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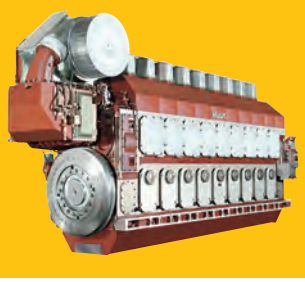

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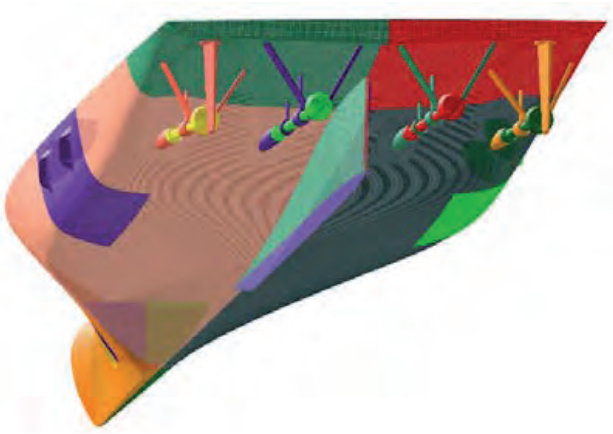
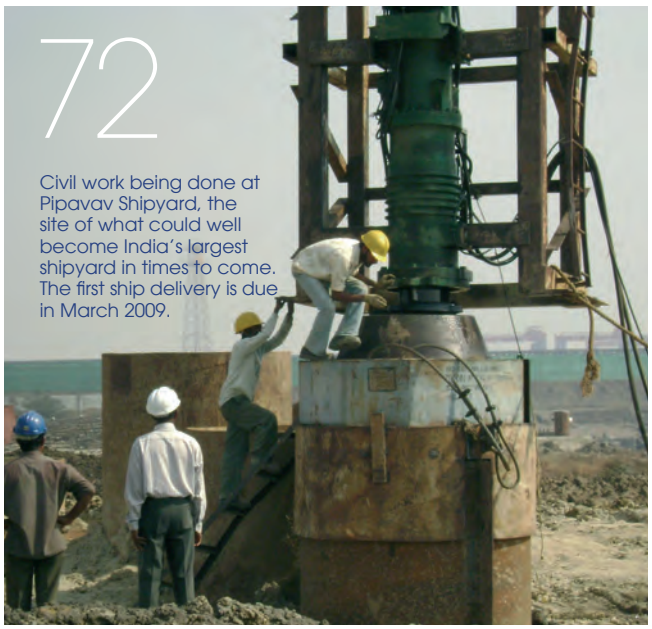


72 Civil work being done at Pipavav Shipyard, the site of what could well become India's largest shipyard in times to come. The first ship delivery is due in March 2009.



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Safety pressures mount on newbuild surge

DNV monitors the annual frequency of serious accidents, and has established a disturbing trend.

A worrying study has emerged from Det Norske Veritas, which confirms that, in a crucial aspect, accidents involving ships are on the increase, after years when shipowner associations were able to claim that the number of incidents was in decline.

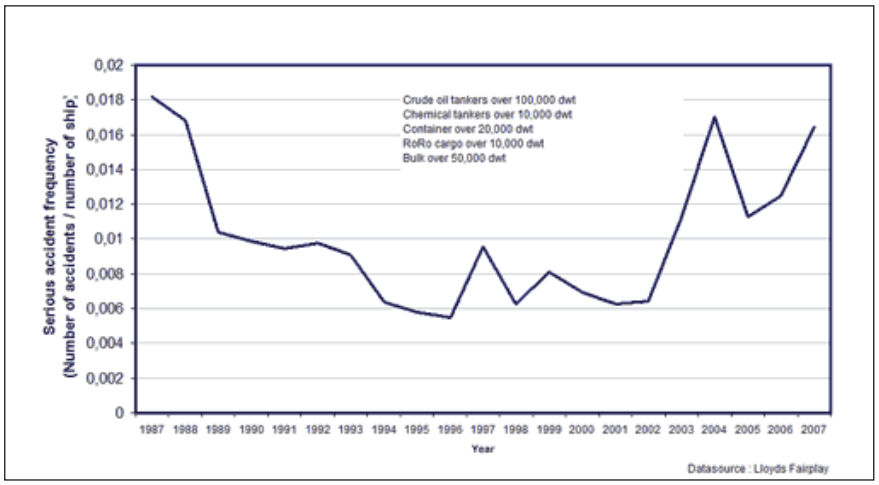
Updated figures for 2007 show that the losses from navigational accidents within the shipping industry are continuing to increase. This trend is also confirmed by the insurance industry, DNV says. Premiums may increase by as much as 30% in 2008.

DNV monitors the annual frequency of serious accidents. Over the past five years, there has been an increasing incidence of serious navigational accidents in several shipping segments. This increase is confirmed by leading insurance companies such as Skuld, Norwegian Hull Club, and The Swedish Club.

In addition to the increasing frequency of navigational accidents, DNV says that the cost of each repair caused by accidents is rising. At this time, yards are overbooked, making it hard to find a repair slot and resulting in increased prices. Collisions, groundings, and contacts now account for 60% of the most costly accidents.

Dr Torkel Soma, principal safety consultant, DNV Maritime, says: 'DNV's statistics show that a ship is twice as likely to be involved in a serious grounding, collision, or contact accident today compared to only five years ago. In addition, estimates also show that the costs of these accidents have doubled. Since this is the general trend for the international commercial fleet, the maritime industry needs to act on this immediately.'

DNV points out that one consequence of the boom in the shipping market and increased deliveries of newbuildings has been an increase in the pressure on crews. 'The shortage of officers has resulted in lower retention and faster promotion,' the class body says. 'As a result, the general level of experience is decreasing onboard. At the same time new technical solutions have been introduced which might have increased the complexity of operations.'



Navigational accident frequency for various ship segments.

Dr Soma says: 'Reliable technology and complying [with] manuals are no assurance against making errors. Collisions, groundings, and contact accidents do almost always involve human acts.'

Helge Kjeøy, regional manager, DNV Maritime South East Asia adds: 'The main factors explaining the negative developments over the past few years are that the undersupply of crew worldwide results in reduced experience and that the high commercial pressure results in a high workload. Adding new and more complex equipment [alone] does not help the situation. Avoiding accidents under such situations requires a good safety culture, something which the maritime industry evidently needs to focus more on.'

The experience of leading shipping companies shows that the focus has to be turned more in the direction of human elements and organisational factors, including all those involved - from the directors of the company to the officers on the bridge. Dr Soma sums up: 'Radical safety performance improvements with reduced accident frequency have been achieved through a structured approach addressing behaviour and culture. For the industry to maintain its traditional good track record, the resilience of operations has to be addressed on a larger scale by industry players.' *NA*

Regulation

Bahamas backs IMO Conventions

The Bahamas has acceded to two major IMO conventions: the International Convention on the Control of Harmful Anti-fouling Systems on Ships, 2001 (AFS Convention) and the International Convention on Civil Liability for Bunker Oil Pollution Damage, 2001 (Bunkers Convention).

The AFS Convention, which will prohibit the use of harmful organotins in antifouling paints used on ships and establish a mechanism to prevent the potential future use of other harmful substances in antifouling systems. The AFS Convention will enter into force, generally and for the Bahamas, on 17 September 2008. Accession by the Bahamas brings the number of States having ratified the Convention to 28 and the tonnage figure to 43.79% of the world's fleet.

The 2001 Bunkers Convention was adopted to ensure that adequate, prompt, and effective compensation is available to persons who suffer damage caused by spills of oil, when carried as fuel in ships' bunkers, and will enter into force, both generally and for the Bahamas, on 21 November 2008.

Cruiseships

Fincantieri signs for luxury pair

Fincantieri and the French owner Compagnie des Iles du Ponant (CMA CGM Group) have signed a preliminary agreement to build two super luxury, small cruiseships. The two ships will be similar in size to megayachts.

The 10,500tonne ships, which will fly the French flag, will be approximately 140m long and 16m wide. Passengers will be accommodated in 134 cabins and suites - all with external view - and 75% of which will have a private balcony. Delivery is due in the first six months of 2010.

The interior furnishings of these luxury ships will be designed on 'a human scale', the builder said, with great attention to detail.

Offshore

Island Constructor is launched

The largest ship to feature the innovative Ulstein X-Bow to date, *Island Constructor*, was launched last month by Norwegian builder Ulstein Werft.

The ship will be delivered to Island Offshore at the end of May. She is first of the Ulstein S series, and will be fitted with a large tower in order to carry out state-of-the-art well intervention offshore. The Ulstein SX121 measures 120.2m long and 25m wide. From the beginning of 2008 through the end of 2010, Ulstein Design will deliver 20 Ulstein X-Bow ship designs to seven shipowners.

Island Constructor is a majestic sight. Photo courtesy: The Ulstein Group/Fuglefjellet.

Heavylift

L&T bags new Rolldock order

India's engineering and shipbuilding giant Larsen & Toubro has secured from Dutch heavylift operator RollDock an order for two heavylift carriers, to add to the six ordered earlier by the European newcomer, *writes Shirish Nadkarni in Mumbai*.

The 8230dwt semisubmersible, multi-functional and ultra-flexible vessels are being made at the Mumbai-based company's Hazira shipyard, and are scheduled to be delivered between the end of the third quarter of 2009 and early-2011.

Work on the original order, which was placed in 2006, is in full swing; and the first of the sophisticated units is being delivered in September this year. Thereafter, deliveries will be made at four-month intervals until July 2010. The two additional ships just ordered will be delivered by end-2010 and by the end of the first quarter of 2011.

Each ship is powered by a double Wärtsilä propulsion plant of 9000kW installed power, developing 18knots, and has two variable pitch propellers, two rudders, three Caterpillar auxiliary engines, and Wärtsilä bow thrusters. The vessel also boasts two 350tonne capacity Liebherr cranes.

A highlight of the 142.3m long, 24m wide RollDock vessels is that they need a minimum draught of just 5.6m, which means they can call at ports with limited water depths. While the submerged draught is 11.9m,

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the hold is 116.2m long and 19m wide.

With GL Ice Class E2 certification, the vessels are billed as extremely reliable and safe. They have already been booked for service between Thailand and Australia, to carry equipment for Woodside Petroleum's Pluto Project.

Containerships

Ice-going pair for Aker

Aker Yards has been awarded a contract by Royal Arctic Line A/S in Nuuk (Greenland/Denmark) to build two ice-going containerships for Arctic operation. The total contract value is about €80 million. Delivery by Aker Yards Germany is scheduled in the second and third quarter of 2010.

The two new ships are of the type Aker ACS 587 which fulfils the latest international demands. Both vessels have high ice class 1A, and are 113.0m long and 22.7m wide. The basic design was developed by Royal Arctic Line according to their needs in the Arctic environment. With deadweight of 8550tonnes the ships have a total container stowage capacity of 587TEU each with 237 reefer sockets (FEU), of which 130 reefer containers can be transported in holds. With a main engine (MAN B&W 6S46MC-C) output of 7860kW and a controllable pitch propeller plant they reach a speed of 15.3knots. The ships will be equipped with a bow and stern thruster of 780kW each and two cranes with a capacity of 45tonnes SWL at 29.8m each.

The largest azimuthing propulsors using the mechanical geared transmission principle to date.

Propulsion

Steerprop for the Arctic

Steerprop has been chosen by two Russian shipowners operating Arctic vessels to engineer and build the largest azimuthing propulsors of mechanical geared transmission principle to date.

The four icebreakers are being built, with two from Baltiysky Zavod, St Petersburg, Russia for RosMorPort and the other pair from Keppel Singmarine in Singapore for Lukoil.

The two RosMorPort's line icebreakers are 114m long, and 27.5m wide. The design draught is 8.5m, speed 17knots. The vessels are specified to operate at the speed of 3knots in level ice of 1m having snow cover of 0.1m-0.2m. The ships will substantially improve the marine and environmental safety of the oil transport in the Baltic Sea.

The Steerprop SPO 4.5 ARC azimuthing propulsion units will be built to the rules of RMRS, ice class LL6. Each unit is able to transmit 8000kW from the electric drive motor to the 4500mm diameter, open built-up propeller made of stainless steel. The azimuthing function is actuated by electric motors, typical to Steerprop azimuth propulsors. The electric steering with frequency converters is an excellent solution to ice operation for accurate and smooth control.

The Arctic Supply Vessel for Lukoil was recently launched by Keppel Singmarine.

The two Lukoil Arctic vessels will support the Varandey Terminal in the Barents Sea. They are being built to different specifications: the Arctic Supply Vessel is 81.6m long, 18.5m wide; the draught is 9.1m. The two Steerprop SPO 4.0 ARC units are to transmit 5200kW each through the propeller of 4.0m diameter. According to RMRS rules the ice class is LU6. The icebreaker is 100m long, 21.7m wide, and the draught is 10.5m. The twin Steerprop SPO 4.5 ARC units transmit through 4.5m open propeller 8400kW each. They are the largest geared azimuthing propulsors built. *NA*

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Propulsion

Wärtsilä drives on

Wärtsilä has been awarded a contract for propulsion systems to be installed in the five chemical tankers to be built for Iason Hellenic Shipping Co, Greece, at the Pha Rung shipyard in Haiphong. Each vessel will be equipped by Wärtsilä with a five-bladed fixed-pitch propeller of 4.3m diameter, shafting, stern-tube including seals and bearings, and an intermediate shaft bearing.

A greater scope of supply will be delivered by Wärtsilä to Vinashin for eight car carriers to be built for Ray Car Carriers Ltd, Israel. For each vessel, Wärtsilä will deliver a five-bladed Wärtsilä fixed-pitch propeller of 6.45m diameter, together with shafting, stern-tube seals, shaft bearings, and two Wärtsilä transverse thrusters with capacities of 1000kW each. The contract for these propulsion systems was signed at the beginning of the year.

Wärtsilä also recently received an order via the Ben Kien Shipyard in Haiphong that involves the supply of a propulsion package for a 564TEU multi-purpose carrier to be built for fellow Vinashin subsidiary Hai Duong Shipbuilding & Shipping Co. The vessel, designed by Marine Design & Research Institute of China, will be 115.0m long and feature a moulded breadth of 20.8m.

The Wärtsilä propulsion package will comprise an eight-cylinder Wärtsilä 38 diesel engine, 4.40m-diameter four-bladed controllable-pitch (CP) propeller, shafting, reduction gearbox, stern tube, and shaft seals. The Wärtsilä CP propeller will be equipped with a Lipstronic 7000 pitch control system, while the overall engine control will be provided by a Wärtsilä Unified Controls (UNIC) C-2 system. The main engine will develop a maximum continuous power of 5800kW at 600rev/min.

The propulsion package will be delivered to the shipyard in January 2009.

Contact Wärtsilä Corp, John Stenbergin ranta 2, PO Box 196, FIN-00531 Helsinki, Finland
Tel +358 10 709 0000
Fax +358 10 709 5700
www.wartsila.com

Ancillary equipment

RR's Vietnam marker

Rolls-Royce Marine is stepping up efforts to break into the Vietnamese market. The company opened new offices in Hanoi in January. A Rolls-Royce representative said the supplier had already secured two orders for its Syncrolift ship lifting system for two Ministry of Defence yards – the Song Tu yard and 189 Shipbuilding Co (of Haiphong), and was in negotiations over a third deal.

The company is also reckoned to be in discussions with Vinashin over a joint venture that would look to supply complete propulsion packages, as well as deck machinery.

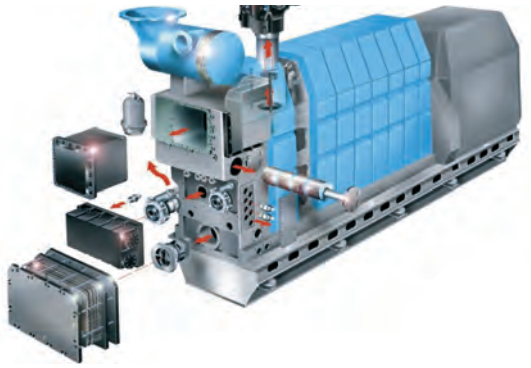
Contact Rolls-Royce International Ltd, Unit 402, 4th floor Asia Tower Building, 6 Nha Tho Street, Hoan Kiem District, Hanoi, Vietnam
Tel +84 4 9380 228
Fax +84 4 9380 230
www.rolls-royce.com

Power

Peter Brotherhood steams in

Fred. Olsen Production has chosen UK engineering company Peter Brotherhood Ltd to supply two condensing steam turbine generator sets for FPSO *Knock Allan*, a vessel which will be deployed in the Olowi field off the coast of Gabon. Reckoned to be the world's most powerful turbines to be installed on an FPSO, each 27MW generator set comprises a turbine, gearbox, and generator, all mounted on a common bedplate which incorporates the oil system.

The turbines will accept steam from gas fired boilers on the vessel and will exhaust to a separate condenser, also supplied by Peter Brotherhood. The generator sets will incorporate features to enable them to operate reliably in a floating environment where they can be affected by, for example, the pitch and roll of a ship.



One of the 27MW steam turbine-driven generator sets delivered to Fred. Olsen Production.

The sets have been tested at Peter Brotherhood's manufacturing facility and will be delivered to Dubai Drydocks for installation on the top deck of *Knock Allan*. The vessel is currently being converted from a tanker into an FPSO and it will be able to store 1 million barrels of oil and produce 22,000 barrels per day once operational.

Contact Peter Brotherhood Ltd, Werrington Parkway, Peterborough PE4 5HG, UK
Tel +44 1733 292200
Fax +44 1733 292300

E-mail sales@peterbrotherhood.co.uk
www.peterbrotherhood.co.uk

Coatings

International gets certified

International Paint Ltd's Intershield 300 abrasion-resistant, aluminium pure epoxy coating has been awarded Lloyd's Register's first IMO performance standard for protective coatings (PSPC) type approval certificate.

Mike Hindmarsh, worldwide marine business development manager, International Paint, is in favour

Michael Hindmarsh (right), business development manager, International Paint, receives the Intershield 300 Type Approval Certificate from David Howarth, global technology leader, Lloyd's Register.

of the new certification: 'We have always supported the introduction of a standard that would help increase the service life of coatings for seawater ballast tanks and directly contribute to improved safety of life at sea.'

The requirements of the PSPC certification state that coatings must either pass stringent laboratory testing, be subjected to inspection and confirmation that the coating has provided a minimum of five years of good service performance, or gain existing B1 Marintek approval.

In addition to this, to meet the Lloyd's Register standard, coatings must meet the approved supplier criteria for each supply location, as set out in IACS UR Z17 and PR34. This includes the provision that if the manufacturer makes coatings in different locations under the same product name then infrared identification shall be used to demonstrate that the coating is of the same high quality and specification.

Lloyd's Register has also recognised International's Technical Service training programme for coatings inspectors as having equivalent merit to NACE Coating Inspector Level 2 and FROSIO Inspector Level III qualifications.

Contact International Paint Ltd, Stoneygate Lane, Felling, Tyne and Wear NE10 0JY, UK
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Fax +44 1914 383711
www.internationalpaint.com

CAD/CAM update

CFD gives RAPID results

MARIN's CFD technology is now said to give a good numerical alternative for the flow-aligned orientation of hull appendages. Several correlation studies have been made between experimental and computational results to corroborate the reliability of the numerical predictions, using two sets of experimental data comprising predictions by the inviscid flow code RAPID and the viscous flow code PARNASSOS.

The PARNASSOS results compared quite well with the experiments, suggesting that CFD can give a detailed picture of the flow in the vicinity of a strut, provided that free surface deformation, sinkage, and trim are taken into account. It can also give guidance in the twisting of the strut, or in choosing a proper mean orientation angle.

A claimed advantage of using CFD is that information on the complete flow field is obtained. This is said to provide better advice to customers.

Contact MARIN, 2 Haagsteeg, PO Box 28, 6700 AA Wageningen, The Netherlands
Tel +31 317 49 39 11
Fax +31 317 49 32 45
E-mail info@marin.nl
www.marin.nl

Steering

Record-breaking Becker

Becker Marine Systems has received the largest joint order in its history for rudders to be installed aboard container vessels being constructed at Hyundai Heavy Industries' (HHI) shipyard in Korea. The contracts mean that Becker is equipping around 60% of all container vessels larger than 10,000TEU under construction at HHI until 2011.

TLKSR type rudder systems will be fitted to the containerships, and nearly 200 of this rudder type have been ordered and designed to date. These twisted leading edge rudders are claimed to reduce fuel consumption and avoid cavitation erosion on rudder surfaces of large and fast vessels.

Becker has already begun designing the second generation of its twisted rudder system, with new designs including the VORTEX-B-Deflector and the VORTEX-

Becker managing director Henning Kuhlmann with a model of the new TLKSR design.

S-Deflector. Both versions will be designed and tested to deflect the hub vortex that is created with certain propeller configurations.

The VORTEX-S-Deflector design will be applied to the rudders ordered for HHI, and all new orders from Becker will be thus equipped.

Contact Becker Marine Systems, Neuländer Kamp 3, D-21079 Hamburg, Germany
Tel +49 40 24199 0
Fax +49 40 2801 899
www.becker-marine-systems.com

Propulsion

Heavylifters receive MAN power

SeaMetric International, of Norway, has ordered a package of 24 MAN Diesel 8L27/38 marine generating sets to be fitted onboard four specialised heavylift transport vessels. Additionally, a memorandum of understanding has now been agreed between the two companies for future identical gensets to power planned newbuildings.

Six gensets have been ordered for each of SeaMetric's four twin marine lifter ships. The sets will power a diesel-electrical propulsion and positioning system with four thrusters.

Two of the DP3-type vessels are 140m long, with a deadweight of 25,000tonnes, whilst two are 180m long with a deadweight of 35,000tonnes. All have a beam of 40m, available accommodation for 41 persons, and will be capable of submersion to -20m.

The heavylift vessels will be capable of transporting very large construction sections, jack-up drill rigs, and the majority of semisubmersible drilling rigs, as well as topsides modules and other major loads. The gensets will be supplied from MAN Diesel's Korean licensee, STX Corp, during the second and third quarters of 2009, and China National Petroleum Co's Liahoe Shipyard will deliver the first vessels in the fourth quarter of 2009.

Graphic impression of SeaMetric's twin marine lifter system.

Contact MAN Diesel A/S Teglholmsgade 41, 2450 Copenhagen SV, Denmark
Tel +45 3385 1100
Fax +45 3385 1030
E-mail mandiesel-cph@mandiesel.com
www.mandiesel.com

Lifesaving

New freefall in tankers

Schat-Harding is introducing the FF750/LA750 fully integrated lifeboat and davit system for use on tankers and bulk carriers. The system was designed and tested in Norway and has entered production in Qingdao, China, with first deliveries scheduled for early summer 2008.

The freefall system has a skid angle of 45degs, saving almost a metre in length for the installation, compared to older designs with similar capacity. The FF750 boat can accommodate 32 persons, and the seating has been configured to be more spacious than the requirements set down for international regulations. Specially adapted seats also make boarding easier.

The boat is constructed from fibreglass reinforced polyester, and has a length of 8.97m. It will weigh 4820kg fully equipped and 7700kg fully loaded. Although it has been safely tested to 30m drop heights, its certified drop height will be 23m.

The bow design is configured to give a soft water entry and reduce g-forces on the occupants, while at the same time producing optimum surfacing speed for the typical merchant ship drop heights, allowing the boat to speed clear of the ship under its drop momentum. A freefall simulator system is also available, which allows crews to train in safety.

Contact Umoe Schat-Harding AS,
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Speed loss due to added resistance in wind and waves

Professor Kwon* presents an extension to the original approximate formulae, developed by Dr R L Townsin and the author in 1983, to include block coefficient (C_B) 0.55 – 0.85 and Froude Number (F_n) 0.05- 0.30.

The weather formulae used in this paper are based on interpretations of detailed calculations of speed loss due to wind (van Berlekom: Ref 2), motions (Maruo: Ref 3), and wave reflection resistance (Kwon: Ref 4). These methods have been recommended in ISO 15016 (Ref 5). Some comparisons are presented, for series 60 hullforms, between the results of the new proposed approximate formulae and the ones of detailed calculation as shown in Fig 1. The results of the formula were also compared with some published model test data (Takahashi et al: Ref 9) full-scale data (Aertssen: Ref 8). The comparison revealed that the formula provides a good approximation for practical purposes.

Introduction

There are a number of reasons for determining speed loss at sea due to weather, for example:

- To analyse sea trial data
- To improve estimation of a service power margin
- To determine accurate optimum speed for fuel economy
- To improve performance descriptions in connection with chartered party conditions

The added resistance due to wind may be readily estimated on the basis of coefficients derived from wind tunnel tests or inverted ship model tests in a towing tank. For example, van Berlekom, (Ref 2) provides a good account of these procedures together with worked examples.

Unfortunately, it is difficult to determine acceptable values of the added resistance due to waves. This has been continually reported and discussed by the Seakeeping and Performance Committees of the International Towing Tank Conferences (ITTC) in 1978 (15th) and 1981 (16th). One of the main reasons for the inaccuracy is that most conventional methods hardly take account of the accurate added wave resistance caused by wave diffraction and reflection, which is nonlinear in nature. Another difficult problem is that estimating the added wave resistance is too complicated to use practically, as shown in Fig 1. To solve the above mentioned problems the author has presented both methods for the first problem (Ref 4) and with Dr Townsin the second problem (Ref 1 and Ref 6). The methods in references 4 and 6 have recently been recommended by the ISO 15016 guidelines (Ref 5). However, the method presented in reference 4 is a computer-based one using NAG library routine and is still the tool of the research worker rather than the practioner and reference 1 is only applicable for the case of block coefficients C_B=0.62, F_n=0.25 and C_B=0.8, F_n=0.15. Moreover, reading values off a scale on the graphs in reference 6 is still not very convenient to use and the calculations of added wave resistance in oblique seas inspire less confidence than head sea calculations.

The purpose of this paper is to provide a simpler and easier way to estimate the effect of wind and waves over a wider range of parameters as follows:

- Extending Townsin-Kwon's approximate formulae (Ref 1) to include block coefficients (C_B) from 0.55 to 0.85
- Extending Townsin-Kwon's approximate formulae (Ref 1) including Froude number (F_n) from 0.05 to 0.30

Approximate formulae

The formulae are intended to provide an estimate of the percentage speed loss in bad weather when that weather is

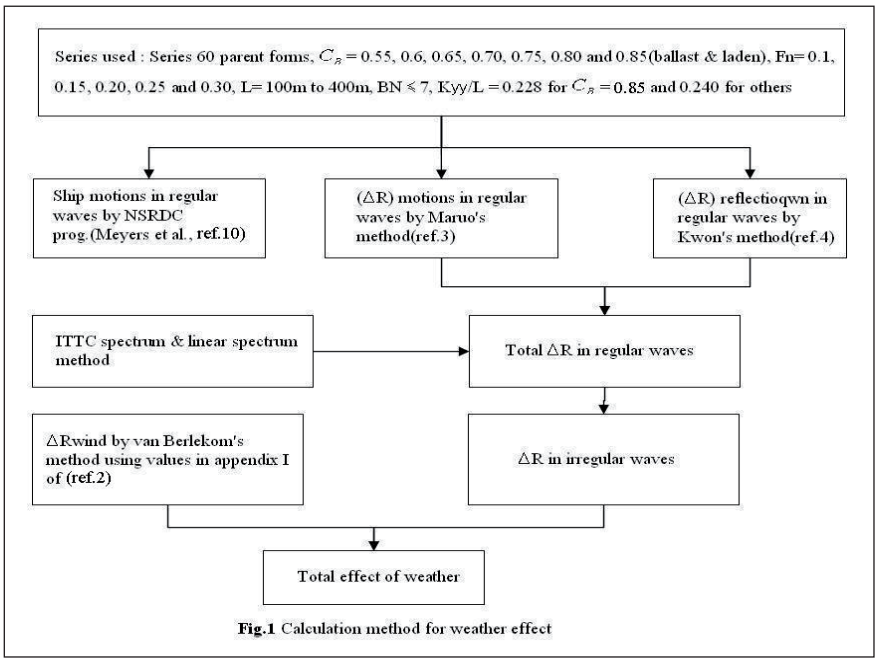

Fig.1 Calculation method for weather effect

*Y J Kwon, MSc, PhD, FRINA, School of Naval Architecture and Ocean Engineering, University of Ulsan, Republic of Korea

described simply in terms of Beaufort scale (BN), the correction factor (α) for block coefficient and Froude number, and weather direction reduction factor (μ). The head weather formulae are derived from calculations for containerships in their normal service condition and for tankers both laden and in ballast, thus representing both fine and full forms.

The percentage of speed loss is given by

$$\alpha \cdot \mu \cdot \frac{\Delta V}{V} 100\%$$

Where:

- ΔV speed loss due to head weather
- V design service speed
- $\frac{\Delta V}{V}$ is the speed loss in head weather given by equation (1)
- α is the correction factor for block coefficient (C_B)and Froude number(F_n) given in Table 1
- μ is the weather direction reduction factor given by equation(2)

C_B	Condition	α (correction factor)
0.55	normal	$1.7 - 1.4F_n - 7.4(F_n)^2$
0.60	normal	$2.2 - 2.5F_n - 9.7(F_n)^2$
0.65	normal	$2.6 - 3.7F_n - 11.6(F_n)^2$
0.70	normal	$3.1 - 5.3F_n - 12.4(F_n)^2$
0.75	laden or normal	$2.4 - 10.6F_n - 9.5(F_n)^2$
0.80	laden or normal	$2.6 - 13.1F_n - 15.1(F_n)^2$
0.85	laden or normal	$3.1 - 18.7F_n + 28(F_n)^2$
0.75	ballast	$2.6 - 12.5F_n - 13.5(F_n)^2$
0.80	ballast	$3.0 - 16.3F_n - 21.6(F_n)^2$
0.85	ballast	$3.4 - 20.9F_n + 31.8(F_n)^2$

Table 1. Values of correction Factor α.

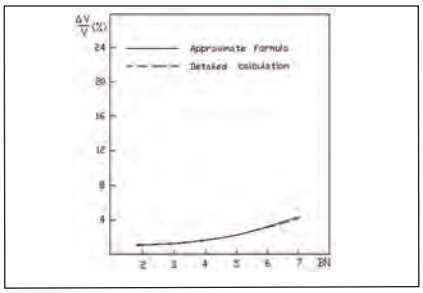

Fig 2 C_B = 0.60 (normal) F_n= 0.30 ∇ = 204,700m³.

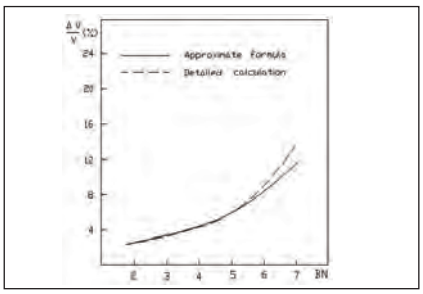

Fig 3 C_B = 0.70 (normal) F_n= 0.20 ∇ = 273,000m³.

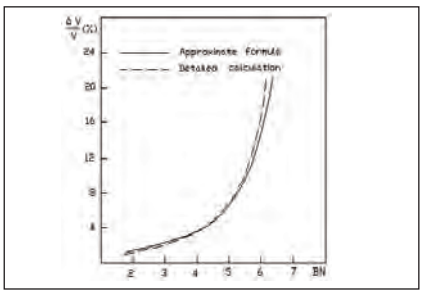

Fig 4 C_B = 0.80 (normal) F_n= 0.10 ∇ = 484,200m³.

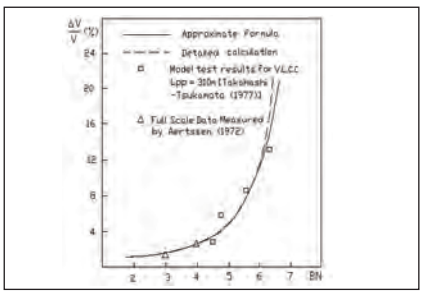

Fig 5 Comparison of the approximate formula with detailed calculation, model tests, and full scale data.

Head weather percentage speed loss

For C_B = 0.75, 0.80, and 0.85, vessel in laden condition (all ships except containerships):

$$\frac{\Delta V}{V}100\% = 0.5BN + \frac{BN^{6.5}}{2.7\nabla^{2/3}} \quad \text{(Eq 1 a)}$$

For C_B = 0.75, 0.80, and 0.85, vessel in ballast condition (all ships except containerships):

$$\frac{\Delta V}{V}100\% = 0.7BN + \frac{BN^{6.5}}{2.7\nabla^{2/3}} \quad \text{(Eq 1 b)}$$

For C_B=0.55, 0.60, 0.65, and 0.70, vessel in normal condition (containership):

$$\frac{\Delta V}{V}100\% = 0.7BN + \frac{BN^{6.5}}{22\nabla^{2/3}} \quad \text{(Eq 1 c)}$$

BN is Beaufort Number and ∇ is volume of displacement in m³.

Weather direction reduction factors

Weather direction has a marked effect upon speed reduction even to the point of increasing propulsion in following weather at low Beaufort numbers when the motions are small. At present, calculations of added wave resistance in oblique seas inspire less confidence than head sea calculations, the latter of which show some agreement with model test result. The view has been taken therefore that weather direction corrections to the head sea results are best derived from full scale data.

Advantage has been taken of Professor Aertssen's formula (Ref 7) for calculating the effect of weather direction. The ratio of speed loss in oblique weather to speed loss in head weather was calculated from the Aertssen's equation for a range of ship length. For each direction the ratio was found to be little dependent on length but to vary with Beaufort number. The ratios, or weather direction reduction factor, can be closely represented and expressed conveniently as follows:

$2\mu_{bow} = 1.7 - 0.03\,(BN - 4)^2 \quad 30^o - 60^o$

$2\mu_{beam} = 0.9 - 0.06\,(BN - 6)^2 \quad 60^o - 150^o$

$2\mu_{following} = 0.4 - 0.03\,(BN - 8)^2 \quad 150^o - 180^o$

Justification of the formulae for head weather speed loss

The first step in justifying the approximate formulae is to see how well they represent the results of the detailed calculations of percentage speed loss in head weather at various Beaufort numbers. The accuracy of fit may be seen in Figs 2 to 4.

The result of the approximate formula is also compared with some published full-scale data (Ref 8) and model data (Ref 9) as shown in Fig 5.

Conclusion

It follows that equations (1) will become progressively more suspect as the Beaufort number increases. Equally, detailed calculation methods become inaccurate at higher wind and sea states. In practice, propeller racing may occur at about Beaufort 7 and above as Aertssen has shown. Voluntary speed reductions also may be expected at higher Beaufort numbers depending upon fineness, size, and operating conditions. For all the above reasons equations (1), and the detailed calculations which they represent, are unlikely to be accurate for Beaufort numbers above 6 or thereabouts.

However, for most sea routes Beaufort numbers above 6 occur infrequently. *NA*

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First application of new steel plate

Ground-breaking corrosion-resistant steel plate for oil cargo tanks will find its first ever application before the year is out.

Five years of research prove that the material 'JFE-Steel for Ship Inside Protection - for Oil Tankers' (JFE-SIPTM-OT) limits deterioration of crude oil cargo tanks, according to Mitsui OSK Lines, Ltd, and the shipping line is about to apply the material to a ship for the first time.

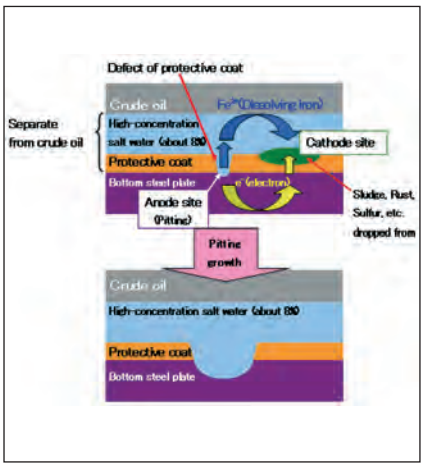
The new corrosion-resistant steel plate, developed by MOL in collaboration with JFE Steel Corp (JFE), is set to feature on the bottom and upper plates of the cargo oil tanks of an MOL-operated very large crude carrier (VLCC) to be launched in November 2008.

While the International Maritime Organization (IMO) has been discussing ways to improve corrosion protection by painting inside the cargo tanks of crude oil tankers, Japan has promoted the use of corrosion-resistant steel as well as painting.

According to MOL, the new material combines several particular elements, significantly reducing corrosion by slowing down pitting to one fifth of the level seen with conventional steel. It shows excellent corrosion-resistance, even for general corrosion, which occurs on the rear side of the tank's upper plate.

The material has the same weldability and machining performance as conventional steel plates used in the hull structure, while at the same time reducing maintenance work in drydock.

Pitting corrosion mechanism of crude oil tanker's cargo tank bottom plate.



In current vessels, the bottom plate of the cargo oil tank is covered with a corrosion-resistant membrane, but pitting occurs when the membrane gets chipped. It corrodes up to about 4mm annually and if no action is taken, this poses a risk to safety. General corrosion will occur at the rear of the upper plate in the cargo oil tank due to the effects of hydrogen sulfide. As corrosion spreads, it may reduce the strength of the hull structure, too.

MOL said it believed adopting this new corrosion-resistant material offers economic and safety benefits. In addition, 'it helps to reduce CO_2 emissions.' *NA*

Tanker designs for whitefield developments

As oil and gas exploration in the harsh Arctic environment increases, it is presenting new challenges for the designers of the tankers and gas carriers that are expected to be the workhorses that bring those resources to market.

The industry is already seeing vastly increased transportation of oil from the Baltic with many new owners and operators sending tankers into the main oil terminals in the Gulf of Finland, such as Primorsk, Vysotsk, Tallinn, and Muuga in the dead of winter. But the most recent horizon is much farther north, in the ice-covered waters of the Arctic polar region north of Russia.

In December of last year Samsung HI delivered *Vasily Dinkov* (*Significant Ships of 2007*), the first in a series of 70,000dwt double acting shuttle tankers specifically designed to operate in those harsh northern waters. It is the largest commercial ship designed and built for Arctic service. Dual classed by ABS and the Russian Maritime Register of Shipping (RS) it will operate under time charter to Naryanmarneftegas, a ConocoPhillips/LUKOIL joint venture company. Many more such vessels are projected to be built in the coming years as precious northern energy resources begin to be developed.

The experience from Baltic operations will be valuable for owners as they turn their eyes further north. But a great deal more preparation will be needed if tankers are to operate safely and efficiently in the extreme low temperatures that will be encountered. Compared to the Baltic, the Arctic has a much harsher environment and it is remote with little infrastructure to support year round transportation. The presence of multi-year ice imposes additional loads on the hull, propulsion system, and appendages, which must be accounted for in the design.

Yet the parameters under which new designs and technical approaches must be developed are clear – they must be able to satisfy the needs of industry within reasonable and practicable operational, commercial, safety, and environmental constraints while operating within an environment that, in the past, has been almost exclusively reserved for the world's most powerful icebreakers.

This will demand much more sophisticated vessels, much more expensive vessels, and a willingness to assess and understand the much greater operational risks to which these assets will be exposed. 'These new ventures are creating risk exposures that demand more analysis, greater attention, and more comprehensive and systematic approaches to risk management,' says Dr Kirsi Tikka, vice president global technology and business development at ABS. Finnish-born, Dr Tikka has a visceral understanding of the challenges that lie ahead.

'The capital investments involved, the financial risks of downtime, and the environmental risks of failure are so great that safety can no longer be implied: it must be explicitly understood,' she adds.

Dr Tikka contends that traditional prescriptive standards have served the industry well. 'Empirical knowledge will always form a bedrock upon which appropriate technical standards will be founded,' she says. 'But these techniques are no longer sufficient, by themselves, to offer an acceptable level of confidence that the risks associated with a venture have been properly addressed.

'The increased complexity and larger size of the vessels being developed for operation in harsher and more remote environments are driving the adoption of safety equivalency standards, of unified standards, and of risk-based approaches to lifecycle management that will help promote safe and reliable operation. In many instances these new designs will incorporate novel concepts that go beyond our empirical experience.'

According to Tikka, 'when the new technical frontiers extend beyond known boundaries, it is the application of sophisticated risk assessment techniques that will guide the designers, and form the basis for the classification and statutory acceptance of these new designs.'

She is, however, quick to dismiss any thought that the challenges may prove insurmountable. 'The technology, the brainpower, and the willingness is readily available,' she says. 'Technology breakthroughs such as dynamic loading analysis, probabilistic modelling, non linear structural response, composite materials, quantitative risk assessment, and numerical simulations help us rationalise structure performance and safety requirements and provide us with the risk superior moves the industry counts on.'

Vasily Dinkov, the first in a series of 70,000dwt double acting shuttle tankers specifically designed to operate in the ice-covered waters of the Arctic polar region north of Russia.

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In looking to the Arctic, class has already taken a leadership role with the development of the new IACS Polar Class Rules that took effect at the beginning of March. The new Rules, jointly developed by the IACS member societies, grew from the acceptance that vessels operating in the Arctic region are exposed to a number of unique demands. The presence of first year and multi-year ice imposes additional loads on the hull, propulsion system, and appendages. Low temperatures impact the ship, and the cold, the lack of light and visibility affect the crew. In addition, the protection of the unique Arctic environment is of particular concern as the resources in this new frontier are exploited.

To promote the safety of navigation and to prevent pollution from ship operations in Arctic ice-covered waters, the Marine Safety Committee (MSC) and Marine Environment Protection Committee (MEPC) of IMO approved the Guidelines for Ships Operating in Arctic Ice-Covered Waters in October 2002. These Guidelines are recommendatory rather than mandatory for vessels traveling in the Arctic ice-covered waters.

IMO Guidelines refer to the IACS Unified Requirements (UR) for Polar Class for structural design and construction. Since the existing generation of tankers intended for Baltic winter operation is generally built in accordance with the Finnish-Swedish Ice Class Rules (FSICR), designers are familiar with those Rules and have been looking to the class societies to help them understand the differences between the FSICR and the new Polar Ice Class requirements.

These are significant even though the lowest two Polar Ice Classes (PC6 and PC7) are considered to be generally equivalent (but not exactly so) to the two highest Finnish-Swedish ice classes (1A Super and 1A respectively). Ice classes 1A and 1A Super are based on 0.8m and 1.0m ice thicknesses respectively.

There are seven Polar Ice Classes and their assumed operational profile varies from a 'year-round operation in all Polar waters' for the highest ice class PC1 to 'summer/autumn operation in thin first-year ice which may include old ice inclusions' for the lowest ice class PC7. The Polar Class requirements are based on the assumption that the ship is able to operate independently (ie without icebreaker support) in the designated ice condition.

Some of the main differences between the approaches adopted by the two rule sets include:

PC 1	Year-round operation in all Polar waters
PC 2	Year-round operation in moderate multi-year ice conditions
PC 3	Year-round operation in second-year ice which may include multi-year ice inclusions.
PC 4	Year-round operation in thick first-year ice which may include old ice inclusions
PC 5	Year-round operation in medium first-year ice which may include old ice inclusions
PC 6	Summer/autumn operation in medium first-year ice which may include old ice inclusions
PC 7	Summer/autumn operation in thin first-year ice which may include old ice inclusions

Polar class descriptions (source: IACS).

- The definition of the ice belt, which defines the extent of reinforcement, is different in the two rule sets. The FSICR divides the ship into three regions: forward, midship, and aft. The forward region is further divided into three vertical sections: upper forward ice belt, ice belt, and fore foot. This means that for the midship and aft regions, the sections below the ice belt are not reinforced. And the extent of reinforcement for side shell plating and framing are different in the FSICR. The Polar Class requirements divide the hull into four sections longitudinally: bow, bow intermediate, midbody, stern; and three sections vertically: bottom, lower, and icebelt region
- The ice load definition in the Polar Class requirements depends on hullform angles whereas the FSICR load does not. The FSICR load depends on propulsion power, whereas the Polar Class requirement does not. The Polar Class ice load model is based on theoretical analysis models for the glancing (tangential impact) ship/ice interaction, while the FSICR ice load is based on experimental measurements in the Baltic Sea. In the Polar Class requirements, peak pressure factors are used to account for the pressure concentration on local structural members when the ice load is applied to determine scantlings, while in the FSICR, the pressure is assumed uniform inside the load patch
- In the FSICR, the corrosion margin is a constant 2mm, whereas in the Polar Class the corrosion/abrasion margin depends on the location, ice class, and coatings
- The main difference in the approach to the scantling requirements is that the FSICR frame strength requirement is based on the elastic section modulus and in the Polar Rules on the plastic section modulus. The FSICR require brackets at the connection of a side longitudinal to a web frame
- Polar Class includes longitudinal strength requirements for ramming, whereas the FSICR does not
- Polar Class machinery requirements include ice loads and failure criteria but the detailed scantling design is to be done either using advanced analysis methods or accepted industry engineering practice. The FSICR include scantling equations
- Polar Class gives clear requirements for material class selections to prevent material failure in low temperature, while FSICR does not include such requirements

The average and extreme temperatures in the Arctic are lower than in the Baltic and the design and the operation must be adjusted to these temperatures. The reliability and the redundancy of the machinery and safety equipment, insulation of spaces, and ergonomic considerations are some of the issues that need to be addressed. Since these aspects are not covered by the traditional ice class requirements, classification societies have developed additional criteria for winterisation and cold weather operations (eg the ABS *Guide for Vessels Operating in Low Temperature Environments*).

Design considerations critical for cold weather operations of tankers but not covered by Ice Class Rules may include such items as material and coatings selection; hull construction/arrangement and equipment that takes account of the likelihood of tank contents freezing, the need for protection of the personnel and the impact of ice accumulations on vessel stability.

Machinery arrangements may be required to be modified as a result of low ambient temperatures. Sea water supplies for essential operational systems and safety systems must be provided during navigation and at port in ice-covered waters. Essential equipment and systems must be available at all times and in any temperature conditions.

Heating of spaces and equipments must be considered. The definition of the design

Vessels operating in the Arctic region are exposed to a number of unique demands.

service temperature (DST) for the vessel is important for setting the requirements for materials and equipment. For example the definition adopted in the IACS Unified Requirement S6 defines DST as the lowest mean daily average temperature in the area of operation for data taken over at least a 20 year period.

Tankers and other vessels intended to trade in the Arctic Region should be designed to take into account all the current and foreseeable statutory Regulations for environmental protection in addition to coastal state requirements related to the same issue. IMO Guidelines (IMO, 2002) makes a strong statement in this regard by referring in a considerable number of its sections to the need for preventing pollution from ships navigating the Arctic Regions.

These are just some of the issues that must be tackled by designers as they develop the new generation of Polar Class tankers for the new whitefield energy developments in the Arctic. A multitude of research projects being undertaken in Finland, Russia, and Canada, many in cooperation with the leading class societies, will provide the necessary technical understanding to tackle these design challenges with confidence. *NA*

To MARS via Korea?

BAE Systems has formed a partnership with Daewoo Shipbuilding Marine Engineering, to bid with BMT Defence's design team for the construction of six tankers for the Royal Fleet Auxiliary.

An early indication has emerged of the solutions that may be needed to satisfy the Ministry of Defence's plans to build six new tankers for the UK Royal Fleet Auxiliary, after BAE Systems said it would team up with South Korea's Daewoo Shipbuilding & Marine Engineering Co in submitting its response to the MOD's Pre-Qualifying Questionnaire for the Military Afloat Reach and Sustainability (MARS) programme.

The powerful consortium, led by BAE Systems, also includes BMT Defence Services as design partner to bid for the contract for the ships.

With the deadline for expressions of interest in building the petroleum Class II and III clean product tankers with capacity of up to 18000m^3 not due until 15 February 2009, BAE Systems is the first to break cover in proposing how such ships may be built to meet MOD cost and delivery requirements.

BAE Systems said that, through its Surface Fleet Solutions business, it would act as lead contractor and programme manager in the proposal, with the ships intended to be built by DSME in Korea. 'This approach combines the best global experience in both commercial and military shipbuilding,' said BAE Systems.

Vic Emery, managing director of BAE Systems Surface Fleet Solutions, said: 'By bringing together this unique mix of UK and Korean commercial and naval design, ship-build, and project management capability, the consortium will offer the Ministry of Defence an unparalleled degree of flexibility and experience in delivering the MARS fleet tankers.'

However, the plans include contingency arrangements which could see the tankers built in the UK after all. Mr Emery added: 'While it is intended that all vessels will be constructed in Korea, a unique feature the consortium offers, in terms of flexibility, is the ability to provide UK build options, should such an approach become necessary.'

A BAE Systems spokeswoman explained that the consortium had factored in that the location of build would partly depend on how work progressed on the future aircraft carriers at BAE Systems' facilities in the UK, and particularly at Govan, Glasgow. If the aircraft carrier project ran to schedule, there would be no capacity at BAE Systems yards to build the RFA tankers in the UK. If, however, work on the two aircraft carriers envisaged for the Royal Navy were to be delayed, part or all of the RFA tanker construction 'could act as in-fill work'.

For its part, BMT expressed itself satisfied with its design role in the consortium. David Rainford, commercial director of BMT Defence Services, said: 'As a relatively small, innovative organisation, we are pleased with the smooth and positive fashion in which BAE Systems has welcomed us as its design partner. Through a commercial approach we will be able to provide a simple yet effective MARS fleet tanker.'

K W Cheong, director of DSME Special Ship Management said: 'This is an excellent opportunity for cooperation between our two countries; the UK being the home of naval shipbuilding and Korea as the hub of commercial shipbuilding. I think the combination of BAE Systems' extensive naval domain knowledge with our own skills and resources will produce excellent results.'

BAE Systems said the MARS programme would become part of the workload of the proposed maritime joint venture between BAE Systems and VT Group, to be called BVT Surface Fleet, upon its completion. *NA*

Six new auxiliary oil tankers for the Royal Fleet Auxiliary will augment military afloat support reach, as currently delivered by ships such as the BAE Systems-built *Wave Knight*.

Stena adds to P-MAX class

The turn of the year saw delivery of the 65,000dwt *Stena Perros*, the sixth vessel in a series of 10 P-MAX tankers from Croatia's Brodosplit Shipyard, Croatia.

Stena Perros, the latest addition to the growing P-MAX fleet from Concordia Maritime/Stena, has been signed to a five-year time charter with French oil and energy company TOTAL to transport refined products.

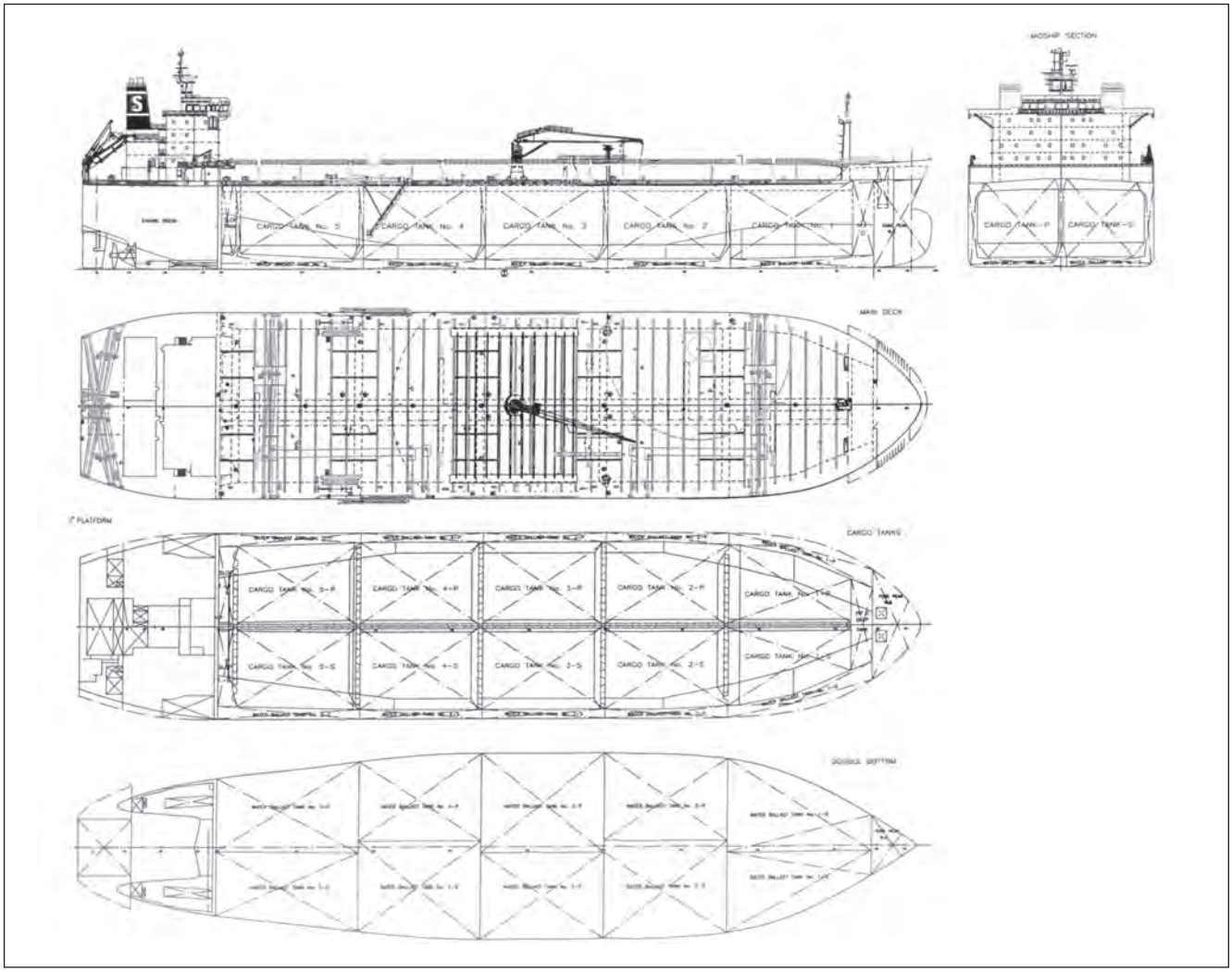
Stena Progress, the seventh P-MAX tanker is due delivery in the fourth quarter of 2009, and has also already been signed to a five year charter with TOTAL.

In developing the P-MAX tanker, Stena says it has been working on the basis that 'proactive safety will soon be the entrance ticket to sensitive waters all over the world'. These areas are not only growing in number, they are also often located in the vicinity of oil-dependent markets. 'As governments and influential organisations cannot afford to take any chances with the carriage of oil, we are facing a public attitude of absolute zero tolerance. Under these circumstances, proactive safety will become the key to long-term business.'

***Stena Perros*, the sixth vessel in a series of 10 P-MAX tankers.**

Claimed to be the safest and most efficient medium-range (MR) tankers ever built, the P-MAX ships have been designed in-house by Stena's technical department, based on the

General arrangement plan of *Stena Perros*.



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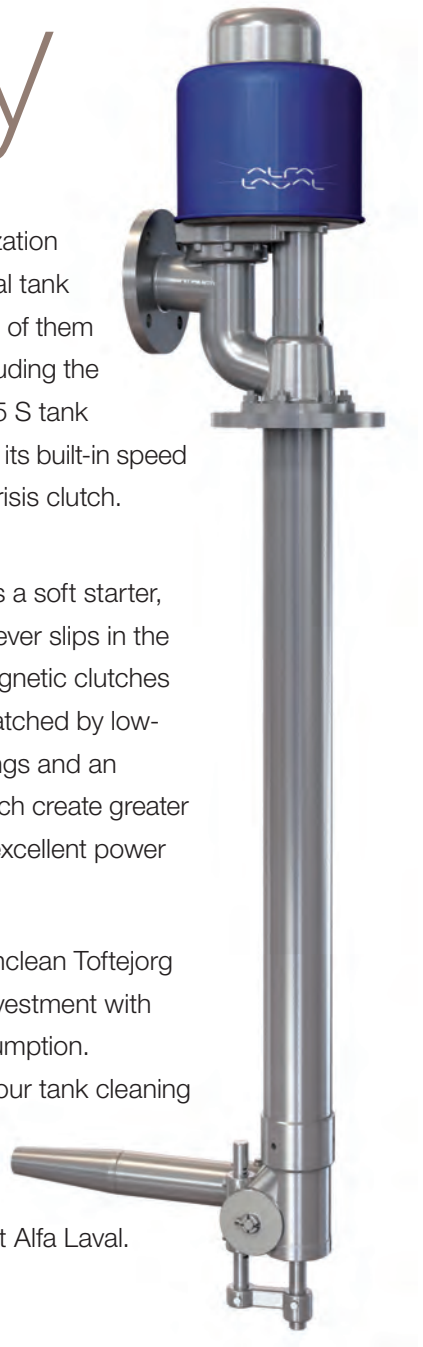

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company's 'MAX-concept for exceptional cargo intake and safety while maintaining a low fuel consumption.'

Stena P-MAX ships are designed and constructed for a fatigue life of 40 years. They have several features for minimising the risk of casualties, mishaps or incidents. Double hull, optimal corrosion control, two enginerooms with full fire and water integrity, as well as redundant and separate systems for propulsion are said to be vital as safeguards for proactive safety. Added to this is the fact that the ship type exhibits high levels of manoeuvrability and an integrated bridge layout to facilitate safe navigation in narrow waters.

Like other MAX vessels, *Stena Perros* exhibits an exceptionally wide beam, of 40m, where comparable ships will typically feature a beam of 32.2m. The added dimension means that the 182.9m long P-MAX tankers can load up to 30% more cargo than a standard MR tanker at the same draught.

The double hull surrounds a cargo space divided by corrugated bulkheads into five pairs of tanks arranged for clean and dirty oil products, and crude oil. The corrugated bulkheads reduce the remaining amount of cargo onboard after discharge. Epoxy coatings have been applied to the tanks, while the cargo piping and heating coils are of stainless steel.

The ship's design conforms to the DNV RPS (Redundant Propulsion Separate) notation. Main machinery is situated in independent port and starboard rooms, separated by fireproof and watertight bulkheads. Each compartment contains propelling machinery comprising a MAN B&W 6S46MC-C engine delivering 7860kW MCR at 129rev/min, and directly coupled with an FP propeller fitted in front of a plain rudder.

Each engine is served by separate fuel supply and auxiliary systems, and also independent monitoring and control systems. A total of four diesel-alternator sets are installed, each producing 1081kVA, and steam requirements are derived from two oil-fired and two exhaust-gas boilers.

The aft end of the vessel is characterised by an expansive transom stern, above which a large deckhouse is positioned between two widely-spaced funnels and topped by a wheelhouse offering 360deg vision.

Other important inclusions to the design are compliance with Finnish-Swedish Ice Class 1B requirements.

Stena points out that safety is 'ultimately an environmental issue'. Separate fuel tanks offer the option of transporting environmentally-friendly fuel in sensitive areas.

As noted, Stena P-MAX tankers are designed to carry crude oil as well as clean or dirty products. By implementing ETC (Effective Tank Cleaning), a certified effective cleaning system and cargo tanks, changing from dirty to clean products can be achieved in a short time, thus minimising the risk of contamination. This also means that the tanks can be cleaned in the minimum of time. *NA*

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Shell tankers will be ready to trade

Building starts on state-of-the art Jones Act tankers in US yards.

Construction has started on the first of a series of three 49,000dwt, Jones Act chemical/product tankers for San Antonio, Texas-based AHL Shipping Co, after February's steel cutting ceremonies at R&R Shipbuilding, in Port Arthur, Texas, just over seven months after the finalisation of contracts and financing of the project in July 2007.

R&R is one of the primary shipyards involved in the construction of modules for the shallow-draught AHL vessels. The builder further began construction of the engineroom power module for the first vessel on 25 February, with Atlantic Marine Alabama set to begin construction of its hull modules on 18 February 2008.

According to AHL president Richard Horner, these vessels will set a new standard for Jones Act petroleum transportation, featuring diesel-electric redundant propulsion systems, and their status as the first tankers designed and constructed to meet the Common Structural Rules adopted by the International Association of Classification Societies as of April 2006.

Steel cutting starts on the first of three Jones Act compliant 49,000dwt tankers.

Modular construction

They will also be the first vessels of this size to be built in the US using the modular construction concept. The vessels will go on long-term time charter to Shell Trading in 2009/2010.

The vessel design is also suited for incorporation of dynamic positioning capabilities and operation in the emerging Gulf of Mexico shuttle tanker trade.

The 188m long ships will feature beams of 32m, depth of 18m, and draught of 11m at 42,400dwt. All three are being built based on a proprietary AHL design, and will be double-hull, International Maritime Organization Type II and III vessels. They will have a cargo capacity of 330,000 barrels, to transport crude oil, chemicals, and products within domestic US trade lanes. Vessel attributes include twin-screw, diesel-electric propulsion engine systems, to improve vessel efficiency and reduce emissions.

Hull construction and final assembly of the vessels will be conducted at Atlantic Marine Alabama, but several shipyards and specialty companies are under contract with AHL, as well as R&R, including Aker Yards Marine, Louisiana Machinery, and Ship Constructions Strategies, Inc. *NA*

Lindenau breaks green ground

Ecological protection is high on the agenda for Lindenau Shipyard as it delivers the second of its largest series of double hull tankers.

On 22 February this year Lindenau Shipyard delivered *Seychelles Patriot*, a 45,680dwt double hull tanker which is reckoned to set new standards for the safe and environmentally-friendly transportation of oil. After *Seychelles Prelude*, delivered in 2007, she is the second in the Safety Tanker Class series and is now chartered to Seychelles Petroleum Co Ltd.

In an impact situation, the ship's inner hull would detach from the surrounding structure at predetermined stress breaking points and would then be able to deform unrestricted, staying undamaged for a much longer time. This is reckoned to decrease the risk of environmental pollution caused by cargo leakage.

The tanker is approximately 189m long, with a moulded breadth of 32.2m. *Seychelles Patriot* is reckoned to have a favourable speed/power ratio, with a MAN B&W 8L58/64 engine featuring maximum output of 11,200kW at 428rev/min, and reaching speeds of 15.8knots at 8200kW with a 10.5m draught. The result of this is low fuel consumption at high speed.

A rendering of *Seychelles Patriot*, the second delivery in Lindenau's Safety Tanker Class series.

Consideration of environmental responsibility is evident in the design of internal systems, as the new rules for the exchange of ballast water are fulfilled, as well as MARPOL Annex VI requirements regarding NOx and SOx emissions from the main and auxiliary engines.

Additionally, the vessel will have two fuel oil day and settling tanks to enable separate use of low sulphur fuels inside SECAs. The switchover time for the fuel oil should be shortened by this measure. *NA*

PSM stays level headed

A new generation of digital 'intelligent' sensors and systems.

Improved tank measurement and monitoring capabilities are newly available to marine industry customers, following the launch of the latest generation of digital 'intelligent' sensors from PSM. Uniquely, the UK-based supplier says, its 'iCT' series offers users sensors that contain directly embedded programmable functions and intelligent self-diagnostics. All sensors and transmitters are remotely configured and can transmit level, pressure, and temperature on a single communication bus.

PSM said that it could provide various measuring technologies to suit all tank applications onboard exactly and cost effectively. Instruments from the PSM range include FMCW or Pulse Tank Radar, TDR radar, acoustic wave and hydrostatic pressure. 'All integrate into the common bus to ensure the most cost effective gauging solution can be readily tailored to suit vessels of all sizes and duty,' the company said.

PSM is offering newly integrated thinking when it comes to gauging tank levels, pressures, and temperatures.

PSM claims that not only is the system cost competitive but that the new digital bus system would accrue 'huge savings' on cable cost and expensive ancillary devices such as Intrinsic Safety zener barriers. 'In particular, with PSM's unique "one size fits all" iCT sensor, shipyards, and system, providers can now install a common sensor where a pressure, level, or temperature is required, and remotely assign a duty and an individual configuration later saving on installation set-up time.'

Data is displayed on the 'Tankview' gauging system, which can be integrated with a loading programme and may be interrogated remotely via satellite/GPRS link to enable managers and operators to view and monitor all tanks onboard in real-time. For example, fuel consumption can now be monitored remotely, bunkers planned on route, and cargo verified, the supplier said. *NA*

Odfjell subtracts 12, adds seven

Tanker owner Odfjell has suffered a setback in its ship ordering plans in Russia, but is pushing forward with orders in China.

February saw Norwegian owner Odfjell serve formal notice to Russian yard Sevmash that it had cancelled an order for 12 IMO type II, 45,000dwt coated product/chemical carriers.

The order was placed in 2004 with Sevmash, located near Archangelsk, in the expectation that the first tanker would be delivered by September 2007. However, Odfjell chief executive Terje Storeng said that, as of mid-February 2008, ship one in the series had yet to be launched and that he had been advised that the yard would now be expected to make the first delivery in May-June 2009. Work had also been started on a second ship. Since the contract was placed, he said, the yard had persistently raised prices, with the initial fixed total contract price for all 12 vessels of approximately $500 million now running at $544 million.

'Following serious delays in the construction process, combined with demands for further price increases from the Yard, continuous cooperation problems as well as protracted negotiations, Odfjell decided… to serve formal notice of cancellation to Sevmash,' Odfjell said in a statement. 'The installments already paid are covered by standard refund guarantees from international banks. Odfjell will further claim full compensation for its costs and losses caused, on account of willful misconduct and massive contract breaches by the Yard.'

Unless matters were resolved amicably between the parties, the issue would be taken to arbitration in Sweden, Odfjell said, as provided for in the contract.

Odfjell cancels major project, but pushes forward with more orders in China.

Mr Storeng said that, while Odfjell's immediate needs with respect to tonnage of this size were covered, no decision had been made as to how its future requirements would be met.

Shipbuilder Sevmash expressed itself in a state of 'bewilderment' over the mooted claim over willful misconduct. It had 'performed its obligations to construct vessels in good faith and reason. However, an extremely ill-fated contract provision of fixed prices for year 2004 and for the whole period of 12 vessel construction has caused funds shortage. Fair price negotiations have given no results.'

The yard, which has not built chemical tankers before, said it would carry on with the construction project. On completion, the 182m long, 32.2m wide by 18.35m deep vessels would be put up for sale on the open market, with a view to breaking even on the construction.

The day after the announcement on Sevmash, Mr Storeng was preparing to depart for China to celebrate a first order with China Shipbuilding Industry Corp's Chuan Dong Shipyard to build a series of six plus four optional 9000dwt stainless steel chemical tankers. The ships, which are destined for regional trades in Europe and Asia, will feature 14 stainless steel tanks and offer a total capacity of 10,500m^3. They are due delivery between 2010-2012, with the first six firm orders having been placed for a total price of $180 million.

Chuan Dong is reckoned to be the first Chinese yard to design its own stainless steel chemical carriers. Until recently, the yard focused on coastal tankers for domestic owners, but now it is stepping into the international market, and Odfjell is not alone in its preference for the yard. Last year, Singapore-based IMC Group ordered two 5500dwt stainless steel chemical tankers from the yard.

In a separate development, Odfjell's 49% owned joint venture company Odfjell Dong Zhan Shipping (Shanghai) Co has signed a contract for the building of an 8200dwt chemical tanker. The ship will be a fully coated IMO II type carrier that will be built by Zhoushan Penglai Shipbuilding and Repairing Co, with delivery scheduled for late November 2008. Odfjell will be directly involved in the building process and inspection at the building site. The ship will join *Bao Hai Tun* (3845dwt/ built 2006), and service the domestic market in China. *NA*

First Aframaxes for GEM

Gulf Energy Maritime (GEM) has awarded South Korea's Samsung Heavy Industries Co a US$160 million contract to build two high specification double-hulled Aframax tankers.

Independent Middle East tanker owner GEM has ordered its first Aframax tankers. To be delivered before the end of 2011, and named as *Gulf Vision* and *Gulf Valour*, the two fully coated vessels will have a capacity of 114,700dwt each. Built by Samsung Heavy Industries, they will be to Long Range 2 (LR2) specification, and thus be capable of carrying both clean petroleum products and dirty products such as crude and fuel oil.

GEM is a joint venture partnership between Dubai's Emirates National Oil Co (ENOC), Abu Dhabi's International Petroleum Investment Co (IPIC), the Oman Oil Co (OOC), and Thales of France under the UAE Offsets programme.

GEM chief executive, Ahmed Al Falahi, said: 'These tankers will be state-of-the-art and fitted with the latest equipment and meet all international environment safety requirements of being completely double-hulled.'

He said that the Geoje-based shipbuilder was selected following extensive consultations with a number of yards: 'We had to ensure that we build at a yard with a long track record of building similar ships and on the right commercial terms.

'By 2012, many refineries in the Middle East will be up and running. The West is slowing down on building new refineries and GEM will be ideally placed by then to transport either dirty or clean petroleum products to the West.'

The two vessels will join the existing GEM fleet, which currently comprises 11 Panamax and chemical/product tankers, with another eight to be delivered before the end of 2009. The 19 strong fleet orderbook was shared between Korea's Hyundai Heavy and Hyundai Mipo Dockyard. *NA*

Sealing GEM's first Aframax deal: L-R: J W Kim, Samsung Heavy Industries chief executive, and GEM chief executive, Ahmed Al Falahi.

Latest *Eagle* has landed

Tanker owner-operator AET took delivery of the latest addition to its growing fleet in February, in the shape of the 107,000dwt *Eagle Turin*, built by the Imabari Shipyard's Koyo Dockyard in Japan.

The double hull *Eagle Turin*, which will fly the Singapore flag, became the 49th Aframax vessel operated by AET and brings the company's total number of tankers to more than 70, with the fleet also including 11 VLCCs, and 11 product and shuttle tankers.

Eagle Turin, during sea trials.

The ABS-classed *Eagle Turin* is 247m long overall (235m lbp), and has a moulded beam of 42m, depth of 21.3m, and a draught of 14m. Featuring a bulbous bow, the ship is equipped with a Mitsui Engineering and Shipbuilding-built MAN Diesel-designed, six cylinder main engine – the 6S60MC-C, offering 13,717kW of power at 2400rev/min. It also features a single fixed pitch propeller.

The next two months will see AET expand its presence in the product tanker market further, with two new chartered-in 46,000dwt MR2 tankers brought into service by the end of March. The shipowner also has six 58,900dwt crude oil carriers on order from Japan's Tsuneishi yard, with delivery slated for 2009-2011.

In the five years since it was acquired by MISC Berhad, AET said it had become 'the leading operator of Aframax tankers in the Atlantic basin'.

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Ecospeed is an extremely durable hull coating that will save on fuel costs and give increased speeds. It is expected to last for up to 25 years and is guaranteed for 10.

Amongst recent applications are a 275 metre, 5000 TEU container ship, several ice-class cargo vessels and a major cruise liner—with more of each category planned for the near future.

The Belgian Navy have been using Ecospeed on a number of their vessels since 2004 and have committed to applying it on the remainder of their fleet as the time comes for repainting.

The growing appeal of Ecospeed comes down to a number of key factors.

The final hull surface has very low roughness levels. This, together with its corrugated surface, gives fuel savings through reduced consumption and increased speed.

The strength and impermeability of the coating provides a very high degree of protection against mechanical impact and corrosion. The endless cycle of hull repainting every two to five years can therefore be dispensed with. Even after being tested under extreme Baltic winter and ice conditions it has proven to be an effective protection against mechanical impact.

In addition, the coating has no adverse effect on the environment as it is entirely toxic-free.

Ecospeed can be used on most ships, offshore vessels and structures. It has proven to be ideally suited for fast moving container and cargo ships, cruise vessels and ice-going ships. Its use can remove major headaches for ship superintendents. With no repainting necessary, yet protecting the hull surface against corrosion, there will be many additional advantages such as significant savings on repair and maintenance costs.

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MAN's first S50ME-B

The first MAN B&W 6S50ME-B8 engine order has been placed.

TORM, the Copenhagen-based tanker owner, is the first customer to specify installation of MAN Diesel's latest MAN B&W 6S50ME-B8 engine. The new unit has been chosen for seven Guangzhou Shipyard International Co-built 50,500dwt chemical/product tankers. Engines will be delivered by MAN Diesel licensee DMD Dalian Marine Diesel.

MAN Diesel will supervise construction, shop tests, on-site installation, and commissioning of the engines, as well as participating in subsequent sea trials. The company is using the ME-B series to broaden the application of the ME concept in its small bore and medium-sized two stroke engines, using the electronic, fuel-injection control already introduced in its large bore series.

This range is the first to be fitted with TCA 66 turbochargers with variable nozzle rings technology, which facilitates the control of the scavenging-air pressure and thereby compression and cylinder maximum pressure. This gives a large degree of freedom to secure the optimal balance between NOx emissions and fuel oil consumption.

All S50ME-B engines are available in five- to nine-cylinder variants, and the B7/8 will have the same output and installation data as the corresponding S50MC-C/ME-C versions. Additionally, a lower rev/min version with a higher power concentration aimed at new ship designs has been added to the series, designated S50ME-B9.

The exhaust valve of the entire range is operated by a smaller camshaft than normal, when compared with its MC-C counterpart. The advanced fuel-injection control is an efficient way of managing current and future environmental emission requirements, and an Alpha Lubricator comes as standard, aimed at ensuring a very low cylinder lubricating oil consumption, due to the electronic, user-friendly interface, allowing precise adjustment. *NA*

Skaugen opts for Solasafe

Four new Aframax tankers from Skaugen Petro Trans have been fitted with Solar Solve Marine's Solasafe anti-glare roller screens at their wheelhouse windows.

Lightering tankers *SPT Champion*, *SPT Crusader*, *SPT Conqueror*, and *SPT Challenger*, all delivered during 2007 by Tsuneishi Shipyard, Japan, will be retrofitted with Solasafe anti-glare roller screens.

The vessels are all of 105,000dwt capacity, at 123m long with a 42m beam, and incorporate enhanced manoeuvring features with increased loading and de-ballasting capabilities.

Skaugen Petro Trans is a joint venture between I M Skaugen and Teekay Shipping Corp, and its vessels provide ship-to-ship transfer of crude oil, primarily in the waters of the USA coasts, the Arabian Gulf, and the Mediterranean.

Solar Solve chairman, John Lightfoot, commented: 'For whatever reason, the majority of Japanese-built vessels are delivered without anti-glare screens, which means we have to contact owners and operators afterwards to have them installed. In this case, we know that Skaugen is proud of its industry-leading standards of safety and dependability, and therefore the installation of Solasafe screens is in line with this philosophy.' *NA*

VLCC roped into strong fibre

COSCO Dalian, a subsidiary of China Ocean Shipping Co, has selected mooring lines made with Dyneema fibre for its newest Very Large Crude Carrier (VLCC), *Cospearl Lake*.

Following a successful eight-month sea trial on its *Cosmerry Lake* VLCC, Cosco Dalian believes that the Dyneema rope enabled a reduction in mooring time and improved crew safety.

The new ship is equipped with a full set of 22 ropes, each 280m long and with a required breaking strength of 1300kN.

Edwin Grootendorst, marketing manager heavy marine for DSM Dyneema, said: 'More than 75% of new-construction LNG tankers scheduled for delivery in the next few years will be equipped with mooring lines made with Dyneema, and we clearly see increased interest for VLCC and bulk carriers.'

Dyneema fibre is said to be as strong as steel wire, but weighs one eighth as much, claimed to enable the rope to handle more easily. This means that a mooring boat can carry two Dyneema ropes simultaneously, reducing mooring time. The fibre's elongation is less than 2.5% at break, a feature reckoned to decrease backlash in case of failure.

The company says that mooring and towing ropes made with Dyneema have an increased service life when compared to both steel and synthetic ropes.

It says lifetime expectancy is between two and four times greater. Nor is greasing of the rope necessary, as is the case for steel wire, meaning that there is no pollution of the deck area.

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Ships' emissions reach crucial stage

International Maritime Organization delegations respond to a detailed expert working group report on new limits for air emissions from ships. Aline De Bievre, Shipping Research and Reporting, London, UK, investigates.

Later this month, the International Maritime Organization is expected to approve a set of comprehensive amendments revising the air pollution annex of the Marine Pollution Convention (MARPOL Annex VI) and the associated mandatory Technical Code governing nitrogen oxide emissions from ships' diesel engines (NOx Technical Code).

The work done by the air pollution working group last month, at the 12th session of the Sub-committee on Bulk Liquids and Gases (BLG12, 4-8 February 2007), led IMO secretary-general Efthimios Mitropoulos to express confidence that approval by consensus is within reach of the Marine Environment Protection Committee (MEPC).

Following approval of the draft amendments at the MEPC's 57th session, scheduled for 31 March-4 April 2008, MARPOL contracting parties will be invited formally to adopt the two revised instruments at an expanded session of the 58th MEPC, 6-10 October 2008. Entry into force is envisaged 16 months later, in March 2010, subject to the tacit amendment procedure.

The question remains, however, whether the IMO will succeed in persuading politicians and indeed the wider public that it is in the avant-garde of preserving a clean air environment for future generations.

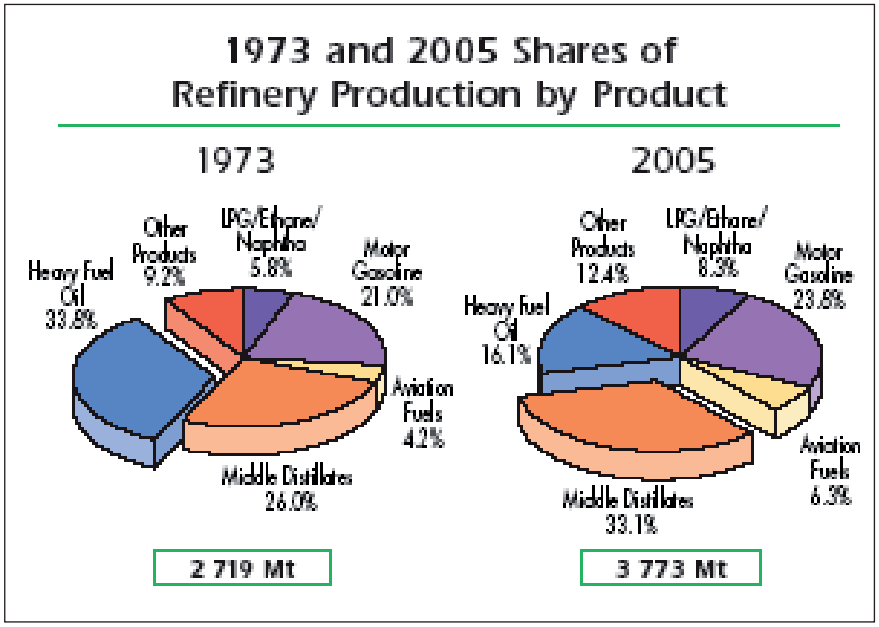
That the revision work is both necessary and timely has never been in doubt. After almost a decade of debate, the conference had to compromise heavily on the critical emission standards - both under Annex VI and the NOx Technical Code - that were well below existing technical capability. Moreover, entry-into-force took until May 2005.

Perhaps not surprisingly, many of the hurdles that the present revision work has had to address are similar to those the IMO had to overcome when it developed the original two instruments in the 1990s.

Calculation assessment	Result 2007 Mill tonnes	Result 2020 Mill tonnes
Total fuel consumption by ships	369	486
HFO consumption by ships	286	382
Marine distillate consumption by ships	83	104
CO_2 emissions from ships	1120	1475
CO_2 emission reductions for a 0.5% S		
Marine distillate global cap	- 43	- 59
Total SOx emission from ships	16.2	22.7
SOx emission reduced by current SECAs	- 0.78	*
SOx emission reductions for a 0.5% S marine distillate global cap	- 12.7	- 17.8
SOx emission reductions in a multiple SECA environment with a 0.5% marine distillate SECA cap	*	-3.4
SOx emission reductions in a multiple SECA environment with a 0.1% marine distillate SECA cap	*	-3.7
NOx emissions from ships	25.8	34.2
PM10 emissions from ships	1.8	2.4
PM10 emission reductions for a 0.5% S Marine distillate global cap	- 1.5	- 2.0

Table 1: Calculated emissions from ships in 2007 and 2020.

Figure 1: Evolution of refinery product slate (IEA, 2007).



Controversies that have had an impact on key aspects of the Annex VI revision are reminiscent of the heated debate that characterised the adoption of the original Annex VI. Once again, opposing views have crystallised around those delegations pressing for a single, global, limit on the SOx content of ships' fuels and those advocating a more flexible approach that allows stricter limits in the most vulnerable sea areas to co-exist with a generally applicable cap.

The challenge of making 'the right decision' is compounded by the fact that the revision of Annex VI has gained an exceptionally high profile as a direct result of the politically charged global debate on the impact of greenhouse gas (GHG) emissions on climate change. Yet Annex VI was never designed to cover GHGs, such as carbon dioxides (CO_2).

A major aim of the original Annex was to control sulphur oxide (SOx) emissions from the combustion of heavy (residual) fuel oils. The need to combat 'sulphur creep' in ships' fuels arose from compelling evidence of the trans-boundary damage inflicted by acid rain, on forests and limestone buildings. Shipping could not be seen to be falling behind land-based pollution control measures in this respect. The current revision of Annex VI is similarly concerned with matching shipping practice with the increasing use of low-sulphur fuels on land.

The linkage of the revision of Annex VI with the global reduction of CO_2 emissions has arisen from concern to avoid a piece-meal approach that would simply perpetuate problems through trans-location. The International Chamber of Shipping has been particularly vocal in warning that a wholesale change-over to much lighter, low-sulphur fuels could not be justified if it were to have the adverse effect of triggering increased CO_2 emissions from land-based refineries forced to break down the heavier part of fossil fuels in order to meet the growing demand for lighter products.

The IMO has a separate work programme on GHGs, for which a work plan was approved 18 months ago (MEPC 55, October 2006). Mr Mitropoulos will propose to MEPC 57 that certain key parts of this programme be fast-tracked so that appropriate decisions on them can be made as early as MEPC 58, nine months earlier than originally planned (MEPC 59, July 2009). In addition to the update of the 2000 IMO study on GHG emissions from ships, the said work programme centres on the identification of technical, operational, and market-based methods for emission reduction and on the development of a CO_2 emission indexing scheme and of a CO_2 emission baseline.

Multiple options

The challenge facing MEPC 57 is to build a consensus position from the three consolidated options (see sidebar) put forward by BLG 12 acting on the recommendation of its air pollution working group.

These were whittled down from six options, which included 'no change' to the requirements of the current Regulation 14 of Annex VI, which concerns a global sulphur cap of 4.5% and a 1.5% maximum sulphur content for IMO-designated 'Sulphur Emission Control Areas' (SECAs). To date, only two 'SECAs' are in force, for the Baltic and North Sea areas, respectively, since May 2006 and November 2007.

A further three options concerned variations on a mix of global and regional area-based standards. The two remaining options concerned an exclusively applicable, single, globally uniform standard, to be achieved either through a switch to distillate fuels or through alternative market mechanisms (eg exhaust gas cleaning systems).

In addition, the working group was instructed to consider a seventh option that was a variant on one of the six options. It concerned the concept of a 'Micro-SECA' and effectively represented an amendment submitted by BIMCO to its originally proposed option.

All the seven options have in common that they are in essence emission-based performance standards as opposed to fuel quality standards. The distinction is important, not least because fuel quality has given rise to intense debate in its own right.

Although the existing Annex VI includes fuel oil quality requirements (Regulation 18), it does not set a detailed

BLG 12-recommended sulphur emission standards for decision at MEPC 57

Option 1: Single global standard
1.00% (10,000ppm) sulphur cap becomes mandatory everywhere in [2012]
0.50% (5000ppm) sulphur cap becomes mandatory everywhere in [2015]

Option 2: Global + regional (Sulphur Emission Control Area) standards
4.50% (45,000ppm) global sulphur cap continues to be in force
0.10% (1000ppm) sulphur cap becomes the new SECA requirement in [2012]

Option 3: Global + regional standards + Micro-SECAs
3.00% (30,000ppm) becomes the mandatory global sulphur cap in [2012]
1.00% (10,000ppm) sulphur cap becomes the new SECA requirement in [2010] 0.50% (5000ppm) sulphur cap becomes mandatory for SECAs in [2015]
0.10% (1000ppm) may be applied in Micro-SECAs, provided (i) they are established at a distance of no more than 24nm from the baseline (*), but they may not extend into straits used for international navigation (in which case the SECA status must prevail), and (ii) their establishment follows the submission to and review by the IMO of a proposal, 'subject to a relaxed set of criteria'.
(*) Micro-SECAs can also be applied in port areas. As from 1 January 2010, European Union ports will effectively be Micro-SECAs as all ships visiting them will be required to use fuel oils with a maximum sulphur content of 0.10 % (1000ppm).

Explanatory note:
ppm = parts per million
nm = nautical miles

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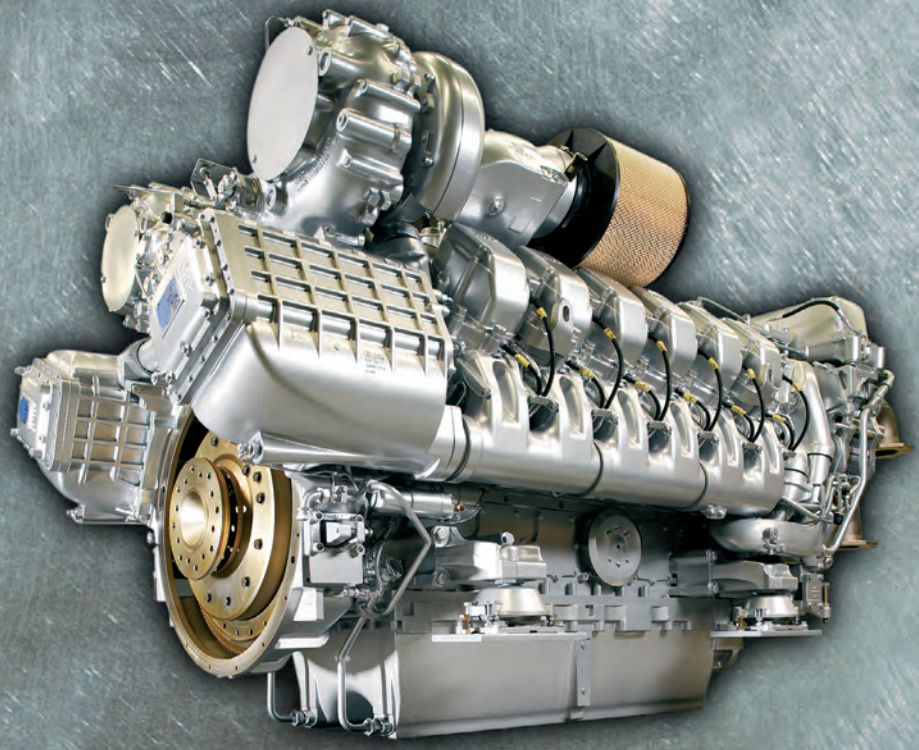

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fuel specification - nor does it cover fuel quality testing for the purpose of proper, and uniform, enforcement of the mandatory sulphur limits. There was much heated debate at BLG 12 on these issues.

Certain Scandinavian and European countries, also supported by the United States, insisted the IMO take 'legal control' of the determination of sulphur content in ships' fuels and agree on a uniform method of compliance with the fuel sulphur standards to avoid numerous - legal and technical - disputes.

The air pollution working group drafted a provision on the verification of sulphur content for inclusion in the revised Annex VI (draft Regulation 18(6)(b)), together with a draft protocol.

Meanwhile, a number of delegations, supported by the Friends of the Earth International, insisted that improved fuel quality standards should be developed for inclusion in the revised Annex. These standards should include fuel quality criteria other than those relating to sulphur content and which had 'sufficient relevance to air quality and ship and crew safety to warrant inclusion'.

However, Greece and many others were vehemently opposed to the introduction of mandatory fuel quality criteria. Many also felt that the IMO should not interfere with the competence of the International Standards Organisation (ISO), but a significant majority did support the proposition that the MEPC invite the ISO to develop a draft fuel quality specification including air quality and ship safety criteria for subsequent consideration by the IMO.

Scientific study

It is widely expected that the findings of the ad-hoc cross government-industry scientific group of experts will once again come under scrutiny at MEPC 57 as it is impossible to predict whether the MEPC will seek to arrive at a final decision on the three consolidated ships' fuels options through a process of elimination, or whether it will endeavour to develop a hybrid solution.

Fuel Consumption and Emissions	2020 Baseline	2020 Total switch from HFO to distillate	2020 Fuel switch from HFO to marine distillate fuel in coastal sea areas
Total fuel consumption by ships	486 Mt	467 Mt	474 Mt
HFO consumption by ships	382 Mt	0 Mt	137 Mt
Marine distillate fuel consumption by ships	104 Mt	467 Mt	337 Mt
CO_2 emission from ships	1475 Mt	1442 Mt	1453 Mt
CO_2 emission by acidic balance of sea water*	30 Mt	6 Mt	15 Mt
CO_2 emission reduction from the baseline	---	58 Mt	37 Mt
SO_2 emission from ships	21.6 Mt	4.7 Mt	10.8 Mt
SO_2 emission reduction from the baseline	---	16.9 Mt	10.8 Mt
SO_2 emission reduction from the baseline (%)		78.2	50.0

Table 2: Estimated CO_2 and SO_2 emissions.

Measure no.	Description	Existing ships gain %	Newbuildings gain %
1	Main engine efficiency rating	2	
2	Main engine optimisation		2
3	Waste heat recovery		5-10
4	Optimise hull shape, incl reduced Cb*		3-10
5	Optimised propeller	2	3-6
6	Maintenance of wetted hull surface	2-5	2-5
7	Improved antifouling paints	2-8	1-2
8	Twin skeg + twin propeller		5-8
9a	Trim optimisation – large Cb ships	1-2	1-2
9b	Trim optimisation – small Cb ships	Max 10	Max 10
10	Misc fuel saving devices	2-6	2-6

Table 3: Measures which can be utilised by new and/or existing ships to limit air emissions.

The scientific group of experts' terms of reference were, in the first instance:

To review comprehensively the effects on the environment, on human health, and on the shipping and petroleum industries of applying any of the proposed fuel options to reduce SOx emissions and emissions of particulate matter.

Particulate matter are not covered by the current Annex VI. In addition, the group was tasked:

To review the consequential impact of the various fuel options on other harmful emissions, including CO_2 emissions from both ships and land-based refineries.

To aid their work, the group split into four sub-groups:

- Shipping and air emissions (2007 figures and 2020 projections) from the world fleet's total fuel consumption
- Fuel supply and the future availability of marine distillates
- Health and environment impacts
- Modelling sub-group

In a nutshell, the group's overall findings highlighted the ship operational and other advantages, including health and

environmental benefits, to be derived from the use of distillates as compared to heavy fuel oils, while also identifying additional price tags.

Additional investments in refinery conversions emerged as particularly expensive, estimated at US$127 billion within a time frame of 15 years or more. Moreover, the CO_2 generation from refineries was estimated to increase considerably, possibly by 11% or 133 million tonnes.

As to the price of marine distillates, the study found that they are more expensive than heavy fuel oils by as much as 50%-75% if there is a demand-supply balance. As one insider commented: 'If there is a shortage of distillate fuels, prices will probably sky-rocket.'

Ship construction date	**Engine certification requirement**
Pre-2000	Identical replacement – no NOx cert requirement
Pre-2000	To be certified to the Tier appropriate to the date of installation (Tier I 2000 – 2010, Tier II 2011-2015) except in the case of replacement engine post 2016 – if possible, goals to be determined – if not Tier II
2000-2010 & 2011-2015	Tier appropriate to the installation date except in the case of [replacement engine] post 2016 – if possible goals to be determined – if not Tier II
2016+	Tier III

MCR 10% increase or substantial modification (as defined in the NOx Technical Code)

Ship construction date	**Engine certification requirement**
Pre-2000	Tier I irrespective of MC
2000-2010	Tier I irrespective of MC
2011-2015	Tier II irrespective of MC
2016+	Tier III

Table 4: Requirements for replacement or additional engines.

Heated debate

If advanced submissions to MEPC 57 are anything to go by, there will be further heated discussion of the group's study. Intertanko, which advocates a wholesale switch to marine distillate fuels worldwide, and which was a member of the group, has already submitted a detailed document identifying what it believes to be 'inconsistencies in data presented in different paragraphs of the [overview] report.'

Technical Code revision

Like the revision of MARPOL Annex VI, the revision of the NOx Technical Code, too, has rekindled questions reminiscent of the original development of the Code. Key issues have concerned the feasibility of applying an emission standard to existing engines ('grandfathering'), and what such a standard should be. Extensive debate has also taken place concerning the choice between different types of NOx control measures, such as 'in-engine' design modifications and additional, 'bolt-on', treatment measures.

The air pollution working group had very extensive discussions on how to articulate an incremental approach that would set a progressively tighter NOx emission standard for new diesel engines (depending on their date of installation) which would bring longer-term regulatory stability in the industry.

It agreed that the ultimate aim should be to ensure substantial emission reductions to offset the predicted increase in emissions associated with growing world trade. However, the standard should take account of availability of novel emission control technologies (eg selective catalytic reduction) and new marine diesel engine design and technology, and of consequential operational and fuel consumption effects. Other associated consequences should also be taken into consideration, such as reliability, engine-load effect on the emission reduction achieved, and CO_2 generation.

The sub-committee noted the various recommendations of the working group and all of them will be submitted to MEPC 57. They included a recommendation for a three-tier approach, with 'Tier I' representing the current 17g/kW standard of existing Annex VI.

The 'Tier II' standard, originally proposed by China, would apply to engines installed from 1 January 2011 and achieve an emission reduction (from the Tier I level) of between 15.5% and 21.8% depending on the engine's operating parameters.

The 'Tier III' standard, which represents an 80% reduction, would apply to newbuildings and be implemented from 1 January 2016, but only in specific emission control areas designated in accordance with guidelines to be developed by the IMO. These areas will, therefore, not extend to coastal areas around the globe as defined by a fixed distance (Japan had proposed this latter approach, with a maximum distance of 50nm from any coast). Engine manufacturers in Japan are reported to already be developing advanced engine treatment systems to meet Tier III.

The working group also developed a tabular illustration of the multi-tiered NOx control requirements as they would apply to major conversions (replacement or additional engines).

Other matters that will have to be considered at MEPC 57 are finalised draft revised guidelines for exhaust gas cleaning systems. These also include wash water discharge criteria for such systems. The limited commercial experience with marine applications of exhaust gas cleaning systems was however acknowledged by the sub-committee.

Furthermore, a number of delegations (Panama, Marshall Islands, Greece, Ireland, European Commission, and Intertanko) warned it was 'essential' to anticipate what type of port and terminal reception facility and what type of waste disposal protocol would be appropriate to deal with residues produced by exhaust gas cleaning systems. They also pointed out that critical information on the characteristics of such residues was lacking.

There was no appetite for market-based solutions to reduce NOx emissions and the working group recommended not to pursue them for inclusion in the revised MARPOL Annex VI, because 'fundamental questions' of both a structural and legal nature remained. *NA*

MAN breaks through with dual fuel option

A unique in-line engine combination marks MAN Diesel's first success in supplying dual fuel four-stroke engines to the LNG carrier market.

A 174,000m^3 capacity liquefied natural gas carrier to be delivered by STX Shipbuilding to Spanish owner Empresa Naviera Elcano by mid-2010 will be the first ship of its type specifying the new dual fuel, medium-speed engine from MAN Diesel. For the first time, too, the LNG carrier will feature five in-line four-stroke engines, where all dual fuel installations aboard such ships to date have featured a combination of in-line and v-type engines.

The ship will also be the largest LNG carrier ever to feature electric propulsion based on dual fuel engines.

The eight cylinder 8L 51/60DF engines from MAN feature a bore of 51cm and generate 8000kW at 514rev/min.

According to MAN Diesel head of sales, cruise and LNG ships, Sokrates Tolgos, electing five in-line engines brought Elcano the 'fuel flexibility' that it required. 'This is a configuration that is gaining more and more friends,' he said. 'Each engine can burn different fuel at different loads.'

New two-stroke selected

MAN Diesel has heralded a new era in two-stroke diesel engines with the production of the first MAN B&W S40ME-B engine.

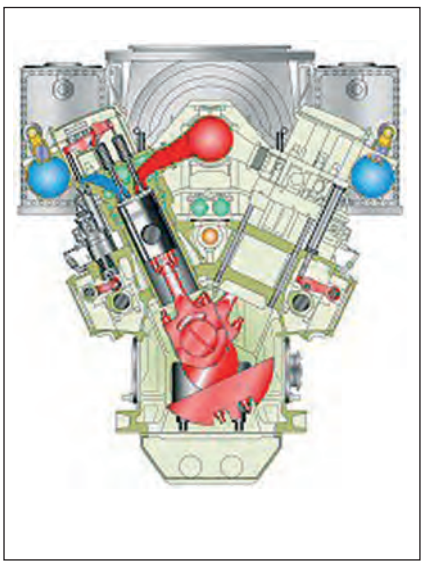
The new engine has been built by STX Heavy Industry Co, Changwon.

The 6S40ME-B is the first such prime-mover for a series of multi-purpose vessels of 25,000dwt currently being built in China by Shandong Huanghai Shipbuilding Co, and ordered by shipowner InterShip Navigation of Cyprus. The engine delivers 6810kW at 146rev/min with an MEP of 21bar.

The ME-B design is based on the experience gathered from MAN Diesel's existing MC-C and ME-C engine ranges. To suit the small-bore segment, the ME-B design utilises a camshaft-operated exhaust valve and an electronically-controlled fuel-injection system as seen with the ME-C range.

The market requirement for the lowest possible propeller speed in relation to bore size has led to the new ME-B engine having a stroke/bore ratio of 4.4. In turn, the new engine has an increased maximum cylinder pressure, giving rise to an improved fuel consumption that is 2g/kWh lower than existing, small-bore engines. Thanks to the electronic control of the engine's parameters, the ME-B is also well equipped to meet the new Tier II emission requirements.

MAN Diesel introduced the ME-B concept in mid-2006 with the small-bore S35ME-B and S40ME-B MAN B&W engine designs. It subsequently expanded the series in early 2007 with the launch of the S50ME-B MAN B&W engine design. Some 63 orders have already been received, spread among the 35ME-B, 40ME-B, and 50ME-B types.



Cross section of MAN Diesel's 51/60DF engine.

The new propulsion system will give the vessel a higher degree of redundancy in terms of maintenance while sailing, and takes advantage of the 51/60DF engine's multiple fuelling options. These comprise its gaseous fuel mode, in which LNG boil-off gas is ignited by pilot injection of marine diesel-oil (MDO), plus two liquid-fuel modes in which the 51/60DF engine can operate on either 100% MDO or 100% heavy fuel oil (HFO) main injection.

The practicalities of multi-installations of medium-speed engines mean, at any given time, one of the engines will be out of service for maintenance purposes. On this basis, operating four out of five identical engines avoids the operating limits that occur in the case of combined in-line/v-type installations, Mr Tolgos said.

'Also, if you take one of five identical engines out of operation, you face a 20% drop in power. If the configuration is three 12-cylinder and one six-cylinder engines, for example, you face a 30% drop. When you look at maintenance issues, downtime for in-line engines is also lower than is the case for v-shape engines.'

The 8L 51/60DF engines will be built in Augsburg and are scheduled for delivery in early 2009. *NA*

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Cat has IMO II in its sights

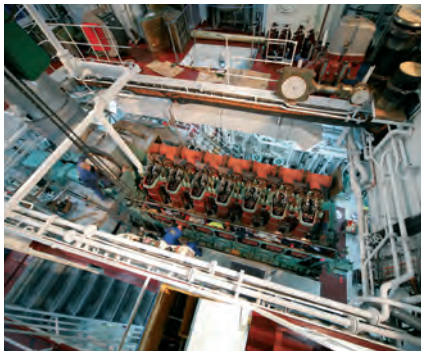
First IMO II-compliant MaK M 43 C Low Emission Engine is already in operation.

What is said to be the first known vessel afloat with an IMO II-compliant engine running on Heavy Fuel Oil (HFO) is in full operation. The MaK 7 M 43 C medium-speed engine onboard the chemical tanker *Fure West* has been upgraded to a Low Emission Engine (LEE) to meet expected future IMO emission regulations.

Furetank Rederi AB of Donsö, Sweden, operates five modern product and chemical tankers on European shipping routes. *Fure West* was delivered by Edward Shipbuilding Co, of Shanghai, in 2006. With 144m length, 21m beam, and 9m draught, these 16,000dwt tankers reach a top speed of 15.4knots.

Until October 2007, the vessel relied on IMO-compliant MaK 7 M 43 C main engines rated 6180kW at 500rev/min. However, Furetank owner Lars Höglund said: 'We have committed ourselves to being in the lead when it comes to the preservation and protection of the environment.'

The existing MaK7 M 43 C on *Fure West* was converted to LEE standard during a scheduled vessel stopover in the port of Rostock, Germany, in October 2007, with connecting rods, camshaft segments, and lower valve trains reworked to cope with LEE requirements. First, a conrod spacer was mounted to lengthen the split-shaft connecting rod, thus reducing combustion volume and increasing compression ratio. As a result, the anti-wear ring needed replacing with a shorter version.



Fure West - retrofitting MaK 7 M 43 C marine engine to LEE standard 1.

In a second step, the camshaft segments were replaced with modified FCT versions, enabling load-dependent variation of the fuel and air system. Lower valve trains, injection pumps, and injection nozzles were exchanged accordingly. In addition, specialists from ABB rebuilt the turbocharger for increased loading pressure, replacing the diffusor and nozzle ring.

The key issue for low NOx emissions is to increase the compression ratio of the base engine. Ten years ago, a compression ratio of 11-12 was standard. For IMO I, the ratio was raised to 14-15 and for IMO II ratios of 17 will be needed. A cornerstone of the MaK LEE concept is the Miller Cycle, ie modification of the engine's valve timing to achieve cooler combustion. For IMO I, only a small Miller effect of 5% was utilised. However, IMO II requires a Miller effect of 20%. This is a big challenge for the turbocharger, says Caterpillar, which has to provide boost ratios of 5 in order to maintain today's Mean Effective Pressure (BMEP) values.

By combining increased compression ratio and the Miller effect, NOx emissions can be reduced by around 30% without sacrificing engine efficiency (BSFC). However, such a simple LEE engine would suffer from poor load pick-up at idle and visible soot emissions at part load. Because of this, the MaK LEE concept uses a 'flexible camshaft' to enable both low NOx emissions, excellent load pick up, and invisible soot at all loads.

Flexible Camshaft Technology (FCT) enables variation of the fuel system and the air system at part load operation. By advancing the start of the fuel injection and increasing injection pressure, combustion is improved and soot emissions are reduced by 50%. Shifted inlet valve timing switches off the Miller Cycle and contributes another 25% reduction in soot. Overall, MaK FCT reduces soot emissions at part load by 75% while improving engine performance at transient operation.

Onboard *Fure West*, Caterpillar says emissions have been significantly reduced compared with current standard IMO I-compliant marine engines. NOx emissions are down to 8.3g/kWh, or 36% below current IMO regulations, and soot emissions reduced to less than 0.5FSN (Filter Smoke Number) over the whole load range. *NA*

Chemical Tanker *Fure West* powered by MaK 7 M 43 C Low Emission Engine.

Wärtsilä invests for the future

Wärtsilä Corp has invested in its Dutch propeller and thrusters manufacturing plant, along with producing ideas for future forms of propulsion. Clare Nicholls reports.

The former Lips manufacturing facility in Drunen, The Netherlands, was the setting for the inauguration of a new Wärtsilä thruster assembly hall in January. Around 100 thrusters per year and fixed and controllable pitch propellers should be manufactured at the new facilities, for use on cruiseships, ro-ro car and truck carriers, offshore support vessels, and other special purpose vessels.

Increasing numbers of ship orders over the past few years have seen a backlog in the production process for ship propulsion. Ole Johansson, president, Wärtsilä Corp, said that the bottleneck in producing components to build engines, propellers, thrusters, and automation had prompted the €10.3 million investment in the expansion of the Drunen facility.

Each propeller made at Drunen will be individually constructed in concrete moulds. Copper tubes and obsolete coins are melted down and poured into the moulds; the moulds being broken to remove the metal when set. The rough propeller is then milled, followed by manual grinding to refine the surface.

The new capacity will be fully utilised by 2009, and the plant will employ a workforce of 40, the majority being recruited and trained locally. Ensuring good relations with its Dutch subsidiary is important to Wärtsilä, as it is the leading marine supplier in The Netherlands with over 1500 employees, comprising an engine knowledge and logistics centre in Zwolle, marine services run from Schiedam, and high loaded engine part reconditioning in Kruiningen.

Additional expansions at the Schiedam and Kruiningen sites, as well as development of the Zwolle factory, are also planned.

Wärtsilä also intends to foster a good relationship with its propeller production location for Asia, in Zhenjiang, China. The company believes that this Asian cooperation has to be balanced, and that being open keeps it in the loop as regards to new developments.

The new Wärtsilä thruster assembly hall in Drunen, The Netherlands.

It is giving Chinese Wärtsilä workers and students the chance to study in The Netherlands, which it reckons will also build up contacts for the future. However, research and development is still based in Drunen, which endeavours to stay one step ahead of the Chinese facility in terms of technology, as Wärtsilä asserts that it is important for the company to keep as many jobs in Europe as possible.

However, Chinese expansion has been rapid. Five years ago there were 150 Chinese employees, but today that figure has risen to 1000. Compact thrusters are also manufactured at the Wuxi plant.

Propulsion: the future?

Overall, 2007 was another profitable year for Wärtsilä, with net sales growing by 18%. In 2008 the company predicts a record 25% growth rate, with the figures based upon contracts already in its orderbook. The corporation is also looking towards the future with its new concepts for efficient and less costly forms of propulsion.

One of these ideas is for an efficiency rudder, a product which has been developed in cooperation with Becker Marine Systems. The design places the rudder behind the propeller to increase thrust and torque. The rudder force generates thrust at low advance ratio, and resistance at large advance radio.

During this project, Wärtsilä has concluded that a ship's rudder and propeller should be designed together, as the rudder is important for the interaction with the propeller. Model testing has indicated that the application of a rudder bulb increases propulsive efficiency and results in lower fuel cost, with reported savings of 5% to 7% for single screw propulsion, and 3% to 5% for the twin screw version.

Noise and vibration reduction was recorded at 30% to 45% for single screw models and 20% to 25% for twin screw. Another claimed advantage is less rudder cavitation, due to better alignment of the flow behind the propeller.

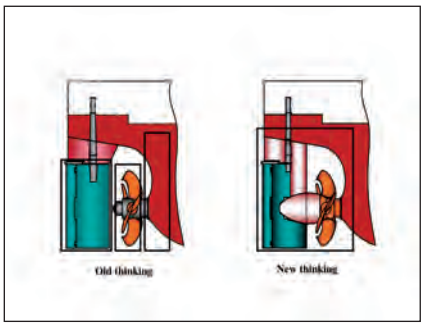
The topic of wing thrusters has been broached as another example of increasingly efficient propulsion systems. Wärtsilä's ship power research and development department believes that three propellers offer a larger disc area,

resulting in lower loading and higher open water efficiency.

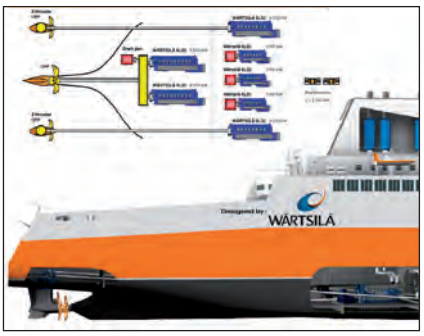
The arrangement is also reckoned to create a more beneficial wake field behind a skeg and a clean wake field for the thrusters. Wärtsilä estimates that the concept offers clear advantages over conventional twin shaft lines due to lower fuel consumption, improved manoeuvring, and a payback time of less than 10 years calculated for a 21,000gt short route ferry.

Podded controllable reversible pitch (CRP) propulsion is a further concept that has undergone development by Wärtsilä. It is said to offer lower power demand than twin shaft lines normally used in ferries, as the aft propeller recovers some of the rotative energy in the slipstream of the forward propeller and there is a more favourable wake and lower resistance with a single skeg hullform.

The company has produced a ferry concept design based upon CRP thruster propulsion, utilising a W46 engine, at an estimated length overall of 186.6m and gross tonnage of 28,500gt, giving a total speed of around 24knots. When compared to a reference vessel with conventional twin shaft line machinery, the W46-powered CRP version required an estimated 11% less propulsion power demand.



Comparison between old rudder design and Wärtsilä's efficiency rudder.



Machinery arrangement example of a ferry powered by wing thrusters.

Additionally, Wärtsilä has designed an offshore support vessel with retractable wing thrusters, claimed to combine the low resistance of a single skeg hullform with the manoeuvring performance of steerable thrusters. This offers the possibility of gaining a high dynamic positioning class.

The concept could offer advantages for a ship operator such as the same power plant benefits as a diesel-electric machinery configuration, but with reduced emission levels and operating costs due to lower fuel consumption. An alternative set-up utilising only one retractable thruster could lower investment costs, along with a smaller space demand inside the vessel. *NA*

8000 series comes into its own

MTU's latest generation for larger ferry applications is finding favour.

For larger fast vessels, of over 100m in length, high-speed engine specialist MTU's largest new engine series, the 20 cylinder 8000, appears to be coming into its own, with around 100 engines of this size produced in 2007 for mining and marine applications.

The 8000 series is now available in three versions, turning out 7200kW, 8100kW, or 9100kW of power, where its common-rail injection provides the base technology to meet pending legislation on air emissions, without any need for after-burn treatment. The company said its development programme also looked to satisfy new regulations on emissions without increasing fuel consumption, in order that CO_2 emissions could also be controlled.

With its in-house designed electronics and sequential turbochargers, this unit is effectively the successor to MTU's 20 cylinder 1163 series.

It was the 8000 series that was preferred for the world's largest existing diesel-powered fast ferry - catamaran or monohull - the much-lauded Austal-built *Benchijigua Express*.

The 127m long, Fred. Olsen trimaran represented a new hullform for large fast ferries on its delivery in 2005, but little acknowledged at the time was the fact that the MTU engine installation was 'open' to upgrade, with sufficient space left within the hull for the installation of new power units.

During its initial sea trials with operating ride control *Benchijigua Express* achieved a speed of 40.4knots whilst carrying deadweight of 500tonnes. With a capacity to carry 1350 passengers and 341 cars the ferry operates between Los Christianos in the south of Tenerife and the islands of La Gomera and La Palma.

The four MTU 20V 800 engines are arranged in two separate enginerooms in the trimaran's central hull. Those in the aft engineroom each drive a Kamewa 125 SII steerable waterjet from Rolls-Royce while the two forward engines deliver their combined power to a Kamewa 180 BII booster waterjet. Each of the three drivelines features Renk transmissions, with lightweight composite shafts fitted between the waterjets and gearboxes and on the output shaft of the forward most engine. The exhausts for the outboard aft engines are dry type, exiting the vessel at the bridge deck through a funnel casing. The inboard engines have a wet exhaust system exiting between the hulls.

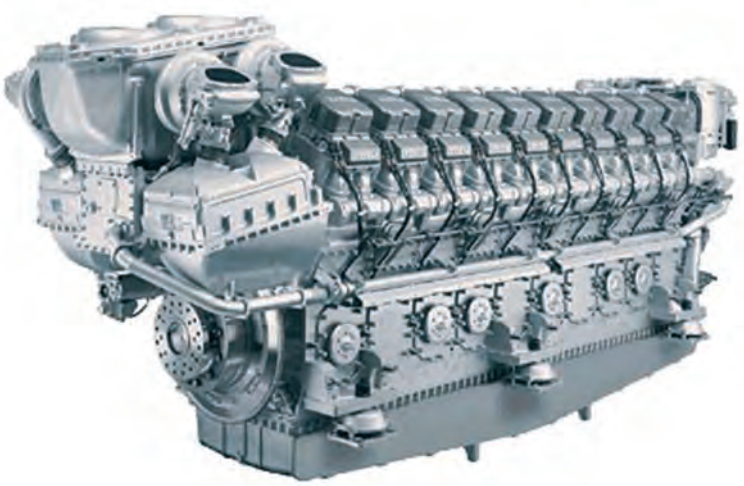
The power upgrading was undertaken last year, when the ship's four MTU 20V 8000 series engines, offering 8200kW at 1150rev/min each, were uprated to 9100kW.

According to MTU, the extra engine power has proved a critical factor in containing fuel costs.

For MTU, the installation aboard *Benchijigua Express* is just one example of its good working relationship with shipbuilder Austal. January 2008 saw the 65m long Auto Express catamaran ferry *Shinas*, built for the Sultanate of Oman, achieve a service speed of 52knots during sea trials, making it the fastest diesel-powered vehicle-passenger ferry currently in commercial service. The vessel, delivered in February and one of a pair for the same customer, is powered by four MTU 20 cylinder 1163 series diesel engines each producing 6500kW and driving Rolls-Royce/Kamewa waterjets.

Four MTU 20 cylinder 8000 engines also power the Auto Express 88m length fast car ferries built for Istanbul Deniz Otobusleri, driving a Lips propulsion system through four Reintjes gearboxes. Again, the 107m long, 40knot capable Auto Express vehicle-passenger catamaran *Alakai*, delivered to the Hawaii Superferry Corp in mid-2007, features four MTU 20V 8000 M71 8200kW at 1150rev/min.

Current research and development across MTU's range of 2000, 4000, and 8000 series engines is focusing on the need to keep components cool enough to touch via a water/air/water triple cooling process. *NA*



The latest 8000 series engine from MTU.

The Royal Institution of Naval Architects

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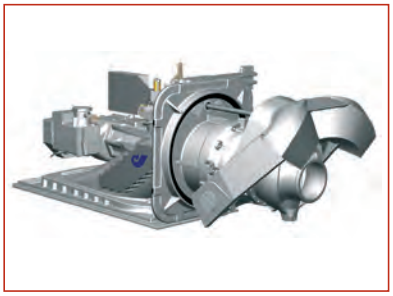
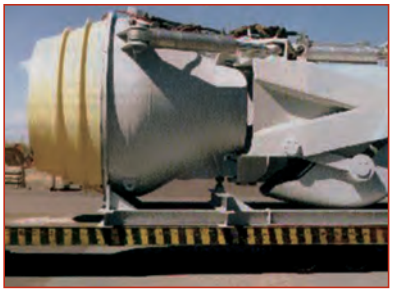
This international conference continues the very successful series of RINA events looking at developments in waterjet propulsion.

Waterjets are now accepted as a proven technology, particularly for high speed craft and they are increasing their penetration into small craft, leisure, workboat, patrol and military markets. Today, waterjets are becoming the preferred propulsion choice where high efficiency, enhanced manoeuvrability, shallow draft capability and low maintenance are key requirements. Continuing developments now include very large units of 30MW capacity and the use of waterjets for high speed boost propulsion.



As the technology matures, designers need better tools to help predict the performance and efficiency of these systems across a wide range of operating conditions. Computational fluid dynamics is an increasingly powerful tool which has become almost universal, but traditional model testing and trials measurements are still required to confirm critical results.

Designers and manufacturers also continue to seek to reduce noise, wake and wash as well as optimise the strength and weight of the various mechanical components and to improve reliability, reduce installation time and maintenance.



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The future is turbocharged

ABB Turbo Systems has a new generation of turbochargers, designed to meet even the toughest of future air emissions legislation envisaged.

ABB Turbo Systems intends to press home its market leading status in the turbocharger market through technological development, with the coming launch of its new generation A100-L turbochargers for low-speed engine applications.

The veil is still drawn over the precise specifications of the coming generation, but what is known is that, where pressure ratios for ABB's existing TP series turbochargers are thought to peak at 4.5πc, the new A100 series will feature pressure ratios of up to 5.8πc in high-speed and medium-speed diesel and gas engine applications, and up to 4.7πc in low-speed engine applications.

ABB sees the existing TPL-B turbocharger type for low-speed engines as continuing to service the need for engines in service, but expects the A100 series to come into its own when used in combination with newer engines. In accordance with coming, tighter regulations on air emissions, such engines will operate at higher brake mean effective pressure (BMEP), in order to achieve higher specific output. For the turbocharger, this means the same amount of air, but operating at a higher pressure ratio.

The supplier points out that higher pressure ratios confer greater efficiency. In a low-speed application, the A100 series will be able to cover engines operating at up to 23bar, in line with what is expected to be necessary to meet the IMO's future Tier III air emissions criteria. This will be achieved through a single shaft aluminium configuration, without needing to resort to exotic materials or titanium. A100 units will feature new compressor and turbine stages.

What is known is that the first unit in service for low-speed applications will be the A175-L, which is expected to be working onboard a ship in combination with two stroke engines before the first quarter of 2009 is out. Here, the '75' refers to the frame size and 'L' refers to low speed.

'A lot depends on what the emissions regulations turn out to be,' said ABB Turbo Systems general manager, marine, Arie Smits. 'No one yet knows what IMO III will mean. Will it call for an 80% cut [in NOx], where we will need to use SCRs [selective catalytic reduction]? We just don't know. But we do know that engine BMEPs are going to go up to around 23bar. In fact, although not for a specific vessel, the first 50 bore D engine from Wärtsilä is already developed and that will need an A175L turbocharger.'

ABB launched the first A100-generation turbocharger, the A140-H for high-speed engines, at the end of 2007, and it will be available from the first quarter of 2008. It will be followed in due course by the A100-M series and the A100-L series for the medium-speed and low-speed engine segments, respectively.

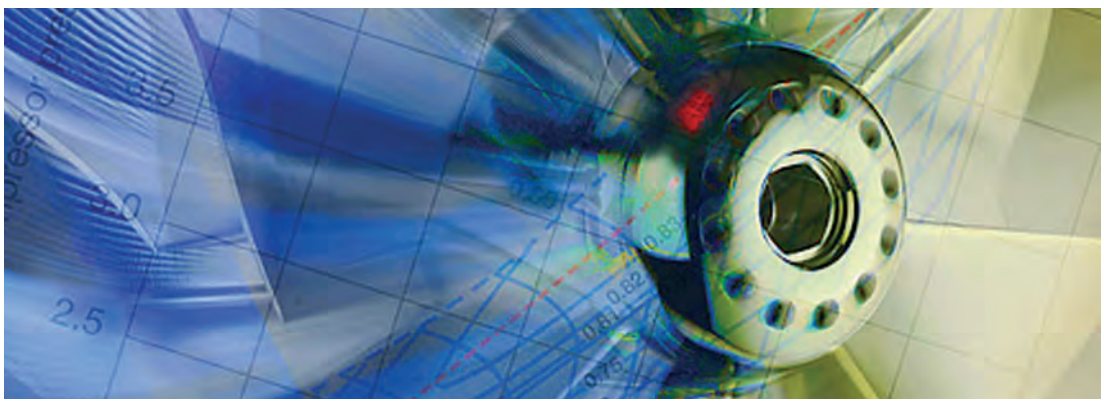
Higher pressure ratios meant that engines could achieve a lower specific fuel consumption than was possible today, Mr Smits said, at the same time broadening opportunities for the application of waste heat recovery technology. *NA*

ABB adds lower power offering

ABB Turbocharging has added to its TPS..-F turbocharger family, with the launch of the .TPS44-F. The new compact turbocharger extends the TPS..-F application range to include small-, medium-, and high-speed engines rated below 500kW.

The TPS44-F is the fifth and smallest member of the family of TPS..-F turbochargers for engine outputs beginning at 400kW. It extends the application to the lowest rated HFO burning medium-speed engines and meets the specific requirements of smaller high-speed diesel and gas engines coming onto the market. Three radial compressor stages support engine operators' efforts to reduce emissions and fuel consumption while providing the high power necessary to compete in the marketplace.

The first of these new turbochargers to be launched are the TPS44-F31 and TPS44-F32, offering users full-load pressure ratios of up to 4.8.



The lid has yet to be lifted on the full specifications of ABB's new generation of A100-series turbochargers.

Optimising air management

The next phase of diesel engine development is set to be dominated by advanced digital electronics as the enabling technology of the highly flexible setting of engine operating parameters, according to MAN Diesel.

On the fuel management side, the advent of microprocessor-controlled common-rail fuel injection technology has given the designer the scope to optimise injection pressure and timing at any point on the operating profile of a large diesel engine.

Paralleling this development, MAN Diesel's turbocharger unit in Augsburg is pursuing projects aimed at achieving a similar level of parameter control on air management.

Driving development is planned legislation to further limit emissions of oxides of nitrogen (NOx) from large diesel engines, as exemplified by the second Tier of emissions regulations from the International Maritime Organization (IMO), as well as efforts to reduce specific fuel oil consumption (SFOC), both for economic reasons and as a route to reduced emissions of the greenhouse gas carbon dioxide (CO_2).

The link between fuel efficiency and emissions has gained new importance as emissions of CO_2 have come to share equal focus with noxious emissions like NOx and oxides of sulphur.

While, essentially, exhaust emissions are in direct proportion to fuel consumption, a special challenge in reciprocating engines is the trade-off between specific fuel consumption and NOx – ie the fact that reducing NOx formation in diesel or gas engines is normally bought at the expense of fuel efficiency.

Optimising the SFOC/NOx trade-off is achieved by advanced turbocharging as a method of simultaneously reducing specific fuel consumption and NOx formation via reduced combustion temperature combined with increased thermal efficiency.

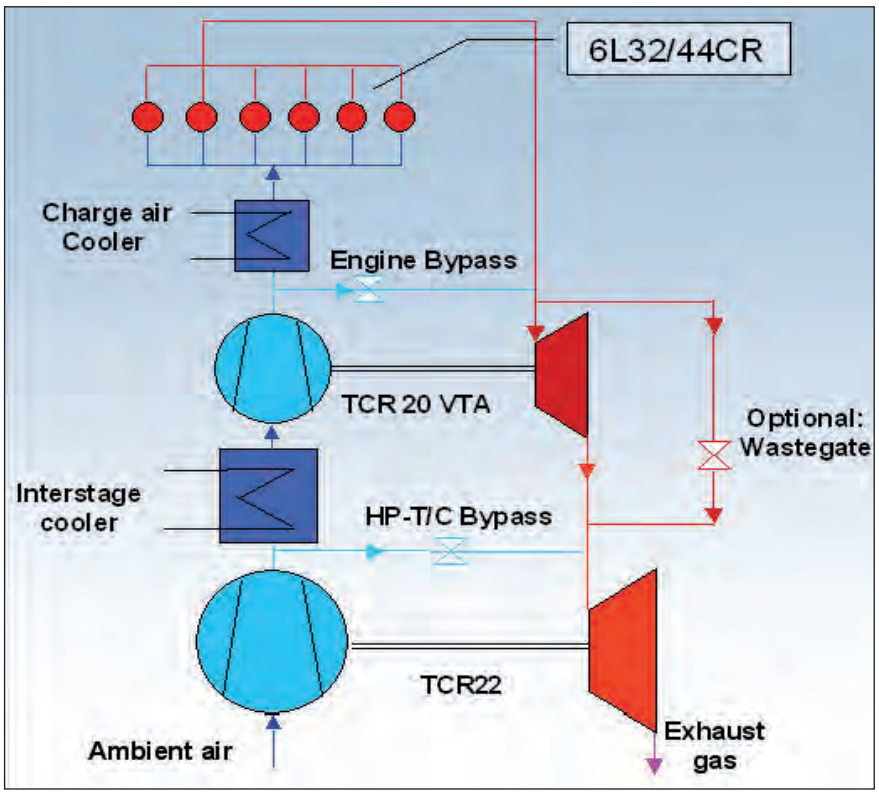
MAN Diesel has developed Variable Turbine Area (VTA) technology on its axial turbochargers in a two-stroke marine engine application and on radial turbochargers employed on its four-stroke type 32/40 PGI gas engine with Otto combustion process.

The company is also currently developing the Sequential Turbocharging System for its high power density 28/33D marine engine, initially for application in naval vessels.

The STC system offers optimum engine-turbocharger matching for special requirements and gives 28/33D engines an extended torque envelope, resulting in economical operating modes and improved engine acceleration characteristics. These modes are said to be especially useful in naval applications and include cruising with a controllable pitch propeller set at optimum pitch for noise while still retaining high acceleration capability; operating a single engine at twice the propeller law in multi-engine systems (eg twin input/single output gears, CODOG etc).

The MAN Diesel STC system is essentially - and intentionally - simple, consisting of two identical, standard turbochargers, one providing copious charge-air at low and medium speeds with the second cutting in at higher speeds.

The VTA system consists of a nozzle ring, equipped with adjustable vanes, replacing the fixed-vane rings used in MAN Diesel's standard TCA and TCR turbochargers. Adjusting vane pitch regulates the pressure of the exhaust gases impinging on the turbine to vary compressor output. The quantity of charge air can be more precisely matched to the quantity of injected fuel, resulting in reduced specific fuel consumption and



Prototype arrangement of a turbocharged MAN Diesel four-stroke engine type 32/44 CR.

emissions, in combination with improved dynamic behaviour of the engine-turbocharger system.

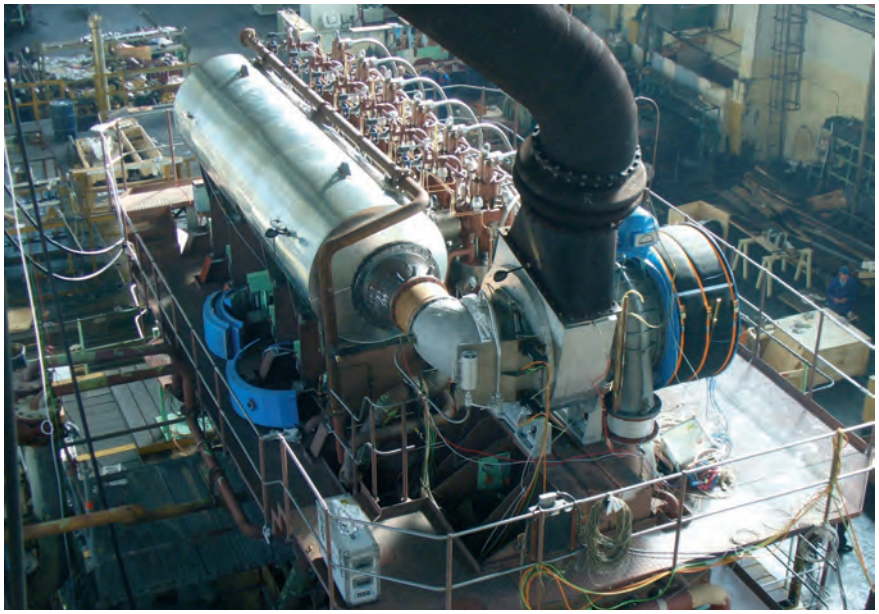
The VTA system consists of a nozzle ring equipped with adjustable vanes which replaces the fixed vane nozzle rings fitted in MAN Diesel's standard TCA turbochargers. In this way, VTA technology can be readily retrofitted to turbochargers already in the field. By adjusting the pitch of the vanes, the pressure of the exhaust gases can be regulated and the output of the compressor optimised at all points on the engine's performance map.

In order to minimise thermal hysteresis and improve adjustment accuracy, each vane has a lever, which is directly connected to a control ring. The control ring is actuated by an electric positional motor with integrated reduction gear whose development was an integral part of MAN Diesel's VTA solution. The adjustable vanes are manufactured in heat- and erosion-resistant steel alloy, and careful selection of fits and materials ensures operation under all conditions without sticking, especially in applications on engines burning heavy fuel oil (HFO).

Control of vane position is fully electronic with feedback or open-loop control with mapped vane adjustment. A comprehensive range of control signals can be used, including charge air pressure after the compressor and exhaust gas temperature before and after the turbocharger. In this way, MAN Diesel states, it can offer control packages precisely tailored to a specific application, including both mechanically-controlled engines and engines with electronic management. For retrofit applications, MAN Diesel will offer complete packages including the VTA nozzle ring, the actuator, and the associated control system.

The first application for an axial turbocharger with VTA technology is a two-stroke, low-speed marine engine, while a radial turbocharger with VTA technology is being tested on MAN Diesel's revolutionary 32/40 PGI gas engine.

The VTA system on an axial turbocharger is also under test on a six cylinder, 46cm bore 6S46MC-C engine built by MAN Diesel's Croatian licensee Brodosplit. The HFO-burning 6S46MC-C features mechanically-controlled fuel injection and exhaust valve actuation and is one of two engines installed in a twin engine propulsion system aboard the 70,000tonnes, shallow draught tanker *Stena President*, built at the Brodosplit shipyard for the Stena Concordia Maritime shipping line.



The MAN Diesel VTA system is under test on a six-cylinder, 46cm bore 6S46MC-C engine built by MAN Diesel's Croatian licensee Brodosplit powering the shallow draught tanker *Stena President*. Here, the engine is seen during shop testing.

Inclusion of VTA technology on the axial TCA55 turbocharger allows up to 0.5bar variation in compressor output pressure at part load. Overall results show the expected improvements at part load in terms of fuel consumption, considerable reductions in emissions of soot and unburnt hydrocarbons, as well as improved engine response under load changes. It was also demonstrated that VTA technology gave a useful new dimension to the mechanically-controlled engine. The effects are said to be comparable to the use of variable valve timing and electronic engine control. To attain the best possible comparison the engine with VTA turbocharger runs alongside a second 6S46MC-C engine with conventional turbocharging.

Specifically, the benefits of the higher scavenging pressures in part-load operation provided by the VTA turbocharger include lower SFOC at part-load, improved torque and engine acceleration, lower combustion chamber temperatures, and the exacted savings in electrical energy to drive the auxiliary-blowers, depending on the engine load-profile.

On a slightly longer timeframe, MAN Diesel is also pursuing single and two-stage high-pressure turbocharging. In its single stage, high-pressure turbocharging concept, MAN Diesel employs optimised Series compressor wheels to achieve pressure ratios up to 6bar at 80% turbocharger efficiency.

By employing the inter-stage cooler between the two turbocharging stages, the energy required to compress the intake air to high pressure is considerably reduced compared to a system without this feature.

These high-end turbocharging techniques offer decisive improvements to engine performance data, especially by enabling strong Miller valve timing to improve the trade-off between SFOC and low NOx emissions. As the comparative table shows, mean cylinder pressures over 30bar are possible while the strong Miller process allows NOx reductions in excess of 30% savings with no SFOC penalty.

At the same time an increase of up to 8% is possible in thermal engine efficiency combined with a 2% improvement in fuel efficiency, while future potential for SFOC and NOx savings is also considered substantial. *NA*

Composite shafts press their case

Growing demand for carbon fibre drive shafts for ship and boat propulsion.

Weight-saving composite materials became a commonplace feature of civil aviation in the early 1980s. Since that time, such materials have also been gaining ground in maritime applications, with the need to increase vessel speeds by reducing their weight especially coming to the fore in the case of high-speed ferries.

Endurance, stability, and low weight: these are all features which have rendered carbon fibre applications interesting for marine propulsion, according to a leading supplier of drive components.

CENTA, of Haan (near Düsseldorf, Germany), reckons to have been one of the pioneers among those using composites for drive shafts, with research and development starting 12 years ago in cooperation with the Technische Universität Darmstadt (Germany) and classification societies.

Today the company's portfolio includes over 20 elastic couplings, drive shafts, and supplementary products, covering a torque range of 1kNm up to 650kNm. Among these are drive shafts with a capacity of more than 25MW per shaft, while 600 of these shafts are already in service.

According to CENTA, demand for composite drive shafts is constantly growing. 'More and more high-speed ferries, cruise vessels, luxury yachts, tug boats, and rescue boats are being equipped with lightweight shaft solutions,' the company says.

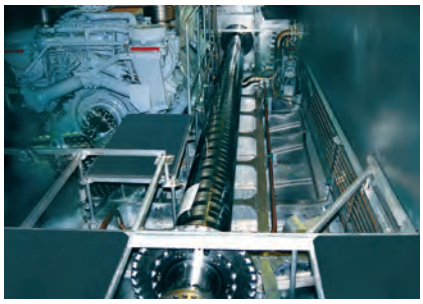
CENTA points out that carbon fibre is around 70% lighter than conventional steel, while the material also exhibits a long service life, extremely low thermal expansion, and excellent noise damping characteristics.

Moreover, composites allow longer spans without additional intermediate shaft bearings. This, the company argues, in turn, implies further weight savings, reduced costs, less assembly work and maintenance, and a further reduction of noise and energy loss.

Composite sections of up to 12m or more are possible and, by combining sections, no limit has thus far been established to overall shaft lengths. Applicable torques of 1000kNm have already been delivered, while those of up to 2200kNm have been designed. The biggest shaft ever supplied by CENTA transmits 23MW from a gas turbine to a waterjet.

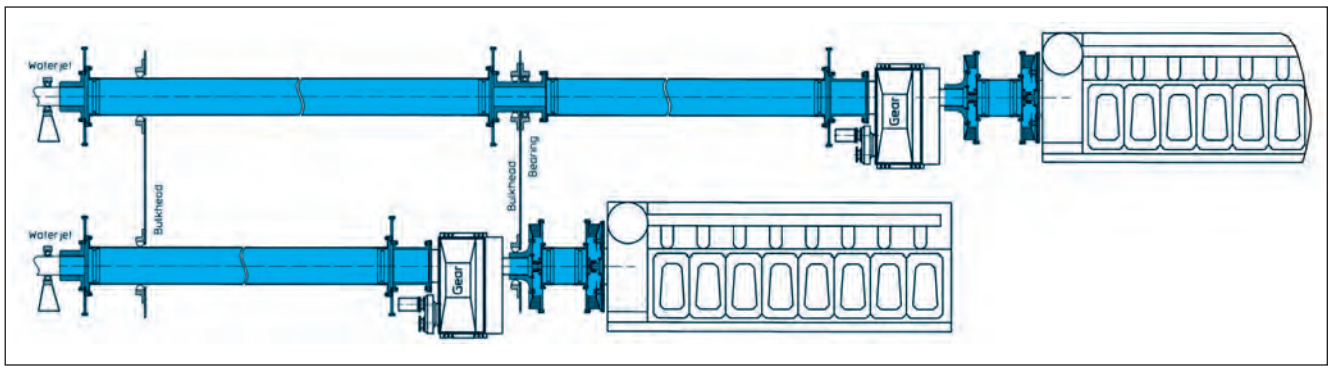
The latest development from the company sees the introduction of the 'CENTADISC-C' – a flexible shaft, consisting of fibre-reinforced composite membranes and composite hollow shafts. Areas of application include: ship propulsion (namely waterjets), wind power plants, cooling towers, and general engineering. The unit is extremely low in weight, maintenance-free, and applicable to torque ranges of up to 20kNm.

According to the company: 'The good experiences CENTA has obtained with carbon fibre as composite material speak for themselves: more than 150 ships have been equipped with carbon fibre shafts during the last 10 years. Every single one of them is working reliably. Market prices for the composite shafts are still higher than those for steel, but including the overall service life of the shafts into the cost-effectiveness evaluation quickly puts things into perspective. The shafts show no signs of material fatigue or corrosion, and they work maintenance-free. Furthermore, their lightweight construction meets the demands for greater velocities and fuel economy. Comfort aboard a ship is significantly increased by shafts running smoothly and evenly. Thus, it is merely a matter of time before carbon fibres will play as essential a role in maritime applications as they are currently playing in civil aviation.' *NA*



CENTADISC carbon fibre shaft for the vessel *Flying Cat.*

Typical arrangement of CENTA couplings and carbon fibre shafts. The first sections behind the engines also comprise two CENTAX torsional couplings each that tune the torsional vibrations of the system.



Sealed pumps offer safety first

A debate needs to be had on safety levels observed in enginerooms relating to pumps, according to innovative pump maker KRAL, of Lustenau, Austria.

While current Safety of Life at Sea provisions demand fire prevention measures in the engineroom, defining distances between pump booster modules and areas with hot surfaces, and also setting out fire protection requirements, SOLAS also inherently accepts that, in some cases, heavy fuel oil pumps can leak.

In the case of higher pressure common-rail engines, rules require pumps to be jacketed so that no spray can occur within the engineroom. However, in the case of lower pressure systems, no such strictures prevail.

KRAL is exploring levels of interest in developing new rules that could specify hermetically-sealed pump units as the safer option for engineroom operations.

The pump maker points out that the hermetically sealed option affords advantages over conventional booster units when it comes to facing inspections by Port State Control. One of the prime items on PSC and Class checklists on boarding a vessel will be the cleanliness, or otherwise of the engineroom. This is partly why magnetic, hermetically-sealed pump units have been preferred by forward-looking operators, such as Maersk, Columbus Ship Management, and E R Schiffahrt, says KRAL, while also reporting new and rising levels of interest from cruiseship owners.

'We have found that there are different reasons why owners are deciding to opt for magnetic pumps,' says Thomas Flauger, KRAL Pumpen-Volumeter product manager. 'One is they save money over time, because they don't have to replace the mechanical seal three times a year. Also, it can be hard to find well-trained staff to maintain operations onboard, so there is a tendancy to reduce the level of support needed in the engineroom. That means a more reliable product is required, rather than one that needs frequent checking.'

Mr Flauger conceded that owners were often hard to convince of the benefits of magnetic couplings at the newbuild stage, for budgetary reasons. However, he said that, increasingly, after three to five years of a ship being in operation, owners came round as they looked to improve the operational efficiency of their ships. E R Schiffahrt has now installed KRAL magnetic pumps onboard 15 ships, Mr Flauger says.

To support this, KRAL has devised a 'pump upgrade project', through which it offers pumps featuring magnetic couplings on a free trial basis, typically over six to 12 months.

At the same time, however, KRAL is keeping abreast of developments in the larger market for pumps featuring mechanical seals, where changing HFO quality is having an effect on the materials used. As fuel viscosity levels have risen, so has the necessity for pre-heating fuels. Typically, a 380cst quality fuel will need to be pre-heated by 120°-130°, but a 500cst fuel will require pre-heating by 150°. More abrasive fuel types demand different materials in the O-ring, and it is for this reason that KRAL's mechanical seals now feature sicarbide as the sealing material. *NA*

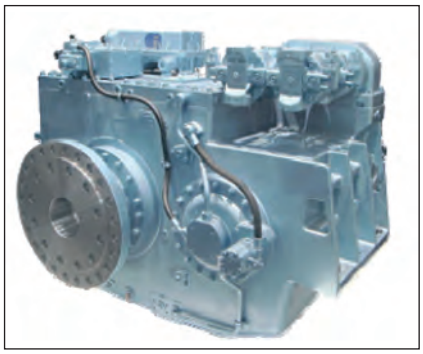
Largest transmission from ZF

The second of a pair of large fast ferry builds for operations in Japan from Tasmanian yard Incat are also distinguished by one of the largest ever marine transmission installations from ZF Marine.

The second ferry for Higashi Nihon Ferry will join her sister *Natchan Rera* (*Significant Ships of 2007*), completed by Incat last August, in service across Japan's Tsugaru Strait between the islands of Honshu and Hokkaido.

At nearly 11,000gt the new 112m long *Natchan World* is due delivery in April and is one of the largest vessels built by Incat. Yet she will function with a loaded draught of just 3.83m, enabling her to operate into the shallowest of ports.

With *Natchan World*, Incat reckons to have reached the pinnacle in high-speed craft luxury and comfort, with this its most valuable export to date. Operating at speeds of approximately 40knots and with capacity for up to 800 persons and 355 cars, or 450 lane metres of trucks and 193 cars, *Natchan World* is almost identical to her sister, *Natchan Rera*.



Horizontal offset, remote mount marine transmission.

Like her sister, the ship has four independent enginerooms, each with a 9000kW MAN Diesel engine at 1000rev/min, and each engine works in combination with one of the largest transmissions from ZF Marine GmbH, the ZF 60000 NR2H. This marine transmission with reduction drive gearing and hydraulically-actuated multi-disc clutch for engagement has an output shaft rotating in the opposite direction to that of the input shaft. The unit has been especially designed for low weight in heavy duty fast ferry applications. It is also suitable for other weight sensitive craft, for example high-speed motor yachts. ZF points out that it is compatible with all types of engines and waterjet propulsion.

The Chinese connection

The world's leading suppliers of propulsion solutions are queuing up to match China's burgeoning shipbuilding ambitions.

Over the last decade, China's shipbuilding output has increased by 500% and, in the period January-September 2007, vessel numbers contracted amounted to 15% above the same period of 2006, while tonnage was up by 40%. Among shipbuilding nations, China achieved number one orderbook status, having 41% of new vessel orders, while South Korea had 30%.

Against this backdrop, it is no surprise to learn that the world's leading suppliers of propulsion solutions are busy developing outlets for their wares throughout China, although they have been adopting contrasting strategies.

After a flurry of agreements, MAN Diesel added a seventh member to its Chinese two-stroke licensee family in January, through a new contract with Zhenjiang CME Co (ZJCME). The licensee is a subsidiary of state-owned China State Shipbuilding Corp (CSSC).

ZJCME already holds a four-stroke licence with MAN Diesel to build generating sets. It signed the new, two-stroke agreement to build engines up to 50cm bore.

Klaus Engberg, senior vice president for MAN Diesel two-stroke licensing said: 'At the moment, we are seeing an unprecedented boom in the contracting of ships, particularly in China. However, although engine production is also on the increase, China is still experiencing a shortage of engines. We therefore warmly welcome the decision of CSSC and ZJCME to produce our two-stroke engines.'

MAN's other Chinese two-stroke licensees are: Dalian Marine Diesel Works; STX (Dalian) Engine Co; Yichang Marine Diesel Engine Plant; CSSC-MES Diesel Co (CMD); Hudong Heavy Machinery Co; and Wuxi Antai Power Machinery Co. The last of these companies, located in Jiangsu Province, has also previously been a licensee for MAN Diesel four-stroke auxiliary engines, with supplies covering vessels in the 10,000dwt-30,000dwt range. It signed a new agreement covering two-strokes at the end of 2007. While production capacity is currently dictated by the availability of crankshafts, the Wuxi plant plans to turn out 45 two-stroke marine engines per year by 2009, rising to 60 in the following year, with the ultimate target being 200 engines per year.

Meanwhile, MAN Diesel has been broadening its engine portfolio in China, with the new dual fuel version of its 51/60 engine apparently being offered through Hudong Heavy as part of undisclosed plans for a non-Chinese owner to build 165,000m^3 capacity LNG carriers.

MAN Diesel Shanghai Co managing director, H J Brenner, said that, in November 2007 alone, MAN Diesel had received no fewer than 10 applications from different investors in China looking for licensing agreements with MAN. 'Demand for small- and medium-sized engines has been particularly incredible,' he said, 'but we have to be selective because we don't want any family disputes.'

Also added as a licensee, at the end of 2006, was Wuhan Marine Machinery Plant Co, with a remit to produce propellers. The first of a batch of 10 propellers was due to have been delivered at the turn of the year, but Mr Brenner said that MAN's ambitions for licensee WMMP extended to production of up to 100 units per year 'once production is up to quality standards.'

12000dwt multi-purpose cargo vessel, featuring a MaK 6 M 43 C marine engine, and built by Jiangxi Shipbuilding.

Four-stroke engines are currently the mainstay of MAN Diesel's German production site, in Augsburg, with units imported into China as engine/gearbox/propeller packages. Its 58/64 in-line engine, the largest in terms of cylinder dimensions to be produced from Augsburg, has proved particularly popular as a consumable by Chinese builders: over 150 of these engines have been supplied to Chinese yards, predominantly for installation onboard container feeder ships, either in a single or a double configuration.

Different strokes

For its part, main competitor Wärtsilä Corp has been pursuing a strategy of developing owned facilities and joint ventures in China, covering the wider propulsion equipment portfolio. It now has over 1000 employees in China, including joint ventures.

It extended its production plant in Wuxi, China in November 2007, which manufactures thrusters as well as seals and bearing products for all kinds and sizes of vessels. Wärtsilä has pumped in €20.8 million into this plant since 2005.

Built on a greenfield site, the Wuxi plant, 100km west of Shanghai, is Wärtsilä's first wholly-owned production venture in China.

'Wärtsilä has a clear strategy to be close to our customers and move with our markets,' said Lars Hellberg, group vice president of Wärtsilä industrial operations. 'The extension of the factory more than doubles the shop floor area and will now, in addition to the production of transverse thrusters, also have production lines for steerable thrusters and seals and bearings products and components.'

Since 2005, the factory has produced 300 tunnel thrusters having propellers of 1.2m-3.0m diameter, with a power range from 500kW to 3500kW, both of fixed pitch and controllable pitch design.

Wärtsilä currently employs 133 staff at Wuxi, which will rise to about 220 when the extension is in full production in 2009. The employees are hired locally with only a few expatriate specialists.

Wärtsilä also has a 55% stake in a joint venture company in Zhenjiang, producing fixed pitch propellers. Wärtsilä CME Zhenjiang Propeller Co Ltd is the biggest fixed pitch propeller manufacturer in China and one of four big producers in the world in this sector. The joint venture was set up in 2004, with a new factory inaugurated in June 2007.

Meanwhile, the joint venture company Wärtsilä Qiyao Diesel Co Ltd (WQDC) - in Shanghai - began the manufacture of complete marine diesel generating sets in June 2006. Wärtsilä said its WQDC joint venture had ambitious plans to ramp up genset production. Esa Kivineva, managing director of WQDC, said: 'Based on our first year, we believe that we can exceed 300 units each year.' While the first year of operation concentrated on the Wärtsilä Auxpac 20 design, production of Auxpac 26 units is set to increase throughout 2008.

Again, the joint venture Qingdao Qiyao Wärtsilä MHI Linshan Marine Diesel Co Ltd (QMD) was established in 2007 to manufacture low-speed marine diesel engines and, while in its start-up phase and as yet a small organisation, with fewer than 50 staff, it is understood that Wärtsilä envisages it growing to an operation 500-700 strong.

Aside from these arrangements, Wärtsilä also has three licensees in China - Dalian Marine Diesel Works (DMD), Hudong Heavy Machinery Co Ltd (HMM), and Yichang Marine Diesel Engine Plant (YMD) - to manufacture Wärtsilä low-speed engines.

Wärtsilä China president, Clas-Eirik Strand, emphasised that the company's approach to the Chinese shipbuilding market ran deep, particularly after the propulsion specialist bought Hamburg-based design house Schiffko last year. He said that Schiffko container feeder ship designs had been specified on over 130 occasions, with the majority of these ships built in China. 'China was on our minds when we bought Schiffko,' said Mr Strand. 'Naturally, we are looking at ways to expand in ship design, building on what Schiffko has been doing so far. In China, there are state-owned competencies, but also private yards with no design capacity of their own. It is not always hull work that is required – it might be machinery, pipe, and shaft lay-outs. We have to decide at what level we should go in and we are currently brainstorming.'

He said that while Schiffko itself had a larger orderbook than at any time in its history, which it needed to concentrate on fully, such was the pace of growth in Chinese shipbuilding, and the attendant opportunities, that there was little luxury for extended planning. 'If we do something, it will be within a 2008 timeframe.' Wärtsilä was considering setting up a 50-strong design office, located in Shanghai. 'It probably won't be called Schiffko, although it could involve Schiffko management. We

H J Brenner, MAN Diesel Shanghai Co Ltd managing director: MAN Diesel received applications from 10 would-be Chinese licensees in November 2007 alone.

Clas-Eirik Strand, Wärtsilä China Ltd president: 'What most people don't realise is that China is a decentralised country.'

will probably go for something generic, like Wärtsilä Ship Design,' said Mr Strand.

In a broader context, Mr Strand said that the sheer scale of the growing Chinese shipbuilding sector meant that Wärtsilä had reappraised its approach to the country. 'What has become apparent here is that we will have to regionalise our sales and services businesses. Take the Dalian area: that is an area that is bigger than Germany, Spain, and The Netherlands combined. Shanghai and Hong Kong have been our base places, but the Dalian office is growing rapidly and, in 2007, we also set up operations in Beijing and Guangzhou.

'What most people don't realise is that China is a decentralised country, and that the provinces are rather powerful, with their own agendas. Ultimately, we may come to look at Chinese production in a decentralised way also – the prop shaft bearings and seals business, for example, could be partly decentralised and there might be other opportunities.'

Roots for growth

Other manufacturers have also been busy laying down roots. Caterpillar Marine Power Systems (CMPS) says it has notched up record sales to shipyards in China. The MaK propulsion solution has been specified by around 250 customers for container feeders, cargo vessels, bulk carriers, and tankers currently on order at, or recently delivered from, Chinese shipyards in and after 2008.

Recent vessel series using MaK main propulsion include 29 x 1700TEU container feeder ships for Zhejiang Yangfan Ship Group (which specified MaK 7 M 43 C main engines), 30 x 2700TEU container feeder ships for Mawei Shipbuilding (MaK 8 M 43 C engines preferred), and 20 x 3880TEU container feeder ships for Mawei Shipbuilding (MaK 9 M 43 C main propulsion).

Other highlights include a massive 73 ship order run, with MaK 6 M 43 C main propulsion preferred for 12,000dwt bulk carriers built in series at Taizhou Sanfu Shipyard, Qinshan Shipyard, Jiangdong Shipyard, and Jiangzhou Shipyard.

Caterpillar said that, with domestic MaK manufacturing capability available from Caterpillar Motoren Guangdong, and investments being made in key component supply and new products, like the new MaK M 25 C marine engine, its boom with customers in China was likely to continue. In addition to ocean-going business, the market for offshore supply vessels was strong, providing additional sales opportunities especially for MaK M 32 C series engines.

Tognum company MTU Friedrichshafen has also recently stepped up its activities in China. It signed a broadened agreement with the China North Industries Group Corp (Norinco (G)) in December 2007, covering a new joint venture to assemble high performance engines of the Series 956, 1163, and 595 from 2009, thus expanding a collaboration that began in 1986. The two companies also announced that Norinco and MTU would jointly manufacture first-generation MTU Series 4000 engines for the Chinese marine market.

Tognum is also transferring the core departments of the MTU Asia headquarters from Singapore to Shanghai, with procurement for the Asian market to be managed from Shanghai in the future. A new Technology Centre is being set up on the premises of the MTU assembly plant in Suzhou, established in 2006. *NA*

RT-flex tops 500

Orders for Wärtsilä RT-flex electronically-controlled common-rail marine engines have passed the 500-engine mark.

Wärtsilä's RT-flex recently passed a significant milestone, with sales of 500 engines since the introduction of the common-rail system in 1998. Although many of these are of the most powerful RT-flex96C type, progress has been achieved with the smallest, the RT-flex50, which has a rapidly growing orderbook.

The new RT-flex82C and RT-flex82T engine types have also made a good start with orders being booked by Hyundai Heavy Industries Co Ltd and Doosan Engine Co Ltd, both in Korea.

So far, orders for Wärtsilä RT-flex engines have been booked for installation in newbuildings at 42 shipyards for 65 shipowners. The engines are being built by 12 engine builders under licence from Wärtsilä.

Eight RT-flex96C engines have been ordered for a series of large containerships contracted by the French shipowner CMA CGM in Korea. The eight ships will be delivered in 2009 and 2010, with the engines being built by Doosan Engine Co Ltd.

Eight 13,100TEU containerships contracted by the Rickmers Group will each be powered by a 12-cylinder Wärtsilä RT-flex96C engine. The ships, which will all be time chartered by a major containership operator, will be built by Hyundai Heavy Industries Co Ltd, Korea, at its Ulsan shipyard for delivery in 2010 and 2011. The engines, having a maximum continuous power of 68,640kW each at 102rev/min, will be built by Hyundai's Engine & Machinery Division (EMD).

Another Hamburg shipowner, Hamburg Südamerikanische Dampfschifffahrts-Gesellschaft KG (Hamburg Süd), recently decided to switch from mechanically-controlled RTA96C engines to RT-flex96C common-rail engines for six 7100TEU containership newbuildings contracted earlier this year at Daewoo-Mangalia Heavy Industries SA in Romania. The ships are due for delivery in 2010. Each vessel will be powered by an eight-cylinder RT-flex96C engine of 45,760kW output. The engines will be built by Doosan Engine Co Ltd. *NA*

Advanced thinking on tricky excitations

The number of excitation sources potentially causing vibration problems can be significantly reduced by CFD and vibration analyses. A report by Wolfgang Menzel, Dr El Moctar, and Holger Mumm (all Germanischer Lloyd).

The source of unpleasant vibrations onboard ships is sometimes easy to detect but difficult to solve. Normally, the respective frequency clearly demonstrates which part of the power train is to blame, pointing to either the main engine or the propeller.

Less frequently, identifying the source itself is part of the problem. Unfortunately, with rare exceptions, this is the case for hydrodynamic excitations, as the respective frequency does not yield any information about the area where, for instance, vortex shedding is generated. Consequently, solving this type of problem is often attempted by 'the exclusion principle', ie by changing all relevant operational parameters that may have an influence.

If not successful, the trial and error approach is applied, starting with alterations of the most likely appendages, such as V-brackets, fins, sea chests, or whatever appears promising in each special case.

There is, however, another approach, through which the number of excitation sources potentially causing the problem was significantly reduced by additional vibration and CFD analyses, allowing for one single measurement trip to pinpoint the area of hydrodynamic excitation.

A yacht's sea trials took place under rather rough weather conditions, not ideal for vibration acceptance tests, but advantageous to fully confirming the natural frequencies predicted by the comprehensive FE analysis. The vibration level excited by the propellers compared sufficiently well to the results of the forced vibration analysis, too. Hence, all seemed to be in good order.

Only one moderate vibration response remained unclear, which could not be addressed to the power train and, although the predominant sea condition was not deemed a fully convincing excitation either, this vibration component was believed to vanish in still water conditions. Calmer times will show whether or not it was caused by the seaway.

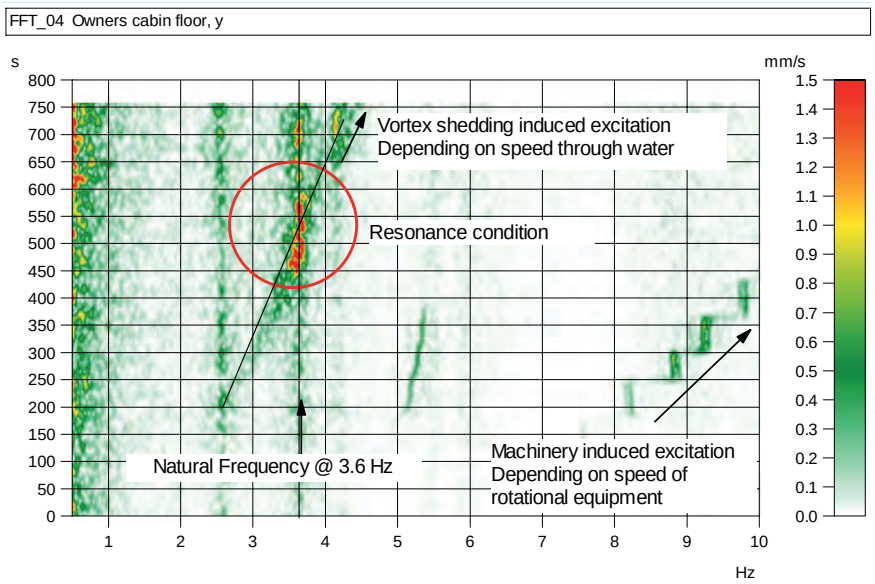


Fig 1: Vibration level (owner's cabin) vs ship speed (frequency).

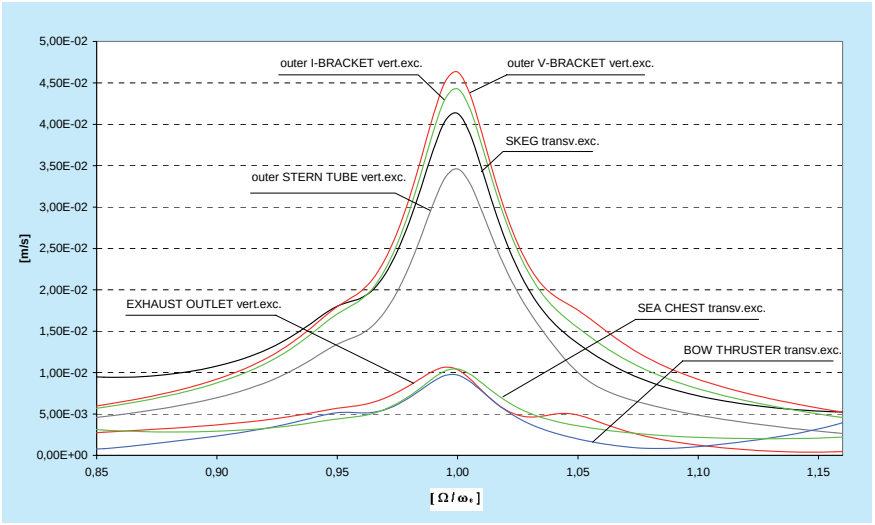


Fig 2: Transverse response at owner's cabin to unit forces acting at different areas.

Unfortunately, within one year of entering service, the owner was repeatedly critical of an unpleasant transverse vibration that was tangibly perceptible in his cabin. He urged the yard to propose countermeasures to fix the problem.

As a result, tests were carried out on all of the components that could possibly be generating or stopping the transverse hull vibration. The possible influences of rudder movements, sea chests, bow thrusters, exhaust gas outlets, etc were all considered at different engine speeds.

The offending vibration turned out to be one that had already been identified during the vessel's sea trials – a one-node torsional

hull mode at 3.6Hz. However, the extensive tests could not pinpoint a specific location of the unpleasant vibration source.

The speed-up manoeuvre shown in Fig 1 clearly shows the characteristics of the vibration problem.

Starting at about 2.5Hz, the excitation in question led to high amplitudes in the owner's cabin when crossing the torsional hull mode shape at about 3.6Hz, corresponding to 16knots-18knots ship speed. At higher ship speeds the vibration response was still present but lower in amplitude as the resonance area had been passed.

When comparing this response to the vibration response at the lower right corner of the figure the difference in character became obvious: the excitation in question was not of this mechanical type, which clearly followed the stepwise revolution increase of the power train.

So, knowledge of the vibration was almost complete: the mode shape (form) and the frequency were known, as well as the fact that resonance at a certain ship speed occurred and (very importantly) that the vibration problem was reproducible. This knowledge would have formed a good basis to solve the problem; if only the number of possible excitation mechanisms were more limited.

It was for this reason that the yard preferred to order pre-investigations rather than rely on the trial and error principle.

In a first step, a vibration sensibility study was performed on the basis of an FE-model aiming at those areas where vortex shedding theoretically may be exciting the hull girder.

Vibration sensibility study

For a start the free vibrations of the yacht were calculated using a 3D finite element model. In the frequency range of interest, the measured one-node torsional mode shape at 3.6Hz was clearly established.

Subsequently, harmonic unit excitation forces were applied at the locations of possible vortex shedding generation, ie at sea chests, exhaust gas outlets, bow thrusters, stern tubes, shaft brackets, and the aft edge of the skeg. The excitation forces were applied separately for each location, both in the transverse and vertical ship's direction. The forced vibration level

Force application Point	x/L-Pos.	Equivalent excitation force to produce 1 mm/s transverse vibration in the owner's cabin	
		Transv. Direction [kN]	Vertical Direction [kN]
aft bow thruster	0.87	10	22
fwd bow thruster	0.90	10	16
fwd exhaust gas outlet PS	0.41	9	33
fwd exhaust gas outlet SB	0.41	9	33
fwd sea chest PS	0.40	9	50
fwd sea chest SB	0.40	9	48
aft exhaust gas outlet PS	0.31	12	9
aft exhaust gas outlet SB	0.31	12	6
aft sea chest PS	0.22	15	50
aft sea chest SB	0.22	15	13
outer shaft	0.16	8	4
inner shaft	0.15	6	6
inner I-bracket fwd	0.08	4	6
outer I-bracket	0.08	5	2
skeg	0.04	2	39
inner I bracket aft	0.03	4	6
outer V-bracket	0.03	4	2
inner V-bracket	-0.02	4	5

Fig 3: Excitation forces required to match the vibration level measured.

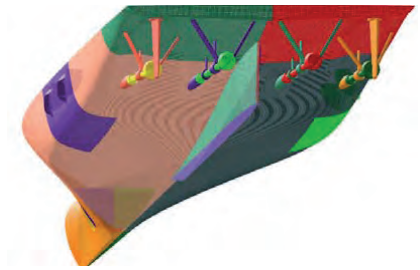


Fig 4: Surface grid for CFD analysis.

was then computed at the owner's cabin at an interval of around 3.6Hz.

The transverse response is illustrated in Fig 2 in an exemplary way for some areas of possible vortex shedding generation. The most significant responses arose from vertical excitation at the outer shaft line - the transverse excitation at the aft edge of the skeg.

Vibration levels due to the unit forces then yielded the equivalent forces required to excite the measured transverse vibration level of 1mm/s in the owner's cabin. This is depicted in Fig 3.

Obviously the one-node torsional vibration mode is most effectively excited by torsional moments acting on the ship's aft body (low force values). This moment can be produced by either transverse or vertical forces acting on the hull girder. Vertical forces are considered to be more likely, since hydrodynamic pressure variations act on a comparatively large and flat hull area.

The next question to address was whether vortex shedding, having a frequency of about 3.6Hz, occurred at all. To clarify this point a CFD analysis was put forward as the second pre-investigation.

CFD analysis

Systematic CFD simulations were performed, analysing the flow around the motor yacht. The first objective of the CFD analysis thus was to determine areas where vortex shedding occurred at a ship speed of about 16knots and then - following the sensibility study - eventually to confirm the source of the 3.6Hz excitation somewhere in the aft part of the vessel.

The analysis focused on the detailed flow description near the hull and the skeg. The computational volume mesh that was generated modelled the hull, the skeg, and the exhaust gas outlets, as well as the bow thruster tunnels, as shown in Fig 4. Furthermore, the flow in the neighbourhood of the propeller shafts and the propeller brackets was computed to investigate the flow interaction between these components.

A Reynolds-averaged Navier-Stokes equation (RANSE) solver was used. The conservation equations for mass and momentum in their integral form served as the starting point. The solution domain was subdivided into a finite number of control volumes that may be of arbitrary shape. The integrals were numerically approximated using the midpoint rule. The mass flux through the cell face was taken from the previous iteration, following a simple Picard iteration approach. The unknown variables at the centre of the cell face were determined by combining a central differencing scheme (CDS) with an upwind differencing scheme (UDS). A two-equation turbulence model was used.

The ship was treated as a double body, consisting of the ship hull below the calm-water surface and its mirror image above the calm-water surface. The free surface was not considered. Velocities that initialised the flow field arose from the inverse of ship speed imposed at the inlet boundary. The 3D flow field surrounding the ship was computed as a transient process. The fluid domain was idealised by a volume grid comprising about 6 million hexahedral control volumes (cells). To avoid flow disturbances at grid boundaries, they were located at sufficiently large distances ahead

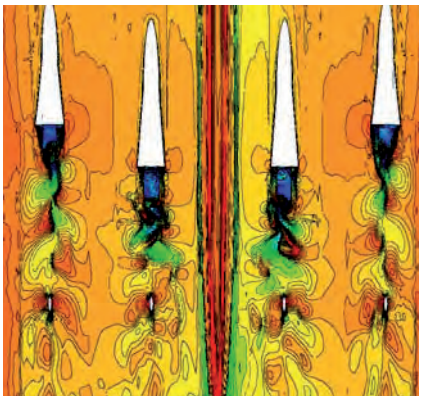


Fig 5: Computed flow velocities around propeller shafts.

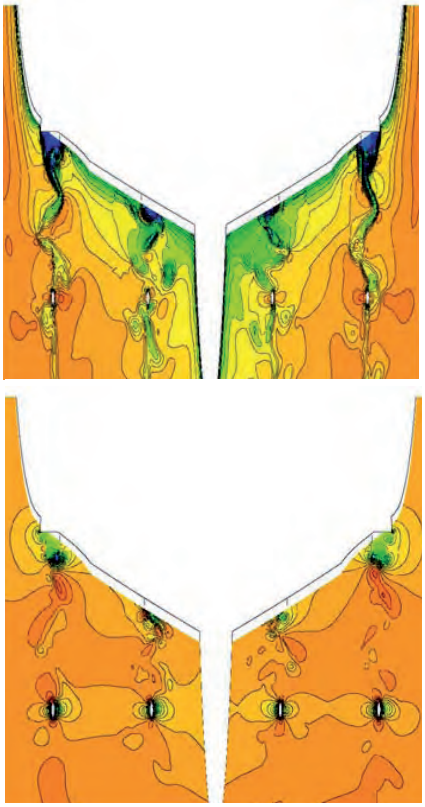


Fig 6: Close-up of the flow velocities and pressure oscillations in a stern horizontal cut.

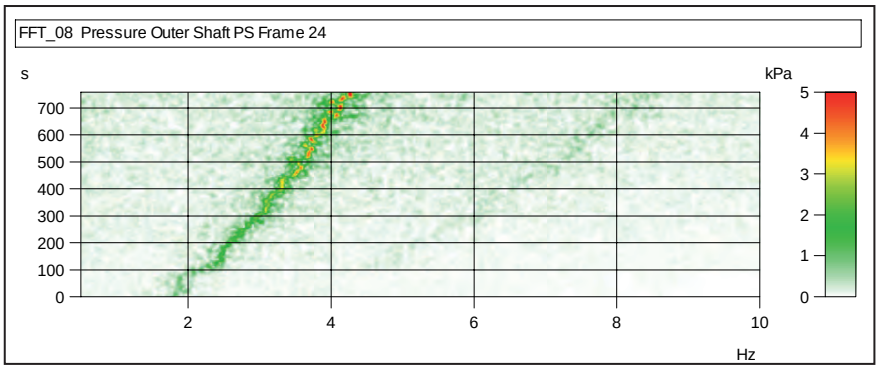


Fig 7: Pressure fluctuations at MP08 (ship speed 10knots-20knots).

of the bow, aft of the stern, and beneath the keel.

Results of CFD analysis

The simulations revealed vortex shedding at the bow thruster tunnels and at the exhaust gas outlets. A stationary vortex was observed port side at the trailing edge of the skeg near the keel. However, no vortex shedding was observed there. Pronounced bow thruster vortex shedding was revealed, but the corresponding fluctuating force amplitudes occurred at a lower frequency. The frequency of the vortex shedding at the exhaust pipes was computed to be about 1.4Hz.

As these results did not allow investigators to pinpoint the possible source of excitation, the numerical simulation was deviated to the flow surrounding the ship's stern in the vicinity of the propeller shafts.

The computations showed that the flow at the propeller tunnel and surrounding the propeller shafts was characterised by the formation of vortices. To help visualise this vortex shedding, Figs 5 and 6 show samples of computed flow velocities in the neighborhood of the propeller tunnels. The vortex shedding frequency was computed to be 3.8Hz for the outer tunnels, for the V-brackets and the I-brackets, and for the outer shafts. So, at least one of these components was to be considered as a possible source of excitation for the one-node torsional hull vibration of 3.6Hz.

Though both the sensibility study and the CFD analysis indicated the aft body of the vessel as the probable area of excitation, it was decided to include all areas where the CFD analysis revealed vortex shedding in the measurement of the following sea trials.

New test trials

As the mode shape and frequency of the vibration were already known, only three accelerometers were applied to control and monitor its appearance. The analysis indicated different hull areas as the possible source. Following the results of the vibration and CFD analyses, a total of four pressure gauges were installed in the outer shell plating covering the most likely excitation areas: one pressure sensor was installed just behind the bow thruster tunnel, one aft of the exhaust gas outlet, while the third and fourth sensors were placed in the shell above the outer shaft frame 16 and 24 respectively.

High pressure fluctuations of one of the pressure signals would indicate the vicinity to the hydrodynamic source in question. The results of all measurement points were valid from both ship sides (sb and ps) due to the symmetry of the hull structure and the propulsion system.

The possibility of not getting a clear indication could not be excluded. It was therefore decided to monitor the surrounding and operational conditions precisely, to re-run parts of the previous test programme, and to add some new items.

To find out the relevant source, the response of the different pressure gauges proved to be decisive. It turned out that only MP8 showed significant pressure fluctuations. These increased more or less continuously with ship speed and attained maximum amplitudes of more than 5kPa, as shown in Fig 7.

These results already prove that the excitation mechanism is acting in the vicinity of the location of MP08 (PS shaft outlet) as all other pressure gauges show no significant pressure fluctuation. Fig 8 displays a five second record of the vibration signal in the owner's cabin (MP 4) as well as the pressure signal in the area of the PS shaft outlet (MP08). For illustration purposes the signals were band pass filtered, showing the tight correlation of the hydrodynamic source and the vibration response at a frequency of about 3.6Hz.

The remaining question is to pinpoint the

The Royal Institution of Naval Architects

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The development of deepwater fields presents significant technical and commercial challenges. They are often in remote locations far from existing infrastructures and in inhospitable environments. The exploration and development of these field needs a whole range of vessels (survey, drilling units, supply ships, anchor handling vessels, floating production units, etc) with greater durability, reliability, large storage and greater handling and lifting capabilities.

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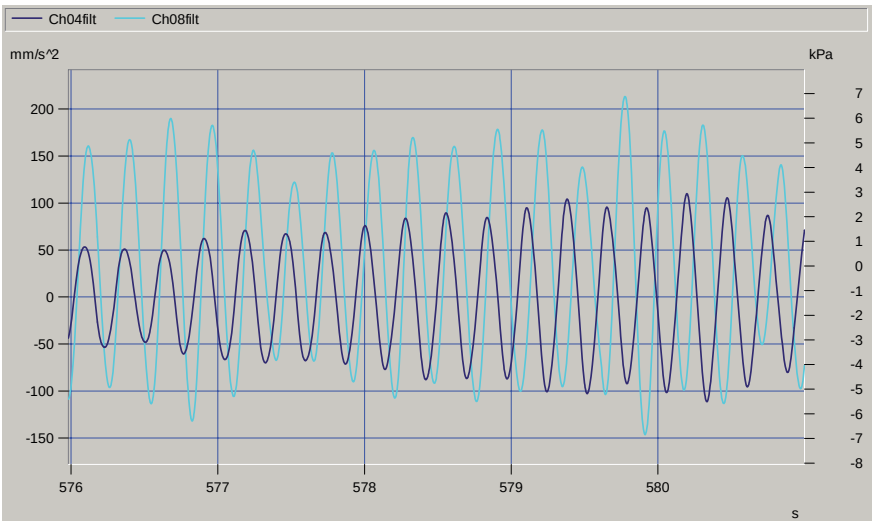

Fig 8: Correlation of vibration in the owner's cabin and pressure fluctuation MP08 at about 3.6Hz.

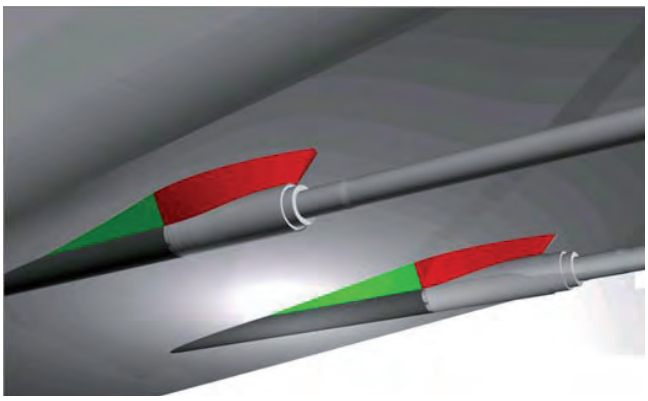

Fig 9: Close-up of the modified design.

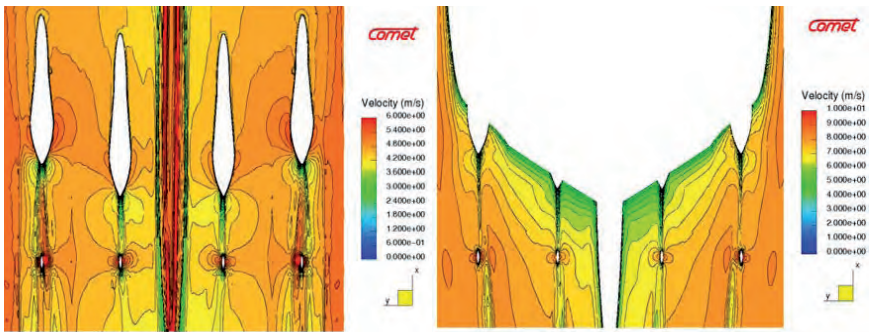

Fig 10: Close-up of the flow velocities in a stern horizontal cut for the modified design.

source itself, not only its area of origin. The detailed CFD analysis revealed the shaft outlets together with the securing device as one of the probable components to generate vortex shedding. This was the reason for choosing the location of sensor MP08. Thus, the evaluation of the speed-up manoeuvres strongly indicated that the outer shafts with the securing device were to blame for the transverse vibrations mainly observed in the speed range of 16knots-18 knots.

Though the problem was understood after the first items of the trials, the complete program had to be finalised to find out whether or not the excitation could be significantly influenced by changing special parameters. In this final stage of the investigation, the variation of operational parameters was deemed helpful

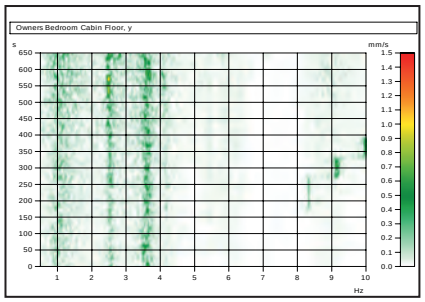

Fig 11: Vibration response after countermeasures (ship speed 10knots-20knots).

for developing countermeasures. But, again, the vortex shedding mechanism turned out to be very stable, while none of the operational changes led to a major effect. The remaining task, ie to change the design of the shafts in a way that vortex shedding is avoided, was again supported by CFD analyses.

Design modifications

To avoid vortex shedding-induced vibration, the design of the vessel's stern part was modified. The design modification consisted of adding streamlined fairings between the propeller shafts and the underside of the hull, as shown in Fig 9.

To demonstrate the effects of the modified design, Fig 10 shows the flow velocities and the time history of the pressure for the modified design. The improvement becomes obvious when comparing these figures to the original state, as shown in Figs 5 to 6.

It can be concluded that the modifications of the design, ie the installation of streamlined fairings between the propeller shafts and the underside of the hull, reduces the vortex shedding in the shaft tunnels and will therefore eliminate the vibration.

Comparing the following Fig 11 to the original situation (Fig 1) makes clear that the countermeasures were perfectly effective. No trace of vortex phenomenon is left.

This troubleshooting example clearly demonstrates that it is worthwhile considering the possible contribution of more complex and sophisticated technologies when deciding how to proceed with a tricky vibration problem. The procedure selected here turned out to be both time and cost efficient and was made possible by applying advanced methods from different technical domains. To rely on the trial and error principle would have meant losing a lot of time and money. *NA*

The case of the singing propeller

Singing propellers – why they happen and how to eliminate them. A report by Raymond Fischer, of Noise Control Engineering*.

A 'singing propeller' occurs when the blade's natural frequency of vibration is excited by a vortex shed from the trailing edge. This vortex has the same 'shedding' frequency as the blade mode, which causes a resonant response. The result can be a high underwater noise level or a high noise or vibration onboard the ship. The worst case is structural damage to the propeller itself.

There are prediction methods [1] that can be used to determine when and if a singing propeller is likely to occur. The controlling factors are the thickness of the trailing edge and the flow speed over this edge. The general approach to eliminating this phenomenon once it occurs is to change the geometry of the trailing edge. It is possible to determine during the initial design phase the likelihood a propeller will sing and take effective steps to ensure this phenomenon is avoided.

A 'singing' propeller typically has a tone generated by the interaction between a blade's natural frequency and a Karman vortex shedding mechanism from the trailing edge of the blade. The vortex sheets shed from the trailing edge cause an oscillating force component perpendicular to the direction of flow. The 'Strouhal' frequency of this oscillation is determined by the Reynolds number, flow velocity, and trailing edge thickness. This excites the 'lightly-damped' propeller blade into chord-wise vibration, a cantilever mode of vibration or a torsional mode when the blade's natural frequency matches the vortex frequency. An example of the multiple resonances of a propeller blade is shown in Figure 1. At some ship operating point, a 'singing' propeller is created when the frequency of the vortex shedding formation correlates or locks onto a blade modal frequency of vibration. Lock-in occurs when the system of vortices is strengthened and made orderly by the vibration of the trailing edge.

The blade's natural frequencies are controlled by the stiffness, shape, and mass of the blade, with the blade's mass per unit area and stiffness varying along its span. The blade's natural frequencies can be accurately computed by Finite Element methods, taking into account the frequency dependant effects of entrained water loading. Water loading reduces the 'in-air' natural frequency by a factor of approximately 0.6. Alternatively a blade's natural frequency can be approximated by empirical methods [1].

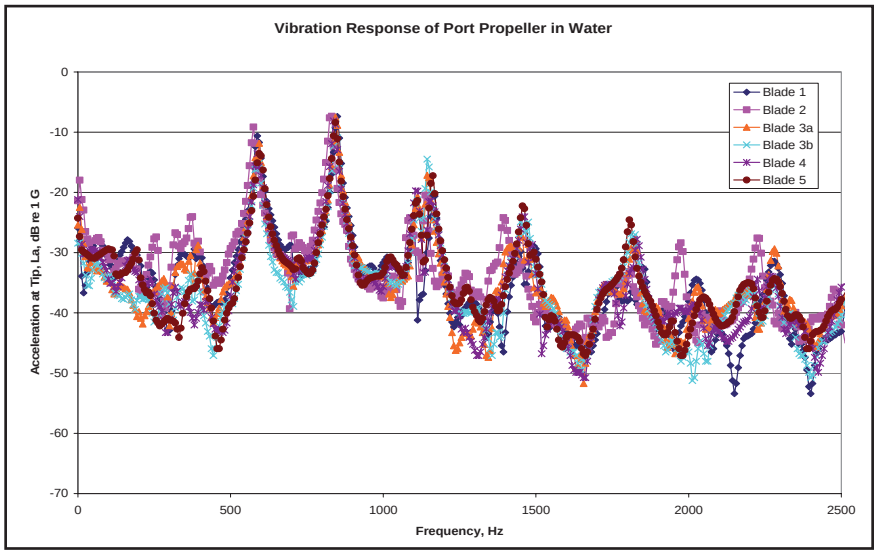

Figure 1: Propeller in-water natural frequencies.

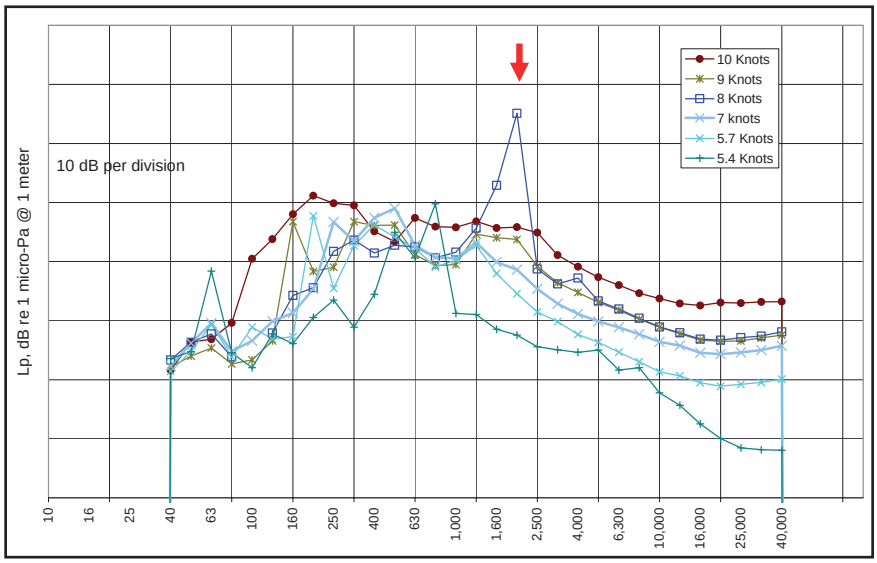

Figure 2: Underwater radiated noise, singing tone denoted by red arrow.

For any resonant condition, small forces can create large displacement. As a result of this large blade displacement, the propeller can radiate high underwater levels (see Figure 2), which can couple to high airborne noise within after compartments of the vessel. Similarly, high displacements on the blade can translate to high shaft vibration and actually cause fatigue failures of the blade. This resonant condition

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nonoise@noise-control.com

can occur through a fairly wide range of flow velocity or propeller rotation rates. Multiple tones can occur on one propeller as it is excited by different vortex shedding from varying radial positions along the propeller or at different operating speeds.

For a given design, not all propellers in a group will 'sing'. Variations associated with surface roughness, marine growth, trailing edge finish, etc, can cause one propeller to sing whereas the others of the nominal identical design do not.

Diagnostics and treatments

The presence of a singing propeller can be confirmed by computing the expected Strouhal frequency and blade natural frequencies to determine if a resonance condition exists. Bear in mind the trailing edge geometry and edge thickness vary with blade radius. As a follow up, measurements of the blade vibration in-water or in-air should be undertaken (see Figure 3). If taken in-air, the frequency should be reduced by approximately 60% to account for water loading. If this blade natural frequency is close to the frequency of concern while operational, then the likelihood of a singing propeller is high.

Underway tests should also be considered. For instance, a propeller will not typically sing during a full acceleration run or while turning, when the propeller is fully loaded.

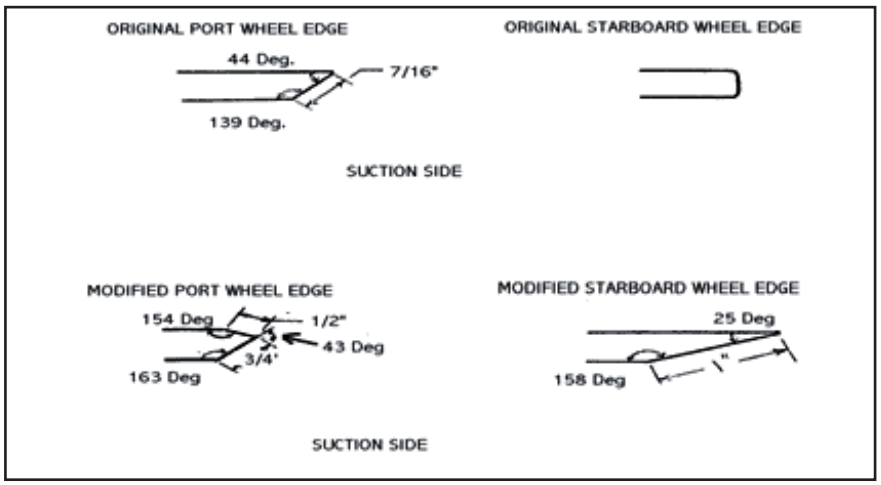

Figure 3: Trailing edge shapes.

The propeller will not usually sing if the vessel is propelled solely on one shaft of a twin shaft vessel. Testing can also be conducted with the propeller 'free wheeling'; the free spinning propeller should start to sing at the appropriate shaft rev/min that singing originally occurred while the powered.

The use of an 'anti-singing' edge is the first line of defence. Examples of these edges are shown in Figure 3. Tests have shown that a blunt trailing edge has an expected displacement almost three times that of a square trailing edge, which provides sharply defined separation points. The author's recommendation, based on several case histories, is to provide a trailing edge with asymmetrical bevels and included angles of 45degs or to use curved bevels or chisel edges with included angles of 25degs or less. These edges change the frequency of the vortex shedding and de-tune the system.

Given today's modelling tools, one can predict or diagnose the occurrence of singing propellers. The best approach, in all cases, is to place anti-singing trailing edges on the blades. These edge shapes do not affect the overall performance of the propulsion system while precluding a potential vibration or radiated noise problem. *NA*

New players in shipbuilding boom

India's private and public shipyards find a platform to push on with international customers. A report by Shirish Nadkarni, in Mumbai.

Just how much Indian private sector shipyards have come on in recent years can be judged by one revealing statistic – the Gujarat-based ABG Shipyard has one ship being delivered every five weeks. At the turn of the millennium, Indian yards struggled to make a delivery every six months.

'Two years ago, the consolidated private sector orderbook in India was US$400 million; today, the orderbook, again excluding state-owned and defence yards, is US$4 billion and growing,' says ABG Shipyard's managing director Rishi Agarwal.

A KPMG report on shipbuilding shows that revenues at the 21 private yards in India have nearly quadrupled from Rs10.17 billion (US$257 million) to Rs36.57 billion (US$926 million) in the last five years. The growth rate of private sector yards is far better than that registered by the seven state-owned facilities.

At the present level, KPMG places the country's share of the global shipbuilding industry at a mere 0.3%, while Japan and South Korea lead the industry with market shares of 38% and 32%, respectively.

Even China, which really launched its shipbuilding drive only in the 1990s, today has a market share of 20%. A cost-effective labour force and the availability of ancillaries helped China capture a significant share of the world market – something that India is only now beginning to replicate.

With trends indicating that the global shipbuilding boom is likely to continue for another five years, the major players in Indian industry expect to take the figure up to 3% by conservative estimates, and 5% by optimistic ones, by the year 2015.

Huge investments, to the tune of Rs185 billion (US$4.63 billion), have been lined up by Indian shipbuilders and some corporate houses that have thus far been unconnected with shipbuilding. Half these investments are being contributed by just five private shipyards.

ABG managing director Rishi Agarwal.

Engineering giant Larsen & Toubro and Pipavav Shipyard head the list with planned investments of Rs30 billion each, followed by Good Earth Maritime with Rs20 billion; and then the Adani, ABG, and Bharti groups with Rs15 billion each. And more investments by companies with no previous experience in shipbuilding are being announced by the day.

In addition, the central government is looking seriously at building one giant shipyard each on the eastern and western coasts of the country.

Companies like South Korea's STX Shipbuilding, the UK's McNulty Offshore Construction, ABG Shipyard, L&T, Essar Constructions, Shapoorji Pallonji & Co, Goodearth Maritime, Apeejay Shipping, and IMC have shown interest in setting up a shipbuilding yard on the east coast, while Bharati Shipyard, STX, and L&T are keen on building a facility on the western coastline.

Mr Agarwal firmly believes that the industry in India has not got as far as it would like to go, and that its worth should be assessed two to three years from now.

'We need to make shipbuilding competitive in the long run,' he says. 'Of the three components that make up successful shipbuilding, ie price, quality, and delivery, we are already on the ball on the first two, and are getting there on the delivery front.'

ABG's new facility at Dahej, on the Gujarat coast, is very much on track to allow commercial production to start in April 2008. In an effort to offer clients added value, the yard is also looking at setting up its own engine factory.

The company's orderbook at the moment exceeds US$1.7 billion, with bulk carriers of different sizes dominating the list and offshore vessels like anchor handlers getting an honourable mention.

Prime amongst the vessels ordered are a dozen 35,000dwt Handysize bulk carriers each for Thailand's Precious Shipping and Hamburg tramp owner and manager Vogemann, six Supramax double-hull, double-bottom bulkers for Mumbai's Essar Shipping and Logistics, and another five 54,000dwt Supramaxes for Precious Shipping, the first such vessels to be ordered by the Bangkok shipowner.

The Precious Shipping order for five Supramaxes is at a contracted price of US$184.5 million; and takes the total number of such bulk carriers under construction at the Gujarat-based yard to 12.

'The image of Indian shipbuilding is improving with each passing day, as we show the world that we can produce quality and stick to our schedules,' says Mr Agarwal. 'There is even more confidence in us when shipowners realise that, like any top international shipyard, we give replacement guarantees.'

Mr Agarwal stresses the fact that, to become successful in shipbuilding, designing ability is a crucial pre-requisite. Private Indian yards like ABG now run advanced software to produce detailed designs that prove cost-effective to shipowners.

'Of late, I have been seeing a very good move in the ancillary department,' he says. 'Vendors from all over the world – and they are big names – are setting up ancillary outfits in India. This will help India grow as a shipbuilding nation.'

The company is now planning to construct a second shipbuilding yard on

the seafront in Surat, on the Gujarat coast, at an estimated cost of Rs14 billion.

The new yard would be housed adjacent to its existing facility; and would be able to build large ships, even very large crude carriers, compared to the 120,000dwt Aframax size tankers that are the largest vessels offered by the present yard due to constraints of space.

Another fast-growing private sector yard, Pipavav Shipyard, took advantage of the growing public interest in shipbuilding and repair to clean up Rs10 billion (US$250 million) in an initial public offering in the closing weeks of 2007. It was the largest public issue in the Indian shipbuilding sector, and reduced the holding of main promoter Sea King Infrastructure Ltd (SKIL) from 35% to 27%.

The funds raised from the offer are being used to expand the yard into an integrated facility capable of building big ships like very large crude carriers (VLCCs) of around 300,000dwt, with a captive labour force housed in a large township on 150acres.

In the second phase, the company will go in for another building yard of 700,000dwt capacity, making it among the largest in the region. The yards, when complete, will take Pipavav into the same league as Dubai Drydocks and South Korean Hyundai Merchant Marine.

'The construction of a greenfield shipyard and shipbuilding on it can take place almost side-by-side, thus reducing the gestation period before the delivery of the first vessel,' says consultant, Ray Stewart.

Pipavav Shipyard chief executive Ray Stewart.

The total project cost has been assessed at Rs19 billion. Mumbai-based Afcons is currently engaged in converting the wet docks into drydocks that will be among the largest in the world. The project is expected to be completed by end-May 2008.

PSL presently has an orderbook running to US$700 million, and has also signed letters of intent aggregating to US$1.08 billion with foreign shipowners. The yard is slated to deliver its first ship by March 2009.

'To be the biggest shipyard in India, and to eventually be the best in the world – that is our ambition,' says SKIL chief Nikhil Gandhi, who gave shipyard industry professional Mr Stewart the mandate of making his dream come true.

With single-hull tankers due to be phased out by the International Maritime Organization, a large market for this activity was envisaged. But with the IMO extending the deadline, the market did not develop as quickly as was hoped. Mr Gandhi decided it would be a good idea to go in for shipbuilding and repair.

In the 18 months since the decision was taken, Pipavav Shipyard has built up its orderbook to 26 Panamax bulk carriers. Six of these will go to Golden Ocean, four to Setaf of France, and 16 to Avgi Maritime Services, part of the Kyrini group of Greece.

That is an astonishing figure for a fledgling shipbuilder, particularly in a country that does not have the best reputation for speed of construction and timely delivery.

'We needed to get our business strategy right,' says Mr Stewart. 'We looked at many different types of vessels, and then decided to keep everything relatively simple.

'The 74,500dwt Panamax bulk carrier is a relatively easy ship to build; and when we offered it, people like John Frederiksen, Bourbon, and Golden Ocean came in. Their coming in helped us get on the road. Our credibility increased due to the quality of the shipowners coming to us.'

The 74,500dwt vessels are all virtually identical, being 225m in overall length (217m between perpendiculars), 32.25m

Civil work being done at Pipavav Shipyard, the site of what could well become India's largest shipyard in times to come. The first ship delivery is due in March 2009.

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in breadth, and with depth of 19.70m, moulded at side. The designed loaded draught, moulded, is 12.40m, while the scantling draught, moulded, is 14.15m.

The main engine is a single MAN B&W 5 S60MC-C, which can power the ship to a speed of 14.5knots. The vessel's cargo hold capacity, including hatch coamings, is approximately 91,000m^2.

The yard has started with building six such vessels a year, and will go up to eight from the second year onwards. Mr Stewart says that the yard actually has bigger capacity, but he wanted to be conservative at the start, and didn't want things to go wrong.

'With our existing facilities, we could do 10 Panamaxes and a few smaller vessels a year, but I feel it's best to be cautious,' he says.

The yard is converting one of the existing wet basins into a drydock, and awarded the contract to Afcons Infrastructure in May last year. Afcons had earlier been awarded the contract for Pipavav port, and had done a good job of it.

'The machinery for the shipyard has been ordered from first-class global yard machinery makers,' says Mr Stewart. 'Really, this is not an Indian shipyard; it is an international shipyard in India. It will be by far the most modern shipyard in the country.'

The yard has sealed technical collaborations with KOMAC of Korea and SembCorp of Singapore, while offshore expert Punj Lloyd has taken 25% of the equity; its involvement and inputs in the offshore field are expected to be valuable.

'Our drydock will be 618m long and 65m wide, and can take care of even very large crude carriers,' says Mr Stewart. 'We will be building two Panamaxes at a time, and floating them out at the same time. We can do three Aframaxes at a time.'

Offshore is another area that could offer the yard big business. Pipavav is already pre-qualified as an offshore vessel supplier with Oil & Natural Gas Corp and Reliance, which saves it a time-consuming three-year long process.

Yet another private sector shipyard growing at a cracking pace is Bharati Shipyard, which won a Rs3.51 billion order from Shipping Corp of India (SCI) for four anchor handling tugs/supply vessels, each of which will cost US$22.32 million.

New 30,000dwt bulk carrier (the fifth in the series of six) that was delivered to the Clipper group by Cochin Shipyard last year.

'The ships will be based on the Havyard Design, being used for the first time for such vessels in India,' says the yard's managing director P C Kapoor. 'The sophisticated design allows higher deadweight tonnage and higher cargo carrying capacity, compared to other 80tonne vessels with similar dimensions.

Having started with simple inland cargo barges 40 years ago, the yard moved into deep-sea fishing trawlers and dredgers; it is now on the point of being able to offer ocean-going tankers, bulk carriers, and container vessels.

Rising CSL

Among the state-run shipyards that cater to merchant needs, the only yard that has consistently made profits over the past five years is Cochin Shipyard Ltd (CSL), which had an outstanding fiscal 2006-07, with income nearly doubling and profit after tax soaring 300% in comparison with 2005-06.

'Our shipbuilding performance improved to 181,395dwt, compared to 110,206dwt in 2005-06,' says CSL chairman and managing director Commodore M Jitendran (Retired). 'Our shiprepair income also shot up from Rs1.51 billion (US$37 million) to Rs2.42 billion in fiscal 2006-07.

'The combination took our total income for the year to Rs8.45 billion and post-tax profit to Rs580 million, which was substantially better than our 2005-06 performance of Rs4.53 billion turnover and Rs192 million profit. And our 2007-08 performance promises to be the best in our history, in terms of both turnover and profitability.'

In November last year, four months ahead of schedule, CSL delivered the last of six 30,000dwt bulk carriers commissioned by the Clipper group of Denmark; and also completed delivery of five of 28 offshore vessels ordered by Norwegian and American clients.

The current commercial building orderbook, worth Rs20 billion, consists of 24 vessels, including a combination of platform supply vessels and anchor-handling tugs, plus the country's first domestically constructed aircraft carrier for the Indian Navy.

'For design, we have a partnership with Rolls-Royce and the Ulstein group, and go with fairly standard designs like 755L and 755LN,' says Cmde Jitendran. 'Earlier, we did diesel propulsion DP-1 and DP-2; but we are now moving into diesel-electric propulsion, and then into clean design

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Marine coatings is an important and key area of shipbuilding technology. There is a demand for thicker and more durable primer coatings to be applied to steel plates prior to initial fabrication of ships to reduce cost of coating larger ships. Anti-corrosive technology in ballast tanks must respond to environmental demands to prohibit the use of tar and reduce the use of volatile organic compounds (VOC). Design and fabrication techniques must adapt to the use and properties of new coating materials.

ISST Poland 2008 will provide an opportunity for all those concerned directly or indirectly with shipbuilding technology to present and discuss the latest developments in these and other aspects of marine coatings.

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(CD) norms. Our in-house design team is busy exclusively with the aircraft carrier.'

As well as plans to build a new facility to cater for offshore demand, CSL plans to set up an industrial area on its premises for manufacturing minor components of shipbuilding. A mini industrial estate is aimed at increasing the indigenous input in all ongoing and future projects like the air defence ship for the Navy and large tankers.

The shipyard is in the process of identifying components common on all types of ships, with a view to ensuring a bulk market for small-scale investors. The industrial estate would include companies making blocks, hydraulics, and electronics.

'We are looking for local partners to manufacture lifts, hydraulics, cranes, and deck machinery,' says Cmde Jitendran. 'We will provide these manufacturers with land and technology. The units will showcase their products to other shipyards, and will be free to sell directly to them.'

Meanwhile, the success of the private sector shipyards has encouraged several Indian corporates thus far unconnected with shipbuilding to venture into the arena.

The country's second largest private shipowner, Mercator Lines, recently announced the formation of a shipbuilding joint venture with Gujarat-based Mech Marine Engineers, to be named Mercator Mech Marine.

The newly formed shipbuilding joint venture plans to build cargo-carrying vessels of all sizes up to the Panamax level at Mech Marine's proposed Rs20 billion shipyard at the port of Vansi Borsi on the Gujarat coastline.

'Our yard would be able to handle the construction of ships of up to 75,000dwt, that could carry dry bulk commodities,' said Mercator Lines chairman Harish Kumar Mittal, who was designated chairman of the shipbuilding venture, while A Mohanlal, managing director of Mech Marine, was named managing director.

'Mercator and Mech Marine have shared a good business relationship for several years,' said Mr Mohanlal. 'Earlier, we built ships for Mercator; now we have started working together by co-promoting a new shipyard. Our first vessel should sail out in 2009.'

Cochin Shipyard chairman and managing director Commodore M Jitendran (Retired).

Mercator Mech has been allotted 180acres of land by the Gujarat government for the yard, for the construction of which it will sell equity to a private financial institution. The company is also scouting around for suitable land for a second yard.

Meanwhile, Mech Marine is independently setting up a new shipyard on 200acres of land in Palghar, Maharashtra, at a cost of Rs3 billion. Even as the civil building work is in progress, the simultaneous construction of three ships has also been taken up.

The Palghar yard is capable of building ships of up to 150m in length, such as small tankers that can carry petroleum products. The company currently has an orderbook of 13 vessels, aggregating Rs7.5 billion.

L&T invests in three

Meanwhile, Mumbai-based engineering and construction giant Larsen and Toubro has decided to pump Rs20 billion into a greenfield shipbuilding venture, to be located in one of three coastal Indian states – Tamil Nadu, Andhra Pradesh, and Gujarat.

The conglomerate already owns a shipbuilding yard in Hazira on the Gujarat coast, but is hamstrung by the fact that there is little scope for expansion of the present facilities.

'What we need is 1000acres-1200acres at a suitable location on the Indian coastline, with adequate draught near the shore, so that we could build larger vessels than we are able to do in Hazira,' says M V Kotwal, L&T senior executive vice-president – heavy engineering.

The group is looking at large, sophisticated vessels like compressed natural gas and liquefied natural gas carriers, and container vessels of up to 300,000dwt. There would also be a smaller shipbuilding dock for constructing offshore support vessels and survey ships.

L&T recently bagged a US$108 million order from the Rotterdam-based Zadeko Ship Management CV (now Rolldock) to build four ro-ro/lo-lo semisubmersible heavylift container vessels for special-purpose cargo movement.

The ships for the Dutch group would have deadweight tonnage of 8250tonnes, with 17,000m^3 of cargo hold, and the capability of carrying 830TEU of containerised cargo. No such vessels are currently being built in India.

'The order for building such highly specialised cargo vessels is just the beginning as we have plans to build ships for the Indian Navy and Coast Guard,' says Mr Kotwal. 'The new shipyard to be constructed would have the capability to manufacture any type of ship, including frigates and destroyers for the Navy.'

Also interested in a shipbuilding venture is the Tata group, which is currently conducting a feasibility study for the construction of a shipyard near Shivrajpur, on the Gujarat coast. Clearly, a shipyard would have considerable synergies with the group's steel business. 'An entry into shipbuilding would be ideal for the Tatas since they are already into steel and transportation, after forging a 50:50 joint venture in December last year with Nippon Yusen Kaisha (NYK) line for setting up a shipping company,' says Divay Goel, director and head of Asia operations for Drewry Maritime Services.

Locating the shipyard in Gujarat would have several advantages for the Tatas, since the state is pushing hard to develop 10 clusters with 10 shipyards in each cluster, and envisages private sector investments aggregating Rs500 billion (US$12.5 billion). Several incentives, including land at attractive rates and extended tax holidays, are being provided by the state government. *NA*

From niche to nub

The marine industry in Singapore is experiencing unprecedented levels of growth. A report by Clare Nicholls.

Singapore's marine industries now generate annual turnover of Sing$7 billion (US$5 billion) and employ some 48,000 workers, representing a vital contribution to the country's economic growth.

The industry has seen significant growth over the past 40 years, evolving from a small regional shiprepair and building centre into a recognised business centre serving international clientele. Over the last three decades, Singapore's shipyards have gained prominence for quality, specialised services, timely delivery, a skilled and disciplined workforce, as well as the ability to handle sophisticated turn-key projects with complex requirements.

There is a strong propensity towards the offshore sector, as Singapore is now a leader in the conversion of Floating Production, Storage, and Offloading (FPSO) vessels and Floating Storage and Offloading (FSO) units. It is a niche player in the building of customised and specialised vessels, as well as jack-up rigs.

The country's shipbuilding industry has progressed from minor projects such as the construction of wooden launches and fishing boats to major projects like steel vessels and specialised ships. Vessels built include cableships, containerships, product tankers, naval ships, landing ship tanks, and patrol craft.

In line with the growth of shiprepair, shipbuilding, and rigbuilding activities, Singapore's supporting industries have also evolved. These range from small- to medium-sized workshops, to comprehensive factory facilities. Many overseas manufacturers have also set up local agencies for their own manufacturing, sales, and services facilities, including Chinese giant COSCO, which runs an office in Suntec City.

Substantial growth

The Singapore maritime sector achieved double digit growth across the board in 2007, and the port itself handled a record 27.9 million containers, up 13% from 2006, reinforcing its reputation as the world's busiest shipping hub. Around 140,000 vessels call at the port each year. In a recent World Bank study, Singapore was, in fact, ranked the number one logistics hub out of 150 countries surveyed.

The Singapore Registry of Ships (SRS) also grew by 13.9% last year, reaching 35.9 million tonnes, and the number of international shipping groups operating in Singapore is approaching 100. SRS was established in 1966, with the country's merchant fleet growing at a rate of around 10% per year in recent years.

Singapore takes its environmental responsibility seriously as well, as it is a party to all major international conventions on safety and pollution prevention. These include the 1974 SOLAS Convention, 1978 STCW Convention, 1996 Load Lines guidelines, the 1973/1978 MARPOL standards, and the Convention of Tonnage Measurement of Ships, 1969 (TM 69).

Major players

Two of the largest marine companies in the country are Sembcorp and Keppel. Sembcorp owns two subsidiary shipyards, one of them being Jurong Shipyard.

Jurong has the capability to perform shiprepair, ship conversion, and offshore engineering, as well as being able to construct newbuildings. Sprawling over a total land area of 68hectares in two locations, the shipyard operates four graving docks with a total capacity of 1,100,000dwt and berthing quays stretching over a total length of 2728m with a maximum draught of 9m.

The other Sembcorp-owned yard is Sembawang Shipyard, operating primarily from a 65hectare site on Singapore's north coast. The shipyard has five docks totalling 775,000dwt with adjacent engineering facilities.

Among Keppel's yards are facilities in Tuas, Benoi, and Gul. The Tuas yard comprises three docks spread over 430,000m^2, Benoi specialises in LNG carrier repairs at its two drydocks, and the shipyard at Gul contains three building berths for vessels up to 150m long.

The marine industry is an important factor in Singapore's economic development, and the country's drive to become a leading international maritime hub shows no signs of slowing. *NA*

Some 140,000 vessels call at the port of Singapore each year.

Keppel on the up and up

Singapore's Keppel Corp posted record profits for 2007, on the fifth anniversary of the creation of its amalgamated Offshore and Marine division.

Keppel Corp has achieved double digit growth since 2002, when its Offshore and Marine subsidiary, Keppel Offshore and Marine, was established. For the past two years, the group's overall growth has exceeded 30%.

Keppel O&M comprises Keppel FELS, which constructs and converts jack-up rigs and semisubmersibles; Keppel Singmarine, building offshore support vessels and tugboats; and Keppel Shipyard, which specialises in floating production, storage, and offloading (FPSO) conversions. In 2007 the subsidiary contributed half of Keppel Corp's overall Sing$10.43 billion (US$7.38 billion) earnings, up from Sing$7.6 billion in 2006.

Keppel O&M's 2007 total contract value reached Sing$7.4 billion, with a net orderbook of Sing$12.2 billion and deliveries extending up to 2011 on behalf of companies such as Maersk, Fred. Olsen, Lukoil, and Petrobras.

In fourth quarter 2007 alone Keppel O&M completed one semi-newbuild, two accommodation platforms, one FPSO outfitting, and four barges, among others, as well as securing contracts including one semi-newbuild, one FPSO outfitting, and one semi-heavylift upgrade, totalling Sing$3 billion.

In support of its drive to sustain its workload, the company made a Sing$150 million investment in the new KOMtech technology centre in 2007. According to Charles Foo, KOMtech centre director: 'The scope of KOMtech encompasses the whole spectrum of products and services for drilling and production rigs.

'It will include going into new areas such as the Arctic regions, and we will continue to focus on deepwater rigs and do further development on jack-ups, subsea productions, critical equipment, and miniaturisation of topsides.'

To maximise its resources, the centre will increase its staff of 28 scientists and researchers to a minimum of 70.

KOMtech is intended to bolster Keppel O&M's competitive edge by providing advanced technology such as the provision of drilling solutions for the Arctic environment.

KOMtech is currently developing a conceptual design for a Sing$1 billion mobile ice-resistant drilling unit, intended to drill for oil and gas in icy waters with a depth of 7m to 25m in the Russian sector of the Arctic. It will be able to withstand a force equivalent to 100,000tonnes of ice.

2008 looks to be just as successful for the Keppel O&M offshoot as it has already been awarded a Sing$145 million contract for the integration and completion of a newbuild Bully drillship by a company jointly owned by Frontier Drilling and Shell. This is the second drillship of this design awarded to Keppel O&M by the same owners, and the hull will be built in China, arriving at Keppel Shipyard in first quarter 2009. The vessel is due delivery in second quarter 2010.

The Bully drillships are designed to conduct surface blow-out preventer (BOP) drilling operations in water depths down to 3600m, and subsea BOP operations down to 2500m. The vessels will also be equipped with ice-class hulls and fitted with DP2 capabilities, included in a package by Keppel Shipyard which will provide installation, integration, and completion of the owner-supplied power generation, thrusters, and drilling equipment.

In addition, Keppel Shipyard has won FPSO conversion contracts totalling over Sing$215 million, both for Maersk Contractors, and the first USA Gulf of Mexico FPSO for BW Offshore. Maersk's order involves a new VLCC hull that is due to arrive at the yard from China in fourth quarter 2008, and expected to be completed by end 2009.

The workscope of the fast-track FPSO outfitting includes the installation and integration of the topside modules; the fabrication, installation, and integration of the APL internal turret, flare tower, process piperack, and helideck; and the upgrading of the accommodation. The FPSO will operate in a water depth of around 100m at the Peregrino field in Brazil's Campos basin, and will be capable of producing 100,000bopd with a storage capacity of 1.6 million barrels. *NA*

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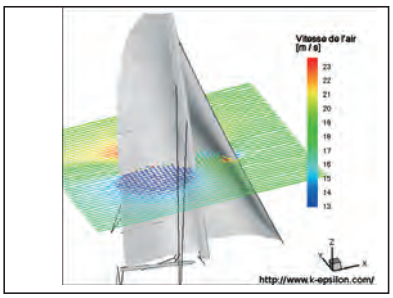
SECOND NOTICE

Organised by the Cité de la Voile Eric Tabarly (CVET), the Naval Academy Research Institute (IRENav) and the Royal Institution of Naval Architects (RINA), INNOV'SAIL 2008 will provide an international forum for the presentation and discussion of the latest scientific and technologic research and its application in the complex field of high performance yachts and competitive sailing. INNOV'SAIL 2008 will provide an opportunity for scientists, architects, engineers, sailors, sail makers and others involved in this fascinating and challenging field to come together to share skills and knowledge.



The conference will be held in the auditorium of the Cité de la Voile Eric Tabarly in Lorient/Brittany, which will open in the beginning of 2008 and is dedicated to the adventure which is modern sailing, of which Eric Tabarly is an emblem. The Cité is situated in the heart of the old submarine base which, after its closure in 1997, is being converted into a big nautical project centre called 'Le Nautic de Keroman'. Already, an important builder of multihull sailboats, a manufacturer of carbon masts, the logistical centre of the biggest European boat fittings supplier, and nine offshore racing teams are installed here, next to the Cité de la Voile Eric Tabarly.

The language for the papers and presentation at the conference is English.

Papers will be presented relating to the following topics:

- Innovative design for performance
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SembCorp sets the pace

Naming ceremonies have been coming thick and fast for SembCorp, as it looks ahead to another busy year.

SembCorp Marine's subsidiary Jurong Shipyard has named a number of vessels of late, following an ambitious schedule of newbuilding. The most recent ceremony was held on 11 January 2008 at Jurong Shipyard, naming the sixth containership built by Jurong for Taiwan's Wan Hai Lines, *Wan Hai 317*.

The vessel is designed to the yard's Jubilee Class. *Wan Hai 317* is reckoned to be one of the largest and most sophisticated vessels of its kind designed and built in Singapore, and follows the deliveries of five sister ships: *Wan Hai 316*, *Wan Hai 315*, *Wan Hai 313*, *Wan Hai 312*, and *Wan Hai 311*.

Due delivery in first quarter 2008, the containership is 213m long, with a breadth of 32.2m, and a depth of 16.5m. The ship has a container-carrying capacity of 2646TEU, including 1688TEU on deck and 958TEU in the hold – where it can accommodate two tiers of high cube containers.

The vessel is equipped with 400 reefer slots and is capable of a highly homogeneous container intake of more than 1960TEU at 14tonne per TEU. Designed with lashing bridges on deck for greater stability during transport, *Wan Hai 317* can reach high service speeds of up to 23knots, while achieving optimal transport efficiency. The hull is also specially designed to minimise propeller-induced vibration.

To date, Jurong Shipyard has delivered eight containership units based on its Jubilee Class design, comprising six container vessels in the 2646TEU series and two units in the 2586TEU series. The class is estimated as the largest and most advanced of its kind built locally.

Another of this class of vessel is the 2646TEU containership *Pontresina*, also scheduled for delivery in first quarter 2008. It is the second vessel of this size the shipyard has built for German shipowner Reederei F. Laeisz, and was named on 3 January 2008.

FPSO *RAROA*, during conversion at Jurong Shipyard, on behalf of Tanker Pacific.

This delivery follows the completion of sister ship *Pontremoli* (renamed *Gulf Bridge*) in August last year, the seventh in the Jubilee Class series.

Containerships are not the only type of vessels Jurong has been producing lately. Towards the end of last year the first of two floating production, storage, and offloading (FPSO) vessels under conversion for Tanker Pacific Offshore Terminals Pte Ltd was christened *RAROA*.

The vessel was scheduled for delivery in February 2008, and will be deployed in the Maari Field, off the coast of New Zealand, where it will be leased to OMV New Zealand. Designed to operate for 15 years without the need for drydocking, FPSO *RAROA* is capable of processing 40,000bopd with a storage capacity of up to 646,548 barrels of oil.

This conversion contract was awarded to Jurong in December 2006, and involved modifying 92,802dwt tanker MT *Andaman Sea* by installing an internal turret and three boilers on deck to generate 24MW of power, renewing the entire piping and electrical systems, and installing new process facilities for crude separation, water injection, and chemical injection, in order to turn the vessel into what is now *RAROA*.

In addition to *RAROA*, Jurong Shipyard is also in the process of converting the 148,255dwt oil tanker *Freeway* into an FPSO to be named *Montara Venture*. The scope of the project includes extensive life extension and conversion works, including installation of an internal turret and process facilities for crude separation, gas compression, gas lift, and gas re-injection.

Scheduled for completion in third quarter 2008, the FPSO will be chartered to Coogee Resources for deployment in the Montara Field, offshore Australia. *Montara Venture* is another vessel designed to operate for 15 years without drydocking, and it has a production capacity of 40,000bopd and a storage capacity of 900,000 barrels of oil. ***NA***

Ro-pax first for Singapore

Singapore Technologies Engineering Ltd (ST Engineering) has secured a contract for the first ro-pax ferry newbuild in Singapore's history.

The marine arm of Singapore Technologies Engineering (ST Marine) has been awarded a Sing$168 million contract (US$110 million) by Louis Dreyfus Armateurs (LDA) of France to design and build a roll-on/roll-off passenger ferry (ro-pax), reckoned to be the first order of its kind in Singapore. The order includes an option for a second vessel.

When completed, the vessel will operate in the English Channel between Le Havre and Portsmouth, in order to reinforce services for LDA's subsidiary, LD Lines. Design of the vessel has already commenced, involving state-of-the-art technologies, and it will be built using exacting engineering applications.

Construction is expected to begin in the first half of 2008, with the vessel due delivery in the first half of 2010. The ro-pax ferry will be classed by Bureau Veritas for short international voyages.

The 4000dwt ferry will have a length of 161m, a breadth of 25.6m, and the depth to the main deck will be 8.3m. Propulsion will be provided by four MAN Diesel medium-speed engines, each rated at 5600kW, which should allow a trial speed of 22knots and a service speed of 19knots. Three diesel generators will also be installed, rated at 1400kW each.

Two fixed cargo decks will accommodate a ro-ro lane of approximately 1500m and a car lane capacity of about 2290m. A 1000m^2 area containing hoistable car decks will also be provided, giving a combined capacity of about 60 trucks and trailers, and 200 passenger cars.

The passenger complement will be 930, housed in 160 cabins across two passenger decks. A summer deck will be installed, and included in the facilities will be one self-service restaurant, one truck drivers' restaurant, a coffee shop, a pub, plus one first class lounge and one lounge comprising 100 reclining seats.

See Leong Teck, president of ST Marine (left), accompanied by Philippe Louis-Dreyfus, president of Louis Dreyfus Armateurs, at the launch of *City of Hamburg* at ST Marine's main yard in Benoi, Singapore.

Previous ro-ros

This ro-pax is in fact the third newbuilding order from LDA for ST Marine, following an agreement with the Singaporean concern to build two conventional ro-ro vessels on behalf of LDA and Leif Hoegh (Norway) joint venture companies Seaplane Two SAS and Seaplane Three SAS. The ro-ro contract is worth Sing$120 million, bringing the total value of contracts awarded to ST Marine by LDA to around Sing$288 million.

Construction of both ro-ros began in 2006, and the first vessel, *City of Hamburg*, was launched at ST Marine's main yard in Benoi on 23 February. The second vessel is due delivery in the second half of 2008.

The ro-ro vessels will initially be chartered by Airbus to carry A380 aircraft oversized components. When not employed by Airbus, the ships will be able to convey cars, trailers, reefer containers on trailers, and heavy ro-ro equipment.

Specially designed to transport aircraft sections efficiently, the vessels are equipped with highly automated ship control systems. To meet the requirements for loading aircraft sections the vessels incorporate unique features such as a stern mooring system and cargo hold environment control and lashing arrangements.

> "Design of the vessel has already commenced, involving state-of-the-art technologies, and it will be built using exacting engineering applications"

The ro-ros are 126.5m long and 20.6m wide, with a depth moulded to the upper deck of 19.65m. At 3500dwt, the vessels are designed with a cargo deck space, including fixed ramp areas, of 9360m^2, 3120m of car lanes, and 500m of ro-ro lanes.

With these contracts ST Marine is bringing new capabilities to the Singaporean marine industry, expanding the range of vessels able to be constructed by the busy hub. ***NA***

SmartMarine saves Six Tee time

The SmartMarine 3D design software package is now being used by Singapore's Six Tee Engineering Groups.

Six Tee Engineering Groups, one of Asia's leading marine and offshore facilities engineering firms, has adopted Intergraph's SmartMarine 3D software. Based in Singapore and China, Six Tee specialises in the basic detail design and project management of marine and offshore structures.

SmartMarine 3D is reckoned to provide a multi-discipline, integrated, and seamless design environment that will facilitate work sharing between Six Tee's Singapore, Tianjin, and Shanghai offices.

The company selected the software in order to increase the productivity and quality of its design work. Projects that the business has been involved in include floating production, storage, and offloading vessels; jack-ups; semisubmersibles; drillships; offshore fixed platforms; pipelaying/derrick barges; subsea pipelines; offshore support vessels; and a variety of merchant ships.

Designed to reduce costs, the program is intended to shorten project schedules for shipbuilders and offshore design firms alike. It comprises engineering, automatic drawings generation, production planning, and manufacturing.

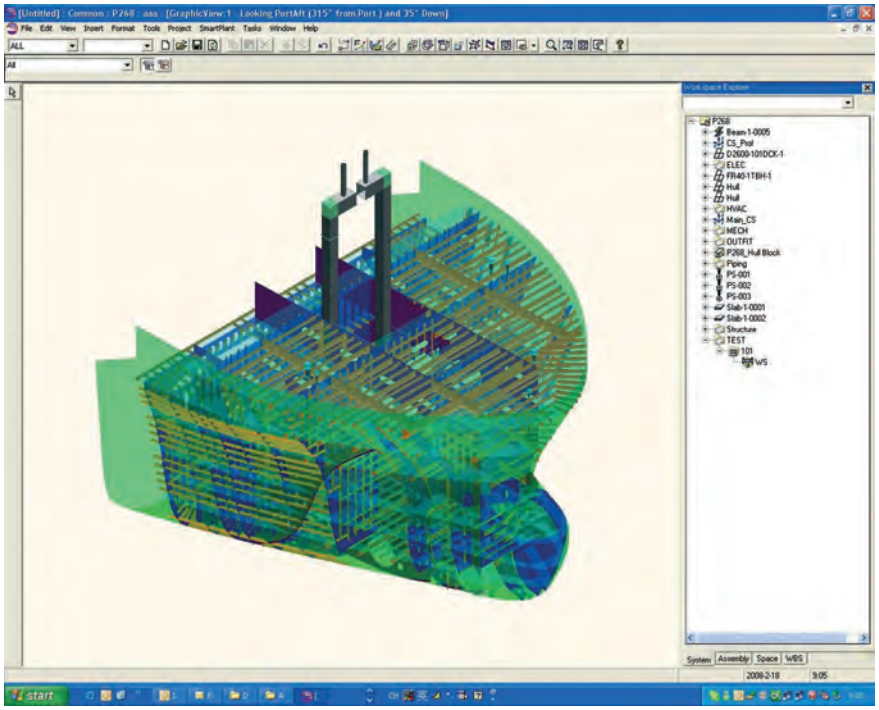


Image created by Six Tee Engineering Groups for a pilot project using SmartMarine 3D.

Six Tee is the most recent Asian adopter of this software. Other users include Keppel FELS of Singapore, Samsung Heavy Industries, and all five shipyards of the COSCO Shipyard Group of China. *NA*

MacGregor Offshore moves forward

Crane and deck equipment manufacturer MacGregor has seen orders roll in for its recently-formed Offshore subsidiary.

MacGregor is setting records for the companies that it acquired in 2007 to create its Offshore subsidiary: Hydramarine AS of Norway and Plimsoll in Singapore. At the end of last year the company signed the single biggest offshore crane order in the history of Hydramarine.

The contract is for 10 large active heave compensated cranes for 10 offshore vessels being built at Zhejiang Shipyard, China, for delivery between 2010 and 2012 to French shipowner Bourbon. The cranes will be manufactured at MacGregor's seaside facility in Singapore.

This order follows in the wake of a number of contracts secured on behalf of the former Plimsoll facility in Singapore. These include five shipsets of deck machinery for Niigata Shipbuilding and Repair, Japan, to be installed on 70m long offshore anchor handling tug/supply vessels being built for a Japanese owner, and a Plimsoll electrically-driven 10-point mooring system for a subsea pipelayer being built at China's Nanjing Shipyard, due for delivery in the final quarter of 2008. *NA*

There Go The Ships

Review by Ian Buxton

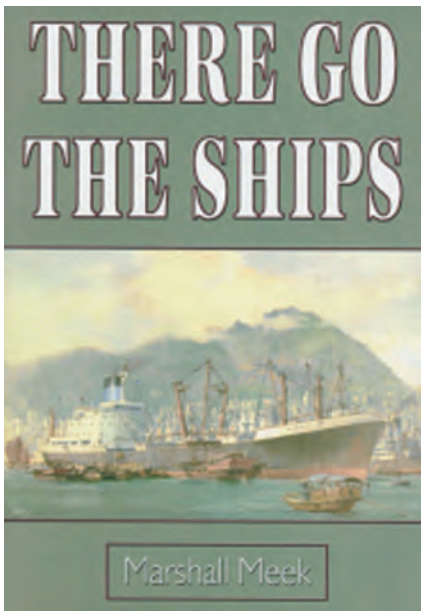
There Go The Ships
by Marshall Meek
The Memoir Club
Stanhope Old Hall
Stanhope
Weardale
County Durham
DL13 2PF
UK
ISBN 978-1-84104-144-5
£9.95

There can be few RINA members who have not heard of Marshall Meek – not only because of the Scottish custom of using surnames as Christian names – but as a past president of both RINA and the former North East Coast Institution of Engineers and Shipbuilders. This autobiography is described as a reprint but is also a second edition, offering the opportunity to amend some of what appeared in the first edition in 2003. The book is well paced, well written, and full of interest.

Marshall comes from a Scottish tradition of God-fearing industrious all-rounders, a sort of jack-of all-trades, having worked in shipbuilding (Caledon and British Shipbuilders), ship operation (Ocean Fleets), R&D (BSRA, NMI, and BMT), defence, and as an honorary academic. Indeed despite the modern tendency to stay in a job only a few years, such a wide-ranging career seems unlikely today, at least in the UK. Older naval architects will resonate with the events described, and recognise many of names and companies, some alas no longer with us, and relish the pithy comments and good advice.

You can pick out almost any chapter and read it on its own, for example, 'The First Containerships', where Marshall is rightly proud of the pioneering outlook of his then employer, Ocean Fleets. Almost total recall of events long ago make for a good story.

Perhaps two episodes underline the core of naval architectural values. The first concerns his then chief who would not increase the breadth of cargo liners despite increasing concern over stability (for fear of increased resistance, yet when fuel was very cheap), adhering to the tenet of 'copy the last ship' – a guide, but no more. When Marshall eventually succeeded him his relief is almost palpable, with the opportunity to embrace the booming new technologies becoming available in the 1960s.



"Older naval architects will resonate with the events described, and recognise many of names and companies, some alas no longer with us, and relish the pithy comments and good advice."

The other concerns the debate in the 1980s about the 'short fat warship', where government ministers refused to accept the advice of the ministry of defence naval architects that the concept was flawed for fast blue-water fighting ships, whatever its potential for coastal patrol-type vessels. The MoD advisory committee, chaired by Marshall, invited the 'short fat' protagonists to put their case.

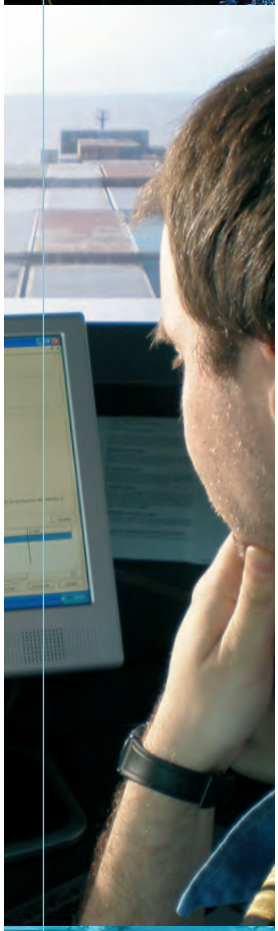
Despite sometimes lacking technical detail, it was clear that what was proposed as a frigate replacement was underpowered, poorly laid out, deficient in damage stability, with costs greatly underestimated. But the minister was convinced that the claim of 'more bangs for the buck' was valid.

Eventually, Lloyd's Register was brought in to evaluate the concept, and came to the same conclusion as the two previous groups of naval architects, that the sums did not add up. Marshall's frustrations with people who could not or would not understand is understated.

Marshall was recognised as a 'safe pair of hands', serving on various bodies, professional institutions, inquiries, and committees. He regrets the largely self-inflicted decline of UK shipbuilding and shipowning, the former having reached a point of no return as far as merchant ships are concerned, the latter having lost almost all the famous companies of yesteryear, hence the book's title.

Family life looms large, with his wife Elfrida of fifty years, three daughters, and siblings all with M names, as indeed does his Christian faith, remaining strong despite the intolerance shown to many of that faith today.

The book is not only a good read, it also poses the question as to what any other naval architect would have done in similar circumstances. While today's young naval architect is unlikely to have the same breadth of opportunity as Marshall had, they can still learn from his experience and have challenging and worthwhile careers. *NA*



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Interested persons should forward by courier mail, their self made applications including a detailed resume, copies of qualifications and two references to:

Director
Virgin Islands Shipping Registry,
3rd Floor, Sebastian's Building
P.O. Box 4751, Administration Drive,
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Tel: (+1 284) 468 2902 /2903 Fax:(+1 284) 468 2913
e-mail: vishipping@gov.vg web: www.vishipping.gov.vg

The closing date for applications is **31st March 2008.**
Interviews will be held in London, UK in the *3rd week of April 2008*
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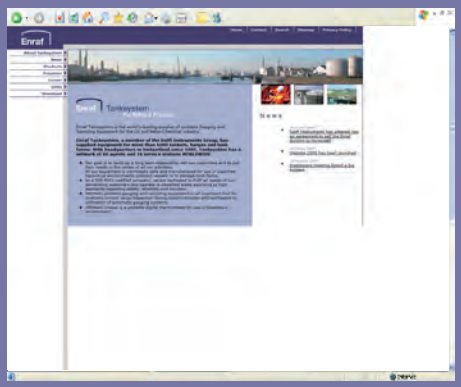

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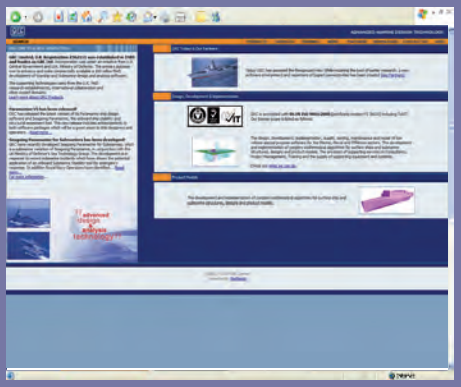

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