ISO 2631-2 standard, where human exposure to whole-body vibration is taken into account, with the aim of limiting the annoyance and comfort effects on occupants of buildings. However, the sensitivity curve has been applied to shipboard comfort in the hope that what has proven to be valid in other fields (i.e., in buildings) would also be valid onboard of ships. Moreover, the issue of long-term familiarisation on board ships has not been considered.

## Old versus new ISO standard

Many comparisons have been made between the outcomes resulting from the implementation of the two procedures outlined in the old and in the new ISO standard [2]. As it was widely demonstrated without any doubt, accordance between the results of the two approaches is not always clear, depending on the type of the signal: this means that something is not correct.

One of the two approaches fails in evaluating the habitability. Based on the common experience that the old ISO standard may be considered fully satisfactory since it is extremely effective in emphasising critical areas, one may argue that the new ISO standard, supplying indications that diverge from those of the old one, does not offer the same requirements of reliability.

As an example, Figure. 3 shows the vibrations measured onboard a cruise ship as calculated by the old and the new ISO standards. The assessment of habitability made on the base of the 1984 version gives a vibration level equal to 17% of the limit, while applying the 2000 version the measured vibration level is equal to 88% of the relevant limit.

The main feature of the frequency-weighted approach is its ability to better reflect the human perception of a broadband vibration. On the other hand, measurements show that the new approach is very sensitive to random vibration due to propeller cavitation. The same conclusion has been reached by Savreux et al. [3]. In short, when high energy is scattered on the entire bandwidth, the frequency-weighted approach clearly tends to react more. This could lead to an overestimation of the vibration effects on habitability onboard.

## A situation difficult to manage

The new ISO standard forces designers to take a very different approach. As the concept of a comprehensive limit entails in itself manipulation of primary data, an overall level is very heavy to deal with by designers when they try to find a direct relation between vibration sources and resulting overall level. The assessment procedure of the new ISO standard is a very demanding work, which is not at all

| Class | ISO 6954 Vibration criteria | |
|---|---|---|
| | 1984 Version | 2000 Version |
| ABS (2001) | | ✓(1) |
| BV (2009) | ✓ | ✓ |
| DNV (2003) | ✓ | |
| GL (2004) | | ✓ |
| LR (2009) | ✓ | ✓ |
| RINA (2004) | ✓ | |
| (1) Based on BS 6841 (1987) | | |

Table 1: Comparison of the comfort class criteria.

suitable for implementation in an early stage design. Practical difficulties to sign any contract are direct consequences of such a situation.

Moreover, according to the 2000 version shipyards can acquire a reliable estimation of vibration-related comfort only after the elaboration of measures taken during sea trials – but this fact happens too late, when the ship is ready to be delivered and measurements are just for checking.

In conclusion, a new contract where vibration limits are based on the new ISO standard cannot be managed by shipbuilders and that is enough to consider the 2000 version an unenforceable standard.

## Some unfavourable reviews on the new standard

The range of measurements from 1Hz to 80Hz denotes a clear disagreement with the purpose of treating habitability with reference to vibrations. In effect, our experience shows that for very low frequencies (up to 2Hz) there are no other excitations than that of the sea. Actually, hull girder modes up to 2Hz may be excited by sea waves, but on the other hand hull deformations are negligible when compared to both local deformations and ship motion amplitudes.

If calm sea is a requirement for acceptance tests according to new ISO rule, it must be pointed out that waiting for calm sea conditions during sea trials would require a lot of time, which is not acceptable by shipyards.

Fulfilment of the new ISO standard is more difficult as the length of the ship decreases. Whereas old ISO 6954:1984 was applicable to merchant ships of length between perpendiculars of 100m or greater, the 2000 version does not provide for this eventuality. Therefore, limit values are independent of ship length. Small and fast craft have potential to produce higher noise and vibration levels than larger vessels, so it is difficult to apply the standard to all vessels.

## The weak point of the old standard

The real weak point of the old ISO standard is that it refers to the concept of the maximum repetitive value (MRV). That gives rise to endless discussions. The MRV measures the highest amplitude that appears regularly in a vibration record every time dominant frequency components are in phase. Clearly, MRV concept was proposed for evaluation of the measured signal in time domain.

Nowadays, time record is not yet subject to peak identification, as collected vibration data are directly processed to obtain a time averaged narrowband spectrum of RMS values. So, the problem arises when, within the ISO 6954:1984 approach, measured RMS values need to be compared with limits expressed in terms of MRV. In conclusion, the main open question remains which would be the better MRV estimator applied to shipboard vibration.

## Best features of the new ISO standard

The new standard is undoubtedly superior in eliminating a lot of sources of ambiguity in measurement procedures and assessment. As an example, it makes a clear distinction among different types of living areas. Moreover, following the trend of modern rules, in this guideline every step of the data collection is detailed and normalised in accordance with ISO 8041.

## Position of the classification societies

The comfort classes issued by the classification societies are based on the ISO 6954 guidelines and they set both standardised procedures and admissible values. Usually, for the cabins on passenger ships the highest rating of each comfort class is lower than that of ISO 6954.

Some classification societies have accepted the point of view of shipyards and owners and consider it opportune to postpone the implementation of the 2000 version. They, therefore, allow users to optionally choose the old ISO approach instead of the new one (Table 1).

## Conclusions

The ideas of many European shipyards regarding the new ISO 6954 standard have been collected by the authors. They are persuaded that the 2000 version is not applicable to ships and support a deep review of the regulation assessment approach. The ISO group working to create the new ISO 20283 standard should also consider that for the new standard to be of practical use a series of prerequisites are essential, that is ease identification of the exciting sources, repeatability and reliability of measurements, and manageability of the assessment procedure.

It is also clear that a better understanding of the mechanism which governs the comfort perception onboard of ships is necessary for defining more reliable assessment standards. *NA*

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(2) Biot M. & De Lorenzo F. (2007). *Noise and Vibrations on Board of Cruise Ships: Are New Standards Effective?*. ICMRT '07, Ischia (Naples), Italy.

(3) Savreux K., Crouzet S., Andreau C. (2007). *Overview of comfort criteria for vibration assessment proposed by ISO 6954 and different Classification Societies*. Ship Noise and Vibration Conference, London, UK.

# DNV launches Silent notation

It's not just oil and emissions that pollute our seas, but also the often over-looked noise pollution that comes from ships, that has now been highlighted by Det Norske Veritas (DNV) new optional SILENT notation.

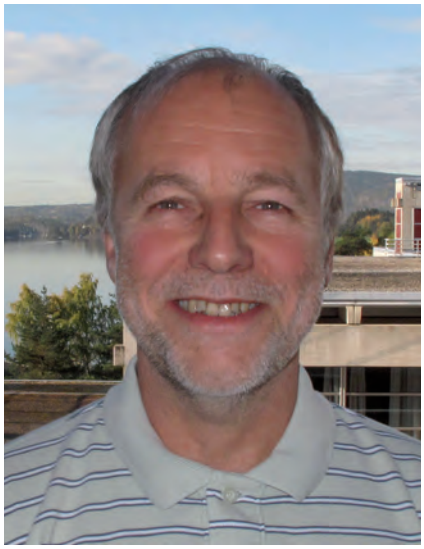
In an effort to help ship owners/ builders manage noise disturbances to underwater marine operations DNV has launched its class notation for vessel-related noise, DNV's SILENT notation.

The optional notation will help ship owners operating in different specialised segments reduce safety and environmental risks caused by noise disturbances to sensitive acoustic instrumentation and marine life. "DNV Silent will enable research vessels, fishing trawlers and different types of offshore support vessels to operate more efficiently, avoid instrumentation malfunctions and minimise their acoustic impact on marine life," says Einar Brubakk, head of section for noise & vibration, DNV.

The project started from a project between DNV and StatoilHydro to study the impact on noise and vibration on StatoilHydro's vessel when operating in deeper waters. Kai Abrahamsen, maritime principal surveyor, DNV, comments on the project: "StatoilHydro asked DNV to study the impact of vessel-related noise on sensitive acoustic instrumentation used in subsea installation communications." "After exhaustive testing, we concluded that while most vessel-related noise is related to propellers, diesel engines, generators, and water flow also contributing to underwater noise," he says.

Mr Abrahamsen highlights that water is an efficient conductor of sound and that a ships hull amplifies the noise from a ships engine and propulsion system. The SILENT notation from DNV will cover a set of criteria and rules for verification. He adds that the environmental sub notation will mean that environmentally conscious ship owners will be able to demonstrate environmental consciousness through the environmental notation and will include larger vessels.

DNV's optional notation looks to quieten the waters for future generations.



Kai Abrahamsen, maritime principal surveyor, DNV.

The SILENT notation is broken down in to separate sub-notations covering acoustics (sub notation (A), seismic (sub notation (S), fishery (sub notation (F), research (sub notation (R) and environmental (sub notation (E) vessel areas. Even with these criteria's in place it will be up to the shipyards to offer the solution needed for vessel to meet them, say DNV. DNV will be offering its consultancy services to owners who are looking to make their vessels fit with the SILENT notation.

Mr Abrahamsen points out that while there is a need for vessels to become more environmentally friendly, there will be limits to how silent a vessel can be. Research carried out by ICES 209 on two vessels under going research in to noise and vibration that employed latest technologies, showed that a vessel could be made to be almost silent, but to do this submarine technology was applied to the design. Mr Abrahamsen added that though the vessel achieved its intended purpose, it was very costly and not a practical solution for ship owners.

The SILENT notation will also cover larger vessels under the environmental sub notation (E). With larger vessels being constructed in China the future at the current moment does not look bright for noise pollution, comments Mr Abrahamsen. He adds that when the Chinese markets starts to recover from the financial downturn there will be larger vessel being constructed that will also require larger power.

"The process now is for new designs coming on to the market to include the SILENT notation. We will see vessels in the coming years with this notation. The newbuild cruise vessels will be at an advantage as they are already incorporating environmental solutions onboard," says Mr Abrahamsen.

He adds: "A lot of the bulk carriers and governments may need some incentive and need an economic and laws imposed. The vessels that will want the notation will be the ones that want to prove that they are noiseless."

The SILENT notation came in to effect in January this year and while it is still too early to see immediate results, DNV expects that ship owners with vessel that are currently sitting on drawing boards, will look to apply this notation to their vessels. *NA*

# Silence is Golden

The offshore industry has been confronted with different operational challenges mainly from vessels now being deployed in deeper and harsher waters as activities for oil exploration and production venture further from shore, the latest being the impact of noise. Guido Perla & Associates, Inc has invested in a concept that will quieten the waters.

With modern offshore vessel design trends addressing and overcoming operational challenges, vessels now have advanced to unprecedented levels of safety, efficiency, and comfort. The last, crew comfort, which is characterised by noise, vibration, indoor climate lighting levels, colour coordination, and safety, has been acknowledged as an increasing requisite in attracting and maintaining a satisfied, efficient crew and is of prime importance in modern offshore vessel designs. Vessels of any type are structures especially prone to transmitting noise and vibration due to the extensive use of steel. Not just the amount but also its shape - large, flat surfaces - propagates noise and vibration throughout the vessel. The most notorious contributors to noise are tunnel bow thrusters, followed by engines and propellers, but also hydraulic equipment, pumps, air conditioning, shaft lines, cargo handling, control equipment, and mooring machinery.

Developments in stabilising such systems and a high level of outfitting are evolving, while significantly reduced noise and vibration levels from current standards are being achieved by a combination of vessel layout, material and equipment selection, sound and vibration studies, and structural design.

One trend in the offshore industry already greatly contributing to the reduction of these disruptive factors is the utilisation of diesel-electric propulsion systems. Not only have diesel-electric systems had a positive impact on fuel efficiency and emissions due to the greater flexibility in the use of power, but also on noise and vibration reduction. Generator Set Vibration Isolation systems, which directly absorb vibration caused by the engines before it reaches and spreads throughout the hull, can be easier integrated in diesel-electric systems than in direct diesel mechanical drive systems. Conventional, purely mechanical systems can sometimes not be outfitted with such systems as the movement caused by the springs used in these isolator devices could cause damage to the rigid drive shafts.

Diesel-electric systems also allow for flexibility in arrangement, which have had beneficial effects on noise and vibration levels. Naval architecture and marine engineering firm Guido Perla & Associates, Inc. (GPA) took advantage of this flexibility and pioneered the relocation of the engine room to the main deck on a 10-vessel series of Platform Support Vessels constructed in 2007/2008. The initial motive for this arrangement was to enlarge cargo capacities below deck, which increased by up to 30% compared to similar sized vessels, but it became clear in the early design phases that this configuration would have a positive effect on noise and vibration levels for the crew, as well. Locating the engine room on the main deck simply creates an additional deck between the bow thrusters, which cannot be vibration isolated in a reliable and practical way, and the crew accommodations, extending the distance between the two. Tunnel bow thrusters can, especially on vessels with extensive dynamic positioning requirements such as offshore vessels, cause significant noise and vibration problems with propeller and drive generated noise being the main source. In any case, careful selection of the thruster type, size and design and its location is required in the early design stages to reach acceptable noise and vibration levels. One of the most economical solutions that GPA has used on their designs is to oversize the thruster and then de-rate it to the required power. This allows the propeller to work in a better load environment. Another solution has been to improve tunnel design.

Classification societies also understand the importance of maximised crew comfort levels aboard any vessels, especially during times of crew shortages and recruitment procedures, which the offshore industry has encountered in recent years partially due to the rapid replacement of older offshore vessels and the subsequent need

A modern offshore vessel designed with crew comfort in mind.

# The Royal Institution of Naval Architects

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The first offshore vessel with the engine room located above the main deck.

for competent and well-qualified mariners. While not mandatory, vessel operators can now obtain class notations regarding comfort, noise, and vibration. Particularly relevant to cruise vessels and other passenger ships, these notations have also been widely applied to ocean-going cargo ships and offshore vessels. Classification societies do not focus on crew comfort alone, but believe that ship noise will become a growing environmental issue potentially evolving into mandatory ecological regulations, aiming at limiting airborne noise in ports and harbours, as well as underwater noise pollution (radiated noise) to protect life at sea. Noise radiated by ships into the water environment is a considerable contributor to the ocean ambient noise. Such elevated noise levels created by ships can compromise sounds produced by marine animals, on which these animals rely as a means of communication, for finding food or detecting predators. Therefore, controlling acoustic effects of vessels is now a major consideration for researchers, naval architects, and operators, especially for vessels destined to operate in environmentally sensitive areas.

Vessel designs can adopt comfort notations from different classification societies to demonstrate improved crew comfort standards. Det Norske Veritas for instance issues the additional class notation COMF-V(crn) with (crn) representing the comfort rating number 1, 2 or 3, with 1 denoting the highest level of comfort and three an acceptable level. Bureau Veritas' issues COMF-VIB-Crew x and COMF-NOISE-Crew x notations. A Habitability Notation, HAB or HAB+, with the latter being the more stringent notation, can also be obtained from the American Bureau of Shipping (ABS).

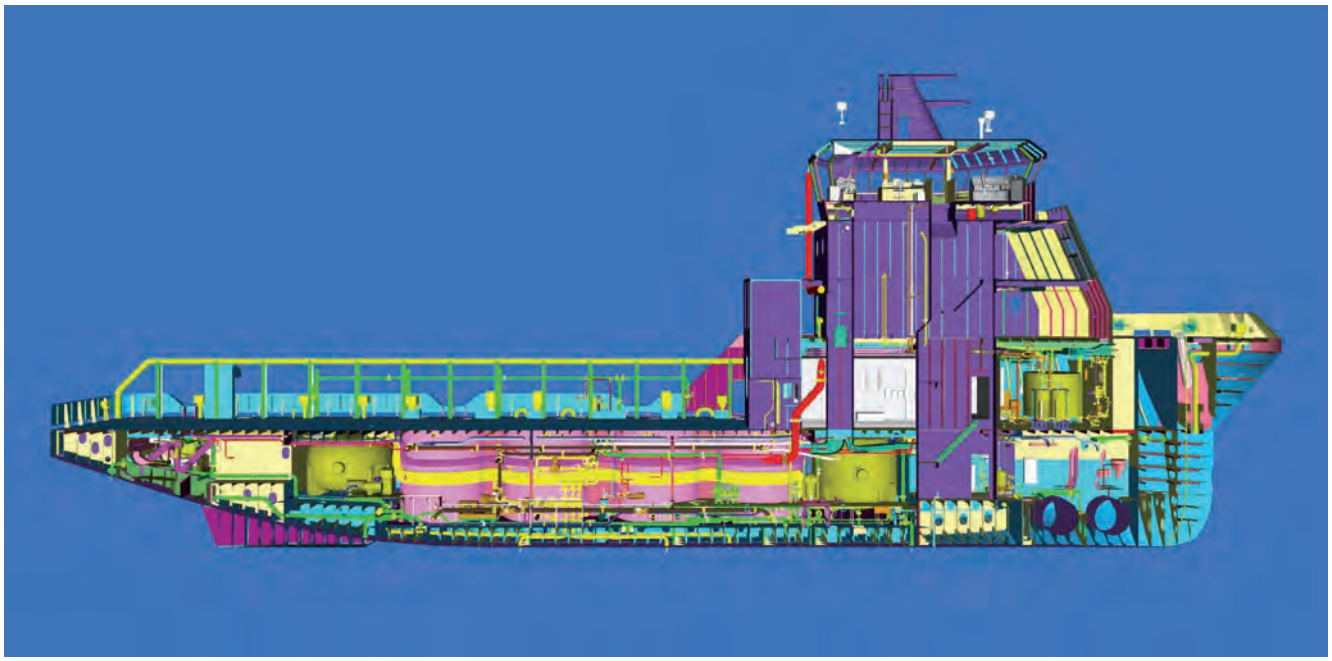
The noise and vibration levels of offshore vessels destined to operate in DP mode are usually measured with the tunnel bow thrusters in operation. Achieving an exceptional rating is very challenging for offshore vessels equipped with machinery and bow tunnel thrusters relatively large compared to the vessel size.

Naval architects and vessel operators continuously strive to further improve comfort standards and while awaiting the advent of evolving technologies, existing technologies hold possibilities not to be underestimated. An increased comfort standard is an important quality of any vessel as it improves the performance and alertness of the crew and therefore the safety on the entire vessel.

Diesel-electric propulsion systems have brought significant improvements in many areas of offshore vessel design, as well as to comfort levels in comparison with conventionally driven vessels. However, it is not a perfect system and the value depends largely on the operational profile of the vessel. To further broaden the applicability of diesel-electric propulsion systems to vessels with a wider range of operational profiles, GPA recently examined existing and new propulsion technologies and configurations to further develop solutions to these challenges with the initial aim to improve engine loads to reduce fuel consumption and improve emission levels. "In 2009, we started developing an Enhanced Diesel-Electric (EDE) propulsion concept implementable on different vessel types and capable of automatically adapting to their unique operational profiles. The concept, consisting of diesel generators, variable speed propulsion motors with fixed pitch propellers, variable frequency drives and high efficiency energy storage, currently Lithium Ion batteries, is specifically suited to offshore vessels to improve fuel economy, especially during DP operations, but is applicable to other types of vessels as well. The batteries incorporated into the EDE system act as a buffer to the power demand and allow for the system to operate within an optimum engine load range of 50-90% at all times," says Stephen Gleaves, vice president, Electrical Engineering Manager at GPA.

The EDE system, now fully developed and combining both proven and state-of-the-art technologies into a propulsion package, which provides for greater fuel efficiency with lower emissions, is also suited to a wide variety of vessel types and sizes due to its independence on a vessel's specific operational profile. Not only does the system lower a vessel's impact on the environment with regards to fuel economy and emissions but also improves noise and vibration levels by making diesel-electric propulsion more applicable. While operating on batteries or in standby mode, the airborne noise emitted by the vessel is greatly reduced, as generators will at times be shut off completely with the vessel continuing to operate at any power level required.

Like any form of power transmission, hydraulic equipment on ships generates noise, as well, with the main source of noise being the pump supplying the flow and the fluid flow within the pipes. As previously mentioned the structure of a vessel is especially susceptible to transmitting and even amplifying noise and vibration throughout the hull, including that of hydraulic equipment. The EDE system, like a standard diesel-electric propulsion system, eliminates the need for hydraulic equipment as pumps and cranes can more easily be electrically driven and with the EDE system, regenerative energy can also be captured and stored.



Navisworks Cutaway of the GPA 654 PSV showing the increased distance between the bow tunnel thrusters and crew accommodations.

While an improvement with regards to noise and vibration on one piece of equipment alone, such as a hydraulic winch being replaced by an electrically driven one, may not seem to have a great impact on crew comfort, the combined contribution of each of the above advances in vessel design can undoubtedly enhance the onboard work environment by providing a higher degree of comfort and safety. *NA*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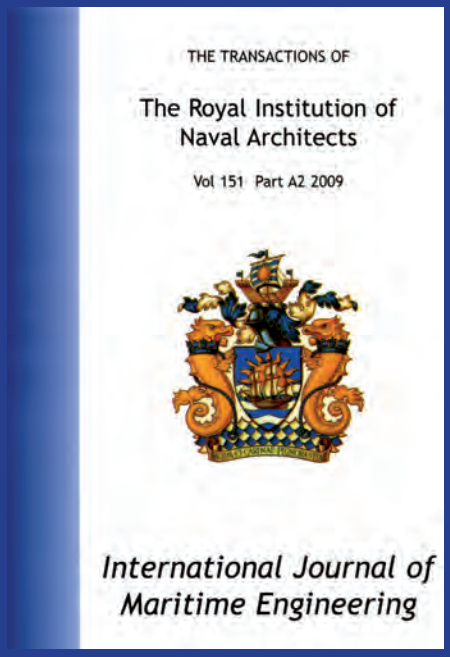


## *International Journal of Maritime Engineering 2010*

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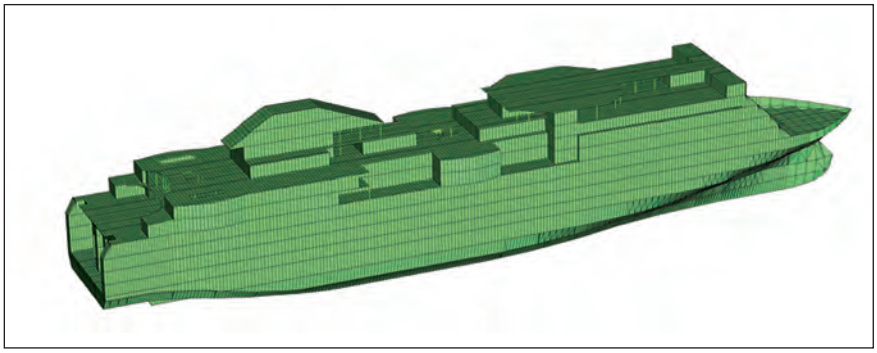
# ScanVibra studies fast ro-pax

ScanVibra, the Copenhagen based ship noise and vibration consultancy, reports on the extensive analyses and prediction studies for a 170m fast ro-pax ferry design currently under construction at Astillero Barreras, Spain.

From the early project stages, high comfort with low noise and vibration levels was a priority for the ro-pax vessel. Also, the high 24knots service speed and 34MW propulsion power implied that careful attention to noise and vibration would be important to a vessel of this type.

The propulsion system on the ro-pax ferry comprises four MAN B&W 7L48/60 medium speed engines, driving twin controllable pitch propellers through 2-into-1 gearboxes, with an open shaft arrangement. Essential for the final noise and vibration levels on this kind of vessel is the reduction of propulsion system noise and vibration "at the source". Thus the main engines have been resiliently mounted on rubber elements in order to reduce the transmission of vibration and structure-borne noise into the hull. For the propellers, shaft arrangement and aft body lines, a careful optimisation has been undertaken in collaboration with Rolls-Royce, the propeller maker, and Marin, the hydrodynamic test facility. The model scale test programme in the depressurised towing tank facility indicates that propeller cavitation and associated propeller induced noise and vibration will be at low levels relative to the high propulsion power.



An FEM model of the 170m ro-pax model currently under construction at Barreras shipyard.

Vibration analysis and hull structural design were particularly critical for this kind of ro-pax given the high propulsion power and the limitations on structural design imposed by the demand for uncluttered car deck spaces. Also special architect features, atriums, balconies etc in the superstructure passenger areas have required attention. The structural analysis was undertaken using the Finite Element method (3D-FEM) based on a global model which allowed for prediction of the vibration level in all relevant areas of the hull. Throughout the analysis, the emphasis was to minimize weight and not interfere with the vessel layout and design, whilst achieving low vibration levels with ample margins of safety towards unwanted resonance phenomena.

The noise reducing measures for the vessel were laid down based on a noise level prediction performed with ScanVibra's in-house developed ShipNP software. All relevant noise sources were integrated in the prediction model, and analysis was performed for air-borne as well as structure-borne noise transmission in the hull. Thus, systematic decisions were made on insulation, damping treatments etc reflecting the dB(A) noise level targets. Special areas of attention included ventilation and HVAC noise, and environmental noise radiated into harbour and surrounding areas.

The first vessel in the series of four vessels is planned for delivery end of 2010 to the Spanish owner Naviera Armas. In connection with the delivery, full commissioning measurements will be undertaken to validate the noise and vibration levels achieved.

The noise and vibration analyses on this Barreras fast ro-pax design are typical of the efforts, which are advisable for vessels with high comfort requirements. ScanVibra has undertaken similar engineering on a number of passenger ships and large yachts delivered during the last years or currently under construction. The company also provides relevant analysis and measurement support for cargo ships, offshore vessels and various special vessel types. Scope of work is varying and highly depends on vessel type and client requirements, but the trend is towards more systematic engineering, weight and cost reduction, and efficiency in calculations and surveys. Some owners show growing concern on environmental issues, related to harbour stay close to residential or urban areas or operation in environmentally sensitive areas. *NA*

**TECHNICAL PARTICULARS**

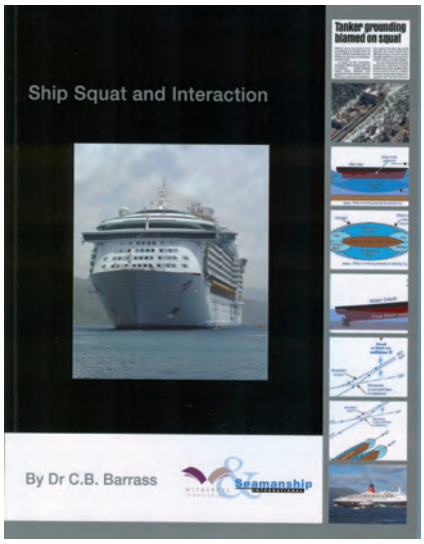
***Passenger ferry vessel***
***Hull No – 1666***

| | |
|---|---|
| Length overall | 171.55m |
| Length between perpendiculars | 159.00m |
| Moulded breadth | 26.40m |
| Depth to upper deck | 14.94m |
| Depth to main deck | 9.50m |
| Design moulded draft | 6.40m |
| Deadweight at 6.40m approx. | 4850tonnes |
| Service speed | 24knots |
| Range at service speed | 3600 miles |
| Classification Bureau Veritas: | 1 Hull MACH Ro-Ro passenger ship, unrestricted navigation, AUT-UMS, MON SHAFT, INWATER SURVEY |
| Propelleling power | 4 x 8400kW at 500rpm |
| Generating sets | 2 x 1100kW at 1000rpm |
| Emergency gensets | 1 x 270kW at 1500rpm |
| Bow thrusters: | 2 transversal variable pitch x 1100kW each, electrically driven |
| Max capacity (crew + passengers) | 1500 people |

# Ship squat and interaction

Review by E. C. Tupper

**Ship squat and interaction**
Written by Dr. C. B. Barrass, published by Witherby Seamanship International as a soft back, 2009, 182 pp. ISBN 13: 978 1 905331 60 4, £60.




The author is widely recognised as the authority on ship squat. In this book he brings together the results of many years of research.

This, his latest book, is in two parts, part 1 deals with squat and part 2 with interaction. Originally conceived as two separate books the two topics have been combined into one volume as they are so closely related. Whilst squat can be predicted with reasonable accuracy there are more variables associated with interaction of ships and guidance is more qualitative than quantitative.

Squat is defined as the decrease in underkeel clearance as a ship moves forward after being static. Interaction is the resultant effect of positive and negative forces around a ship's hull when meeting another ship or obstruction. Squat arises from forces essentially in the vertical plane and interaction from the forces in the horizontal plane. The two sets of forces will interact with each other in restricted waters. Thus two ships passing in a canal will interact with each other and both experience greater squat as they pass. The book explains the nature of the forces and how they arise.

Fifteen signs that a ship has entered shallow water are listed. Amongst others, the ship sinks bodily and may increase trim by the bow or stern; wavemaking increases; the ship becomes sluggish to manoeuvre; propeller revolutions decrease; speed drops and stopping distances increase. Depending upon the depth of water, and any constriction in width of the waterway, these effects may be severe. Decrease in underkeel clearance can be several metres, rpm loss may be 15% to 20%, drop in speed 35% or even 75% in a canal. If a ship is already trimmed when it enters shallow water that trim is likely to increase. Some masters, if finding that their ship, initially at level trim, trims by the bow on entering shallow water, try to compensate by pre-trimming their ship by the stern. The result is most likely to be that the stern trim increases. When a ship is heeled, due, say, to wind forces, she will squat transversely as well as longitudinally. Particularly for modern, beamy, ships this may cause grounding in way of the bilge rather than at the bow or stern. Thus the effects of entering restricted waters are not necessarily intuitive, and the effects can be quite large. Therefore it is important to understand these two phenomena, how they arise and how their effects can be reduced to safe levels. It is this understanding the book sets out to provide.

"Particularly for modern, beamy, ships this may cause grounding in way of the bilge rather than at the bow or stern. Thus the effects of entering restricted waters are not necessarily intuitive, and the effects can be quite large."

The two phenomena have become more apparent and important as ships have grown in size and transit at higher speeds. Increased size means that blockage effects will be greater and the forces involved increase as the square of the speed.

The book is clearly presented, easy to follow and well illustrated with over 130 photographs and diagrams, most in colour. Equations and graphs provide a means of assessing the magnitude of the effects and their use is illustrated in a number of worked examples. Additional set questions are listed in each part. A number of case studies provide an insight to the problems and how the risks to a ship can be reduced.

Mariners will frequently experience squat and interaction in their every day lives. Indeed, they cannot avoid them and may even on occasion be able to use the forces involved to their advantage. Since the results of any misjudgement, can be serious for a ship, her crew and the environment, masters, mates and pilots must understand the phenomena and their potential magnitude. They must also be taken into account by the designers of ships and of the ports and waterways these vessels use.

Bryan Barrass is to be congratulated on bringing together so much research and operational experience in one volume. It can be regarded as the definitive work on these topics. *NA*

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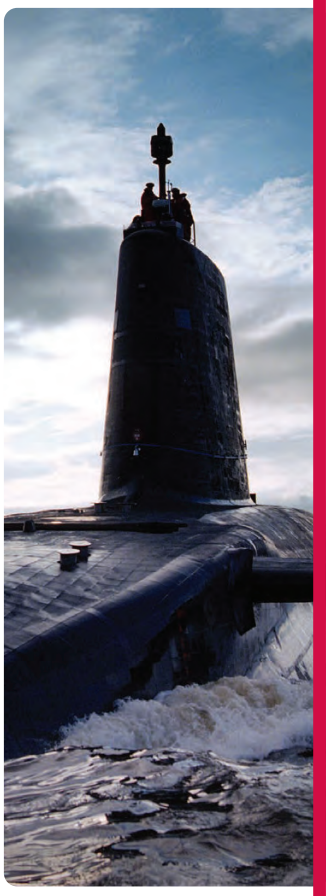

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From the
**30th of August to 2nd of September 2010**

The second Summer School organised by the FP6 Hydro-Testing Alliance Network of Excellence (HTA-NoE) consortium will take place from the 30th of August to the 2nd of September 2010, at MARINETEK, in Trondheim, Norway.

The aim of the Summer School is to provide the participants with an understanding of the fundamentals of model testing and technologies used to aid model tests. The topics will include “3-D Wave field measurements”, “Wireless data transmission”, “Free running model technology” and “Wetted surface area” measurement techniques. The Summer School will comprise of formal lectures as well as practical demonstrations in each topic. The final day of the course will consist of a career’s fair with the participation of the major hydro-testing facilities in Europe and where participants will be interacting with other researchers already working for these marine model testing institutions.

The course is intended for students in their final year of undergraduate studies or doing postgraduate studies and researchers who require understanding of the principles behind model testing technologies.

Lecture notes covering the course will be distributed to participants on arrival. All lectures and lecture notes will be given in English and a certificate of attendance will be given to all participants at the end of the Summer School.

For further details please visit the HTA-NoE project website (http://hta-noe.eu) or for other queries please e-mail ana.mesbahi@ncl.ac.uk.

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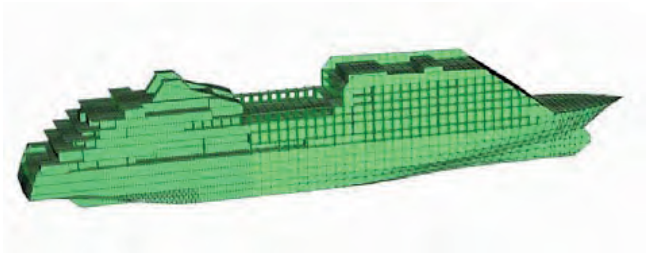

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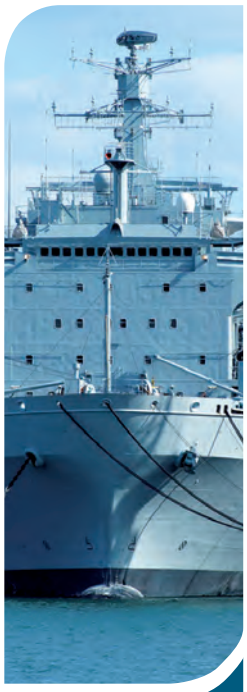

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**Sea Japan 2010**, international conference, Tokyo, Japan.
**Contact** Seatrade Communications Ltd, Seatrade House, 42 North Station Road, Colchester, CO1 1RB, UK.
**Tel** +44 1206 545121
**Fax** +44 1206 545190
**E-mail** jdrury@seatrade-global.com
**www**.seajapan.ne.jp

**May 3-6, 2010**
**OTC 2010**, international conference, Houston, USA.
**Contact** Offshore Technology Conference, P.O. Box 833868, Richardson, Texas, USA 75083-3836.
**Tel** +1 972 952 9494
**Fax** +1 972 952 9435
**E-mail** service@otcnet.org
**www**.otcnet.org/2009/2010.html

**May 11-14, 2010**
**Basic Dry Dock Training Course, training course**, London, UK.
**Contact** Conference Department, RINA, 10 Upper Belgrave Street, London, SW1X 8BQ, UK.
**Tel** +44 20 7235 4622
**Fax** +44 20 7245 6959
**E-mail** conference@rina.org.uk

**May 18-29, 2010**
**RoRo 2010, international conference**, Bremen, Germany.
**Contact** IIR Exhibitions, An Informa Business, Fifth Floor, 29 Bressenden Place, London SW1E 5EW, UK.
**Tel** +44 20 7017 4493
**Fax** +44 20 7017 7818
**www**.roroex.com

**May, 2010**
**Innovation in High Performance Sailing Yachts (INNOV'SAIL 2010), international conference**, Lorient, France.
**Contact** Conference Department, RINA, 10 Upper Belgrave Street, London, SW1X 8BQ, UK.
**Tel** +44 20 7235 4622
**Fax** +44 20 7245 6959
**E-mail** conference@rina.org.uk

**June 7-11, 2010**
**Posidonia 2010, international conference**, Athens, Greece.
**Contact** Posidonia Exhibitions SA, 4-6 Efplias Street, 185 37 Piraeus, Greece.
**Tel** +30 210 4283608
**Fax** +30 210 4283610
**E-mail** posidonia@posidonia-events.com
**www**.posidonia-events.com

**June 9-10, 2010**
**Warship 2010: Refit, Repair and Maintenance**, international conference, London, UK.
**Contact** Conference Department, RINA, 10 Upper Belgrave Street, London, SW1X 8BQ, UK.
**Tel** +44 20 7235 4622
**Fax** +44 20 7245 6959
**E-mail** conference@rina.org.uk

**June 9-11, 2010**
**UDT Europe, international conference**, Hamburg, Germany.
**Contact** Clarion Defence and Security ltd, Earls Court Exhibition Centre, London, SW5 9TA.
**Tel** +44 20 7370 8632
**Fax** +44 20 7370 8815
**E-mail** enquiries@dsei.co.uk
**www**.udt-europe.com

**June 14-17, 2010**
**CIMAC 2010, international conference**, Bergen, Norway.
**Contact** CIMAC Central Secretariat, c/o VDMA e. V. Lyoner Strasse 18, 60528 Frankfurt, Germany.
**Tel** +49 69 6603-1567
**Fax** +49 69 6603-2355
**E-mail** CIMAC@VDMA.ORG
**www**.cimac.com

**June 15-17, 2010**
**Seaworks 2010, international conference**, Southampton, UK.
**Contact** Seawork Team, The Old Mill, Lower Quay, Fareham,Hampshire, PO16 0RA,UK.
**Tel** +44 1329 820479
**Fax** +44 1329 825330
**www**.seawork.com


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