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British Emerald – on delivery, the largest LNG carrier in the world. See feature, *pp8-10*.

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Brave new world for class?

BUREAU Veritas (BV) came to town in mid-July to expand on its mould-breaking plans to take a classification society directly on to the stock market. The class body's initial public offering is slated to be unveiled before the year is out.

Flushed with approval for its listing plans from L'Autorité des Marchés Financiers BV, which is the world's number two in terms of the number of vessels in class, though number six in terms of tonnage, gathered a group of maritime journalists at a swish French restaurant near Tower Bridge. Over lunch, the class body emphasised that current main shareholder Wendel, one of Europe's leading listed investment companies, with a market value of around €7bn, would retain a 50% plus share in BV after listing, and was also committed for the long haul.

As well as being a shareholder in BV since 1995, Wendel had a track record of IPO successes that had included Stallergènes, Biomérieux, Neuf Cegetel, and Legrand, pointed out Bernard Anne, BV executive vice president and marine managing director.

With BV's revenue having quadrupled since 1996 (to reach €1.8bn in 2006), and its profit margin doubling over the same period, to 14.6%, the IPO was part of a continuous development that would further support growth of the organic and acquisitive nature, said Mr Anne. Staff numbers had also tripled since 1996, and stood at 26,207 at the end of last year.

Man in the spotlight - BV's Bernard Anne: 'The IPO will offer BV the possibility to be more visible.'

BV's current objectives included a doubling of the 2006 revenue by 2011 across its eight business streams, and the plotting of net income growth of between 15% and 20%. To achieve this, it would invest in oil and gas, the wider energy market, and mining services, and develop its geographic presence in marine, consumer products, and industry. It expected 8% of its average annual growth to come from organic sources.

'The IPO will offer BV the possibility to be more visible,' said Mr Anne, 'and when you want to attract good people, and to attract good young people, they will be attracted to a good name. And when you want to acquire new companies, their employees will know that they are part of a growing company, part of an organisation that has a successful track record when it comes to acquisition and integration – people will know that they are entering a group where their future is assured.'

To cover natural wastage and growth alone, BV must recruit around 3000-4000 new staff every year.

BV also saw distinct opportunities in offering trans-discipline services to major industrial, marine, and offshore customers. For example, where it offered marine services such as ship classification, offshore rig classification, and marine technical consulting to Petrobras, it was also offering certification like ISO9000 and ISO14000, HSE services, and shop, site, and pipeline inspection. The class body/ planned to widen these offerings, to take in GSIT (oil testing), construction, and other inspection services.

The IPO would mean BV could accelerate its growth strategy, according to Mr Anne, yielding the opportunity to open up in new markets and be aggressive in acquisitions. BV intended to spend around €100m every year on 'bolt-on' acquisitions, targeting small and mid-size companies across the globe.

Marine saw 16% organic growth in 2006, while in 2007 to the end of June, BV classed 9m gt out of a total 62m gt classed by all societies.

The marine sector was 'not so easy' when it came to acquisitions, according to Mr Anne, but industrial work on conformity assessment may be transportable to marine, where opportunities lay in wait on ship decommissioning. BV's experience in greenhouse gas issues also put it in good stead to extend services to shipowners as and when air emissions regulations were made more stringent.

Mr Anne added that, as far as the marine sector was concerned, BV's expansion into new geographic territories would continue through partnership with local class bodies. Its strategy would remain to create teams of local surveyors through mentoring, at the same time engendering the long term loyalty conferred by a stable operation like BV.

But, as BV's abortive attempt to take over Germanischer Lloyd late in 2006 showed, class is different. It exhibits a set of loyalties over and above commercial gain and, with customers rallying to block BV's takeover bid, some also believe being accountable directly to shareholders may not be the right solution for any organisation trading on independence.

Mr Anne dismissed such ideas. He pointed out that it was simply an EU requirement that class societies could demonstrate their independence. Besides: 'We are in the service business and, if we do something wrong, it would not be in the interest of shareholders to push us into doing anything that goes against that service. Losing our image would mean losing our share value. In fact, we will have to be more transparent and more careful of our reputation.'

Furthermore, he pointed out that Wendel was already listed, with BV representing a large part of its assets. 'If something were to go wrong at BV, it would have an effect on Wendel shares at the moment, so there will effectively be no change. I will continue to speak in the same way as I have to date. We were indirectly listed and now we will be directly listed.'

Indeed, while he said he 'hoped that other class societies will not follow us, because that will give us an advantage', and he could see that some class bodies would retain their foundation status, he did not rule out that BV's actions would become 'a trend'.

Welcome to the brave new world of classification.

Huge demand for seismic vessels

THE way in which high oil prices are sustaining strong demand for seismographic ships has been given substance by figures from leading classification society DNV, which said it had experienced a tenfold increase in classification requests for such ships compared to previous years.

'While the newbuilding activity for these vessels was nearly non-existent just a couple of years ago, the demand is now very strong,' said DNV. 'At present, there are 20 seismographic research ships under construction awaiting DNV classification. In 2004, there was only one.'

DNV said exploration companies were facing 'a huge problem' due to shipyards' limited newbuilding capacity. 'To work around this, other types of vessels with high tractive power are being converted into seismographic vessels. While this method is not necessarily less expensive, it enables the vessel to be operative in a considerably shorter time.'

In 2006, 10 ships were converted into seismographic vessels and classified by DNV, compared to zero in 2004. Most of the ships were originally cable layers. This year, five conversion projects have been completed and classified by DNV. Another eight vessels are under conversion and awaiting final classification shortly. These boats were mainly fishing vessels.

Head of conversions in DNV Maritime, Arild Rogne, said: 'Even though rates are currently high, it is hard to predict the market trend and future developments. Thus, newbuildings are a more risky strategy than conversions.'

CNG 25 Coselle Natural Gas Carrier.

LONDON CLUB WARNING ON NICKEL ORE LIQUEFACTION - THE London P&I Club says it continues to receive reports of incidents in which ships have faced severe stability problems as a result of the liquefaction of cargoes of nickel ore mined in Indonesia and the Philippines. In one case, the ship capsized within 48 hours of departure.

Writing in the latest issue of its *StopLoss Bulletin*, the Club says: 'Identifying the risk of liquefaction is clearly of vital importance for safe carriage, and the Code of Safe Practice for Solid Bulk Cargoes (BC Code) sets out the standard methods of determining the Flow Moisture Point of cargoes which may liquefy. However, those test procedures were developed primarily for homogenised metal concentrates, whereas nickel ore is not homogenous and is largely composed of a clay-like material mixed with harder lumps of various sizes.

Moreover, metal concentrates have a typical moisture content of about 10%, whereas nickel ore often has a moisture content in the range of 25% to 40%.

'Several recent expert reports emphasise that the difference in the characteristics between nickel ore and a metal concentrate means that great care is required when testing nickel ore to maximise the prospect of obtaining accurate data on the Flow Moisture Point. Yet some exporters appear to rely on imprecise test procedures which can lead to an inaccurate description of the true flow characteristics.'

The Club has seen several recent cases in which owners have challenged documentation provided by shippers which purported to confirm that the cargo was safe for shipment. In each case, where there was doubt as to the condition of the nickel ore, the so-called 'can test' - which involves the striking against a hard surface of a can filled with ore - proved to be a practical and useful method of obtaining an early indication of the possibility of cargo flow. And in some instances, following further advice from experts and - where appropriate - independent laboratory testing, the cargoes were rejected as being unfit for shipment.

The Club concludes: 'Members considering the carriage of nickel ore should be very cautious about relying on the shippers' documentation alone, and are reminded that guidance on how to conduct the can test is set out in Section 8 of the BC Code.'

ALTERNATIVE CNG FOR SEA NG - GUIDO Perla & Associates, Inc (GPA), of Seattle, Washington is to provide the design to Sea NG Corp, of Calgary, Canada, for two additional versions of the Coselle Compressed Natural Gas CNG carrier, based on a similar design to that approved in principle by ABS in September 2006, and will primarily be engaged on international voyages.

Coselle CNG Carriers are set to use Coselles, a new technology consisting of large coils of pipes wound into a cylindrical storage container, to contain compressed natural gas, so that gas producers can take advantage of what is being touted as an economically optimal solution for the transportation of moderate volumes of natural gas over medium distances. A major advantage claimed for the Coselle system is that it requires minimal onshore facilities due to the ability to load and discharge gas at simple portside facilities not requiring liquefication and regasification equipment.

The original 118m CNG carrier, for which GPA completed the design in 2006, will have a capacity of 50mmsCF (million standard cubic feet) in 16 Coselles. The Coselles are arranged in four equally sized stacks, each four high, in a fully enclosed and inerted cargo house on the main deck. It would be served by a crew of 11.

The two additional versions consist of: one measuring 204m in length, accommodating 20 crew members, and equipped with 84 Coselles, providing a combined natural gas capacity of 250mmsCF; the second alternative will measure 141m in length, accommodate 11 crew members, and have the capacity to carry 75mmsCF in 25 Coselles, which will be arranged in five stacks of five Coselles each.

MAN BAGS BIGGEST - THE Offshore Division of MAN Diesel, based in Frederikshavn, Denmark, won the order to supply generator sets for *Pieter Schelte*, due to be the largest vessel in the world and to be ordered before the year is out by Swiss-based Allseas Group, as a twin-hull construction with main dimensions 360m long by 117m wide. Allseas is currently studying yards in China, South Korea, and elsewhere in Asia over a full build contract, although it has not ruled out the possibility that the topside may be built elsewhere. Once built, *Pieter Schelte* will fulfil a number of functions for clients in oil and gas exploration and production: platform installation, platform decommissioning, platform removal, and pipe laying.

The vessel will have topside lift capacity of 48,000tonnes and stern portal cranes with a jacket lift capacity of 25,000tonnes, plus the world's largest pipelay tension capacity of 1500tonnes. It is targeted for delivery in 2010.

MAN's contract will also involve the first vee-configuration engines to be produced in MAN Diesel's new four-stroke medium-speed engine series, the 560kW per cylinder 32/44CR with common rail fuel-injection technology.

Altogether, nine MAN Diesel 32/44CR engines with a total of 169 cylinders and a massive combined output of 94.6MW will power the generator sets, which will cover demand from *Pieter Schelte's* varied consumers. These include the vessel's diesel-electric propulsion and dynamic positioning system based on 12 thrusters, from Rolls-Royce Marine (see page 37), with 360° azimuthing capability, and give the vessel a speed of 12knots when fully laden; its powerful lifting gear, pipe laying, and other working equipment; plus a range of other onboard consumers, including a considerable hotel load for the large crew of 450.

MØLLER TAKES MARK 9 - MEANWHILE, MAN Diesel received the first order for its 7K80ME-C, Mark 9 engine.

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Hyundai Heavy Industries (HHI) will build four such engines for the A P Møller Group, intended for containerships to be constructed by the Hanjin Group.

The K80ME-C Mark 9 engine is described as 'extremely competitive in terms of production costs and cost per kW'. The engine is an update of its Mark 6 predecessor, with boosted power, and adopts a number of design features also shared by the S65ME-C engine. Distance between cylinders is reduced, making the 7-cylinder Mark 9 engine approximately half a metre shorter than the Mark 6.

Being an ME-engine, the 7K80ME-C9 is characterised by a low SFOC and superior performance due to variable, electronically-controlled fuel-timing, appropriate fuel-injection pressure and rate-shaping at any engine-speed load, flexible emission characteristics with low NOx and smokeless operation, with equalised thermal load in and between cylinders, and a claimed longer time between overhauls, very low speed possible even for extended duration and super-dead-slow manoeuvring. At 104rev/min and a mean piston speed of 9m/s, the K80ME-C9 yields a power per cylinder of 4530kW/cyl.

ABS CLASSES FIRST US-BUILT CSR TANKERS - ABS will class the first common structural rules (CSR) tankers built in the United States. Three, shallow-draught 49,000dwt Jones Act product tankers built for Texas-based AHL Shipping Company are currently under review by the society.

According to Tom Kirk, director, technology and business development, ABS Americas, this design was originally intended to meet ABS SafeHull standards but has been upgraded to meet CSRs adopted by the International Association of Classification Societies (IACS), which came into effect in April 2006. Further enhancements have enabled the tankers to meet requirements for Type II Chemical Tanker per the IMO's International Bulk Chemical (IBC) Code.

The vessels will be the first of this size to be built in the US using modular construction. Hull construction and final assembly of the vessels will be conducted at Alabama-based Atlantic Marine Alabama LLC, with several other shipyards and specialty companies under contract with AHL also participating.

The vessels are scheduled to go on long-term time charter to Shell Trading USA by late 2009 through late 2010. Each vessel will have cargo capacity of 330,000 barrels.

CSR WARNING ON BULKERS - DNV has said that the adoption of common structural rules in the construction of bulk carriers is proving challenging for Chinese shipbuilders.

With bulker orders buoyant, Anders Swerke, director of DNV's Maritime Service Centre Shanghai said: 'Particularly at newly established yards, designers are not completely used to the ramifications of the Common Structural Rules, while the higher reliance on software is also a challenge.'

The corrosion margins that have been established for scantlings take into account the location and the environment to which the structural member's surface is subject. Critical areas include main frame connections to hopper sloping plating, and improved steel grade for bracket and adjacent side plating. Also important are fatigue checks of inner bottom plating connection with lower stool and hopper sloping plating.

Mr Swerke said that new rule requirements introduce a radical shift towards more computerisation of the rule formulations and structural assessment. For shipbuilders that are intensively prepared, the basic hull drawings approval can be completed in under a month.

He warned against simple reliance on software to solve design workloads.

Eventually, the CSR rules will make life easier for the shipyards because all IACS societies will have a harmonised rule set. At the start, shipbuilders will have a greater workload though, because they will have to learn a new set of rules and apply them to the drawings, he said.

WÄRTSILÄ'S CHINA INAUGURATION - WÄRTSILÄ'S joint venture company in China, Wärtsilä CME Zhenjiang Propeller Co Ltd, this month inaugurated its new propeller factory at Zhenjiang in Jiangsu province. The company will be the biggest fixed-pitch propeller manufacturer in China and one of the biggest in the world in this sector. The new factory doubles Wärtsilä's capacity to manufacture this type of propeller.

In 2007 up to May, 425 vessels were contracted in China, which is 45% of the global vessel order intake, ranking China number one in the world.

'Doubling the production capacity is a logical step, as shipbuilding in China is experiencing such tremendous growth,' said Ole Johansson, president of Wärtsilä Corp. 'Together with our joint venture company, we are now able to offer advanced propulsion systems up to the largest sizes required.'

The new factory has more than doubled the annual production output to 6500tonnes of propellers. The new maximum size of propeller that can be produced at the new factory is suitable for the world's largest containerships that are currently envisaged, with propellers individually weighing up to as much as 140tonnes.

The new factory will concentrate on larger FP propellers, with diameters of more than 5m. It is designed for an annual production of some 200 propellers of that size, with individual weights up to a maximum of 140tonnes.

Teuku Darmawan, consul general for Indonesia in Hamburg, Bernard Meyer, Meyer Werft, Wendy Aritenang, secretary general; Hastjarja Harijogi, director general of sea transportation.

The world's largest gas combustion unit (GCU), manufactured at Saacke, leaving Bremerhaven.

MEYER OUT OF THE BLOCKS - THE first outfitted block of 18 blocks in total of *Gunung Dempo*, the new 14,200gt passenger ship for Indonesia, have been put in place in building dock I at Meyer Werft.

Wendy Aritenang, secretary general of Indonesia's Ministry of Transportation, placed the traditional lucky penny on the blocks before the 600tonne crane lowered the block of the new ship. This first unit, a double bottom, weighs approx 133tonnes, is 14m long, and 20m wide.

Gunung Dempo is ship number 24 Meyer Werft has built for the island state. The ferry will accommodate 1583 passengers. The length overall is 146.80m, the breadth 23.40m, and the ship will be able to operate at a speed of more than 20knots.

She will be equipped with two main engines made by Caterpillar (Type MaK), each having an output of 6000kW so that the total propulsive power will be 16,320hp. Moreover, the ship can carry 98 containers. *Gunung Dempo* will be delivered to Indonesia in the summer of 2008.

SAACKE'S LARGEST GCU - THE world's largest gas combustion unit (GCU), manufactured at Saacke - Bremen's fuel burning technology supplier - left Bremerhaven's homeport in June. The combustion unit will be installed at Samsung shipyard in Korea on the largest LNG tanker of the Q-max class built to date, and is expected to be launched in the summer of 2008.

The liquefied natural gas tanker built for the Qatar Transport Company (QGTC) is about 380m long and has a cargo capacity of 266,000m^3 of liquefied gas.

Onboard this LNG tanker, the GCU, equipped with a high-efficiency swirl combustion chamber system, will be burning vaporising gases that are highly explosive, such as methane, in compliance with current emissions limits. The plant is about 16m high, about 6m in diameter, and weighs 40tonnes. The burner output is about 100MW and would be enough to heat 10,000 homes.

A very green Emerald

THE world's largest liquefied natural gas carrier delivered to date also exhibits a host of features highlighting BP Shipping's green credentials.

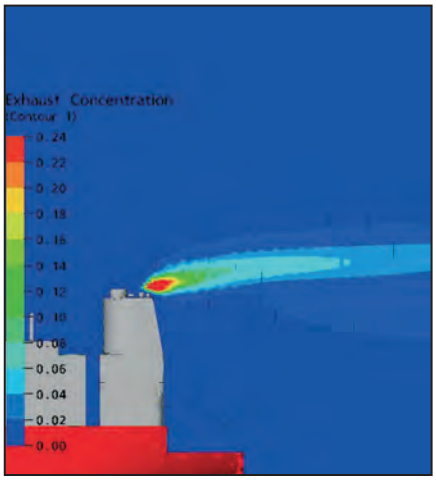
IN July, BP Shipping took delivery of *British Emerald* from Hyundai Heavy Industries for worldwide operations, a ship which will briefly hold the title as the world's largest liquefied natural gas carrier in service.

However, while at 155,000m^3 capacity, the ship's sheer size is of note, a raft of other attributes command interest for the discerning audience, not least because *British Emerald* will be marked out for its 'green' credentials.

This, after all, will also be the first Korean-built LNG carrier delivery to feature dual-fuel diesel-electric propulsion. Onboard are two 12-cylinder 50DF (11,400kW at 514rev/min) and two nine cylinder inline 50DF (8550kW at 514rev/min) engines driving four generators; two motors power a five-bladed propeller, to achieve over 20knots. Engines are configured in two separate enginerooms, for the sake of redundancy.

Dual-fuel technology allows diesel engines to run on boil-off gases from the cargo tanks or on conventional diesel fuel. Being powered by four diesel-electric engines provides a significant improvement in propulsion redundancy, while the vessel is equipped with a bow thruster to assist in mooring operations.

***British Emerald* – on delivery, the largest LNG carrier in the world.**



Exhaust dispersion, in light of the specially broadened funnel with open top section - designed to reduce wind drag and prevent exhaust take-in to the engineroom.

TECHNICAL PARTICULARS
BRITISH EMERALD

Type	Membrane LNG Carrier
Owner	BP Shipping
Built	Hyundai Heavy Industries
GT	99,600
DWT	76,000
Length OA	288m
Beam	44.2m
Depth	26m
Draught	11.47m
Cargo capacity	155,000m^3
Containment system	GTT MkIII
Main engines	Wärtsilä 2x12-cylinder 50DF (11,400kW) plus 2x9 cylinder inline 50DF (8550kW (all at 514rev/min))
Speed	20knots
Electric motors/drive	Alstom/ Converteam
Gas combustion unit	Saacke
Cargo pumps	Ebara
Cargo heater/vaporiser	Cryostar
Cargo compressor	Cryostar
Inert gas generator	Smit
Nitrogen generator	Air Products AS
Custody transfer system	Saab
Automation	Converteam
Propeller	Hyundai
Bow thruster	Brunvoll
Class	Lloyd's Register

British Emerald is the first of a series of four 288m long by 44.2m across the beam 'Gem' class LNG carriers, including the GTT MkIII containment system; *British Diamond*, *British Ruby*, and *British Sapphire* will be delivered by HHI in 2008.

The design and construction of these technologically advanced vessels is such that they are more fuel efficient than comparable LNG carriers, according to BP Shipping, which points out they will result in reduced fuel costs and greenhouse gas emissions.

In fact, according to BP Shipping naval architect, James Collett, the vessel will burn 40tonnes per day less than a conventional steam turbine-driven LNGC of similar size, which would burn about 180tpd.

He said that a typical steam-powered LNG carrier burns over 90tonnes of heavy fuel oil plus 90tonnes of LNG per day. This equated to about 530tonnes of CO_2 and 7tonnes of SOx, whereas the *British Emerald's* DFDE system burned LNG only at a rate equivalent to 140tonnes of diesel oil per day, equating to about 386tonnes of CO_2 and no SOx emissions at all. For each DFDE ship, the annual emission saving was therefore in excess of 36,000tonnes of CO_2 and 1700tonnes of SOx.

At the same time, the DFDE installation allows for a more compact engineroom, where generators are situated directly above the motors, in a configuration reckoned to confer a 5% increase in cargo capacity over ships featuring steam turbine equipment.

Furthermore, the ship has been awarded Lloyd's Register's 'green passport' status, where BP Shipping collaborated with LR to produce the format of requirements.

As with all of BP Shipping's newbuilds, *British Emerald* underwent a shakedown period following delivery, during which time the crew were able to familiarise themselves with the vessel's propulsion, cargo, and navigational systems. However, due to the complex nature of this technologically-advanced ship, this period was extended from the usual five days to 10 days.

But this is a ship whose structural and super-structural, as well as propulsive, aspects are worthy of consideration. For example, the vessel's design fatigue life was increased from the Class Rule requirement of 25 years to 40 years. The trading route used for the determination of fatigue lives was also made more onerous than LR's standard trading route, by replacing the standard 20% of vessel time sailing between the Mediterranean to the US East Coast, with 10% of the time from the UK to the US East Coast and 10% of the time from the Mediterranean to Boston.

Her level 3 fatigue design assessment (LR's FDA level 3 spectral fatigue analysis) was specified for critical structural areas. Plate thicknesses and bracketing details were modified in accordance with the results of this analysis.

Again, although the requirement only became mandatory after the ships were ordered, *British Emerald* has been specified as featuring fuel oil tanks separated from the hull by outside ballast tanks.

Optimised hull

Initial tank-testing of the hullform, conducted at Sweden's SSPA, focused on powering, sea-keeping and manoeuvring, with cavitation tests including propeller erosion potential. The resulting optimised hullform provided a 4% reduction in vessel resistance. Trim optimisation was worked out at variable draughts and speeds, with

Innovation onboard *British Emerald* goes right down to her low solar absorption paint.

Rear view of *British Emerald*, showing its distinctive funnel.

Hyundai Heavy Industries has delivered the first LNG carrier from an Asian shipbuilder to feature dual fuel diesel electric propulsion.

a view to reducing fuel consumption, and indicated that further fuel savings of over 4% are achievable.

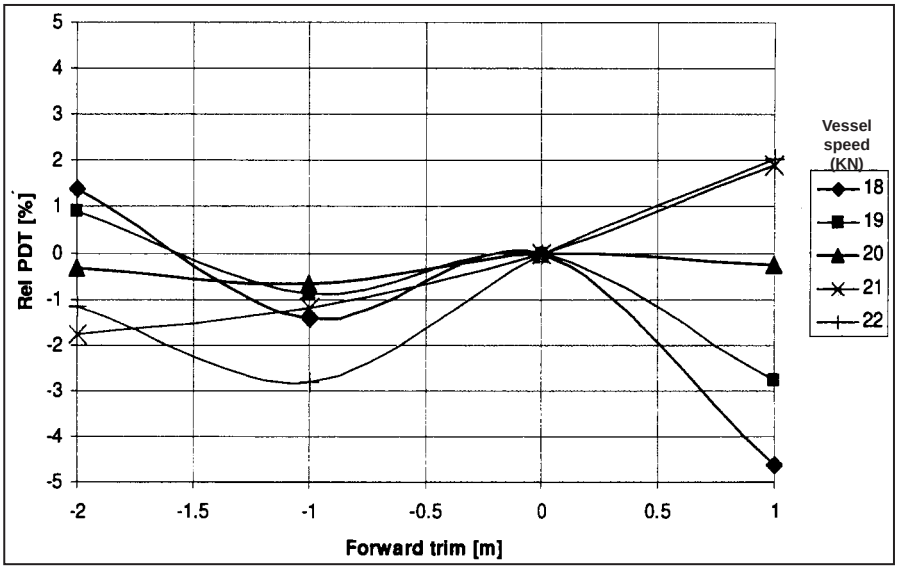
One of her key innovations revolves around the funnel size – which is reckoned to be twice the breadth of those seen on comparable LNG carriers and has resulted in a funnel more reminiscent of those seen in the cruise and ferry sectors. Its broadened construction has been necessary to accommodate the vessel's Saacke-manufactured Gas Combustion Unit. The GCU is used when the vessel is laden with cargo and manouevring at slow speed, during which time the engines do not consume all the boil-off gas. Therefore, the excess gas is burnt within the GCU and the exhaust cooled before exiting the funnel.

Three funnel options were put to the test in wind tunnel trials and through CFD modelling at BMT Hydrodynamics, in Teddington. Work was done to minimise wind drag, and to optimise exhaust gas dispersion, to prevent gas from being sucked back into the engineroom intakes. The result is a funnel design where the top 3m of the external plating has been removed to achieve a significant reduction in wind drag.

Particular focus was also given to the forward end of the trunk deck where there is traditionally a very bluff transition between the mooring deck and the trunk deck. The CFD and wind tunnel testing indicated that significant savings in wind drag would be achieved through the installation of a wind deflector at the front of the trunk inclined at 45°. While common to the cruise market, this is reckoned to be the first wind deflector (spoiler) installed onboard an LNG carrier. Smaller wind deflectors have also been installed on the top of the wheelhouse and compressor room, again with a view to minimising drag.

According to Mr Collett, the result of this testing is a reduction in wind drag of approximately 10%, and overall wind and water resistance are cut by around one per cent. While seemingly marginal, it should be reiterated that the ship will consume 140tonnes of fuel per day – which means that these measures will save over 2m^3 of LNG a day when laden, or over 1tonne of MDO per day when in the ballast condition.

Yet another innovation can be seen in the distinctive use of paints. BP Shipping's tanker fleet livery has been long distinguished by its black hulls and green decks.



Results of trim optimisation.

British Emerald, however, features orange topsides and a sand-coloured trunk deck, for the specific reason that such colours are known to reduce solar absorption. The shipowner's decision on this followed a series of temperature elevation tests by supplier International Paint.

Laboratory tests demonstrated that, when the coloured side of the coated steel plate was heated, the uncoated side experienced the following temperature rises: Black = 49.4°C; Orange = 37.4°C; Green = 39°C; Sand = 28°C. The new colours absorb much less solar energy and thus will result in lower heating of the LNG cargo (minimising boil-off gas) and leading to a less humid atmosphere in ballast tanks - possibly reducing corrosion in these areas.

It is understood that, on the basis of the same colour scheme, coatings containing enhanced reflective pigmentation will be applied to the remaining sister vessels, further reducing solar absorption.

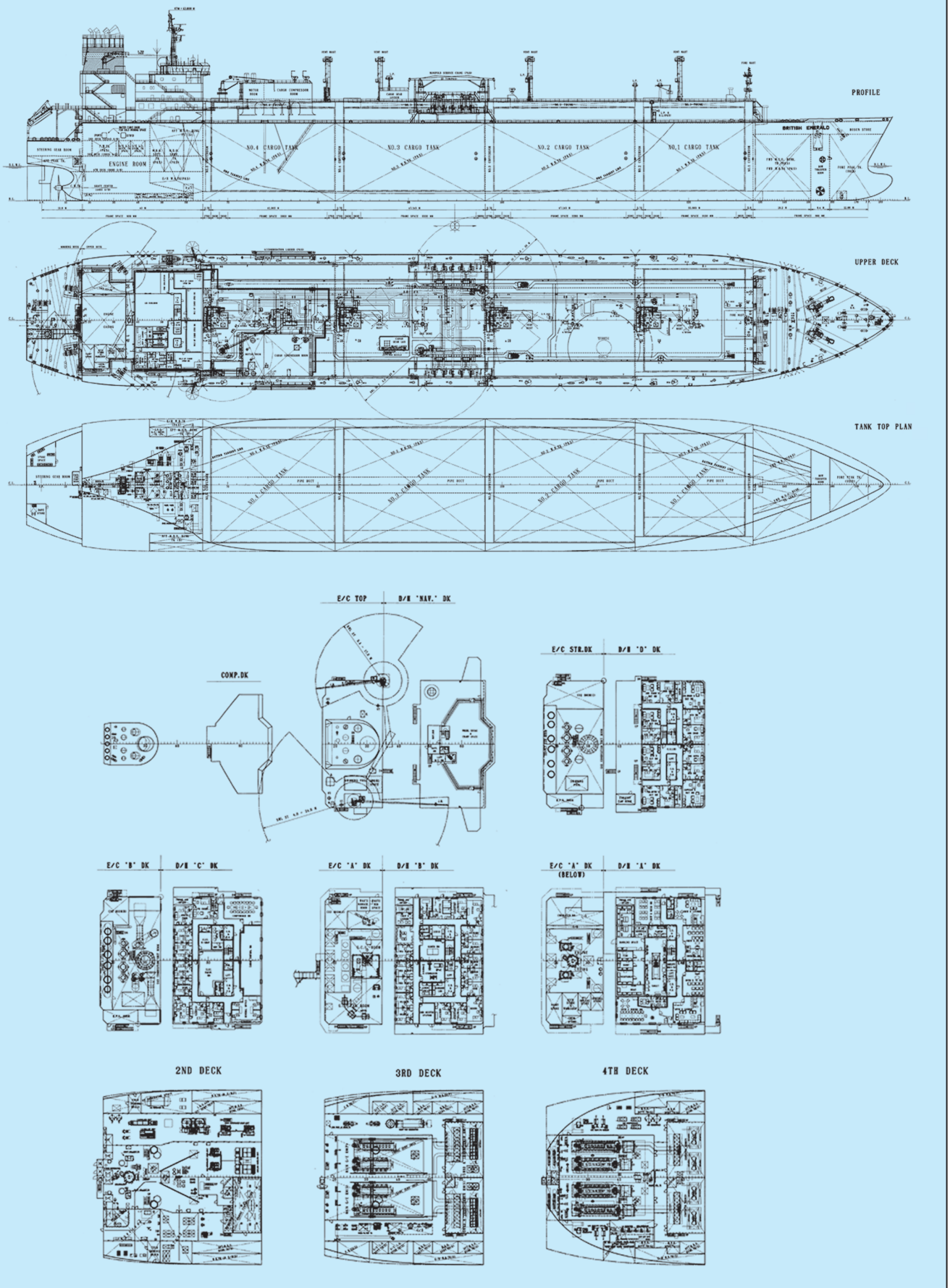
British Emerald is also fitted with a highly advanced A Series Vessel Control System (AVC) from Converteam. The AVC system combines ship-wide supervisory control and monitoring together into a single system, enabling operators to have a complete overview and control of all ship's systems. Distributed field stations provide local plant interface, with multi-function operator workstations providing the human-machine interface.

BP Shipping worked closely with Converteam during the design stage of the AVC system for *British Emerald*, to ensure that it met the needs of the vessel's complex systems in the most logical and user-friendly way.

The AVC system integrates with all other systems onboard, including the power generation, electric propulsion, gas burning, tank control, fire and gas detection, ESD and Navigation/Communication packages, providing the operator with a fully integrated, bespoke solution.

In light of moves in the US to insist on cold ironing in key terminals, *British Emerald* is fully equipped to receive shore-power should the capability be available, allowing the total shut-down of all onboard power generation. The cold ironing connections are located within weathertight compartments inside the engineroom, port and starboard, and are accessed externally via hydraulically operated watertight shell doors.

General arrangement plan: *British Emerald* 155,000m^3 capacity LNG carrier.



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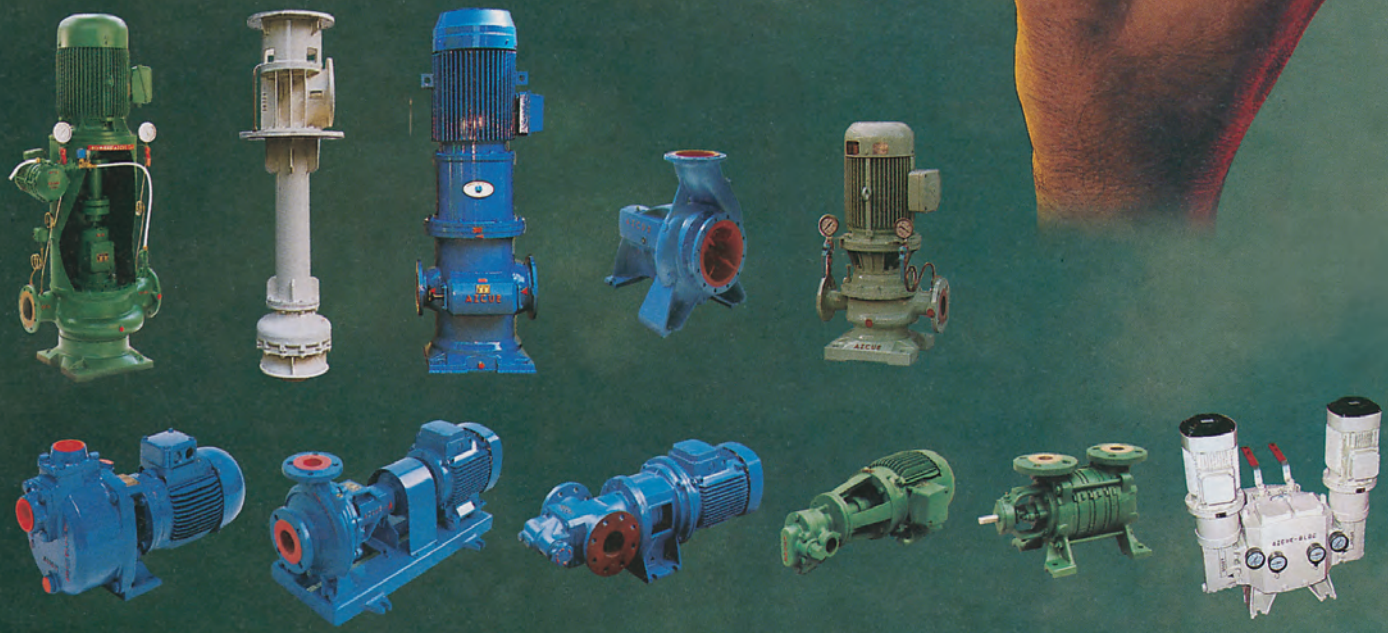

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Wind farm ship lifts off

WESTERN Shipyard has signed a contract that it says represents a massive step up for shipbuilding technology among Baltic yards.

The Klaipeda-based builder, 92.84% held by BLRT Group, said daughter company Western Shipbuilding Yard had signed a Litas150 million deal with German company Bard Engineering GmbH to build what is being described as a unique ship for lifting and transporting heavy and outsize cargoes for operation in the energy market.

Classification society Germanischer Lloyd was due to give the go ahead for construction work to begin at time of writing, with a due delivery date of 29 March, 2009.

At 102m long, 36m wide, and featuring a draught of 3.5m, the 'self-elevating heavy lift ship' is intended for the construction and maintenance of an extensive offshore wind farm along the continental shelf off the coast of Germany.

'The project is unique and interesting because two hulls built in different docks will be interconnected on water by special technology,' said WSY marketing and sales director Jevgenij Petrov.

The two hull sections need to be built in different floating docks because the beam of the vessel is such that WSY does not have a single dock wide enough. Once launched, the 'half-hulls' will be welded together afloat. Engineering and support during this operation will be done by specialised company Korall, of Sevastopol, Ukraine, which WSY says has 'great experience in similar engineering works for other projects'.

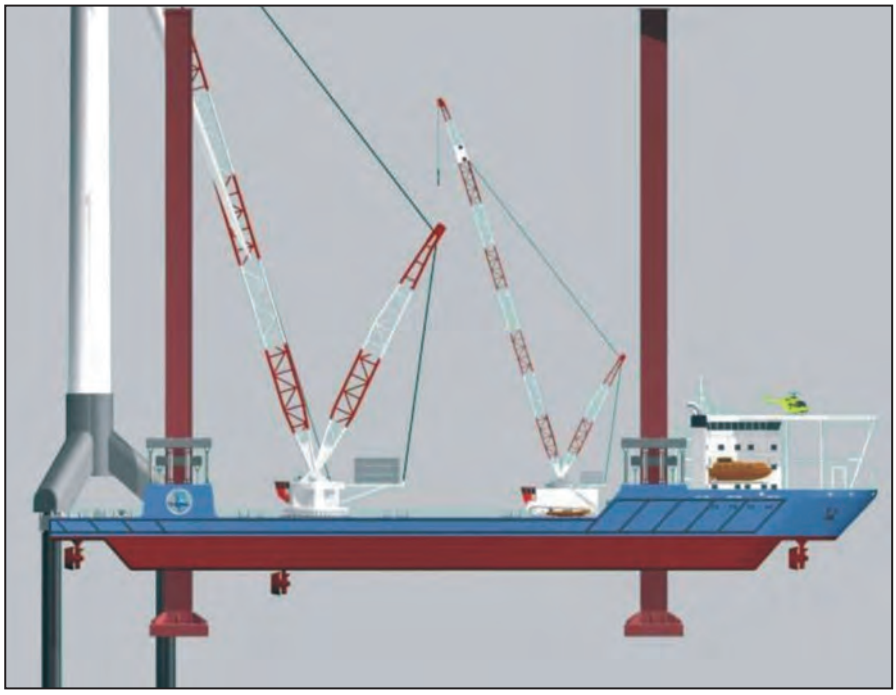
The new ship will feature one 500tonne capacity main crane, two 25tonne auxiliary cranes, and its own helicopter pad. WSY said electronic, hydraulic, navigation, dynamic positioning, and other systems would be supplied by world renowned companies.

So far, Wärtsilä has been contracted as the main engine/diesel generator supplier, while HRP Thrusters will supply 4 x 1100kW azimuthing thrusters, Bosch Rextroth will supply the hydraulic components for the jacking system, with Gusto BV supplying the basic design, main crane, and jacking system. Contracts for the main electrical systems and bridge installation have yet to be finalised.

In October 2004, WSY completed construction of a jack-up type ship project, desiged for port works. The ship was delivered to German company Hochtief Construction and has since been occupied in the construction of the fourth container terminal in the port of Bremerhaven.

After only nine years of shipbuilding, the yard is in celebratory mood over its step up in capabilities.

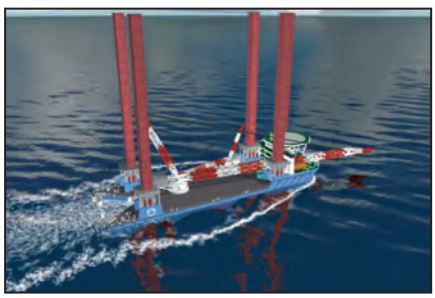
'Step by step we are realising more and more complicated projects,' said Arnoldas Šileika, Western Shipyard general director. 'This year we approached a grand, complicated, sublime project that will really enter not only our company history, but also the history of Lithuanian shipbuilding. We can truly be proud of our shipbuilding company, determined as it is to raise the bar.'



The self-elevating heavylift ship for Bard Engineering will be the first of a kind from a Baltic yard.

An earlier project, when Western Shipyard honed its expertise in jack-up technology.

The new ship will feature one 500tonne capacity main crane, two 25tonne auxiliary cranes, and its own helicopter pad.



Industry divided over emissions solutions

LITTLE sign of harmony is emerging among the different industry voices vying for attention on the subject of air emissions from ships.

NOR-SHIPPING saw Intertanko once more set out its stall for a switch to distillate fuels as the most effective way of limiting sulphur dioxide emissions from ships. However, its carefully orchestrated 'comprehensive strategy for the reduction of air pollution from ships' quickly drew a riposte from those advocating the continued use of residual fuel, in combination with gas scrubbers, as a more efficient and cost effective solution.

Intertanko pointed out that recent moves in the US to launch unilateral legislation which would limit the sulphur content of fuel for ships in US ports to 0.1% by 2010 (well below and well ahead of industry plans, but pretty much in line with the EU Sulphur Directive) had focused minds in the international shipping industry and at the IMO on the necessity of coming up with a comprehensive, practical, efficient strategy on time, to reduce air pollution from ships in the medium-term as well as in the long-term.

The environmental footprint of ships, which carried 90% of world trade covering over 30,000 billion tonne-miles a year, was extremely light compared to other forms of transport.

Yet, despite the industry's tonne-mile efficiency, it had been left behind by other sectors, which were already regulated and compelled to use clean, environmentally-friendly fuels, Intertanko said. 'This means that the shipping industry has become an easy-to-pick fruit, recently targeted by politicians eager to show that they are still doing something on the environmental front.'

Peter Swift, managing director of Intertanko.

Fritz Fredriksen, chairman of IBIA and a major buyer of fuel on behalf of a Norway-based shipowner.

Switching fuel

A switch from residual fuel to marine diesel oil (MDO) offered a comprehensive and practical strategy for an efficient and long-term reduction of air pollution from ships, the tanker association said. Residual fuels had a significant content of sulphur, nitrogen (that contributed to the NOx emissions and thereby ozone or a greenhouse gas), hazardous components, including heavy metals, and polycyclic aromatic hydrocarbons (PAH) that combined to create a cocktail of particulate emissions and generated sludge.

Switching to MDO according to a timescale that took into account fuel availability would deliver immediate, real, and global reductions in atmospheric pollution (SOx, NOx and PM). It would deal with the cause of this pollution rather than the effect, the tanker body said. The position was gaining support from a number of IMO states – including Norway.

'Looking at this course of action from a holistic point of view, it is environmentally sound, where CO_2 emissions from refineries producing additional MDO are overtaken by CO_2 reductions from overall ship operations, actually resulting in lower CO_2 emissions overall,' said Intertanko.

Intertanko argued that, whether the industry shifted to MDO or opted for gas scrubbers, the cost would be borne by shipowners. Higher fuel prices would be recoverable through higher freight rates but, Intertanko suggested, the same could not be said for the fitting, running, and maintenance of fuel purification and emission abatement systems, while shipowners could expect to be responsible and liable for the physical disposal of the liquid and solid wastes generated by such systems.

'Ships, numbering over 40,000 around the world, are not the most efficient vehicles to carry out such a task. These ships would be obliged to dispose of the waste – sludge from the purifying process and liquid (sulphuric/sulphurous acid) and solid (heavy metals etc) waste from the emissions cleaning process – in a responsible manner at sea or ashore. If this waste should be disposed of at sea, such a decision rests with governments, not with shipowners. If such waste should be returned to shore, we might ask ourselves why such waste needs to be delivered to ships in residual fuels in the first place?'

Environmental expense

On the environmental 'expense' side, there would be an additional level of CO_2 emissions from either the de-sulphurisation of residual fuels to produce low sulphur bunkers, Intertanko said, or the production of additional low-sulphur MDO to replace residual fuels on ships, or the manufacture and operation of fuel cleaning equipment and three to four exhaust gas cleaning systems per ship.

On the environmental 'income' side, the use of MDO was the only solution which gave a CO_2 emission saving because it:

- reduced total fuel consumption for each ship by at least 4%;
- made onboard fuel processing, including heating and treatment, redundant (MDO can be put straight into the engine);
- reduced to a minimum energy consumed for onboard waste treatment (200m tonnes of residual fuel leaving behind at least 1.4m tonnes of sludge which needs to be incinerated).

This 'income' provided a significant reduction in CO_2 emissions to offset against extra CO_2 that would, in theory, produce extra low-sulphur MDO.

Intertanko technical director, Dragos Rauta, said that it was the responsibility of the shipping industry to tackle pollution, including air pollution. He said that, in the context of regional regulations developed in Europe and California, and pending across the US, Intertanko's position derived from its sense that air pollution should be tackled at its source, rather than further along the chain.

'We are aiming for MDO, or when the technology is in place we could go for natural gas, but that will take time, so we have suggested to the IMO that all ships switch to MDO, and that will only happen if the regulations are based on fuel specifications.'

Mr Rauta said that an IMO study group on air emissions would investigate available technology, associated costs, and the environmental impact of different solutions to reduce air emissions from ships. It would report at the end of 2007.

Step change

Intertanko managing director Peter Swift added that, if the IMO failed to deliver a 'step

change' on air pollution from ships by 2008, there was recognition that Europe and the US would act. The EU had placed its Sulphur Directive on hold in order to see what the IMO would come up with, but was unlikely to wait beyond 2008. Again, while shipping had been excluded from the provisions of the Kyoto Protocol, the expectation was that it would be included from 2009. The European Council had already said that ships should be included in regulations covering greenhouse gasses.

Mr Rauta said that injection systems and fuel pumps would need to be modified in order to use distillate fuels, but he pointed out that existing liquefied natural gas carriers used boilers for propulsion, with part of their power provided by boil-off gas. 'We have systems today that use HFO and LNG for propulsion – so we are talking about a known technology.'

If Intertanko's position could not be clearer, it took little time for the International Bunker Industry Association (IBIA) to offer the latest in what has become a series of rebuttals. IBIA said that the campaign by Intertanko for all shipping to switch to burning MDO, flew in the face of common sense.

'We all want to improve air quality and reduce emissions from shipping,' said Fritz Fredriksen, chairman of IBIA and a major buyer of fuel on behalf of a Norway-based shipowner. 'But there is more than one way to tackle the issue, and it does not make sense to stifle innovation and shut the door on different approaches by preaching that everyone should be forced into a straitjacket and use one type of fuel.'

IBIA believed that Intertanko's position represented 'a simplistic and narrow viewpoint, which might suit some of the small group of shipowners represented by Intertanko, but which would be unworkable in practice and which would damage the efficient shipping industry on which global trade depends,' said Mr Fredriksen.

IBIA had a 'holistic' approach of its own.

'We believe the rules should focus on outputs, not inputs,' said Mr Fredriksen. 'If we say that ships can only emit this or that, then it is up to shipping to devise the most efficient way to achieve that. One way is to burn distillates, but that is not the only way. Owners can install scrubbers, or can burn low sulphur heavy fuel and achieve the same outcome. So why create a regulatory straitjacket which will harm the industry?'

50 oil refineries

IBIA argued that distillate supply could not keep up with demand if Intertanko's proposal was adopted. 'Europe alone already imports 33m tonnes of distillates,' said Mr Fredriksen. 'We would need another massive product tanker fleet to supply the MDO for ships if we took the Intertanko route, which is perhaps why some tanker owners support the idea. Or we would need to invest $38bn in converting 50 oil refineries to produce more distillates; will the oil industry seriously do that? What about the extra 600 million tonnes of crude oil we would need to produce all this distillate fuel, imagine what that would do to world oil prices, especially as prices are so high already. And while many tanker owners don't buy their own fuel, it comes with the charter, the same cannot be said for the containership fleets on which the world depends. An enforced switch to distillate fuel would seriously disrupt trade and massively push up costs, quite unnecessarily. By all means let us work together at IMO to reduce output emission from ships, but let's keep the door open for more than one way to do this.'

It should come as no surprise that Intertanko disputed the basis for these assertions wholesale. On the subject of pricing, Mr Swift pointed out that the price of residual fuels had tripled over the last five years 'and we are still moving goods'. Rising fuel prices were a fact of life.

Furthermore, citing IEA figures, Intertanko pointed out new refineries coming on stream by end 2011 would add 14% to refining capacity over end 2005, or 660mtpa. Out of this new capacity, one-third could produce yields of medium/heavy distillates (such as MDO) – or in this case 220mtpa. In addition, current refineries were being upgraded and they would have spare capacity for increased production. These two developments would create capacity that would be more than enough to provide MDO for all ships.

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Interim report from Estonia studies

A special report for *The Naval Architect* on May's interim workshop concerning the *Estonia* sinking, held at Strathclyde and Glasgow Universities.

MV *ESTONIA* sank in the Baltic Sea on the night of 27/28 September 2004 with an official death toll of 852. A Joint Accident Investigation Committee set up by the governments of Estonia, Sweden, and Finland produced a report some three years later which resulted in widespread heated debate.

In response to the ongoing controversy, the Swedish Government appointed VINNOVA (The Swedish Governmental Agency for Innovation Systems) to commission a research programme into the sinking sequence of *Estonia*, to enable recommendations to be made on the design and operation of ro-ro vessels. Two consortia were appointed to carry out research in parallel but independent of each other. The SSPA consortium consists of SSPA Sweden AB, The Ship Stability Research Centre of the Universities of Strathclyde and Glasgow, Marin of Wageningen, and the Department of Shipping and Marine Technology of Chalmers University. The HSVA consortium consists of the Hamburg Ship Model Basin and the Technical University of Hamburg.

The research programme was scheduled to last two years, and on 11 May, 2007 a workshop was held at Strathclyde and Glasgow Universities to present progress made after the first year.

The first part of the workshop consisted of presentations about what had happened in the past. Markus Kurm, a prosecutor with the Swedish Government, introduced the work of the committee of experts. They had reviewed the JAIC report and found problems that were still unanswered, but they were only able to investigate the investigation. They could not gather any further information. They had concluded that there was no reason to doubt the statements made, but that there were contradictions to be found that could be traced to interview techniques. They had concluded that they could not say that the report scenario was wrong but that it could not be defended totally because of its contradictions and shortcomings. There was a necessity to differentiate between facts, opinions, and hypotheses.

Tools have been developed to simulate the different scenarios covering *Estonia's* sinking process, of which there are perhaps as many as 10 to the power 8!

Werner Hummel, who had conducted the German investigation, outlined findings on the condition of the ship's visor and ramp before the incident, and the re-evaluation following filming and samples taken by the Bemis/Rabe group indicating an explosion.

Bertil Calamnius, of the survivor's group AgnEF, expressed the families' frustration at the heavy handed attitude of the authorities and the role of newspapers in legitimising government decisions. He used the *Derbyshire* sinking as an example, where the families' groups and the International Transport Workers' Federation had found the reasons for the sinking after 20 years. He wanted all restrictions on the *Estonia* wreck to be lifted, research for further evidence to be carried out, and the investigation re-opened, this time in an independent manner.

The Workshop then progressed to a look into the future, with John Graffman of VINNOVA outlining the view that it was the intention to study the sinking sequence to determine the most probable scenario and produce proposals for demonstrations of products, methods, and services to improve safety and give a better understanding of the sinking sequences of ro-ros. The research was at a half-way stage, with the final report due in March 2008.

Dr Petri Valanto of the HSVA consortium outlined work on the flooding of the vessel with the ramp fully open, and the drifting of the wreck, based on the debris field. HSVA was also modelling the evacuation, which was confirming that about 300 people actually escaped from the sinking ship.

Dr Claes Kallstrom and Bjorn Allenstrom of the SSPA consortium demonstrated the systematic model testing and computer simulations being conducted to explain the sinking sequence and suggest improvements. They then showed fascinating film of the 4m model being used to carry out tests at different heel angles, headings and speeds, with the ramp open and closed, showing that flooding is very speed dependent.

Prof Olle Rutgersson and Martin Schreuder of Chalmers University showed how they were reviewing evidence and forming loss scenarios from transcripts of interviews, video of diving operations, interviews with divers, and available technical documentation of the ship. A data bank was being developed for collected factual material to use to study a plausible sequence of events.

Dr Jan Blok then illustrated how Marin was going to use its model experience to provide material to validate the computational tools with wet experience. It was building a 6m model to a scale of 1:20 with a transparent plastic deck 4, which it will flood with about 1tonne of water to measure velocities through doors and apertures during the sinking process.

Dr Andrezej Jasionowski of the Ship Stability Research Centre outlined how the organisation was examining the sinking process, the heeling process, and the stability deterioration process. Research was not targeting the 'before or after', but studying the sinking mechanism, and was using data and statistics, numerical simulations and experiments, and expert judgment. The tools have been developed to simulate the different scenarios of which there were perhaps as many as 10 to the power 8!

The workshop then concluded with a panel discussion chaired by Dr Tom Allan. With some 85 invited delegates from widely differing backgrounds this was lively and reinforced how much controversy still surrounds this sinking.

Mr Johan Franson, the director of maritime safety, Swedish Maritime Safety Inspectorate, was particularly closely questioned. Concern was expressed from the floor about the lack of a comprehensive diving survey that would have answered many of the outstanding questions, and whether or not the ramp was fully open during the incident.

A final report is scheduled to be produced by the consortia in March 2008, but it was stressed that the Consortium is not investigating how the incident happened.

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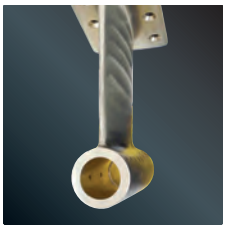

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X-Bow ready to take on the world

NEW applications of the X-Bow concept were rolled out at Nor-Shipping, as Ulstein explained that the design that has shaken up the offshore industry could do the same in the wider commercial shipping market.

The revolutionary bow concept was first launched in 2005, with its inverted bow gaining immediate interest from leading shipowners, with the Ulstein AX104 *Bourbon Orca* becoming the first vessel built to specification and going on to demonstrate important benefits for offshore applications.

Ulstein Design managing director, Rolf Inge Roth, said: 'The principal features of the Ulstein X-Bow are as relevant for a number of merchant vessel applications as they have proven to be for offshore applications.'

The recent establishment of the new Ulstein Es-Cad parternship, in Turkey, provided the platform for taking such new applications forward.

Tore Ulstein, Ulstein Group deputy chief executive, said: 'By merging a track record within merchant and short sea shipping with the expertise and proprietary technologies of the Ulstein Group, we are now uniquely equipped for offering innovative ship designs for merchant and short sea shipping.'

Technical manager of Ulstein Es-Cad, Cem Aktüre, is heading the development of new concepts using the Ulstein X-Bow for merchant applications. He said: 'The features of Ulstein X-Bow directly translate to enhanced profitability by increasing the earnings potential and reducing the operating costs of vessels, while also offering environmental advantages.'

Advantages of the concept included: higher transit speed in adverse weather conditions; reduced fuel consumption in head seas and following seas; reduced fuel consumption in ballast condition due to improved lightweight distribution; negligible slamming reducing the risk of damage to the vessel; lower pitch and heave accelerations, and enhanced protection of cargo areas reducing the risk of loss or damage of cargo; and increased payload capacity for certain applications and configurations.

'Small- and medium-sized vessels engaged in regional trades are set to capitalise on the benefits offered by the Ulstein X-Bow,' said Mr Aktüre, 'and we are currently evaluating this feature for use on container feeder vessels, ro-ro vessels, and certain general cargo vessels.'

Håvard Stave, Ulstein Design design manager, added: 'Ulstein Es-Cad can become a provider of design and equipment packages for Turkish yards. At the same time, Ulstein Es-Cad will have the responsibility for developing a portfolio within merchant ships, particularly in short sea shipping. This will include tankers, ro-ro-vessels, and container vessels, and contribute to a broader market segment in the Ulstein Group.

'Ulstein Es-Cad has experience in designing merchant vessels. The Ulstein Group´s competence and technology from the offshore sector will strengthen Ulstein Es-Cad in this segment. With this know-how, Ulstein Es-Cad can perform engineering work for Ulstein Design and yards that the Ulstein Group sells designs to, including Ulstein Verft.'

The first container vessel featuring the Ulstein X-Bow is a concept ship developed by Ulstein Es-Cad and Ulstein Design.

Eidesvik concept for two large seismic vessels that will feature the X-Bow.

In the meantime, Ulstein pressed home the desirability of the X-Bow concept with the announcement of a series of new orders from offshore clients.

Newly formed, Dubai-based shipping company Eastern Echo has ordered four ships featuring X-Bows to the Ulstein SX124 design, which will be the first seismic vessels of Ulstein design. The contracts are worth a combined Nkr400m.

Peter Zickerman, a director of Eastern Echo, said: 'The Ulstein X-Bow concept is interesting and an improvement compared to traditional ship designs. We are convinced this will be a good design for us, particularly with regard to the environment. It is very important to us that the crew has good, safe working conditions, and we believe this design will be an important contribution towards that end.'

The vessels will be built at the Barreras shipyard in Vigo, Spain, with the first ship ready for operation at the end of 2008, and the three remaining ships to be delivered a few months apart during 2009. They will be equipped for 3D seismology and have up to 10 streamer winches each.

Eidesvik went on to order two large, state-of-the-art seismic vessels of the type Ulstein SX120 from Ulstein Verft. The 106m long by 28m wide ships will be delivered in spring 2010. The contract's total value is about Nkr1.3 billion. The owner cited the X-Bow's excellent sea-keeping and fuel reducing characterisitics as key to its investment.

Elsewhere, Marine Subsea Inc signed a contract with Ulstein Verft to build an offshore construction vessel specialised in inspection, maintenance, and repair operations to the Ulstein SX121 design. The value of the contract is about Nkr900 million.

The ship will be delivered in 2010 and is the fourth vessel of the type Ulstein SX121 from Ulstein Design.

The vessel will be 25m wide and 120m long. She will accommodate 100 persons. She will be fitted with a tower for module handling, a moonpool, ROV hangar, offshore crane, helideck, and a diesel-electric propulsion system.

Marine Subsea managing director, Christian Nygaard, said: 'The vessel with the new hull type can operate in all weather conditions. The hull shape makes for smoother sailing, giving the crew a more comfortable and safer work platform. The bow improves the operations the vessel will perform. The hull design also gives the ship more volume in the forepart and thus more space for accommodations than a conventional hull.'

Strong demand for zero speed stabilisation

A STRONG response from potential customers has been reported by Rolls-Royce in the first few months after the launch of its retractable fin, stabilisation at rest system for large yachts, with the first order also placed for installation onboard a vessel exceeding 100m in length.

The company has secured eight orders in total for the new system and reports inquiries from 50 potential customers for a system launched in August 2006.

The SAR system's appeal is based on the fact that a new generation of owners and guests are entering the megayacht market who may not have great seafaring experience, and may be discomfited by roll onboard a vessel, even when it is at rest. Rolls-Royce said that owners were increasingly demanding zero speed stabilisation, sometimes as a key priority in their yacht choices.

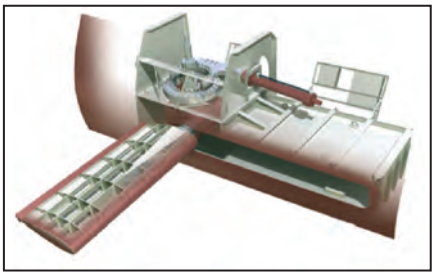
Rolls-Royce's motion control centre in Dunfermline has received four orders for the original Aquarius 50 SAR so far, through Dutch yacht builder oceAnco, of Alblasserdam, which has been converting a series of commercial vessels into luxury yachts.

The Aquarius 50 delivered to date has featured pairs of moving 'tadpole' fin profiles fitted at the mid-section and operated by tilt actuators, with one fin apiece being fitted on either side of the ship. The fin area is up to 6.1m^2, while the maximum sweep of latest designs is up to 40°. Recently, after CFD analysis, a new 'teardrop' fin design was developed that is reckoned to offer improved performance at rest and underway, offering a greater degree of lift and less drag.

At the heart of the system is a new control and electro-hydraulic system that senses the start of any roll. At rest this system tilts the fins at a high angle to generate reaction load to counteract wave motion. When underway, the system takes the lift forces generated by the ship's forward speed to dampen roll motion. Tests at the Maritime Research Institute Netherlands concluded that the system reduced yacht roll in sea heights of 0.5m by up to 80% while the ship was at rest, by 80%-90% when the ship was underway, and by 30% when the fins were in their passive mode.

The fins can also be retracted to ensure complete safety, to reduce drag at higher speeds, or for manouevring in narrow seaways. Interlocks have been introduced to control the safe operation of the fins when laying at rest and manoeuvring for anchor operations.

Hull no 702 from Dutch yacht builder oceAnco – the first vessel to feature Rolls-Royce's latest retractable stabilisation at rest system. Picture supplied courtesy of OceAnco.



Design concept for the retractable stabilisation at rest system.

The first vessel to feature the Aquarius 50 system has already completed sea trials and has been delivered to its owner, with the second due delivery over the summer. The third and fourth yachts are due delivery from 2008.

All four of these yachts are in the 80m-82m length ranges, with a roll period of just over nine seconds. The supplier said that the Aquarius 50 system was appropriate for vessels of between 65m and 88m in length, while two variants had been developed, one apiece for larger and smaller craft. The Aquarius 25 features a 1.5m^2 fin area and was designed for vessels of up to 65m in length and, at 12tonnes in weight, was the smallest retractable fin unit in the world. It has been specified for a small ferry under conversion at Portuguese yard ENVC, and for a 55m-long yacht. Meanwhile, the Aquarius 100 was designed for vessels of between 80m and 90m.

Rolls-Royce said among its most recent orders had been a SAR system for a 100m plus length ferry under conversion into a luxury yacht in Greece. Vessels of this length would need to feature two pairs of retractable fins, the supplier said, which is to be fitted with the new Aquarius 100 system, possibly as an Aquarius 100 and Aquarius 50 combination. The supplier said it had also been asked to quote for vessels of between 120m and 130m in length.

First ship online for condition-based maintenance

REAL-TIME monitoring of marine engine performance has become a reality, after Wärtsilä Corp selected Nor-Shipping as the venue to exhibit its new on-line condition-based maintenance, connecting live to systems aboard the drill ship *West Navigator*, operating off the Norwegian coast.

The Seadrill Offshore vessel, built in South Korea in 2000, is a dynamically-positioned ship able to drill down to 9000m in water of 2500m depth. It is powered by seven Wärtsilä diesel generating sets, comprising four six-cylinder in-line Wärtsilä 46-engined sets, two 16-cylinder Wärtsilä 32-engined sets in V-configuration, and one nine cylinder in-line Wärtsilä 20 engine set, having a combined output of 37.53MWe. It is currently operating on the Ormen Lange gas field, which is about 100km north-west of Molde, Norway.

Wärtsilä said its latest innovation represented an extension of the CBM on-line service it had already established for land-based operations, where it today serves 64 power plants around the world.

The on-line CBM solution provides potentially continuous guidance to engine users to ensure installations are performing to optimum effect, while signposting any deviation from the engine's normal operating parameters. It can spot fault sources and emerging operational trends before any failure occurs, thereby enabling proactive rather than reactive maintenance. It should thus ensure longer times between overhauls and minimise downtime to guarantee optimum engine performance under all conditions. CBM also helps keep a close watch on the stock of spare parts, providing for ordering of parts in advance of coming needs.

With sensors monitoring mechanical and thermal conditions, including the fuel system, the cooling water system, and the lube oil system, Wärtsilä manager, CBM technical service, Johan Pellas, said the service offered the opportunity to get the best performance out of installed equipment, both in terms of operating costs and fuel consumption. Engines could be operated as close to their design values as was possible. He said that CBM would reduce the number of unplanned engine stops and that over 90% of required maintenance procedures should be predictable in the critical seven to 30 day window before maintenance was essential. He added that the service provided a new means for data to be analysed remotely, where between 60% and 80% of engine failure cases could be traced to 'human misjudgment'.

Johan Pellas – Wärtsilä manager, condition-based maintenance service.

Wärtsilä's CBM monitoring operation in Vaasa, Finland.

'Fuel cost savings of between 1% and 4% are available through the optimisation of operations and maintenance,' said Mr Pellas, 'and maintenance costs can be reduced by between 10% and 20%.'

In the case of *West Navigator*, all information in the shipboard system is available in real time, to be transmitted 24/7 to Wärtsilä service engineers at the CBM Centre in Vaasa, Finland, Wärtsilä in Norway, and the Seadrill office in Stavanger, Norway. The service team then assesses the overall status and condition of the plant - and ultimately the maintenance it needs, and makes regular reports to the engine users, based on established guidelines and specific operating conditions. Measurements made are available for six months, in order to establish any trends in the performance of a particular engine.

Marine installations use satellite communication to connect to the CBM Centre. An engine installation can be connected to the CBM Centre through the Internet using a VPN (Virtual Private Network) connection or through the e-mail server onboard the ship. There is also a manual alternative for data collection and e-mail sending which uses Wärtsilä's own software.

Once connected, the CBM Centre receives operations data information about the specific engines, including load and ambient conditions. The received data are automatically analysed by the Wärtsilä-developed software.

Marine installations most commonly still send operating data by batch once a day to assess engine condition. In the future, according to Wärtsilä, 24/7 online connections will be more and more common because of the increasing satellite connection capacity and reduced data transfer costs.

Mr Pellas said Wärtsilä was also able to provide owners with a monthly engine performance management report, taking in emissions, on-day predictive maintenance requirements, fuel consumption, and so on. He said a standard subscription would cost €500 per report, but that this cost was easily offset by proven and guaranteed savings on fuel cost.

Wärtsilä said the on-line service was a valuable development of its range of CBM services to the marine industry. The company said it had existing, more conventional CBM contracts on 134 ships and power plants, including almost 500 engines with an output of more than 4500MW globally. The major marine segments for CBM services had so far been cruise, offshore, and general cargo vessels.

***West Navigator* – the first vessel to benefit from on-line engine performance monitoring.**

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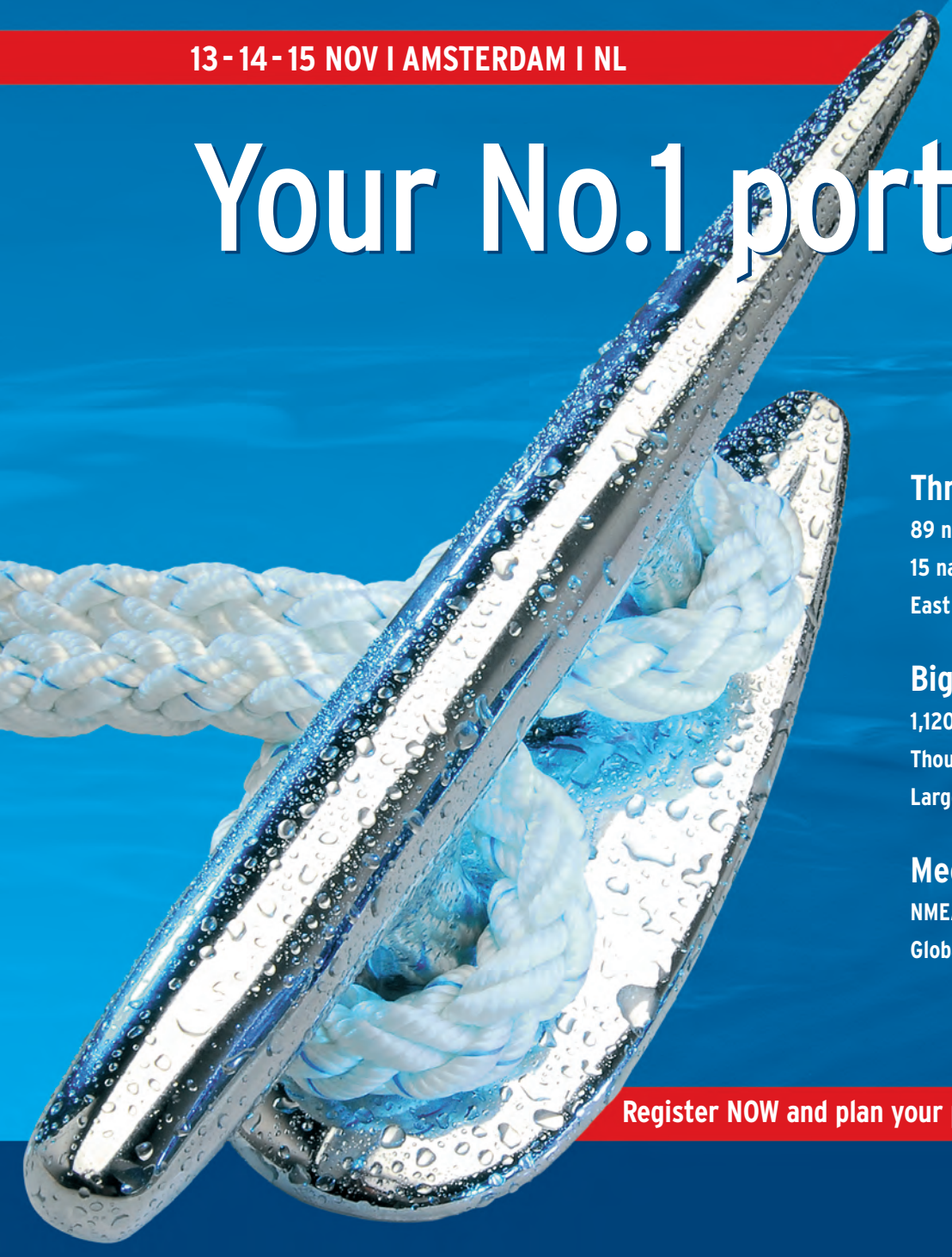

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Fail-safe solution for illegal discharge

TECHNOLOGY that aims to beat those disposed illegally to discharge oil overboard using automation is beginning to find its place in the shipping market.

Rivertrace Engineering said demand for a fail-safe product to detect, record, and deal with illegal overboard discharge had led it to develop SmartSafe, a 'plug and play' system that monitors and measures all aspects of the discharge process in real time. The UK firm reported at Nor-Shipping that it had secured its first orders.

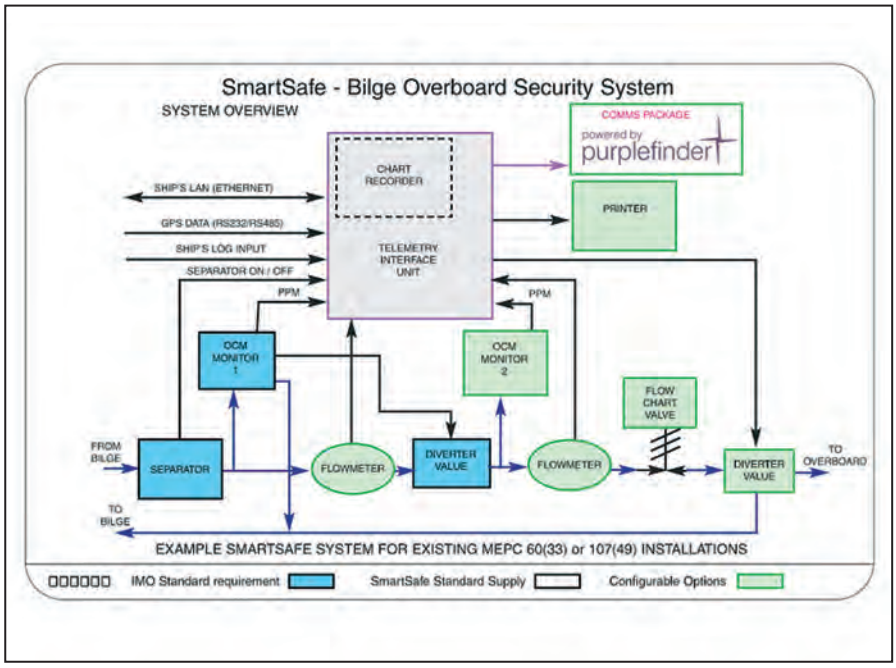
The UN joint Group of Experts on the Scientific Aspects of Marine Environmental Protection has estimated that 12% of marine pollution is the direct result of ship operations. It suggests that an avoidable 68% of this pollution can be attributed to deliberate discharge.

A review of operators who have admitted liability demonstrates that the issue is not restricted to substandard operators. There are very conscientious owners who have invested in state of the art ships, expensive oily water separator systems, and well-trained crews, and yet the very same crews can be totally negligent in their operation of the OWS system. Meanwhile, some cases of illegal discharge have been as a result of faulty OWS systems.

Today, however, Marpol regulations on oil discharges have or are being incorporated into regional and national laws that go as far as criminalising accidental oil discharges, with those at the forefront of such thinking including the European Union, the US, Canada, and Australia.

Rivertrace sales manager, Graham North, said: 'Last year we were asked to develop a bilge overboard security system capable of both ensuring the bilge oily waster separator isn't being bypassed, and detecting any attempt to bypass it, such as through the use of a magic pipe. The message we received from the market was that existing systems were useful in identifying the causes of an illegal discharge post-event, but were not providing a line of defence against discharge occurring in the first place.'

Rivertrace said that it had won orders for five shipsets for its SmartSafe system, while another ship was trialling the technology. As well as acting independently, Rivertrace has been making the new approach available through separator suppliers, including Victor Marine and Coffin World Water Systems.



SmartSafe: the compact unit designed specifically to beat those prepared to discharge oil at sea illegally.

Rivertrace and its communications partner Polestar were given leave to present the SmartSafe system to delegates at July's 56th meeting of the Marine Environment Protection Committee.

Tracked over the web via Purplefinder remote equipment monitoring, SmartSafe monitors and records separator control, oil content output, flow rate, and cumulative flow through the discharge pipe. In this way it can anticipate illegal discharge and, crucially, deal with it by shutting off the overboard discharge valve if necessary.

Should anyone try to tamper with the system, or shut it down, a spring loaded valve is tripped, forcing the diverter to close.

To assist with regulatory compliance, at the end of the discharge process a batch record is printed, containing all aspects of the discharge and any errors or inconsistencies that occurred during the process. The printout can be attached to the manual oil record book for presentation to Port State Control surveyors. Up to two years of data can be stored and presented in this way.

Rivertrace said that the data stored within SmartSafe could also be played back graphically on the in-built screen, sent for storage to the ship's local area network, printed remotely, or downloaded to a personal computer. Each start and stop of the oil discharge process created a secure and unique file.

Lyngsø hits it big in Vietnam

LYNGSØ Marine of Hørsholm, Denmark, chose Nor-Shipping as the platform to announce a major contract for the supply of integrated automation packages for installation aboard a series of 14 54,000dwt bulk carriers under construction at Hanoi-based Vinashin Group's Dung Quat and Ha Long yards.

The SAM Electronics subsidiary said that ships would be delivered to the shipbuilder's own shipping line between 2008 and 2010.

Each vessel package comprises complementary MCS 2200 integrated monitoring and control and PCS 2200 propulsion control systems, together with newly-developed EGS 2200 electronic governors for main engine control. The systems, which will be mounted in purpose-designed engineroom consoles, all feature open architecture as well as standardised hardware and software modules.

All packages will be assembled under DNV supervision by SAM Electronics' Chinese subsidiary concern in Taizhou, SAM Taihang Electronics. The contract has been secured under the PartnerShip alliance between Lyngsø Marine and SAM Electronics, based on their collective experience of outfitting more than 10,000 automation systems onboard commercial and naval vessels.

Rutter Radar joy

RUTTER Technologies, a division of Rutter Inc, launched its latest RADAR-100S6 specialty radar system at Nor-Shipping.

The supplier said that its new radar leveraged its proven S6 technology, providing the superior imagery and enhanced target detection necessary for improved situation analysis and superior decision making.

The RADAR-100S6 was a practical solution, in particular for specialty radar applications such as ice detection, search and rescue, coastal surveillance, port security, and vessel traffic systems, the company said.

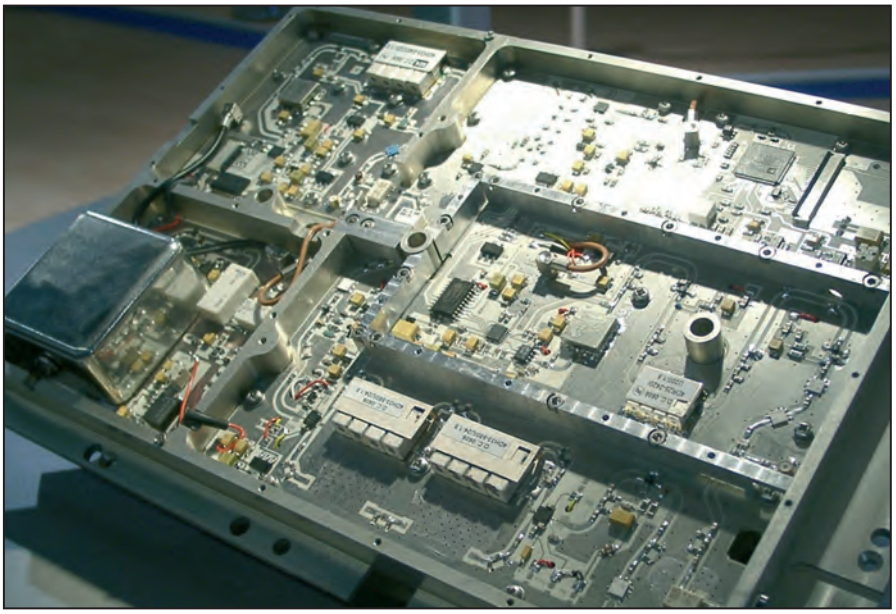
First glimpses of a SharpEye

FIRST deliveries of SharpEye, the Kelvin Hughes technology that is leading the marine navigation market, are set for August and September.

As part of its celebration of 60 years of commercial radar at this year's Nor-Shipping, Kelvin Hughes provided an update on the technology, launched at last September's SMM, which eliminates the magnetron and high voltage modulator from radar transceivers. Instead, a new solid state transceiver enables more information to be extracted from radar returns before processing by the display, allowing detection techniques that are normally only found in multi-million dollar military systems to be available to commercial marine radar users.

The supplier said that SharpEye had been selected for three super yachts and 15 merchant ships, the latter being a mix of bulk carriers, containerships, and tankers, and including five newbuilds and 10 retrofits.

Orders have been secured for the S-Band version of SharpEye, which is able to detect targets in clutter long before conventional radar, deploying a monostatic pulse transceiver that uses the Doppler effect to determine the target's velocities. It features advanced pulse compression, which processes received echoes into velocity bands, enabling it to separate the wanted targets from clutter.



SharpEye features no wearing parts, with a maintenance policy revolving around a single monthly visual inspection.

While better performance in clutter conditions is advantageous, Kelvin Hughes managing director Russell Gould said that this was not necessarily the driver for uptake in the commercial setting, where operators are more concerned with SharpEye's competitive procurement cost and low through-life cost. Set against the many hours per year required to maintain conventional equipment, he said that SharpEye's no wearing parts meant that its maintenance policy revolved around a single visual inspection each month, with preventative maintenance reckoned to take less than two hours per year by a semi-skilled operative. At all events, the amount of time reckoned to be required to restore SharpEye to full operation was estimated at less than five minutes.

SharpEye can be fitted to existing Kelvin Hughes Nucleus 3 and Manta systems. In the SharpEye radar the solid state power amplifier has a peak output power of just 170W, in contrast with typical marine radar systems in which the magnetron has a 30kW peak output. But, according to Kelvin Hughes, SharpEye also produces more energy than the magnetron system, therefore exceeding conventional radar in detection performance.

SharpEye continuously measures key performance parameters such as RF output power, VSWR, oscillator frequencies, and receiver sensitivity, and informs the operator that the radar is operating within its performance envelope. The system automatically alarms if there is any degradation in radar performance and removes the need for the periodic performance checks.

Mr Gould also reported that Qinetiq is in the final stages of awarding the S-Band version of SharpEye type approval, which, he added, performed at a level equivalent to a conventional X-Band service. The company intends to make X-Band and I-Band versions of SharpEye available in the first quarter of 2008, with the X-Band version expected to be targeted at the coastal surveillance and naval markets, and the higher cost I-Band version expected to remain the preserve of the military.

Servomex analyser passes the test

MARINE gas analysers manufacturer Servomex received an e-mail from Lloyd's Register during Nor-Shipping, confirming that it had received marine approval for its new portable analyser.

The new 5100 Marine analyser, for oxygen or methane, had passed the latest MED performance requirements that included new vibration and drop tests, plus the latest anti-static material rules.

Aleks Cvetanovska, Servomex product manager for the 5100 Marine, said: 'In replacing our long-established 262A analyser, we wanted to be sure that the new unit maintained our reputation for reliability and low cost of ownership. The new product includes customer requested improvements, such as a pump and lithium ion batteries, whilst retaining the use of non-consumable sensors. This ensures that customers only need to calibrate the unit themselves, rather than having to frequently replace sensors and/or send the analyser ashore for calibration.

The new Servomex 5100 Marine analyser, for oxygen or methane, has passed the latest MED performance requirements.

'For maximum safety and to allow use for many years, we also chose to design to the newest MED and international hazardous area (IEC Ex) rules. With -30°C drop tests and limits on uncoated plastic surface of 20cm^2, plus all the normal challenges of producing intrinsically safe equipment, these were very challenging. However, the design team eventually delivered what I think will be a very successful product, and initial feedback from users at the show has been incredibly positive.' Ms Cvetanovska said that she expected the product to also receive ABS, NKK, and DNV approvals soon.

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Amot valve makes market debut

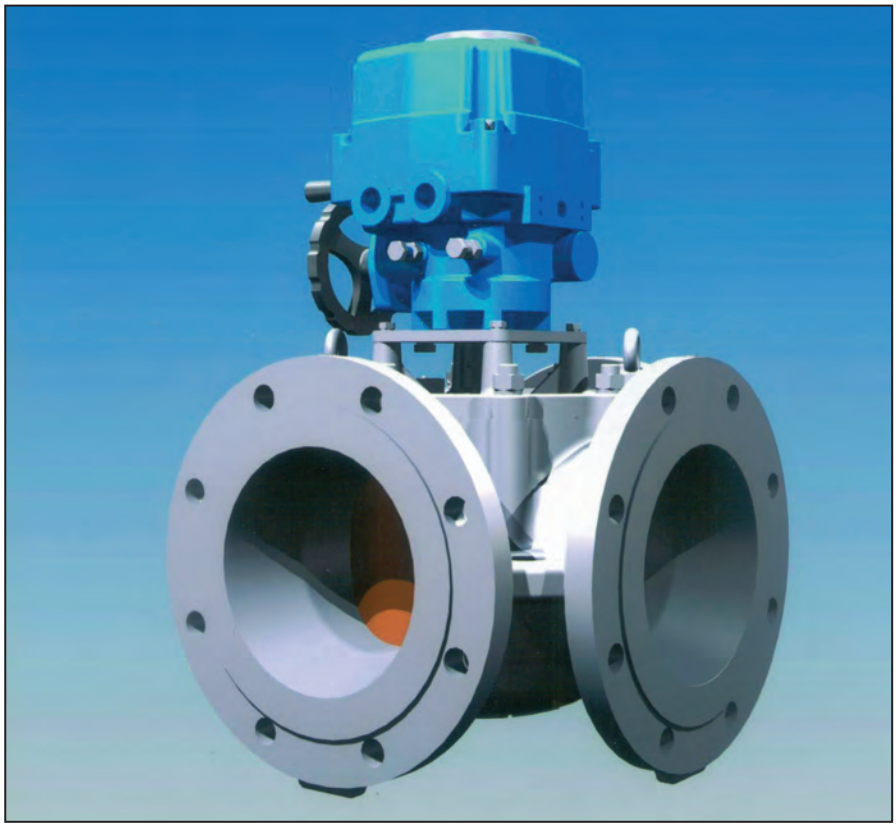
AMOT launched the latest version of its Amot G temperature control valve at Nor-Shipping, with a product designed to ease integration in application to ensure that, when selected, the valve size is the same size as the pipe.

The company said that the updated valve, used for oil temperature control, jacket water cooling, charge air temperature control, central cooling, and sea water cooling, offered the smallest envelope size for a temperature control valve. It optimised matching to the installation piping, resulting in reduced installation times and lower installation costs.

Amot said the product was ideally suited for both mixing and diverting applications, and typically used fluid temperature control in large diesel and gas engines in the marine and power generation industries. It offered rapid and accurate regulation of fluid temperatures to 100°C with flow rates up to 3000m^3/hr.

The valve offered the same benefits as its forerunner, being lightweight, compact, and port configurable.

Accessories included a brand new 8071/2D PID controller, incorporating temperature dead band, remote alarms, and logic outputs to drive 25A solid state relays, having significantly higher performance than standard relays, the company said. An Amot 8060 temperature sensor was also included. A choice of electric, pneumatic, and electro-pneumatic control systems was offered.



Amot's new Amot G temperature valve – enhanced for easy integration into application.

More electric propulsion for LNG

KNUTSEN OAS Shipping has broadened its commitment to dual fuel diesel-electric propulsion, after specifying the approach onboard three 173,400m^3 liquefied natural gas carriers, due delivery in 2010.

The shipping company, which already operates two diesel-electric powered suezmax shuttle tankers and a similarly equipped coastal LNG carrier, confirmed that it had ordered two vessels from Daewoo Shipbuilding & Marine Engineering (DSME) in South Korea, both of which had secured 20 years employment with Repsol. At the same time, it declared an option for a third ship, also due to be delivered in 2010. The ships would trade from South America, and to Spain.

The three ships are larger than the LNG tankers operated by the company today, which a company spokesman said provided one reason for breaking with steam turbine propulsion.

Main power generation will come from three 12-cylinder and one nine cylinder Wärtsilä DF50 units, driving two main electric engines and four auxiliaries.

The Norwegian owner has specified Converteam in the contract to supply the electric power and propulsion systems. They will be fitted with Converteam's solution, based on induction motors and PWM type MV7000 converters.

The vessels will be of the twin skeg design and will be driven by two 13.6MW – 570rev/min high torque density induction motors, each fed by two dual PWM type MV7000 converters.

Converteam will also supply the generators and the Main and Cargo MV switchboard.

Converteam said the solution would significantly increase propulsion performance, offering far better availability, higher efficiency, and reduced operational and maintenance costs when compared to competing systems.

Earlier this year, Norwegian Cruise Lines and Aker Yards selected this same Converteam technology for two cruiseships (each 2 x 24MW at 130rev/min).

FORCE backs Hempasil performance

FORCE Technology tests have endorsed Hempel's Hempasil anti-foulings as having significantly lower skin friction compared to conventional tin free coatings, the manufacturer announced at Nor-Shipping.

For a large container vessel, the required power for propulsion was reduced by up to 10.6%, Hempel said. These results could be directly translated into fuel savings according to FORCE. The power reductions and translation to fuel savings were computed in a manner which has been verified before. The results were highly reproducible, said Hempel.

FORCE Technology, recognised among shipbuilders and operators as an independent institution specialising in objective testing, ran towing tank experiments comparing Hempel's Hempasil silicone-based fouling release coating to other generic anti-foulings.

To accomplish the tests, a dedicated test rig was engineered to be attached onto a towing carriage in a 220m-long towing tank. The rig measured movement through water of test plates emulating ship surfaces.

Hempel also announced that its Hempadur Fibre 4760 epoxy coating had been awarded B1 certification from Det Norske Veritas. B1 is the highest rating and is now the required rating in new International Maritime Organization standards for protective coatings for ballast tanks.

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Optimising propulsor efficiency

NEW studies aim to increase the hydrodynamic efficiency of podded propulsion systems, while cavitation concerns are emerging for ice-going double acting tankers. A report by Patrik Wheater.

DESPITE countless studies into the feasibility of podded propulsion applications to various shiptypes – containerships, fast craft, naval vessels, to name but three – the pod remains predominantly the domain of ice-breaking and cruiseship tonnage.

However, with 25% of the world's remaining undiscovered natural resources (particularly liquefied natural gas) claimed to lay hidden under the frozen seas of the high north, the pod has propulsion potential in ice-going tankers and possibly Arctic LNG carriers, particularly in the form of the double acting ship concept.

Early in July, South Korean shipbuilder Samsung Heavy Industries (SHI) delivered its first ice-breaking tanker to Sovcomflot, in what marked the first of three 70,000dwt double acting tankers (DAT) contracted by the Russian state-owned shipowner. A pair of 70,000dwt double-acting ice-class shuttle tankers will also leave St Petersburg's Admiralty Shipyards, bound for Gazprom subsidiary Sevmorneftegaz, next year.

The Samsung ships, designed by Samsung under a cooperation agreement with Aker Arctic Technology, which supplied concept design and support during design and construction, are propelled by twin 10MW Azipod drives, supplied by diesel alternator sets with a total power of 24MW.

The hydrodynamic design of these ships is to a large extent governed by the very high ice-class, but this leads to some conflicts with respect to desired open water performance. To develop the speed-power relationship, Samsung contracted the Swedish research institute SSPA to investigate.

Some minor changes to the hullform were introduced but the performance of the ABB designed propellers was found to be satisfactory despite the high ice-class. Cavitation tests showed the advantages of a twin pod propulsion configuration as the cavitation extension and pressure pulses were very small compared to single podded ships of a similar design that were tested earlier. Even at full power bollard pull condition, the cavitation volume and pressure pulses were moderate and no cavitation related problems were experienced during these studies.

Cavitation damage on the exit section of the cast resin test piece.

Sample cavitation pattern showing large unstable cavity behind the main blade.

Ice milling effects

However, although the (Azi)pod was developed specifically to meet Arctic ice-breaking requirements, the system, in its double acting ice-breaking tanker guise at least, is the focus of an extensive joint research programme aimed at gaining a better understanding of how ice milling affects the propeller. Initial findings are worrisome.

Generally, the propulsion system of the double acting tanker is exposed to less impact/shock loading, but typically operates in the low-pressure wake of the oncoming ice. This is thought to pose a significant risk of cavitation damage, vibration and blade failure, and forms the basis of investigations at Newcastle University. Here, the School of Marine Science and Technology, in collaboration with Sumitomo Heavy Industries, the builder of the world's first double acting tankers – *Tempera* (delivered in 2002) and *Mastera*, (2003) – is carrying out the research at the university's Emerson Cavitation Tunnel (ECT).

Use of the cavitation tunnel allowed the propeller/ice interaction to be studied under correctly scaled pressure conditions, something not normally possible in conventional ice tanks. However, key to conducting the tests in the relatively 'warm' waters of the cavitation tunnel was finding a suitable model ice block – a Styrofoam-based crushable porous plastic commonly used at the florists to keep stems sturdy and moist, was finally selected. This was mounted on a hardwood back and held in a substantial hydraulic test rig in front of the propulsor.

The main objective of the work, which is ongoing, was to study ice milling phenomena. But given the nature of the tests and due in part to experimental limitations, the research was broken up into two phases: a blockage or non-contact phase (carried out in 2006) to provide additional insight into milling, and the milling phase itself (carried out in early 2007).

Blockage tests were entirely static and considered a series of 12 cast resin blocks of different

geometries and positioned at fixed distances from the propeller. The 'ice blocks' were positioned and fed into the propeller at the required feed rate and propeller advance coefficient. First indications showed that cavitation played a significant part in all aspects of the model test.

Indeed, according to Rod Sampson, whose research at the University's School of Marine Science and Technology under Prof Mehmet Atlar forms the basis of a PhD: 'The test was characterised by violent and extensive cavitation observed on the blockage and on the propulsor, together with tremendous hydrodynamic noise.'

Sheet cavitation on the blade section of the propeller was evident from this first phase stage and was observed in nearly all of the tests. In the downstream wake of the propeller, the tip vortex failed to exhibit the characteristic helix pattern and instead was disturbed by the presence of the blockage and drawn toward the propeller, bursting as it cleared the blockage.

'It is clear that the effect of the blockage increases the thrust coefficient considerably, attributed to the proximity/gap effect of the propeller operating close to a surface and experiencing high velocity flow (increased lift) over the blade sections,' said Mr Sampson. It was also evident that the influence of cavitation had an effect on the performance of the propeller.

'As the pressure reduces and the shaft rotation increases there is a performance breakdown of the propeller; the greater the depth of cut [depth-of- cut refers to the increase in ice thickness], the greater the effect.'

The pod model in situ with one of the blockage test pieces.

Increased loads

But perhaps the most important finding from the blockage test was the nature of the load increases on the propeller. It was found that when a blockage is in front of a propeller, the increase in oscillation is such that it impacts on structural fatigue limitations.

Mr Sampson said: 'The ferocity of the cavitation during the experiment began to erode the test blocks, and indeed the propulsor, by the end of the experiment. The block used was cast from polyester resin and painted to a smooth and fair finish. No other paint areas were damaged on this block other than shown. The cavitation responsible for this damage was attributed to the violent bursting tip vortex cavitation. Not only was the damage enough to remove the paint, but an 8mm-deep fissure was eroded into the resin. It is interesting to note that the damaged areas of the blocks were consistent with block failures during the milling tests; something that was initially attributed to a manufacturing failure.'

The propulsor used for the tests was based on that installed on an existing ice class vessel, and in relating these findings to the design conditions of a double acting vessel, the effect of cavitation would clearly be problematic, Sampson claimed.

He added, however, that there was a trade off in that the ice class propeller, by its very nature, was stronger than a conventional propeller. Indeed, most propeller designs are characterised by thick, almost corpulent blade sections with a less aggressive pitch distribution, and benign blade outline able to withstand the impact. So the effect of cavitation may seem innocuous for these ice class designs, and indeed relatively few cases of full-scale cavitation damage on ice class propellers have been reported, acknowledged Sampson.

The lack of full-scale evidence could also be due to the propeller seldom operating in areas where blockage is sustained on a continuous basis – although the new double acting tankers may change this. 'But the model test plainly demonstrated the erosive nature of the interaction, something even the strongest propeller would succumb to,' said Mr Sampson.

Lloyd's Register's John Carlton said he was not entirely sure that cavitation erosion will be a major problem - unless the propellers are milling ice constantly, which they tend not to do - but there are other areas where more research is needed: hydrodynamics and materials science.

'Most of the sealing problems have been resolved, but bearing problems remain an issue,' said Mr Carlton. 'Generally you don't get a problem with pods up to 11MW or 12 MW; but above this there have been a number of bearing integrity issues. Nevertheless, I think these will be ironed out with a combination of materials technology and a fuller understanding of the hydrodynamic loads that are induced. Bearing material quality has been an issue but the manufacturers, to their credit, have been doing a lot of work in this area.'

Mr Carlton said that in certain manoeuvring configurations, flow from one pod may exhaust into another and this can then significantly increase the bending moments and side forces on the propulsor's bearings. 'The load-carrying capability of the bearings, both shaft and slewing ring, must be greater than the loadings generated by the propeller and pod body during a manoeuvre: the difference in these loadings being the design factor of safety.'

If manoeuvring operations are frequent enough and the factors of safety insufficient then the bearings are susceptible to fatigue failure, most commonly by Hertzian shear stress action. In the cases Lloyd's Register has been involved with, bearing failure is often associated with the forward inner raceway of the thrust bearing.

'The principal issue is understanding these bending moments and side forces, and how the bearing accommodates these loads, said Mr Carlton. 'The ability of the bearing to withstand the load has got to be greater than the load put upon it. This obviously means you need a bearing material with mechanical properties capable of withstanding the loads, but implicit in this requirement is that you have to be able to accurately define the loadings. This is extremely difficult, as they can change with each operation.'

Mr Carlton explained that Lloyd's Register, as part of its ongoing research programme, has been assessing various control strategies and philosophies for podded propulsion systems that avoid putting the unit through its heaviest loading conditions but still meet the Master's operational demand in the optimum time. 'It's about manipulating the load on each pod.'

In his November 2006 paper: *Podded Propulsors: Some Results of Recent Research and Full Scale Experience*, Mr Carlton said: 'The characteristics of the podded propulsor's control system influence very significantly the actual hydrodynamic loadings that are imposed on the shaft line, which then have to be reacted by the bearings and ultimately the pod structure… discussion has underlined the importance of a proper speed control regime for transient control of the propulsion system, including accelerations and decelerations.'

Lloyd's Register's research in the area suggests that a suitable control system would prevent motor overload and control the bending moments, and forces imposed on the shaft line during manoeuvring operations. The control system's software would need to be layered in order to control the main engines, the podded propulsors and, possibly, exhaust emissions, but the real complexity lies within the 'different paths through which the algorithm can lead the control function and, thereby, poses the problem of endeavouring to eradicate intermittent faults which may occur during operation, with serious safety consequences, such as when manoeuvring in confined waters.'

Another area in which Mr Carlton and the classification society believe could go some way to reducing the impact of the hydro-mechanical loading relationship is the way in which SOLAS requirements are interpreted during sea trials, in the context of an active rudder. 'The podded propulsor is basically an active rudder but is it fair and reasonable to treat an active rudder in the same

way as a passive rudder? Would you need the same steering angle regime at speed in order to achieve the result required by SOLAS?' asked Mr Carlton.

He said he believed that a 'holistic approach for a ship and its installed propulsion and manoeuvring systems is required in the assessment of the different loads that may be experienced' and that pod designs must be able to recognise all anticipated operational conditions.

He said there is a need to determine an acceptable manoeuvrability test together with a greater understanding of the performance comparisons between a podded and conventional propulsion-rudder system on a variety of hullforms. 'These tests need to be directed towards what is required to demonstrate that the operation of a podded propulsor within the defined limits of power and steering angles will provide acceptable manoeuvring qualities that are no less than those for a conventional shaft driven propeller-rudder arrangement,' Mr Carlton said. 'We are not talking about amending the existing requirements, but it's the way in which they are interpreted. The idea is to define a pod steering angle in order to get the same steering effect as for an equivalent sized conventionally-propelled ship.'

Pre-swirl to increased efficiency

Another area in which research is ongoing to better pod propulsor and propeller hydrodynamic efficiency is the development of a pre-swirl stator concept aimed at significantly reducing the rotational energy lost in the propeller slipstream.

There have, in the past, been attempts to recover this energy with technology such as the formidably coined 'Grim Wheel' and the contra-rotating propeller. However, while it is thought that devices ahead of the propeller (ducts, fins, guide vanes) are easier to integrate with the hull structure, SSPA believes that pre-swirl stators are the way forward.

From research carried out at the SSPA model basin, South Korean shipbuilder DSME has been developing a pre-swirl stator concept that consists of stator blades mounted on the boss end of the hull in front of the propeller. These blades re-direct the flow before it enters the propeller disc and the altered interaction with the propeller blade improves propulsive efficiency and results in power reduction.

On a single screw ship, the stator typically has four blades of a diameter equal to the propeller diameter. Three to six blades have been investigated in various configurations over the years.

During 2005 and 2006, SSPA tested DSME-designed pre-swirl stators on its 58m and 60m beam VLCCs. On a series of repeated test occasions a consistent and average gain of 4% on propulsion power was achieved at design draught with optimised stator angles. Blade angle optimisation was carried out for several stator configurations before the optimum one was selected. The influence of stator diameter in relation to propeller diameter was also investigated, said SSPA in its in house magazine *Highlights*.

SSPA said that the propeller must be designed for the chosen stator configuration to achieve the same rate of engine revolutions as a ship without a stator. By careful tuning of the blade angles, beneficial interaction between the propeller blade and the flow direction can be achieved.

Hans Liljenberg, SSPA project manager said: 'The propulsion efficiency is increased and – somewhat unexpectedly – the propeller cavitation performance and cavitation generated pressure pulses may also be improved. The latter may not be so important for a VLCC but of greater value to smaller single screw ships of the same fullness, such as Aframax, Panamax, etc. It should be emphasised that the stator configuration and blade settings have to be optimised for each hullform configuration as all hull shapes do not necessarily benefit from a pre-swirl stator. At present the full-bodied single screw ship seems the most promising one. These are frequently built in series where the development cost can be spread. A first contract was recently signed for application of a pre-swirl stator to a VLCC ordered by a European owner. It will be delivered in 2008.'

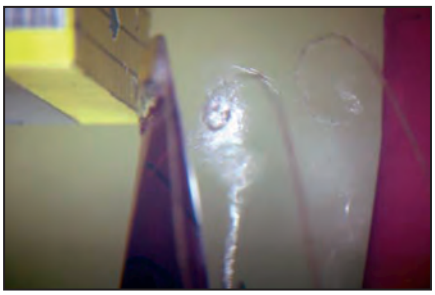
SSPA is also looking at the development of a different kind of propulsor but would not elaborate further, as the project is in its embryonic stage.

Aker Arctic Research managing director Mikko Niini argued, however, that greater propulsion efficiency could be achieved with the contra-rotating propeller. He said: 'There are some applications by ABB where a direct shaftline drive has been combined with a pod drive used in a CRP mode, like the two high-speed ferries in Japan, trading between Yokohama and Hokkaido. This is a very unique solution, but gives an overall propulsion efficiency improvement of up to 15%.'

According to Aker Arctic's preliminary investigations, this combined CRP mode could also be used in ice going vessels and benefits the double-acting vessel.

ABB Marine's vice president, sales, Jukka Kuuskoski, saw potential application for its CRP to ro-pax and certain types of container vessels. 'As containerships get larger, single screw configurations can't deliver the power. CRP configurations can improve efficiency of the total plant, especially for 6000TEU plus vessels,' he said.

The CRP Azipod propulsion system consists of two contra-rotating propellers. These are installed on the same axis, but without physical connection. The pulling propeller of the Azipod unit contra-rotates in relation to the shaft-driven main propeller. As such, there is no need for a conventional rudder because the pulling Azipod unit acts as one. Both propellers are fed by independent power supplies, which means high redundancy.



Bursting tip vortex cavitation observed behind the reference blade as the vortex filament exits the blockage wake.

Extensive model tests have already been carried out to determine the most efficient propulsion system for Ultra Large Container Ships (ULCS). The tests, which took place in Samsung's Ship Model Basin in South Korea, compared the efficiency of three different propulsion configurations: CRP, twin-screw twin-skeg, and single-screw systems.

At 25.5knots with a 15% sea margin, the CRP Azipod system delivered propulsion power that was 11.4% lower compared with twin-screw and 7% lower compared to single-screw system.

The tests showed that total efficiency for the system was 9% better compared with twin-screw, and 5% better with single-screw system. Conventional shaftline losses were estimated to be 1.5%, and electrical losses - including generators, switchboards, transformers, drive, and motor - were estimated to be 8%.

The result showed that the CRP Azipod propulsion system was the best choice for ULCSs of 12,000TEU size and beyond. ABB said that with the CRP system, propulsion power could be produced with optimum machinery, thus minimising operation costs due to lower fuel consumption. With less installed diesel engine power, power plant principle, and extra cargo-carrying capability, savings could top $10 million over a 15-year period when compared with the twin-screw twin-skeg system, said ABB.

Mr Kuuskoski said he expected a podded containership to be on the orderbooks by 2010.

Meanwhile, ABB is developing its next generation Azipod and although too early to give any technical data, it should be on the market by 2009.

Vacon unveils redundant control

FINNISH AC drives manufacturer Vacon has introduced Vacon DriveSynch, a new fully redundant control concept for parallelling high-power, liquid-cooled Vacon NXP drives.

Type approval certificates have already been issued by classification bodies Bureau Veritas and Det Norske Veritas. With the Vacon NXP used as a control platform, the control concept is based on Vacon DriveSynch technology, which allows the control of one motor by means of two to four power units of 100kW – 2500kW, thus bringing significant redundancy in the processes controlled by AC drives.

Per Halvor Rønningen, Vacon managing director, said: 'With our Vacon DriveSynch technology we can create a redundant drive system and thus significantly improve system safety and availability.'

Vacon has delivered AC drives to control a range of applications, including main propulsion, thrusters, and steering gear, as well as drawworks, topdrives, rotary tables, and various types of winches.

Deliveries also include AC drives to control pumps used in the dredging, cooling, cargo handling, and oil drilling sectors.

Edda Fram: a ship of superlatives

BRUNVOLL and Voith could set the benchmark for offshore vessel propulsion systems with a Rim Driven Thruster and Voith Schneider propulsion.

NORWEGIAN thruster manufacturer Brunvoll has completed the first commercial installation of an 810kW Rim Driven Thruster (RDT) unit, to *Edda Fram*, an innovative platform supply vessel under construction at Spain's Astilleros Gondan yard for Norwegian shipowner Østensjø Rederi.

The vessel, at the time of writing undergoing sea trials, will also be fitted with Voith Schneider propulsion and eight integrated drill cutting/special purpose tanks which can be utilised for a variety of different cargoes.

'Design, production, and testing of our prototype 100kW RDT has brought us invaluable experience to use as we go further with our development,' says Brunvoll technical director Knut Andressen.

'We also completed additional tests on this prototype in 2006.' This 810kW tunnel thruster is quite a departure from the first prototype.'

Ostensjo Rederi selected the concept as it needed a third, compact thruster to work alongside the two Brunvoll conventional thrusters in the bow, 'but we generally have an avid interest in product development,' project manager Carl Johan Amudsen says.

The RDT is electrically driven with a permanent magnet (PM) motor, where the motor windings are in the stator and where the rotor has a number of permanent magnets.

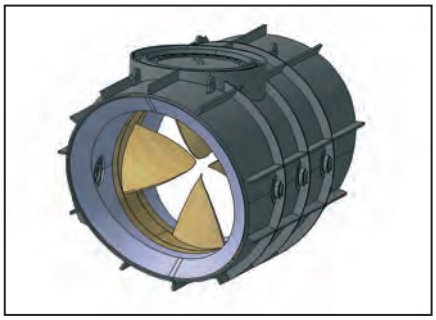
The rotor bearings are located at the periphery of the rotor. The fixed pitch propeller is directly connected to the rotor and hence the thruster unit has no central shaft. The development of the RDT has been triggered by the market demand for an increased number of ships where both the main propulsion units and the manoeuvring thrusters have electric motors with variable speed drives.

Brunvoll cites a number of advantages to be gained from the system. As the motor is an integral part of the propeller nozzle in a ducted azimuthing thruster, and an integral part in a section of the tunnel in side thrusters, more space is available onboard the ship, giving greater flexibility.

Propeller efficiency has also been optimised due to the omission of a central shaft and shaft supporting struts. The inflow to the propeller is therefore undisturbed, which is beneficial both with regard to propeller efficiency and propeller induced noise and vibration. The lack of a central shaft and shaft support stays, and the fact that there are no dynamic seals, is also beneficial with regard to damages due to line and rope entering the thruster. Additionally, the propeller blade thickness may be reduced, and the radial thickness distribution, as well as the radial load distribution, may be changed to enhance propeller efficiency.

Østensjø Rederi's *Edda Fram*, developed to 'radically improve on the safety, capacity, and costs involved in transportation and handling of drill cutting', is also the first offshore vessel to be fitted with Voith Schneider propulsion. Two 2500kW systems were selected, following a joint investigation programme with Voith Turbo Marine over a number of years to optimise the performance of the VSP thruster especially for use in escort tugs, but also for offshore vessels. This resulted in the inclusion of an active roll reduction functionality, especially attractive to offshore vessel operations.

The investigation programme comprised extensive model testing at Voith Heidenheim, Marintek, Trondheim and Vienna Model Basin, Vienna, where the suitability of the Voith Schneider propulsion concept for offshore vessels was verified, documenting a



Brunvoll's RDT. Before any more information or photographs are made available, Brunvoll and Østensjø wish to gain experience from the seatrials and operation.

An artist's impression of *Edda Fram.*

***Edda Fram* is the first offshore vessel to be fitted with Voith Schneider propulsion.**

RINA – LLOYDS REGISTER SHIP SAFETY AWARDS

Nominations are invited for the 2007 RINA - Lloyds Register Ship Safety Awards.
Entries close 1st January 2008

The RINA- Lloyds Register Ship Safety Awards
recognise recent innovations or developments which have led to an improvement of safety at sea, or which have the potential to do so.

Entries may be submitted directly by individuals or teams from universities and industry from any country, and may cover design, construction, research, equipment or operations. Entries are judged on originality, quality of design, feasibility of production and contribution to ship safety.

Members who are aware of recent work by a university, company or organisation which has or could lead to an improvement in safety at sea are invited to nominate them for one of the Awards, giving brief details of the achievement. The nominated university, company or organisation will then be invited to submit an entry.

There are separate categories for universities and industry. An Award of £1500 is made in each of the categories and will be presented at the 2008 RINA Annual Dinner.

Requests for further information and expressions of interest should be forwarded to:

Director of Professional Affairs
The Royal Institution of Naval Architects
10 Upper Belgrave Street, London SW1X 8BQ
Tel: +44(0)20 7235 4622
Fax: +44(0)20 7259 5912
Email: profaffairs@rina.org.uk

Lloyd's Register

Rolls-Royce thrusters for world's largest vessel

For what will be the largest vessel in existence when delivered in 2010, *Pieter Schelte*, the multi-purpose offshore vessel, with its barge-like aft and catamaran-type bow, will be equipped with Rolls-Royce azimuth thrusters, in what is the largest thruster order for a single vessel in the company's history.

Twelve thrusters will be supplied to the vessel, which at full load will displace more than 900,000tonnes. The 12 5500kW UUC 455FP-type thrusters are capable of being installed or removed underwater without the need for docking the vessel. Each unit produces a thrust of about 100tonnes to provide a propulsion speed of 11knots or for DP operations. Three units have been installed under each pontoon of the catamaran type hullform and the other six are fitted at the stern (three port and three starboard). These and other consumers will be powered by nine MAN Diesel 32/44CR engines with a massive combined output of 94.6MW.

The order follows the recent development of a number of new propulsion concepts from the supplier, which early this year added to its propeller range with a new controllable pitch propeller hub, developed to improve the power-to-weight ratio by about 20% without compromising its strength. Based on its established XF-5 design, the new Kamewa CP-A hub has a simple, compact, and strong arrangement in which the pitch of the blades is set by a hydraulic piston connected to a crosshead in the hub, which carries slide blocks riding on pins in the blade feet (see p71).

The propeller blades bolt onto the hub and are individually designed to suit the vessel and its operating conditions. However, compared with the earlier design, the shape of the blade root has been modified to give slightly more space between blades and an improved contour for the whole blade root/hub, reducing the risk of root cavitation and providing a small but significant increase in efficiency of about 1.5%.

The new Kamewa CP-A offers an improved power-to-weight ratio of about 20%.

The CP-A standard hub covers speeds of up to about 30knots, but an advanced version, the CP-A/H, has been developed for faster vessels. Both versions are available in a wide range of sizes, covering powers of 500kW with no defined upper limit. Nickel aluminium bronze and stainless steel hubs and blades will be available, covering normal and Ice Class requirements.

In parallel with the hub redesign, the hydraulic system has also been updated. The new power pack has load sensing hydraulic pumps to substantially reduce the amount of power required to operate the system, particularly in installations where propeller pitch changes are not frequent.

high propulsion efficiency with potential fuel savings compared to contra-rotating azimuth thrusters. The shipowner expects a saving in fuel consumption of 5%-20% depending on operational conditions and speed.

For instance, a fuel saving of 10% is attainable if sailing in free running mode at 14knots, depending on the loading conditions, while 20% could be achieved at 10knots.

Additionally, due to its special construction, the VSP also has a quick thrust response time from port to starboard of about two seconds, which allows the thruster forces to counteract the rolling motion of the vessel. In some cases, roll can be reduced by up to 90%.

Unlike screw propellers, the speed through the water over the whole VSP blade is constant, says Voith Turbo Marine. The blades are not twisted and there is a clear zero thrust position of the kinematic energy, independent from the speed of rotation. The rectangular effective propeller area of a VSP is about 60% larger than the area of a screw propeller and can ostensibly be considered as a twin propeller, as each blade is used twice during each revolution.

Moreover, the system works at very low speed of rotation. The hydrodynamic principle of a cycloidal propulsor forms the foundation for control of thrust in magnitude and direction steplessly, precisely, and quickly. Furthermore, the VSP allows low noise operation during all working conditions, especially manoeuvring; a significant advantage for vessels operating sonar.

Aside from the development of the VSP for offshore vessel application, Voith Marine Turbo has also recently launched a new type of multi-functional manoeuvring system. The basic idea of the Voith Cyclodial Rudder (VCR) is to modify a VSP with just two blades in such a way that it can be used for a dual purpose.

There is a passive mode, in which the VCR acts like a conventional rudder, and an active mode, in which the VCR acts like a VSP. In passive mode behind a screw propeller, the blades are stationary, and only the rotor casing turns through 30°, whereas in active mode, the direction of thrust is infinitely variable over 360°. The active mode is used when the ship is moving at low speed. In this case, the effects of a passive rudder are very slight, owing to the quadratic dependence of the rudder forces on the inflow speed. At low speeds, the VCR gives high manoeuvring forces, thus simplifying the ship's handling and enhancing its safety.

Ships' rudders are often over-dimensioned for high speeds because the required rudder forces at low speed dictate their area. With its two modes, the VCR provides the choice of a smaller rudder area entailing less drag. At low speeds, the active mode ensures manoeuvrability.

As a result, the ship is highly manoeuvrable. The VCR allows all important ship's manoeuvres, such as forward and reverse motion, turning on the spot and, when two VCRs are fitted or in combination with a bow thruster, pure traversing manoeuvres as well.

In terms of propulsion, the VCR is a redundant system. If the main propulsion system fails, the VCR enables the ship to be moved safely on its own, provided that the power supplied to the VCR is independent of the main propulsion system.

Roll motion can also be reduced. Like a rudder roll stabilisation system, the VCR can damp the rolling motion of a ship. This is possible because thrust forces can be transferred very quickly from port to starboard in the VCR's active mode; it is also possible to reduce the rolling motion while the ship is stationary.

The system is currently at an advanced stage of development, with numerical simulations, model, and full-scale tests carried out on the Seefahrtschule Leer-operated training ship *Aurora*. The former buoy layer was fitted with two VSPs, with one converted to use as a VCR.

Lessons learnt on lightweight materials

LASS, the Swedish-led 'Lightweight constructions at sea' project is heading towards its conclusion. *The Naval Architect* asked project coordinator Tommy Hertzberg, of SP Fire Technology, Sweden, for an update.

THE proposition for the LASS project was an endeavour aiming to improve the efficacy of marine transport, but at the same time to increase the competitiveness of the Swedish shipbuilding industry by developing techniques to use lightweight materials for construction.

The consortium behind the project consists of representatives from the Swedish shipping industry, Swedish and European materials manufacturing industries, Swedish universities and research institutes, as well as public authorities and classification societies.

Until recently, a major obstacle in the path of deploying lightweight material at sea has been the potential for fire hazards. Fire safety issues have to be solved before shipbuilders can utilise other materials than steel, and fire safety has been a central theme for LASS.

For a long time, the prescriptive rules for safety at sea in SOLAS have excluded other construction materials than 'steel or equivalent' material, which, among other things, means that the materials used have to be non-combustible, ie to consist of inorganic compounds. However, SOLAS (chapter X) also defines high-speed crafts (HSC) as within safety regulations given in the HSC-Code that do allow combustible construction materials, provided that they are 'fire restricting'. Such materials must be tested according to ISO 9705 in the Room-Corner fire scenario with tough requirements on the amount of fire effect and smoke produced by the material.

The IMO regulation for offshore construction, meanwhile, is the MODU (Mobile Offshore Drilling Units) Code (which first appeared in 1979) and it can be seen that many requirements for fire safety onboard offshore constructions very much resemble the requirements for ships. However, in the Code (Ch 9.1.2.) it is stated that: 'Units constructed of other materials' (than steel) 'may be accepted, provided that in the opinion of the administration they provide an equivalent standard of safety.' Once again it is a more modern code and it, at least, provides an opening for the use of other materials than conventional steel.

In July 2002, a new regulation - 17 (part F) - sanctioning 'alternative design and arrangements' appeared in SOLAS that made it possible to use a functionally-based safety design instead of the earlier design based on prescriptive rules. The constriction was that the same level of safety had to be demonstrated as if prescriptive rules were used. This sounds good enough, but one problem is that no safety level is actually defined in SOLAS, ie the Code provides a set of prescriptive rules but no measure of what the usage of these rules means with regard to safety.

Figure 1: Studied object A: a marine military craft.

Figure 2: Studied object B: high-speed aluminium catamaran *Stena Carisma*.

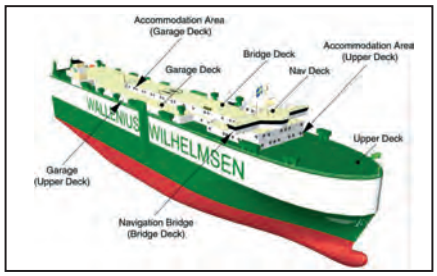


Figure 3: *M/S Undine* in original version with decks and areas specified.

Figure 4: Image of the Stena Ro-pax. © Stena Line AB.

This new chapter in SOLAS opened up the potential to use other construction materials than 'steel or equivalent', provided a suitable methodology could be found to demonstrate safety equivalence.

The strategy from LASS has been to follow the prescriptive Code as closely as possible, ie provide the same functionality as required by the prescriptive SOLAS Code.

As an example, an explicit functional requirement of an A-class division is 60 minutes fire resistance, which can also be obtained for a combustible construction material using appropriate fire protection.

Another strand of the project has been to develop a risk-based safety design where fire tests, together with fire and egress simulations, are used in order to demonstrate safety levels.

Both the above approaches depend on fire tests and many such tests have been made as part of the project.

Six different objects have been part of the investigation of which two (object E and F below) were added to the project when it was ongoing. The reason for these additions was interest from the industry and possibilities for synergy effects from similar types of constructions.

Object A is a troop carrying military vessel in aluminium. The task within LASS was to redesign the vessel in aluminium in order to fulfil the requirement of a civil passenger craft according to the DNV High Speed Light Craft Rules, and thereafter make new designs in FRP composites and make a comparison between materials. Four different designs were made based on glass (GRP) or carbon (CRP) fibre reinforced polymers.

Object B is the aluminium HSC *Stena Carisma*. In the study, the superstructure has been redesigned based on FRP composites and the DNV HSLC regulations. The dimensioning was based on local loads. Different design cases were tested, eg glass or carbon fibre reinforced polymers, and different numbers of pillars used in combination with various composites in order to minimise weight. Object C is the Wallenius vehicle carrier *Undine*. An aluminium deckhouse situated on the weather deck was designed. Three different designs were made. The first was based on the following:

- the design shall follow the Lloyd's Register class rule book
- the vertical centre of gravity for the modified deckhouse and added cargo shall not be moved upwards for the modified version
- the deckhouse is not considered to contribute to the global hull beam
- in the garage, two lines of pillars are considered
- natural frequencies of plates or panels shall not be less than 10Hz.

Designs 2 and 3 followed the same requirements except for the first. Here, instead, FEA were used together with the guidelines from Lloyd´s Register dealing with direct calculations. Extruded open or closed aluminium profiles were used for designs no 2 and 3 respectively.

Object D is the ro-pax vessel *Stena Hollandica*, where the steel superstructure was exchanged for a glass fibre reinforced composite.

Here, the design philosophy for the composite superstructure can be summarised according to the following list:

- designed according to Det Norske Veritas using the load cases from Rules for Ships (DNV Rules for Ships) and using the Rules for classification of high-speed, light craft and naval surface craft (DNV HSLC & NSC) for GRP and sandwich calculations
- the original stiffening arrangement is to be kept while plates and longitudinals are replaced and rearranged by an equivalent GRP structure
- superstructure panels are designed to be produced using a vacuum infusion process
- weight optimised superstructure subordinating in favour of yield ability
- restrict the translation of global loads in the superstructure
- make use of existing hull structure for load translation
- the superstructure is not to carry any global loads.

Object E is a dry cargo freight carrying vessel where focus is on exchanging the steel superstructure and steel hatches for FRP composites.

The vessel is very much optimised for inland channel transport and is often unable to carry a full load due to channel size constrictions. A lowered construction weight could therefore easily be transformed into extra pay load.

Object F is an offshore living quarter (LQ) unit where the original steel module will be replaced by an aluminium construction. The LQ module is interesting since many technical obstacles and fire requirements are similar for the offshore and the ship industry and hence, there is a possibility of learning from each other. There is also an increased concern from the offshore industry about platform weights . This is related to the need for more active components on the platform, eg drilling equipment, as it has become economically interesting to drill deeper than before. Therefore, when new platforms are made or old are being reconstructed, lightweight materials are asked for.

Figure 5: Object E: The Thun dry cargo vessel for inland transport.

Figure 6: Object F: Offshore living quarters.

The results are in

The project will be finished by December 2007 but the design studies for objects A-D are already finished, while the E and F objects are still being investigated.

However, some preliminary indications are available of what weight reductions can be achieved.

As stated initially, the fire safety aspects of the project are very important and for combustible composites it is necessary to use some kind of fire protection, eg some sort of fire insulation. It is a necessity for a lightweight construction at sea, not only to have proper fire insulation but also to have lightweight fire insulation. When the LASS project started, no certified fire insulations existed for such FRP sandwich constructions. Together with the companies Thermal Ceramics and Saint-Gobain/Isover, successful fire tests have been conducted for deck and bulkhead FRD 60 constructions, including sandwich penetration tests. The weight of the fire insulation that passed the FRD 60 test was 6.9kg/m^2-7.5kg/m^2, which is good; actually it is comparable to some A60 fire insulation weights used for steel. Successful tests have also been made with lightweight insulation material on sandwich constructions in the Room-Corner test scenario for certified fire restricting materials, using insulation weighing 0.95kg/m^2-1.6kg/m^2. The insulation companies mentioned are part of the LASS consortium.

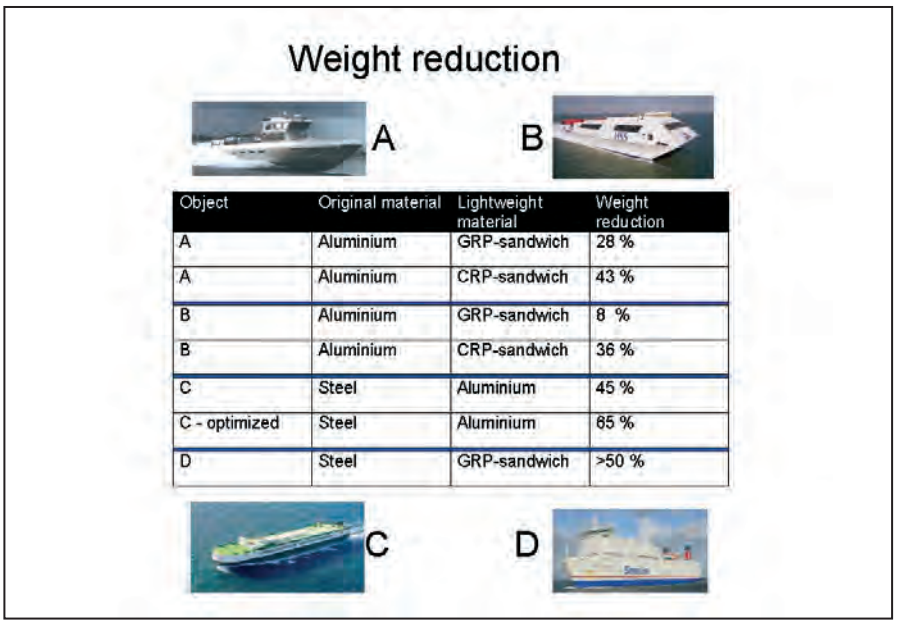
Figure 7 summarises the weight reductions obtained in the project for objects A-D. Notable is the difference between the CRP (carbon fibre reinforced) and GRP (glass fibre reinforced) composite design. The 'C' results are based on the simplest rule book-based design (45%) and the optimised FEA based aluminium design (65%), whereas the 'A' and 'B' designs are the best (lightest) GRP and CRP designs respectively. The figures given are based on the parts of the vessel that has been redesigned, ie the >50% weight reduction for the ro-pax (object D) refers to the superstructure. All figures include insulation weights.

Preliminary estimations for the object E indicate that similar weight reductions for the hatches and superstructure as for object D will be obtained, ie >50%. For the last concept it is estimated that the total weight of the offshore LQ-module, ~2300tonnes, will be reduced by 12%-17% by using aluminium instead of steel. This includes the insulation weight.

With regards to cost, the calculations indicate that object A will actually be cheaper using FRP composite than using aluminium, partly because less propulsion power will be needed. More advanced materials are usually more expensive and a life cycle cost (LCC) analysis is therefore necessary in order to motivate an increased initial cost. In the case of object C and D, a pay-back time of less than five years is estimated, based on increased payload. For objects B, E, and F, the calculations are not yet finished.

On 31 October 2007, a full day seminar will take place in Borås with detailed project result presentations at SP Technical Research Institute of Sweden. All interested are welcome.

For more information please contact Tommy Hertzberg, tommy.hertzberg@sp.se



Object	Original material	Lightweight material	Weight reduction
A	Aluminium	GRP-sandwich	28 %
A	Aluminium	CRP-sandwich	43 %
B	Aluminium	GRP-sandwich	8 %
B	Aluminium	CRP-sandwich	36 %
C	Steel	Aluminium	45 %
C - optimized	Steel	Aluminium	65 %
D	Steel	GRP-sandwich	>50 %

Figure 7: Results for the A, B, C, and D objects.

i Code for the Construction and equipment of Mobile Offshore Drilling Units: MODU code, International Maritime Organization, IMO publications, London 2001

ii BP Groans under weight of Valhall- Heavy topsides pose problems for installation on Norway field, *Upstream News*:18, pp 19, August 2006

Life cycle management draws on ship design

TRADITIONALLY focusing on managing complex data for onshore industries, Intergraph Corp has now extended the scope of its management software to the marine industry. SmartPlant for Owner Operators (SPO) is a new life cycle management tool, which joins Intergraph's suite of marine enterprise applications.

SPO is based on the IntelliShip ship design software, developed by Intergraph since 1998, in conjunction with Samsung Heavy Industries, Odense Steel Shipyard (OSS), and Universal Shipbuilding Corp. OSS used IntelliShip for the engineroom and casing area design on *Emma Maersk*, currently the world's biggest container vessel (featured in *Significant Ships of 2006*, pp45-46).

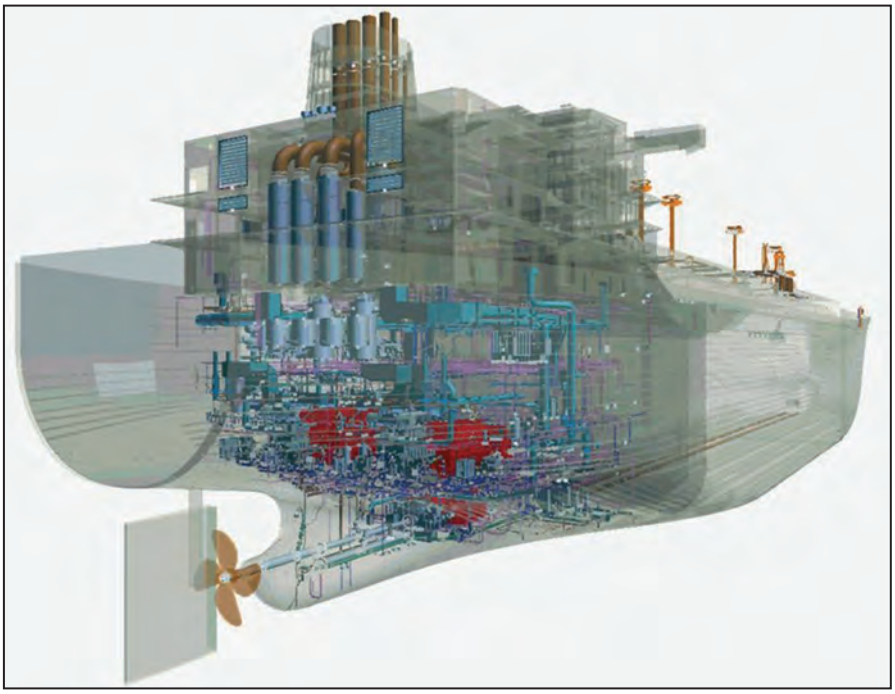
Intended to support owner operators throughout the life cycle of a facility, SPO is designed to assist delivering both ship design and offshore projects to agreed specifications within allotted budgets and schedules. It is also aimed at achieving safe, predictable production at the lowest sustainable cost.

Igor Juricic, EMEA marine business development, Intergraph, explained: 'This new solution was developed by leveraging its experience from implementing integrated solutions with major process and marine industry customers. By bridging the project and operating phases of stationary and floating plants, SPO brings a new dimension to life cycle management.'

The system functions through a web-based portal, with user profiles tailored to each project role. When users login, it is claimed that they will receive exactly the information they need to perform their job and to make rapid decisions, based on relevant information.

Web services included in the system enable the exchange of data between contractors and suppliers for plant asset information, such as tags and documents, as well as technical queries and non-conformities. It is thought to reduce error discovery time, and the aim of the system is to control work processes electronically throughout the project value chain.

Changes made during a project can also be tracked using SPO, and although it relies on engineers initially inputting the correct information, it is designed to ensure engineering data quality and consistency. However, owner operators are legally required to keep all information updated. Mr Juricic adds: 'This solution will help owner operators to better manage the dynamic engineering design basis of their projects, and track design changes through the lifetime.'



A 3D rendering of a ship by the SPO system.

For example, if a reliability engineer logged in to search for a pump tag, the tag number would be input, and the results would include related information and links. A 3D model of the part can be displayed, and different pump types could be viewed. If the engineer changed the model number, all windows would be automatically updated. There is also the facility to enter a notification of a problem, as well as to manipulate and create data.

The intention is for SAP NetWeaver to provide the enterprise resource planning (ERP) system for the software, as a lot of customers already use the platform, and it creates compatible integration. Intergraph is now working with SAP to achieve 'Powered by NetWeaver' certification for the initial SPO components. The company is also working towards an MS Sharepoint compatible system.

SPO is claimed to ensure data synchronisation and cross-application interoperability between engineering design tools, ERP systems, reliability systems such as Meridium, and other systems needed to support the life cycle of plants.

It creates a single source of information that can be accessed by different departments, such as maintenance or engineering. Usually each department would not be familiar with the other's systems, but with SPO drawing information from three different sources, all users receive the same data. This is said to avoid disjoint between workflows.

SPO exploits existing SmartPlant design tools to support the maintenance of engineering data, conceptual engineering, and estimating during early project evaluation phases. An updated release of the software will occur in 2008, which will include tag and document management, plant data loading, on-plant engineering and design, plus a plant information browser.

As SPO is a complex solution involving Intergraph technologies, third party applications, and integration technologies, a network of support will be provided. Customer problems will be captured by Intergraph's Siebel corporate CRM system. Regional support offices will pass reported issues to the SPO Competence Centre, which will be responsible for finding where a problem lies and forwarding it to the appropriate organisation for solution and follow-up.

***Emma Maersk's* engineroom and casing area were designed using Intergraph's IntelliShip software.**

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New plate protects against pitting

THE inner bottoms of all crude oil tankers and supertankers built for Nippon Yusen Kabushiki Kaisha will feature a new, highly corrosion-resistant steel plate developed by the shipping line, in collaboration with Nippon Steel Corporation.

Following two years of trials onboard a supertanker, The NSGP-1 grade plate (designated as part of Nippon Steel's Green Protect-1), will be specified for all new tankers, including those currently on order.

The shipping company pointed out that crude oil containing salt water had a salt concentration several times higher than seawater, and over time this salt water separated from crude oil and accumulated at the bottom of tanks. This led to pitting on the inner surfaces of tanks, raising the potential for oil leaks.

The newly developed steel plate is designed to protect the tanks from such pitting. As part of the development, Nippon Steel simulated an environment in which salt water accelerated the corrosion of the bottom of the tank, and discovered the types and amounts of alloying elements that should be combined to create a highly corrosion-resistant steel plate suitable for oil tanks. Building oil tanks using this steel plate required no special management because conventional steel welding and processing techniques could be used.

To ensure the feasibility of the steel plate, the two companies tested the new material on the tank bottom of *Takamine*, a supertanker built in 2004 by Mitsubishi Heavy Industries. Two and a half years later, a regular inspection showed that the steel plate, which was free of any anticorrosion coating, was capable of preventing the occurrence of pits. NYK thus decided to use the steel plate on five supertankers on order from IHI Marine United and Imabari Shipbuilding Co.

Two years of trials involving a new grade of steel fitted on the supertanker have proved that a coatings-free solution can be deployed to protect tank bottoms from pitting, according to NYK.

NYK said that, by using NSGP-1 for crude-oil tanks, anticorrosion coating became unnecessary, as did coating agents and volatile organic compounds. For this reason, this steel plate would make it possible to eliminate expensive coating agents used for building or maintaining oil tanks, and would 'greatly contribute to creating environmentally-friendly ships'.

Conventionally, a defective or degraded coating could hasten the corrosion of a tank, but such a problem would 'never occur' when the new steel plate was used. This would help to 'greatly improve the safety and reliability of marine vessels'.

NYK said the success of the project had changed thinking at the International Maritime Organization (IMO). The UN agency has held discussions concerning measures to prevent pits and thus improve the safety of oil tankers, initially recognising anticorrosion coating as the only possible solution, and has begun to consider making the application of anticorrosion coating mandatory on newly built oil tankers. However, given the work by Nippon Steel and NYK proving the NSGP-1's 'outstanding anticorrosion performance', NYK said the IMO was considering adopting the use of the steel plate as another way to prevent corrosion on oil tankers. 'This indicates that the steel plate's effectiveness is highly recognised globally,' the shipping company said.

Austal upgrades router processes

THE new panel line at Austal USA's City of Mobile, Alabama shipyard incorporates state-of-the-art processes that are expected further to improve the quality and efficiency in production for the US Navy's littoral combat ships, as well as Austal's commercial vessels.

As well as the panel line shop, Austal is also in the process of constructing an addition to its southern-most assembly bay, where the second Hawaii Superferry vessel is under construction, to include a router/fit-out shop to be completed in December 2007. The building will house a recently purchased high-speed router cutter designed specifically to support aluminium ship construction.

The equipment will be operated with data from numerical cutting files of the required nested parts, enabling the minimisation of waste and the efficient recovery of scrap material. This router technology has been developed specifically for aluminium plate material and delivers parts of precise dimensions with machine-cut edges to the production team. This accuracy, in conjunction with the detailed pen marking of each cut part, removes the need for large lofting boards to fit the cut parts together.

Located on the north side of Assembly Bay One, the yard's new panel line shop opens directly into the assembly bay, allowing panels to be easily transported from the shop onto the production floor. The ground floor of the building, where the panels are assembled, is 200ft long by 45ft wide, totalling over 9000ft^2. The second level will house offices and meeting/training rooms. The panel line shop is an addition to the building where the two US Navy LCS are under construction.

Austal USA's City of Mobile yard, Alabama.

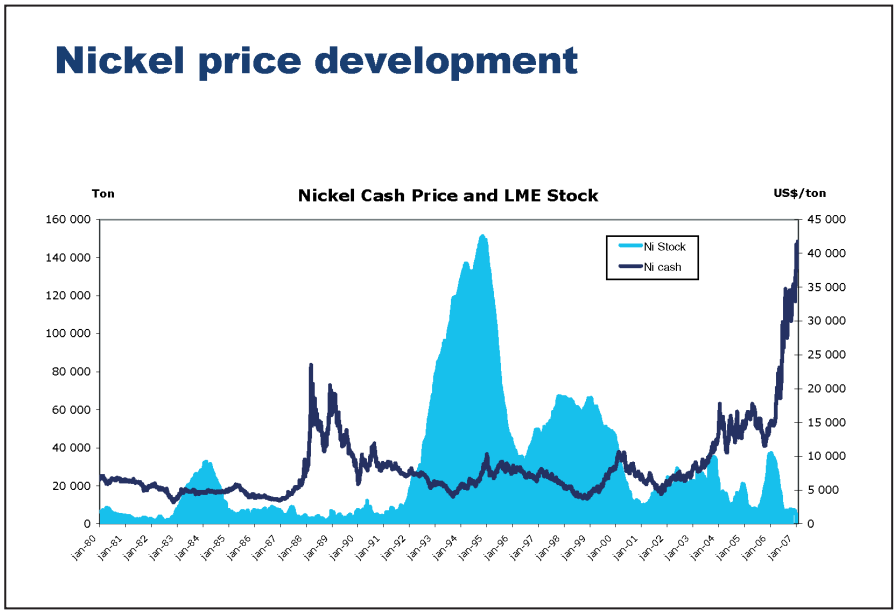
Low nickel content for high strength steel

A FIRST shipboard application of a grade of high strength, lean duplex stainless steel, already widely used in land-based storage applications, is reported by Swedish supplier Outokumpu.

One of the river barges feeding into Norwegian owner Utkilen's European paper mill marble slurry distribution network features LDX2101 grade steel. The 2000dwt vessel, built in Poland by Stocznia Kozle Serwis, features 85tonne stainless steel cargo tanks to the LDX2101 specification, which has already been widely deployed in storage tank installations that include land-based flour silos, molasses tanks, palm oil tanks, and wine tanks. The material is available in a variety of forms, including quarto plate, coil and plate, coil and sheet, billet, wire rod and bar, welded tube and pipe, rectangular hollow sections, and welding consumables.

According to its supplier, LDX2101 exhibits a high degree of versatility and can be used in many applications where lower strength stainless steels are used today. It offers a great potential for substituting grade 304 and coated carbon steels.

Duplex stainless steels are reckoned to be twice as strong as ordinary austenitic stainless steels, but LDX2101 is also distinguished by its low nickel content. Between January 2006 and January 2007, cash nickel prices almost tripled, and approached US$45,000 per tonne. LDX2101 has a nickel content of just 1.5%, where comparable products have a nickel content of around 12%. Thus, Outokumpu is marketing LDX2101 as not only cheaper, but also as a product likely to retain its price stability.



Rising nickel prices? Time to rethink nickel content.

The material is also low in weight and, according to its supplier, as well as exhibiting good weldability and high resistance to wear, LDX2101 offers corrosion properties that are reckoned to be close to grade 360 stainless steel. It also promises excellent resistance to stress corrosion cracking, thermal expansion equivalent to conventional materials, and a wide service temperature range, of between -40°C and 250°C.

Outokumpu reports that its latest step has been to develop a welded beam version of LDX2101.

Welding for the next generation

WELDING costs are claimed to be dramatically reduced by using electrodes with high deposition rates. Rates can be improved by the use of high recovery electrodes and wire welding.

Typical are the MIG/MAG welding products from UK-based ESAB. Comprising the Origo MIG L305 and L405 step-controlled power sources, and the Origo Feed L302 and L304 wire feed units, the new range is claimed to be easy to use as well as reliable. Each package contains a PSF welding torch and a 1.7m, 5m, or 10m connection set. Three wire feeder mounting options are offered: wheel kit, suspension bracket, or mast and counterbalance.

The L305 and L405 power units are fitted with rugged casing, and are rated to IP23, enabling outdoor as well as indoor usage. L305 offers ten voltage steps and a 60% duty cycle of 190A/24V, while the L405 has 40 voltage steps and a 60% duty cycle of 365A/32V.

The wire feeders use electronic speed control and 30mm diameter rollers to maintain an accurate and stable arc, intended to ensure high-quality welding. The L302 uses an economical two-wheel feed mechanism, but the L304 utilises a four-wheel feed with grooved drive and idle pressure rollers, to give a positive drive with claimed low wire wear.

L302 handles wires up to 1.2mm diameter, and L304 accepts wires up to 1.6mm in diameter. Both units are suitable for use with steel, stainless steel, aluminium, and cored wires; additionally, the L304 has controls for creep start, spot welding, inching, and gas purge.

In June, ESAB launched a new set of MIG welding products, in the shape of the Aristo MIG C3000i integrated welding power source and wire feeder, along with the Aristo MIG L3000i power source, and the Aristo Feed L3004 wire feed unit. Their development is aimed at professional users working with advanced welding applications, requiring welding currents of 16A-300A and wire diameters up to 1.2mm.

The machines can be used to weld mild steel, stainless steel, aluminium, high-alloy, or nickel-based materials, and are also suitable for pulse MIG, MAG, and MMA welding. The separate power source and wire feed utilise extender connection cables to enable a working radius of up to 35m.

Aimed at enhancing reliability by reducing the number of cables required, a CANbus system is used for control and communications. Two power source control panels are available, the MA6 or the Aristo U8.

The MA6 includes a data bank of synergic lines and a memory for 10 sets of welding parameters, whereas the Aristo U8 has over 100 pre-programmed synergic lines, a memory for storing up to 255 sets of welding parameters, and soft keys for direct access to functions such as hot start, crater fill, and 2/4 stroke.

The innovative Eye-Tech II reactive welding helmet.

TIG and other ranges

In comparison, Unitor offers the UWI-400 Multi-Process Welding Inverter, with electromagnetic capability said to exceed CE requirements. This ensures minimal interference with electronic equipment, and is claimed to comply with the code of safe working practices for merchant seamen.

The UWI-400 allows selection of optimal welding characteristics for different types of welding processes: stick electrode welding with arc force control hot-start and anti-stick function; air carbon arc gouging; and TIG welding with efficient lift-arc, eliminating tungsten contamination. The SC 12 RC utilises the UWI-400 as its power source and can weld all wire types and sizes from 0.6mm to 2mm.

An alternative product for TIG welding from ESAB is the Caddy TIG 2200i AC/DC power source, which is said to be lightweight, have improved corrosion resistance, and a new smoothly rounded exterior. The power source can be used on all types of weldable metal up to 5mm thick.

It is claimed that a stable, consistent arc is achieved in both AC and DC modes, with a QWave function optimising the AC wave form to give a smooth arc.

Two control panels can be used, the TA33 panel or the TA34 panel. The TA33 machine takes care of all AC TIG welding parameters apart from plate thickness, for ease of use, but for DC TIG, AC/DC TIG, and MMA welding, the TA34 should be used.

Operating from a 230V single-phase supply, the Caddy TIG 2200i has a setting range of 4A-220A for TIG AC/DC welding, or 16A-160A for MMA welding. With applications calling for a higher duty cycle, an optional water cooler is available, said to be a noteworthy safety feature.

Another two TIG welding machines included in a set of ESAB new releases are the Origo Tig 3000i AC/DC and Origo TIG 4300iw AC/DC power sources, which are usable on virtually any weldable material.

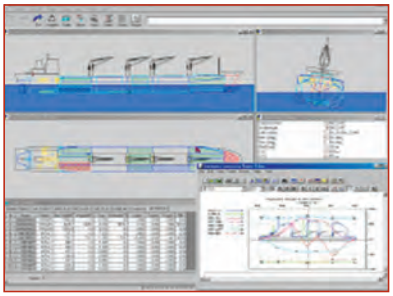
The Royal Institution of Naval Architects

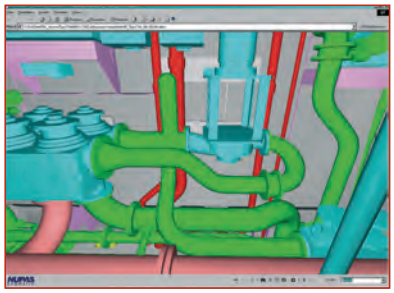
THE INTERNATIONAL CONFERENCE ON COMPUTER APPLICATIONS IN SHIPBUILDING (ICCAS 2007)

18-20 September 2007, Portsmouth, UK

Second notice

SHIPBUILDING ICCAS Portsmouth • 2007





ICCAS 2007 will be the 13th International Conference on Computer Applications in Shipbuilding. The 2007 conference will be held in Portsmouth, UK, on 18-20 September 2007.

The conference will review operational experience from existing computer applications in the design and build of ships and offshore structures. It will also examine the advances in Information Technology which have contributed to increased productivity in both shipbuilding and maritime operations; including increasing co-operative working between shipyards, marine equipment and system manufacturers, engineering partners and shipping companies.

The conference will cover the full range of topics related to computer applications for:

- Concept design, tendering, initial design, general arrangement, cost and work estimation, hull form, hydrodynamic analysis and basic structural design, risk based design
- Detailed and production design
- Structure, machinery, hull and outfitting design
- Parts manufacturing and assembly
- Prefabrication, shop automation, robotics, assembly, simulations and accuracy control
- Material management
- Material control, supply chain management, Logistics and e-solutions
- Inspection and maintenance
- Life-cycle maintenance, parts and systems reliability, inspection standards and Risk management.
- Knowledge Management and Innovation Management

The conference will attract a large international audience and provide a forum and means of professional development for all parties interested in computer applications in shipbuilding.

Key dates and up to date information will be displayed on the website at: www.rina.org.uk

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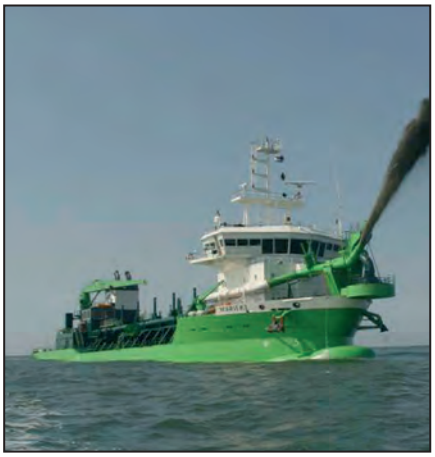


Dredger handling equipment can suffer wear and tear, which can be repaired using welding.

The Origo MIG L305 power source.

One of the TXH range of TIG torches.

The TA24 control panel can be used for AC TIG, DC pulsed TIG, and MMA welding, and in AC TIG mode the AC balance and frequency can be set so as to optimise the weld pool. If True AC rating is selected, the true current is automatically maintained at the set current level.

A QWave function and a two-programme function are included, and electrode preheating enables the level of preheating to be adjusted to suit the selected tungsten electrode. The ESAB logic pump is built into the water cooling unit and water-cooled torch option, plus an energy save mode ensures the pump and fan only operate on demand.

Functioning from a 400V three-phase supply, the 3000i and the 4300iw have a setting range of 4A-300A and 4A-430A for TIG AC/DC welding, respectively, or 16A-300A and 16A-430A for MMA welding.

New TIG torches are also available, with the TXH range incorporating '+' and '-' buttons on the torch handle to adjust the welding current. To use these buttons, an adaptor is required to connect the torch to any welding power source with a CANbus-compatible control system.

The torches are claimed to be suitable for applications where access is difficult, with four models even featuring a flexible head. Self-cooled and water-cooled torches are available with either 4m or 8m cables.

The range is available with 60% duty cycle welding currents ranging from 120A-400A, with the smallest model accepting tungsten electrodes from 1mm-3.2mm diameter, while the largest takes electrodes from 1mm-4.8mm diameter.

In the case of heavy lift vessels, sea fastening to secure a vessel's cargo can be optimised with effective welding. A product which could enable this process is the Unitor welding rectifier UWR-852. It is an 850A unit which performs stick electrode welding, TIG welding, and heavy duty air carbon arc gouging.

The control panel features single range amperage adjustment, said to provide easy and efficient operation. Other features include hot start, which facilitates arc striking; remote ampere control, which allows for current adjustment from the work site; and electromagnetic compatibility, complying with CE requirements.

The Unitor heavy duty welding current distribution system is aimed at reducing preparation time, increasing safety, and decreasing cable wear and tear. It allows for amperage adjustment and full 850A output from the UWR-852 at the work site, through permanently installed cables.

Helmets for safe welding

Two new welding helmets have been introduced to the market that aim to enhance operational safety and efficiency.

ESAB's latest product includes an option to add full head protection or a respiratory protection system. The Eye-Tech II has a curved front cover lens that helps to prevent spatter from sticking, and a contoured design intended to protect the lens from damage if the helmet is placed face-down on the floor or workbench.

The helmet functions with a solar-powered cartridge, which ensures the batteries are always charged. Furthermore, the electronics automatically switch off if the helmet is left in a dark place for longer than 10 minutes, only reactivating when brought back into the light.

Covering the ears and neck, Eye-Tech II is available in four models, ranging from the entry level 10-11, through the 10-12 and 9-13, to the 5-13 – which is said to be suitable to use with almost all applications, including gas welding and plasma cutting. In addition, the head harness can be removed and replaced with a specially designed protective helmet where this additional protection is required.

When full-face respiratory equipment is needed, a choice of two air feed units is offered, which deliver up to 190l of air per minute. Both can be used with all four models of helmet. The helmets can also be used in conjunction with an air-fed, grade B energy impact grinding visor.

Also new is the 3M Speedglass Welding Shield, which is claimed to be the lightest welding shield ever offered with an auto-darkening filter. Weighing in at just 360grams, the 'super light' new model fuses the performance of the 3M Speedglas Auto Darkening Shield with new, lightweight liquid crystal cell technology. It incorporates a number of new features that optimise its comfort, visibility, protection, and durability.

A recent survey by 3M highlighted that the top priority for many of its arc-welding customers was a welding shield with lighter weight. The product is therefore particularly suited for occasional welders where lightweight PPE is key.

The 50% lighter 3M Speedglas SL filter and a new manufacturing technique have resulted in a shield that is at least 26% lighter overall than other models. A versatile headband uses a pattern of holes that enables it to be breathable and conform to different shaped and sized faces and heads. Meanwhile, the shield can be tilted to set a preferred viewing angle and set closer or further away from the face to accommodate different sized noses, safety glasses, and/or 3M respirators.

The welding filter features four user-selectable sensitivity settings and five dark state levels (8-12). The tough, non-absorbent shield also retains its strength in high humidity, while a new motion detector automatically turns the filter on and off as the welder picks up or sets down the shield. The outer protection plate can be quickly removed and replaced, and the new Speedglas SL filter from 3M can be used with most arc welding processes such as MMA, MIG/MAG, TIG, and plasma welding. The filter is particularly appropriate for low-to-moderate amperage welding (0.1A to 250A).

3M offers a range of 3M Speedglas auto-darkening filters (ADFs) that turn dark as an arc is struck, and light again after the arc stops. The 3M Speedglas SL Welding Shield with ADF conforms to European Standard EN 379 (eye protection for welders) and is CE marked.

Welding is an important process in many areas of shipbuilding, used to repair corrosion, help secure cargo, and when efficiently pursued, it can reduce maintenance costs.

Knowledge and sustainable business

ORIGINALLY developed for storing and searching InterSHIP research results, the back-office tool BAL.KMan can be interrogated to keep knowledge alive. Markus Lehne, BALance Technology Consulting, reports.

TANGIBLE back-office benefits have been yielded through the development of BAL.KMan, a tool from BALance Technology whose evolution has been part of the InterSHIP project, the €39m integrated project launched by the European shipbuilding industry under the initiative of Euroyards and following LeaderSHIP 2015 recommendations.

The InterSHIP project is scheduled to finish in March 2008.

Initially, BAL.KMan was meant to support employees in quickly finding and digesting research project outcomes. Based on close cooperation with a friendly user group at Meyer Werft, BALance further developed and implemented the concept of a tool for 'presenting knowledge in a way to support freedom of solution-finding while providing more safety in decision making'.

The tool was extended to search company information bases with additional data types like: e-mails and their attachments, company standards, failure reports, drawings, etc, in order to categorise them in a similar way as had been done before for the research reports.

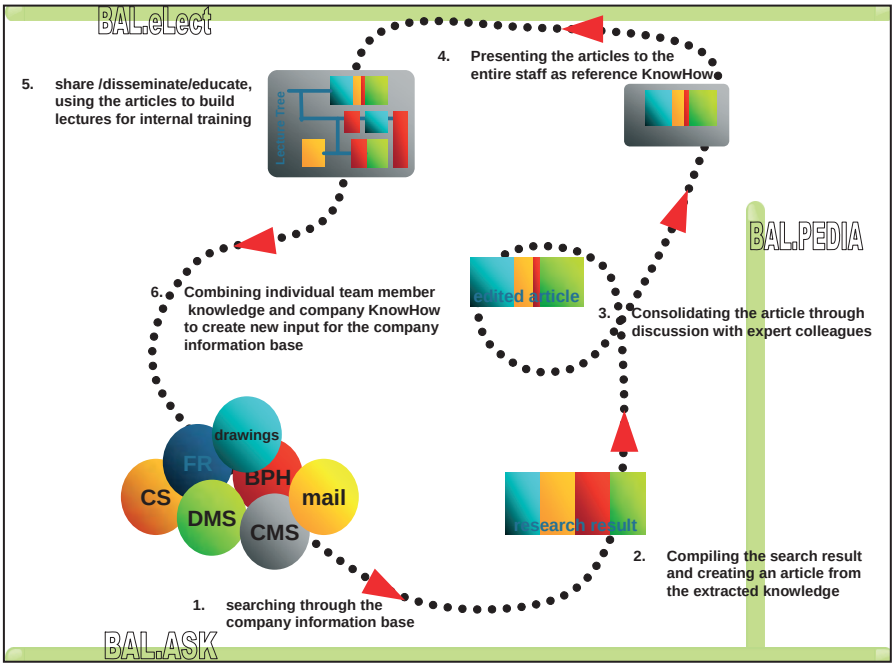
So far, the system is installed at Meyer Werft, while test installations are available at Navantia's Ferrol shipyard and at Aker Yards SA (St Nazaire).

Knowledge is the most valuable resource of a competitive company. All actions are based on knowledge and the better the knowledge, the more successful actions tend to be. Therefore, each of us is already pursuing active knowledge management: by learning, by archiving, by retrieving knowledge.

As long as we do this for ourselves alone, this is a comparatively easy job. If someone works in a team it immediately becomes obvious that the effectiveness of the team could be improved if the individual team members' knowhow could be shared. In shipbuilding and marine engineering, collaboration is a must and team members are dependent on each other's expertise to assure a perfect product development.

Therefore, utilising team member knowledge is a key success factor, especially in the case of the immediate use of experience to feedback from production – this is a strong lever in 'one of a kind production'. To exploit this source of wisdom the main question is: how to get the best support for the knowledge process?

To make knowledge available to the company's employees and to keep it alive is one of the most challenging tasks in modern business. Knowledge needs to be made accessible to all company employees in a most effective way.



BAL.KMan looks to exploit all available knowledge within a company in a digestible manner.

BALance Technology Consulting has developed a solution that is based upon the requirements of a broad industrial community. After having analysed the 'knowledge process' in different companies, a best practice common process has been identified:

1. Searching the company information base, going through archives, performing an Internet search, searching the company network to answer questions like: what does the company already know? Is it necessary to complement this knowledge? Where is the information? Can the information be trusted? Is it up to date?
Most of these questions cannot be answered from a pure document search but require an additional discussion with company experts.

2. Compiling the search result and creating a 'summary' from the knowledge extracted is a typical way of working. In particular: collecting the result of the study, sorting it, analysing it, digesting it, compiling it. So common, these steps can be very different in terms of the ways of doing them. Some people build piles of papers, others create files on a computer, others pin the findings on a wall and draw connection lines between them.

3. Consolidating the summary into an 'article' through discussions with expert colleagues is the most logical way, because discussing the compiled result with expert colleagues helps to verify whether an aspect or a piece of information was missed. Consolidating the findings and documenting the outcome of the study in the form of a memo or presentation will thus help not only the searcher but potentially also the rest of the company.

4. Presenting the 'articles' to the entire staff as reference knowhow. This step is neither well established in today's companies nor is it easy to refer to 'one best way'. Some companies use internal papers to spread knowledge, others prefer workshops or company websites to inform the staff.

5. Share/disseminate/educate - using the articles to build lectures for internal training. Once you have a consolidated documentation of a certain topic, this documentation will be made public to those in the company interested in the topic. This would enable both providing the information in a database for individual use but also utilising it in the form of classroom lectures to actively train people on a particular topic.

6. Combining individual team member knowledge and company knowhow to create new input for the company information base is the ultimate step in this process. Companies which have successfully implemented these steps contribute to the company culture with a good support for a lively innovation atmosphere.

Beating the unavoidable

Starting with the information base, notice that up to 85% of the company data is unstructured. To solve this issue, some companies introduce document management or content management systems where documents get indexed, categorised, and in some cases even get abstracts written to help

find the documents when they are needed. These manual actions are time consuming and will not be done for e-mails and their attachments for company standards, failure reports, or drawings.

The approach supported by BALance's BAL.KMan tool provides a functionality which automatically categorises the document base, which automatically writes abstracts, and which automatically indexes the entire dataset. The only thing the company has to do is to define the categories and train the system to let it 'understand' what the meaning of each category is. Then, the system needs to be informed about the directories to be monitored and it starts its analysing process. Once this is done, a search term is entered and BAL.KMan yields the search result representation in a hyperbolic tree which organises the search result by categories, and thus lets the user find the relevant information five times faster than exploring a list of results.

'With this functionality, it is very easy to display the results of a documents search. One can navigate through the tree by enlarging or hiding found documents in order to focus quickly on the sub-tree of interest,' says Pierre Berseneff, Aker Yards SA.

Considering today's internationalisation, the document base in most of the companies is already bi-lingual (at least). That is why a search of the company data should be performed in all the languages used therein. BAL.KMan supports the building of a company specific dictionary and thus performs the search in different languages simultaneously. 'Originally developed for storing and searching InterSHIP research results, it soon became obvious that all electronically available documents in English and the mother tongue can be treated. Having tested the search procedure with a couple of examples, we found out that the consumed time was at least cut down by one power of ten,' says Thomas Witolla, Meyer Werft GmbH.

The system also provides support for the second step of the knowledge process. The result of any study can be converted into 'WIKI' like articles with one important difference, the editor to maintain the articles works in a similar way to commonplace word processing systems and does not require any strange syntax. It even allows importing video streams into the articles to make the article not only more informative but also more entertaining to explore. So the result of the study will be nicely documented either for own-archive or, preferably, to be discussed with colleagues. In contrast to a 'WIKI' practice, colleagues are allowed to comment on the article but cannot alter its content. This is the consolidation of the article the author should do by himself, once the consultation process with all the company experts is finished.

The following steps build on the idea of reusing these articles for particular lectures, which would enable newcomers to the domain to investigate the specific articles or lectures instead of exploring the entire company information base again.

One of the key features of the search function is that the search can be limited to particular types of information such as e-mail including attachments, documents, articles, article discussions, lectures, drawings etc.

One of the main problems when introducing a new tool is the 'fear of change'. BAL.KMan can claim to match established processes (like search) and add value for all people undertaking it. When it comes to storing and discussing the findings of the study, people are free to use this functionality, and when deciding to do so, they immediately gain the benefit. In other words, the advantages of the system are coming for free as an add-on to the work they have to do anyhow, and which becomes easier with the new tool.

'Easy to learn and get familiar with - therefore, much easier to exploit. Searching and classifying is enhanced by the multi-language environment. This extra searching capacity becomes practical and effective. The Graphic Hyperbolic tree interface is really welcome. It comes to grips with the hassle of jumping among pages,' notes Jorge Quiroga, Navantia S A.

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InterSHIP chief executive
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Modelling next generation aircraft carriers

SIMON Rees, Frazer-Nash Consultancy, lifts the lid on the CFD modelling underlying the future aircraft carrier project.

THE Royal Navy's (RN) future aircraft carriers - still conventionally known as CVF, although the names *HMS Queen Elizabeth II* and *HMS Prince of Wales* have now been selected - will be the RN's most potent surface ships ever constructed, and will offer a significant expansion in capability over the existing Invincible Class of carrier.

The CVF design and operational requirements incorporate new challenges to flight deck operational and aircraft handling procedures. Part of the design assessment for CVF involves evaluating these.

Specifically, the challenges included:

- an increase in deck size
- an increase in the number of aircraft sorties per day
- the ability to accommodate both Short Take-Off and Vertical Landing (STOVL) and, potentially, conventional (CV) aircraft
- the novel twin island superstructure design.

Furthermore, CVF is intended to be a key platform for the STOVL F-35 Joint Strike Fighter (JSF) – an aircraft designed to operate in a wider range of weather conditions which the CVF design needs to support.

Understanding air wake is a crucial part of overcoming these challenges and maintaining safe operation. Figure 1 highlights just some of the major elements which can influence the flow of air over the flight deck.

Flow separation over the bow, sponsons, and the islands could cause high turbulence for aircraft launch, while the stern burble and engine plume could hinder aircraft performance during recovery – the naval term for the safe landing of an aircraft. The severity of the air wake will depend on the operating conditions, in particular the relative wind speed and direction.

Historically, wind tunnels were used to test these areas, but doing so can be costly and there are limits to the number and location of measurement points and to the type of data each point can record. Wind tunnels still provide valuable engineering input, and indeed have been used for CVF, but new computational analysis tools have, for the first time, been widely used to complement wind tunnel techniques.

Modelling the carrier's air flow using Computational Fluid Dynamics (CFD) can have a number of advantages over wind tunnel techniques:

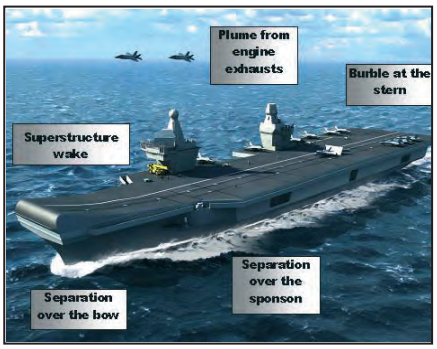


Figure 1: Air wake associated with an aircraft carrier.

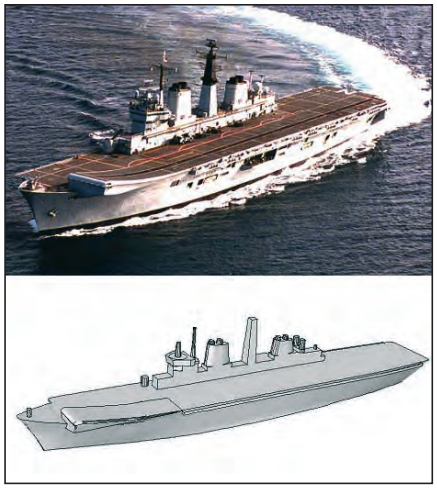


Figure 2: *HMS Invincible* CFD model.

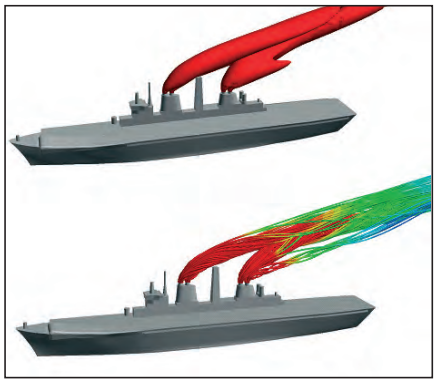


Figure 3: CFD prediction of GT plume.

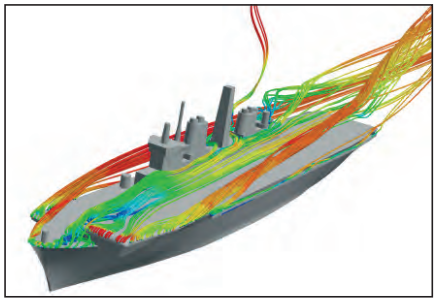


Figure 4: Pathlines released from vortex core regions.

- the entire flow-field around the carrier can be analysed easily
- individual flow features can be tracked as they flow over/around the carrier
- large numbers of measurement points can be easily set up to monitor a wide range of flow parameters
- full scale data can be used to construct the model, instead of having to account for the geometry scaling effects associated with using a model.

All main superstructure features were included, so that flow separation effects and engine plumes would be accurately predicted. Particular care was taken to represent the geometry of the ramp and forward section of the carrier, including the lip and rounded edge of the ramp, together with the port and starboard walkways. Small fixtures such as aerials were not included, since they would not affect the air wake significantly.

The convention used to define wind direction was to specify an approaching wind, with the wind angle direction increasing from the bow of the ship (0°), in a positive clockwise direction. For example, a wind approaching the ship from its port side (red) would have a wind direction of –90°, while a wind approaching the ship from its starboard side (green) would have a wind direction of +90°.

The results from the CFD models, using Fluent, were analysed to clearly convey possible problem regions that could affect aircraft performance. Particular consideration was given to regions of separation, vortices, and wakes. An aircraft recovery and launch flight path was used to extract turbulence, temperature, and velocity data. This enabled the effect of these parameters on aircraft operation to be assessed, and benchmark levels to be estimated.

Three main flow parameters were chosen to assess the results.

Delta-T was defined as the local increase in temperature above ambient. This quantity allowed the magnitude and extent of the temperature field generated by the hot gas plumes to be assessed.

Velocity magnitude highlighted the global effect of blockages such as the superstructure on the surrounding flow field.

Gust velocity represented the local velocity fluctuations due to the turbulence flow field. This provided a simple method for highlighting regions of significant turbulence or velocity fluctuation such as wakes and vortices. This was derived from the turbulent kinetic energy predicted by the model.

Before applying numerical analysis to a programme of the scale of CVF, it was first necessary to build and analyse a validation case. The vessel selected was the name ship of the RN's current aircraft carrier class, *HMS Invincible*.

So began a thorough CFD modelling of *HMS Invincible* at full-scale: 209.4m long, with the waterline situated 15m below the flight deck level. All of the main superstructure features

were included, so that the separation effects and Gas Turbine (GT) plumes were accurately predicted.

The CFD air wake predictions allowed the dominant flow features to be identified:

- **Plume efflux**. The GT plume extends a long distance downwind (Figure 3), and as expected is parallel to the relative wind direction. The height of the plume efflux reduces as the wind speed increases due to the reduced jet-to-crossflow momentum ratio.
- **Superstructure wake**. The blockage associated with the superstructure generates a large turbulent wake region, which extends a long distance downwind. In addition, vortex shedding is expected from some superstructure components. The strength and frequency of the superstructure wake increases with wind speed.
- **Separation**. Vortices are generated at the bow, port side of the ramp and starboard sponson, which are washed downwind (Figure 4). The effect of these vortices is generally small, but the strength does increase for 10° wind directions. Figure 5 shows an iso-surface of helicity, which is a measure of vorticity aligned with the free stream.
- **Stern burble**. The shear layer formed at the stern causes the burble effect which has been known to naval pilots for many years. This shear layer causes the stern vortex to dip and then rise.

The wind direction has a significant influence on the flow features over the deck. It determines the path of the plume efflux and the blockage produced by different components on the flight deck. Overall, the results showed that the turbulence levels associated with a green wind were significantly worse than the other wind directions due to the wake from the superstructure crossing the flight deck.

The wind speed also has a significant influence on the flow features over the deck. An increased wind speed caused the wake and separation effects to be more significant and reduced the height of the plume above the flight deck. Large bow separations at high wind speeds are likely to affect launch performance. In particular, the lower plume efflux for the green 10° wind means that the Sea Harrier would travel through the plume during recovery, further affecting performance, although green 10° is not normally a flying course.

Acceptable wind conditions for safe operation in the Sea Harrier are known for recovery and launch operations. In addition, experienced pilots can identify where on the flight path the greatest turbulence is experienced. The CFD predictions confirmed that in some operating conditions, in particular green winds, the island wake and exhaust plumes made turbulence levels too high for safe recovery. This agreed well with operational experience.

The CVF capability requirements are significantly more demanding than the Invincible Class. An increase in the number of aircraft sorties per day means that in general, the flight deck will experience more continued use, as opposed to the intermittent but high intensity burst on the Invincible Class.

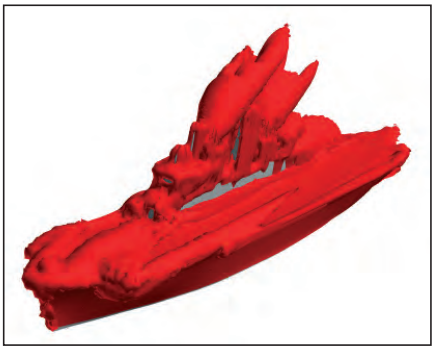


Figure 5: Iso-surface of helicity indicating regions of high vorticity.

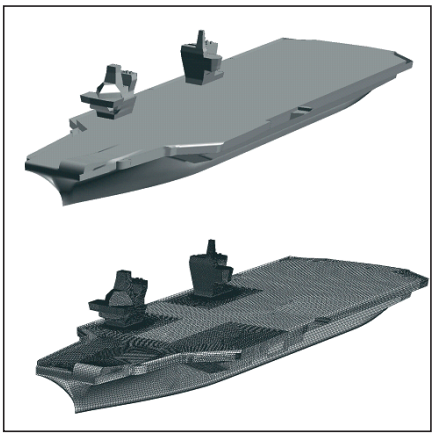


Figure 6: Geometry and mesh for CVF model.

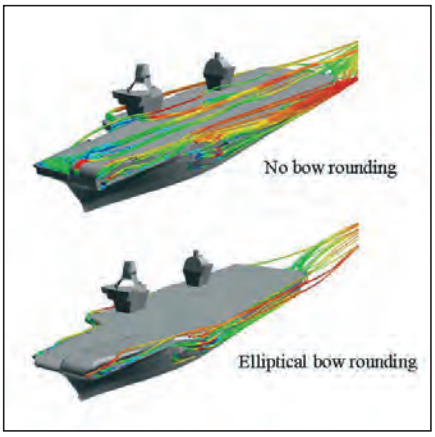


Figure 7: Pathlines released from vortex core regions.

The capability of the F-35 JSF also represents a step change from the Sea Harrier. It will be capable of operating in a wider range of weather conditions. This makes it all the more important to minimise the effect of the CVF air wake and so maximise the operating envelope.

The dominant flow features, such as the plume, island wake, and bow separation were compared at the same conditions. Predictions of turbulence along the F-35 JSF vertical recovery path and ski-jump launch were evaluated against the performance criterion developed for *HMS Invincible*.

The CFD predictions showed that in a head wind, CVF compared well with the benchmarks set for Sea Harrier operation on *HMS Invincible*.

As the wind angle was increased, two main aspects of the CVF design resulted in a less favourable comparison with *HMS Invincible*. The most notable of these was the exhaust plume. The exhaust outlets for CVF were initially situated at a much lower height above the flight deck and have lower momentum, resulting in a comparatively poor plume penetration. In a green wind, the turbulence and high temperature associated with the plume, propagates across the flight deck, interfering with launch and recovery flight paths.

The other factor potentially reducing aircraft performance was the extent of separation at the bow and port sponson. *HMS Invincible* has a pointed prow and no port sponson, whereas CVF has a bluff prow and large port sponson. These differences arise from the requirement for increased deck space on CVF.

For wind directions greater than 10°, these two factors contribute to turbulence levels exceeding the benchmarks set for Sea Harrier operation on *HMS Invincible*.

Plume penetration is mainly dependent on the ratio of jet-to-crossflow momentum. Some simple hand calculations indicated that the CVF jet momentum ratio was lower than for *HMS Invincible*, resulting in poor penetration.

Frazer-Nash, in conjunction with the Aircraft Carrier Alliance (ACA), generated the following design solutions:

Basic aerodynamic principles and experience gained from other ships indicated that an elliptical profile would reduce flow separation. The elliptical rounding was added to the flat face of the bow, and fillets were added to the bow corners and port sponson.

A number of modifications were made to the island design to promote plume penetration. These included changing the relative position of the exhaust outlets, increasing the stack size, and changing the island shape to reduce vortex generation.

The bow and port sponson design modifications significantly improved the flow over the bow of the carrier by reducing vortex generation and turbulence over the bow (Figure 7). This improved conditions for launch, especially in ahead and green winds.

Additional CFD air wake predictions use a modified island design and a ship-build bow rounding. The modified CVF design compared favourably with the limits set by *HMS Invincible*, and in general showed that with careful application and thorough validation, computational techniques can provide valuable support to ship design.

These modifications have subsequently been tested in a wind tunnel and their benefits have been confirmed. The rapid increases in computational power seen in recent years are certain to continue, and the CVF project is showing how these techniques will lead to huge improvements in future vessel performance.

DNV stars in CD-adapco tie up

DET Norske Veritas has extended its technical consulting service line by selecting a new software solution for computational fluid dynamics (CFD) from CD-adapco.

The software is reckoned to be a valuable addition to the DNV tool box to provide accurate and reliable estimation of slamming and sloshing loads, which are critical for the design and operation of both ships and offshore structures.

Dr Bo Cerup-Simonsen, head of DNV Maritime Technical Consulting and DNV fellow in computational mechanics, said: 'The shipping and energy industries are faced with a number of new challenges, driving the need for novel designs and technologies. For shipping this concerns, among others, container and LNG [liquefied natural gas] vessels as well as more specialised ships. The lack of experience for a novel design demands accurate prediction of loads, motions, resistance, and propulsion efficiency. For example, slamming pressures on the bow and aft part of the ship and sloshing effects in LNG tanks are some of the areas that are critical and challenging. This new computational fluid dynamics solution combined with our world-class competence will extend our capabilities to better meet this demand.'

Dr Bo Cerup-Simonsen, head of DNV Maritime technical consulting and DNV fellow in computational mechanics.

CD-adapco vice president of marketing and business development and director for the energy sector, Dr Dennis Nagy, added: 'By working closely with DNV, we intend to further refine our technology to meet the industry demands.'

DNV said its engineers would use CD-adapco's STAR-CCM+ to tackle problems involving sloshing resonance. Liquid motion resonance could lead to sloshing impacts at sharp corners and knuckles inside tanks, it said, with a potential risk of damage. The software would allow DNV to simulate sloshing behavior driven by a wide range of sea-conditions, allowing engineers both to visualise the liquid motion and to identify critical events that may cause high sloshing induced impact forces. DNV would also use STAR-CCM+ for the analysis of vortex induced vibration and for general six-degree-of freedom free-surface calculations, the class body said.

About STAR-CCM+

Released in 2004, STAR-CCM+ takes CAD to post-processing, and delivers the entire computational fluid dynamics process in a single integrated software environment. This approach meshes model set-up and iterative design studies, enabling engineers to deliver better results, faster.

Engines to support the human designer

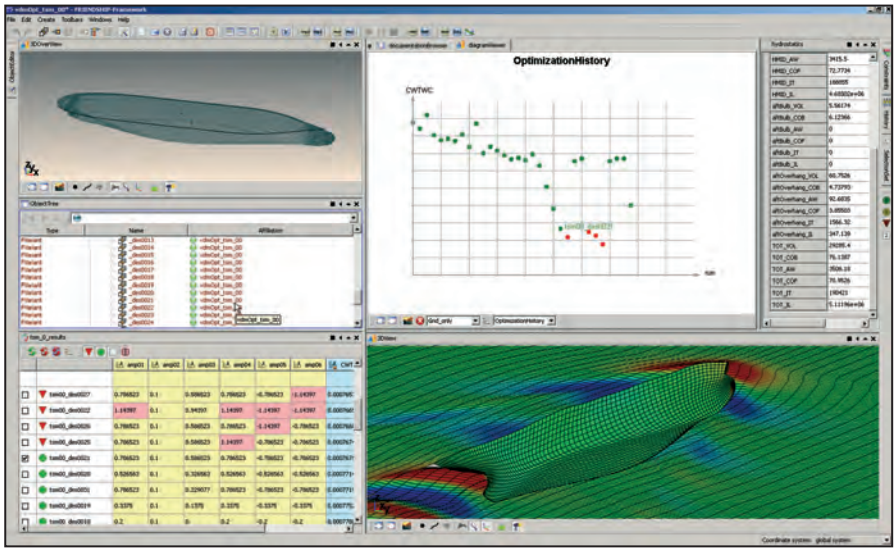
THE novel CAD-CFD platform FRIENDSHIP-Framework by the German software provider FRIENDSHIP SYSTEMS offers a unique approach to modelling, simulation, and optimisation, as reported in the January 2007 issue of *The Naval Architect*. The FRIENDSHIP-Framework supports the process of hydrodynamic fine-tuning in ship design by means of conventional, partially parametric, and fully parametric modelling. It provides easy access to plugged-in CFD codes and it now offers even more formal techniques of optimisation.

FRIENDSHIP SYSTEMS calls these formal techniques of optimisation Design Engines, to give credit to the fact that not only human beings may drive the design - mathematical strategies, too, can serve to advance the process.

Within the FRIENDSHIP-Framework, the various Design Engines that are made available range from simple investigations to full-scope multi-objective optimisation, built on both deterministic and stochastic algorithms.

Examples for simple investigations are the exhaustive search and its slightly modified sibling called 'ensemble investigation'. An exhaustive search subdivides the space of interest equidistantly, while an ensemble investigation allows for individual settings for each variable. A typical application is to check the influence of one, two, or three free variables. For instance, the design team may want to evaluate the change of the centre of buoyancy on resistance for two trim-draft scenarios.

Since the effort grows very rapidly (p to the power of n with p as the number of sample points, ie, number of subdivisions plus one, and n the number of free variables), more sophisticated strategies are often needed. These strategies can be drawn from the theory of Design-of-Experiments (DoE) which aims at gathering as much information with as little effort as possible. Within the FRIENDSHIP-Framework, the prominent Sobol algorithm is provided for ready application. Sobol is a low discrepancy sequence which samples points in design space more uniformly than pure random number sequences, avoiding the clustering of sample points. From a DoE table, dependencies of objectives from design variables can be studied, and promising starting points for subsequent exploitation can be nicely identified.



Key data of interest when optimising a hullform with the FRIENDSHIP-Framework.

Following an exploration study on the basis of a DoE, the design team might want to launch a more focused search. The FRIENDSHIP-Framework again offers a variety of algorithms for this phase of exploitation. If a local improvement is to be realised with high efficacy, deterministic strategies often make a good choice. Two of the strategies provided are the Simplex and the Tangent Search algorithms. The Simplex algorithm, for instance, is a gradient-free search strategy that wobbles through an n-dimensional design space as an (n+1)-dimensional amoeba-like figure towards a local optimum.

In the case where the design team disposes of substantial computational resources, more sophisticated algorithms such as the NSGA-II and the MOSA can be employed. The NSGA-II, for instance, is a certain type of genetic algorithm which intrinsically handles competing objectives. It requires quite a lot of functional evaluations of the objectives, but holds the potential of identifying many different optima.

The figure illustrates what data and information are usually generated when using Design Engines within the FRIENDSHIP-Framework. The optimisation data are presented in table form from which important plots such as a history diagram and trend analyses can be generated. Statistics on the free variables, the objectives, and the constraints are given. Valid and failed designs are highlighted.

For convenience, in the event that quite a lot of constraints need to be observed concurrently, the validity of each variant is displayed in the form of a traffic light. The traffic light allows for a quick check on how many constraints are fulfilled, how many constraints are violated, and how many constraints are within a certain warning distance (which means close to becoming active). Naturally, the computed data of each variant – such as the hydrostatics, the wave field etc – can be directly loaded for inspection and comparison with alternative designs.

More details on the FRIENDSHIP-Framework were reported recently at the 6th International Conference on Computer Applications and Information Technologies in the Maritime Industries (COMPIT 2007, Cortona, 23 to 25 April 2007). FRIENDSHIP SYSTEMS' paper can be downloaded from www.FRIENDSHIP-SYSTEMS.com.

Aveva takes new Korean order

PLANT and marine design engineering lifecycle solutions provider Aveva has won a new contract with South Korean shipbuilder, SLS Shipbuilding Co Ltd in Gyeongnam.

SLS Shipbuilding Co - one of Korea's oldest shipyards - is a highly specialised constructor of medium-sized vessels and chemical tankers. The group has contracts to manufacture up to 18 of the region's chemical tankers and ships in 2007, with plans to produce an additional 30 vessels by 2010. It is seeking to become a world leader in the production of medium-sized product and chemical tankers.

Jae Woo Son, SLS chief research engineer, said: 'Today's competitive global marketplace necessitates production excellence, operational efficiency, and technological advantage to stay ahead. For this reason, we have engaged Aveva's expertise in marine engineering solutions to support our operational and technological needs.'

Peter Finch, president, Aveva Korea-Japan Division, said: 'SLS Shipbuilding Co Ltd has the advantage of working with a portfolio of integrated design and production products, combined with open and flexible lifecycle management solutions that provide the fastest, most productive, and risk-free way to design, build, and operate large marine projects.

'Given the nature of the marine engineering environment, marine projects often carry various complexities in their outfitting and design systems. With Aveva's solutions, our aim is to provide our clients with the best tools from the onset and throughout all stages of the production life cycle in the fastest, most efficient, and risk-free manner so that they can continue to stay competitive, highly effective, and profitable in meeting the demands of an ever changing global marketplace.'

Sener meets Sanoyas in 3D

JAPAN'S Sanoyas Hishino Meisho Corporation (Sanoyas) has signed a contract with Spain's Sener for the use of FORAN as its new shipbuilding 3D CAD software.

The order was recently sealed by Sanoyas executive director Takafumi Itoh and Sener marine business unit vice president Luis García, at a special ceremony in Tres Cantos, Spain.

Sanoyas has hitherto used 3D CAD developed by a major Japanese shipbuilder, but it has been seeking its next shipbuilding package by comparing the different systems available in the market, in order to achieve further integration of design and production, as well as efficient design with a core focus on a modern 3D CAD systems.

As such, it joins a FORAN reference list that includes over 120 shipyards, and design offices located in 25 countries.

FORAN is an integrated computer system developed for design and construction of ships, comprising several main packages (hullform definition, naval architecture, hull structure, outfitting, electrical, accommodation), a number of common modules (build strategy, drafting, walk-through design review, collaborative engineering), links with production equipment (cutting machines, bending machines, robotic systems, etc), interfaces to management systems, and its own integrated development environment.

Running on Windows workstations, connected through LAN or WAN, FORAN permits an interactive and concurrent definition of the ship 3D product model.

According to Sener, Sanoyas first eliminated almost half of the candidate systems by means of exhaustive questionnaires regarding ship hull and outfitting. It then studied various operational issues through presentations, joint training courses, and demonstrations, and eventually came to the conclusion that FORAN would be the most appropriate system.

In the last stage of the selection process, experienced ship hull and outfitting design engineers from Sanoyas analysed the prospective system by conducting a three week training workshop at Tres Cantos. The evaluation concluded with a full study of the support strategy for the system, which had to be fully adapted to Japanese shipyards, as well as a thorough technical assessment.

On signing the contract, Mr Itoh said: 'It is true that we were concerned about being the first [Japanese] user, especially in the ship hull system. We therefore confirmed Sener's attitude towards the Japanese market, especially in regard to the maintenance - we directly requested secured cooperation and got its promise. In the future, starting from setting up the super-user team and applying the system sequentially to new ships, we aim at a speedy implementation by accumulating system improvements. Seeking a practical system for Sanoyas actual operation, the challenge has only begun.'

The first group of Sanoyas 'super-users' started their advanced training in late June at Tres Cantos. The Implementation plan spans a period of four years, between 2007 and 2010, during which a steadily growing number of seats and services will be supplied. Sener said its Okayama office would provide intensive local support when the system enters into real production at Mizushima Works and Shipyard.

Using this contract as a springboard, Sener said it would continue to put all its efforts into making FORAN the design and production system of reference in the Japanese shipbuilding market.

Abiding by the rules

IACS permanent secretary, Richard Leslie, was asked for his thoughts on the relationship between common structural rules and finite element analysis.

'THE issue of application software associated with any set of rules is an interesting one as it brings to the fore so many aspects, such as; common and consistent application of the rules, engineering productivity improvements, information management, and relating the initial structural evaluations with follow-up monitoring in service, to name a few,' said Richard Leslie, permanent secretary of the International Association of Classification Societies.

It also brought to mind other aspects covering common software, or common sub-modules among IACS members or the interfacing of a common system with individual IACS member systems.

'These, as well as a few more, are software-related issues that IACS members have been wrestling with since the Common Structural Rules (CSRs) for Double Hull Oil Tankers and Bulk Carriers were first contemplated.

'Although IACS continues to discuss these matters, the primary emphasis to date has been with the actual rule development and maintenance aspects of the CSR themselves.

'We agree [that] CSR aims to provide a unified set of rules and to instill greater co-operation between classification societies. However, the interaction between prescriptive rules and FEA is a complex issue that is not so easily summarised.

'As ships are complex structural systems made up of interacting members, the evaluation solution is similarly complex and, therefore, the CSR philosophy was to strike a balance between the prescriptive portion and the FEA strength assessment of the rules. Both portions seek to transparently apply the loads and engineering modelling representations to review the pertinent modes of strength (yielding, buckling, and ultimate strength) as well as fatigue.'

Verifying strength

Mr Leslie said the prescriptive portion incorporated engineering first principles to provide the baseline requirements, which also included minimum criteria in many areas, while the FEA was used to verify the strength of the structure for the interactions between the structural members and the loads.

'The primary reason for including prescriptive rules and minimum requirements is to cover any gaps in the design loading conditions and associated maximised loading of individual structural areas analysed during the FEA.

'Another balance between prescriptive and FEA rules that has to be considered is in the area of achieving common results among Class Societies as well as designers.

'In general, the more prescriptive the rules are, the easier it is to achieve commonality, and the more strength assessment using FEA is employed, while perhaps being closer to realistic application, will have a greater potential for less commonality. We would generally say that the balance between the degree of prescriptive rules and FEA strength assessment is about the same as that seen in recent rules. Similar discussions and considerations regarding the balance between prescriptive and analytical requirements are also taking place at IMO.

'With respect to challenges presented to software developers, with the development of rules that are transparent (clear distinction between loads, capacity model, and acceptance criteria) and the interaction between complex structural elements, the associated application software is equally complex in both its user interfaces and its calculation routines. This specifically includes the FEA software.

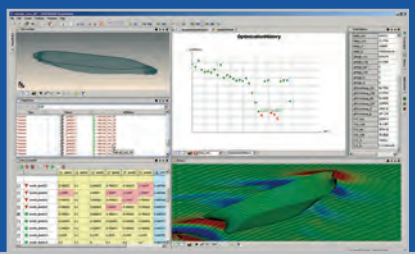
Common structural rules for bulk carriers have software implications.

The realistic approach

'The FEA software associated with the CSR has to be able to handle the modelling of fine mesh zooming, as well as the model properties associated with the net scantling concept which represents a more realistic approach associated with the actual structural corrosion behaviour encountered in-service.'

The loads associated with the CSR were also more complex and were broken down into static only cases and static plus dynamic cases, and the boundary constraints and applied forces at the ends of the partial-length model representing the hull girder had to be properly applied. This included complex asymmetrical cases.

'When it comes to reporting the FEA results and assessing them against the CSR acceptance criteria, the acceptance criteria is different depending on whether the case is static only or a static plus dynamic case. The CSR acceptance criteria is also different, depending on the structural component of the vessel, and therefore the software system has to be able to map the results to the actual structural component of the ship. For example, the system has to be able to know the difference between a tight double-bottom girder and a non-tight double-bottom girder and apply the correct acceptance criteria against the results obtained for each. Similar complexities are also seen when it comes to the evaluations performed for fatigue.'



Latest version of ship simulation game launched

A NEW version of a simulation game that puts the player at the helm of some of the most varied and detailed ships found at sea has been launched. Ship Simulator 2008, by VSTEP gives players a number of tasks, all set within a 3D environment.

Players can take control of an array of ship types, such as cargo ships, ferries, speedboats, yachts, and even *Titanic*. Available environments include Southampton, Marseille, and San Francisco harbours.

VSTEP has built upon last year's initial release of the game, by taking player suggestions into account and implementing some of their requests. Among the new features are:

- dynamic ocean waves, with realistic ship motions
- long distance travels, open ocean voyages between ports
- visible damage system
- 30 new complex missions
- extensive day, night, and weather systems
- six new ships, each with walkthrough functionality and interactive bridge controls
- controllable container crane.

Several features providing a more advanced gaming experience were only announced a short time before the game's launch. One such addition is a vector graphic sea chart, which is based on realistic 3D seabed models, with a full-screen display option, transparency setting, and level of detail on text and depth readings.

Other new elements include a damage system, showing dents and holes in the ships after severe collisions; free-roam mode, where players can set all parameters; realistic bow splash water, with support from an advanced physics simulation model; mapping options for the keys and joystick buttons; a rope system which allows players to connect and disconnect their ships to other ships or mooring boulders; and the addition of icebergs, which cause damage when a player collides with them.

A free upgrade patch will be available around September this year, comprising:

- a system for sinking ships when damaged below the waterline
- a system for scoring and ranking in different ship type classes, linked to a player's online profile on the Ship Simulator forum
- two extra player ships: a jet-ski and a hovercraft
- additional language versions of the game, such as French, Italian, Spanish, Dutch, or Polish
- players will be able to set waypoints in free-roaming mode
- a mid-mission save function.

There are two further functions which are intended to be ready after September: multi-player functionality; and mission editor. The latter option has been designed so that people can create their own adventures and share them with their fellow players on the online forum.

Pjotr van Schothorst, technical director, VSTEP, said: 'There are many improved elements to the game that make this a realistic and challenging experience. Some of the new features may also attract a whole new audience to the game, for example, professional sailors who may never have touched a game before. They will now get a chance to experience the feeling of controlling a massive cargo ship again, all from behind their desk at home.'

A screenshot of Ship Simulator 2008, depicting *Red Jet 4* near Marseille.

Pro/ENGINEER keeps Open Mind

OPEN Mind Technologies has renewed its membership in the PTC Partner Advantage Program. The partnership makes German company Open Mind's 2D, 3D, HSC, and 5-X CAM hyperMILL software available to Pro/ENGINEER Wildfire users while working concurrently in the Pro/ENGINEER Wildfire CAD environment.

Accordingly, there is no loss of data through translations, and associativity with the model is maintained.

HyperMILL has been available to manufacturers in many industries, including the marine sector, for over a dozen years and has always maintained a unique platform strategy. It has been integrated into various popular and important CAD platforms and provides users with an alternative CAM system, deep integration, and high performance, especially in feature technology automation and in multi-axis processing. The hyperMILL kernel is currently also available standalone and integrated into other popular mid-range CAD systems.

Open Mind said there were many benefits to the deep integration offered by hyperMILL in Pro/ENGINEER. Firstly, being integrated directly in the Pro/ENGINEER Wildfire CAD system allowed users to work in a comfortable and powerful CAD environment, yet access the benefits of hyperMILL's CAM strategies. The overall product integration eliminates the passing of Pro/ENGINEER CAD data to the hyperMILL CAM system by a plain file, and eliminates the chance to lose data quality that is common with neutral-language (IGES and STEP) translators.

Open Mind's hyperMILL has an advanced Feature Technology toolset. In a CAM environment, Feature Technology is used to organise and add intelligence to the CAD data, enabling the application of stored machining process macros, as well as reducing the chance of programmer error when searching for holes, planes, pockets, and other geometry patterns in a complex model file. HyperMILL's Feature Technology also incorporates non-traditional Feature types such as strategy curves and surface groups, or even User Defined Features.

The Autoship experience

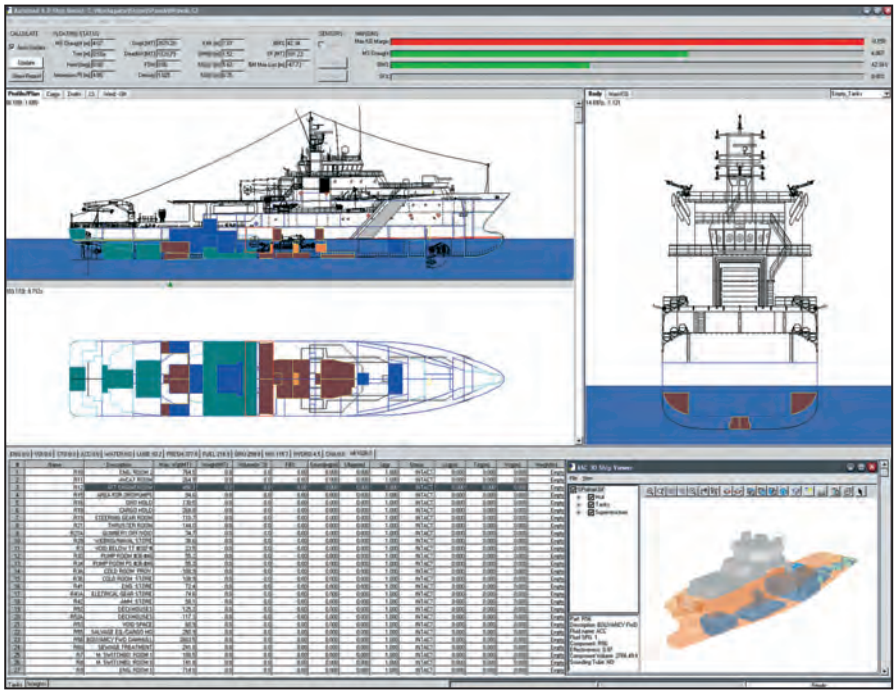
AUTOSHIP Systems Corporation (ASC) says it has experienced a significant increase in marine CAD/CAM sales during the first half of 2007.

The company says that the market has shown new appetite for its integrated approach for the naval architect to complete the full design package of drawings, after 25 years in the field of marine design software.

ASC says it is soon to release another round of upgrades for the Autoship Pro (Hull Design and Surface Modelling), Autohydro Pro (Hydrostatics and Stability) and Autostructure Group (Vessel Structure Modelling and Nesting) packages.

During 2007, clients that added new software from the Autoship System Suite have included: Acergy MS Limited – UK; Arsenal Do Alfeite – Portugal; Black Line Designs – South Africa; Blue's Naval Design – Japan; Chantier Naval Allais – France; Con-Dive, LLC – USA; Coriolis AB – Sweden; De Voogt Naval Architects – The Netherlands; Dowland Naval Architects – UK; Everglades Boats – USA; Far East Hydrofoil Company – Hong Kong; Inocean Poland – Poland; Kvichak Marine Industries, Inc – USA; Leenaars BV – The Netherlands; MacMarine Development Ltd – Canada; Marintek AS – Norway; Mari-Sys Pte Ltd – Singapore; Martifer Energia – Portugal; Miho Shipyard Co, Ltd – Japan; Multi Maritime AS – Norway; Naviform Consulting – Canada; Navtec Marine – Croatia; Offshore Technology Development – Singapore; Premier Yacht Co Ltd – Taiwan; Seabus International Co Ltd – China; Seaway Marine Transport – Canada; Ship Classification Malaysia – Malaysia; Sterling Yacht & Shipbuilders Co, Ltd – Japan; Suporte Consultoria e Projetos – Brazil; Tero Marine Pte Ltd – Singapore; United Ship Design SDN BHD – Malaysia; Vancouver Shipyards – Canada.

New educational installations this year have included: Hong-IK University – Korea; Instituto Panamericano de Ingenieria Naval – Uruguay; Institutt for Marin Teknikk – Norway; Kanazawa Institute of Technology – Japan; National Maritime Research Institute – Japan; Naval Academy Mircea Cel Batra – Romania.



Autoload screen capture 300.

Meanwhile, UK dealer, Autoship Systems UK, has delivered the first three Autoload packages to Rolls-Royce Marine & Electrical Systems for installation onboard the *Samudra Prahari*, *Samudra Paharedar*, and *Samudra Pavak* pollution control vessels – under construction at the ABG Shipyard in India for the Indian Coastguard Service. These ships, based on the Rolls-Royce UT517 ship design, will assist in minimising the damage caused by potential environmental crises - particularly oil spills - from ageing merchant ships in Indian waters. The vessels will feature a range of Rolls-Royce propulsion, steering, and motion control equipment, and will be built at the ABG Shipyard in Surat.

The Autoload software is designed to govern onboard stability. It is available in versions suitable for any vessel type and, most importantly, can handle any type or combination of cargo. ASC has delivered systems ranging from an integrated ship planning system for the complete Wallenius Wilhelmsen fleet, to an integrated onboard stability solution for Thunderhorse - the biggest semisubmersible rig ever built. At present, Autoload has been installed onboard more than 400 vessels.

Largest FPSO online via Aveva Net Portal

WHEN delivered, the largest floating production storage and offloading vessel (FPSO) in the world to be built to date will use the Net Portal solution from Aveva to manage critical information for operations.

The Chevron vessel *Agbami*, to be located 70miles offshore Nigeria, will produce 250,000 barrels of oil per day. The FPSO, to be delivered in 2008, is under construction at Daewoo Shipping and Marine Engineering (DSME) of South Korea, in a contract valued at $1.1bn. *Agbami* will inject water and associated gas for reservoir pressure management. It will also be equipped with the latest environmental protection technology.

When operational, the FPSO will be managed from the Chevron offices in Lekki, Nigeria. The design and engineering work will be coordinated over a number of sites internally in Nigeria, with specialist contractors internationally, and with the *Agbami* FPSO itself. Aveva's Nigerian agent, Lonadek, will be responsible for aspects of the delivery of the *Agbami* Engineering Portal system, as well as on-going support after it goes into operation.

Utilising the Aveva Net Portal, information can be continually updated on the master hub and then synchronised with the replicated data onboard the FPSO, which will include P&IDs, the 3D ship/facility model, documents, and other information, ensuring that reliable and accurate data are available online at any time during operation.

The Aveva Net Portal is a web-enabled solution for the integration and collaborative use of all engineering information. 3D models, schematics, documents, and data from any application can be accessed and navigated in context, with full intelligence, without needing the source application that originally created the data.

Based on ISO15926 and XML technology, it provides a fully flexible and easy-to-implement solution for the management of engineering data across the life cycle of a project. It is said to reduce the time it takes to find information, increase quality and consistency of data, and make the information accessible across all stakeholders on a global basis, reducing risks and costs in the design, build, and operation of large capital engineering projects.

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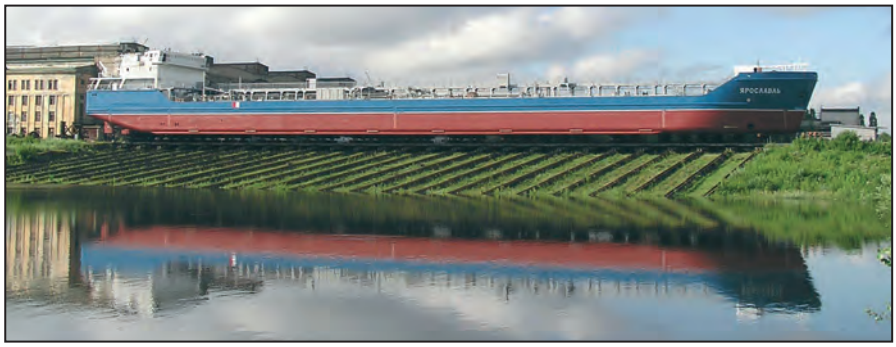
River-Sea drives MNP

WHILE the future shape of Russia's shipbuilding industry remains unclear, MNP Group has commercial ship orders to 2010.



Krasnoye Sormovo built this river-sea tanker to the 19614 design.

RUSSIA'S publicly-held shipbuilding sector has been served notice of a major shake-up, in the wake of new legislation looking to the private sector to buy into a consolidation of the nation's state-run yards as part of newly combined holding company arrangements. Foreign investors are not excluded from the plans.

The Russian government set up a United Shipbuilding Corporation OJSC, after a decree issued on 9 June, in which it owns a 100% stake. The state-owned shipbuilding group, which will exhibit at NEVA 2007, incorporates major yards including Baltiysky Zavod and Severnaya Verf. It is expected that a formal structure for the new group's holdings will be finalised by 1 April, 2009, with a view to attracting investors thereafter.

The future, then, is unclear, with naval business thin on the ground, and an understandable hesitancy the most notable characteristic of commercial shipowners with the potential to place orders in Russia. It is nonetheless important not to lose sight of the fact that, from a production point of view, commercial shipbuilding activities continue.

MNP Group, in particular, has been pushing forward with energetic construction plans for river-sea vessels, after a reorganisation in 2004 that saw the shipbuilding and offshore design and construction company split away from the OMZ Industrial Corp.

Its holdings now include the Krasnoye Sormovo Shipyard (Nizhniy Novgorod) and the Volgograd Shipyard, as well as engineering companies Volgo-Caspian Design Bureau (Nizhniy Novgorod) and Friede & Goldman (USA), plus engineering plants Sormovskoye Mashinostroeniye (Nizhniy Novgorod) and Volgograd Special Engineering Plant. Working in both commercial and naval shipbuilding, MNP covers a wide product range – from dry cargo ships to diesel submarines.

MNP Group is not a part of United Shipbuilding Corporation, but the group said that the government-controlled stake in its Krasnoye Sormovo Shipyard (33.53%), would be transferred to USC.

The company said it had achieved significant shipbuilding productivity gains since its split with OMZ, a split which also led to the spinning off engineering (machine-building) companies, Sormovskoye Mashinostroeniye and Volgograd Special Engineering Plant, from the shipyards.

In 2006, yards under the MNP Group of companies launched vessels equivalent to over 90,000dwt, compared to 70,000dwt in 2005. Clients included leading shipping companies: Palmali Group, Azerbaijan State Caspian Shipping Company, Svithoid Tankers AB (Sweden), Pietro Barbaro S A (Italy), Irinvestship Ltd, Panalpina, Saipem SpA, etc.

At present, the MNP Group orderbook is full until 2010.

'During the last three years, MNP Group revamped and renovated our yards,' the group said. 'In 2006, [a] line for sections auto-assembly and auto-welding was commissioned at Krasnoye Sormovo Shipyard. Krasnoye Sormovo Shipyard is the first Russian yard where such state-of-the-art equipment is installed. Commissioning of the line [has led] to production output increases: two sections of dimension up to 18m are produced [in] one shift. In 2006 and 2007, two plasma-cutting machines (PCM) with rotatable plasmotrons were commissioned at Krasnoye Sormovo Shipyard as well. [The] line for steel blasting and painting will be commissioned by the end of summer 2007.'

Production by MNP Group's yards focuses on both river-and-sea-going tankers from 4000dwt up to 13,500dwt (for transit to the Black and Baltic seas) and up to 60,000dwt (for transit to the Caspian Sea), dry cargo ships and special purpose vessels, as well as offshore structures and modules of drilling and production platforms.

As noted, on top of its shipbuilding capability, the MNP Group encompasses the in-house Volgo-Caspian Design Bureau (VCDB) - until recently, known as the group's engineering centre - whose naval architects have 40-years of experience in designing tankers, chemical tankers, and dry cargo vessels of different purposes, at a basic and detailed level. Volgo-Caspian Design Bureau employs 70 designers.

The operation prides itself on its use of modern systems of computer-assisted design. The software applied includes: AutoCAD; Nupas-Cadmatic; Ship Model (for ship surface); Poseidon (strength calculations); and Project 1.

It was last year that the Bureau started using the renowned 3D engineering and design system, Nupas Cadmatic. A set of licenses possessed by the Design Bureau makes it possible to work on hull design and ship systems, as well as to produce nesting programs and other designer documentation. In the future, MNPGroup said the Design Bureau planned to widen its Nupas Cadmatic licenses to cover 'all qualifications', as well as to purchase a set of licenses for the Napa computer-assisted design system that will enable 3D modelling in general ship design.

Vessels type	Year of lead ship launching	Totally Launched	Shipyard
Tanker, project 00200	1995	2	Volgograd Shipyard
Dry-cargo ship, project 17310	1995	8	Krasnoye Sormovo Shipyard
Dry-cargo ship, project 16291	1995	6	Volgograd Shipyard
Tanker, project 00201L	1998	10	Volgograd Shipyard
Tanker, project 19612	1999	5	Krasnoye Sormovo Shipyard
Barge, project P156C	2000	4	Krasnoye Sormovo Shipyard
Barge, project 05074C	2001	7	Krasnoye Sormovo Shipyard
Tanker, project 19614	2002	9	Krasnoye Sormovo Shipyard
Tanker DWT 5600	2005	4	Krasnoye Sormovo Shipyard
Dry-cargo ship, 00101 Rusich	2003	3	Krasnoye Sormovo Shipyard
Barge, project 004ROB05 Paloil	2004	3	Volgograd Shipyard
Dry-cargo ship, project 006RSD05	2004	8	Volgograd Shipyard
Tanker, project 19619	2004	8	Krasnoye Sormovo Shipyard
Tanker, project LG002	2004	2	Volgograd Shipyard
Tanker, project 17103	2004	2	Volgograd Shipyard
Barge, project 01103C	2004	2	Volgograd Shipyard
Construction barge Ersai-1	2005	1	Krasnoye Sormovo Shipyard
Tanker, project 00608	2006	1	Volgograd Shipyard
Non-self-propelled barge G248	2006	1	Volgograd Shipyard
Dry-cargo ship, project RSD 17	2006	5	Krasnoye Sormovo Shipyard
Dry-cargo ship, project RSD 19	2006	3	Volgograd Shipyard
Chemical tanker, MNP 4450	2007	1	Volgograd Shipyard

Table 1: Vessels, built MNP Group since 1995.

Flexible tonnage

MNP Group yard Krasnoye Sormovo is one of Russia's oldest shipyards, with a history that can be traced back over 150 years. The yard has made an important contribution to the development of both military and commercial vessels segments (tankers, dry-cargo ships, etc).

Its current workload includes commercial vessels of up to 13,500dwt, while the yard's production capacities also serve the offshore structure sector, including drilling and production platforms.

Here too, the use of CAD/CAM technology is employed in all phases of the design and construction of ships.

The yard's orderbook includes tanker projects 19614 and 19619, which feature designs from the Volgo-Caspian Design Bureau. Tanker project 19619 has been particularly noteworthy, in that it has seen first deliveries of a 13,450dwt vessel that is the largest river-sea tanker built for the Caspian Sea to date. The 150m long by 17.3m wide by 10.5m deep ship is able to moor at any port of the Caspian Sea outfitted with oil-loading terminals, as well as being able to make it to the Black Sea and other seas without needing tug assistance, by virtue of its maximum draught of 6.99m.

Featuring double sides and a double bottom, this is a high performance, twin screw tanker with bow thrusters. The river-sea-going tanker offers sea endurance for 20 days and operates at up to 10knots. It is designed for transportation of crude oil and oil products with flash point less than 60°C. It is fitted with twelve cargo tanks (of total capacity 14,770m^3) and one slop tank. There are also ballast compartments in the double sides and double bottom. The tanker is capable of carrying two types of cargoes in a voyage and is also capable of operating in different climatic conditions, in regions of moderate cold marine climate (It is classed KM Л1 I I A1 by the Russian Maritime Register of Shipping).

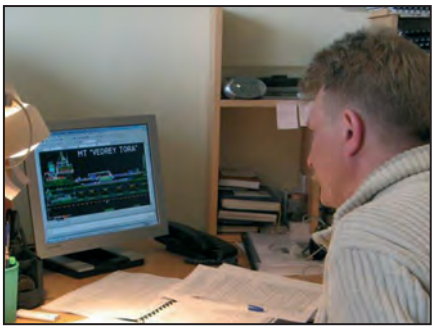
Five tankers of this design have already been delivered by Krasnoye Sormovo to the Azerbaijan State Caspian Shipping Company (KASPAR), while the tanker *Makhmud Afandi* has also been delivered to Safinat An-Najaat Shipping Company Ltd. Three more of these tankers are now under construction at the Krasnoye Sormovo Yard for Palmali Group.

Krasnoye Sormovo Shipyard has also recently built three 5600tonne tankers for Pietro Barbaro S A (Italy), in the shape of *Elektra*, *Klimena*, and *Maya*. These 141m long, 16.9m wide by 6.1m deep ships draw a draught of 3.7m and operate at 10knots. They are designed for inland waterways, and sea operations in non-Arctic regions. In April of this year, the shipbuilder signed a contract with the same customer covering a fourth ship in the series, with delivery due by May, 2008.

MNP Group said its Volgo-Caspian Design Bureau had been steadily extending the range of tanker designs it offered, to take in larger sizes. It had already developed several outline projects for tankers of 18,000dwt, 26,000dwt, and even 60,000dwt for Caspian Sea operations, which could be built by adopting welding afloat methods in the Caspian.

'Our specialists have got the necessary experience of connecting and welding afloat of large-size complexes,' the Group said. 'In 2006 we delivered a construction barge of 141m length and 42.6m breadth to Saipem SA. The barge is being successfully operated in the north of Caspian Sea for the construction and development of Kashagan field.'

The 19619 design *Babek*, from Volgo-Caspian Design Bureau, built at Krasnoye Sormovo - 13,450dwt vessel that is the largest river-sea tanker built for the Caspian Sea to date.



70 designers populate Volgo-Caspian Design Bureau.

In September 2005, five dry cargo ships to the RSD17 project design were ordered by Palmali Group from Krasnoye Sormovo Shipyard. At 6270dwt, these 121.7m long ships are for areas of restricted navigation, to transport all types of general cargoes, including 9ft, hi-cube ISO containers, metal, grain, lumber, coal, bulky, and heavy cargoes. At 16.7m wide and 6.20m deep, and featuring a draught of 5.06m, the ships have three cargo holds of total capacity 9370m^3, while ballast tank capacity is given as 3120m^3, and each ship can accommodate 234 containers. The vessels are designed to operate at 11.5knots.

Keels for all of the first five vessels to this design were laid in 2005, with the lead ship, *Mirzaga Khalilov*, handed over to the customer in November, 2006. The second vessel - *Ismayl Shikhly* - was delivered at the end of April, 2007, *Shirvan* - the third - joining in May, 2007 and the fourth - *Riad Ahmedov* - being accepted in June, 2007. This project has been designed by Maritime Engineering Bureau (MEB), to class KM*ЛУ2 I A1 from the Russian Maritime Register of Shipping. Detailed workshop documentation was worked out by Volgo-Caspian Design Bureau.

In December, 2006, lead dry-cargo ship *Mirzaga Khalilov* was also certified by RS as conforming to its 'ECO' standard, introduced in 2006 as its class symbol indicating the highest environmental safety standards. The RSD17 design thus becomes the first vessel with the ECO symbol built in Russia.

February 2007 saw Palmali returning to Krasnoye Sormovo Shipyard, this time to sign a contract covering the construction of 10 x RST22 chemical tankers, of 6900dwt. Here, the preliminary delivery date for five of the tankers is year 2008, with the other five due in 2009.

In this case, the maximum length of the vessel is 139.95m, with breadth at 16.60m, depth at 6.0m, and draught given as 4.60m. With a cargo tank capacity of 7800m^3, the ship's main engine power is 2x1200kW, and its speed 10.5knots. It has been classed by RS as a KM*ЛУ1 II A1 tanker.

The design was worked out by MEB, with detailed workshop documentation again coming from Volgo-Caspian Design Bureau.

Build up at Volgograd

Volgograd Shipyard reckons to have built over one thousand of tankers, trawlers, crane ships, oil skimmers, hulls of dry-cargo ships and chemical tankers, diving depot ships, and floating pumping stations in its 75 years of history.

Here too, Palmali Shipping has been an active customer of late. In October, 2006, Volgograd Shipyard completed a series of seven dry-cargo vessels for the owner, designed for domestic sea-and-river-going dry-cargo operations to transport bulk, timber, and grain cargoes as well as standard containers and hazardous cargoes.

The 6970dwt ships are 140m long, 16.5m wide, and 6m deep, and feature 11,400m^3 of cargo tank capacity, operating at 10.5knots. They are distinguished by two 'all-round' rudder-propellers, which enable the ships to move in any direction and turn on their own length.

The vessels are intended for year-round navigation in ice-free seas, in broken open ice (small floes) of non-Arctic seas (running voyage in broken open ice - small floes - of 0.40m thick at speed of 5knots; or following an icebreaker in an

ice lane in the floe-ice of 0.35m thick at a speed of 3knots). The ship was designed by MEB to the RS's KM ЛУ1 1 II A1 class.

In August, 2006, Volgograd Shipyard and Beaufort Shipping Ltd (Malta) also concluded a contract for construction of dry-cargo ship project 006RSD05.

The order came after a busy period for the yard, after it signed contracts with Irinvestship Ltd in August, 2005 covering the construction of four river-sea-going dry-cargo ships (project RSD19). In this case, the lead ship was launched in November, 2006, the second laid down in June, 2006, the third in October, and the fourth in December, 2006. All four vessels have now been handed over to the customer.

These 140m long ships are 16.70m wide and 6m deep and their sea/river deadweight is given as 6750tonnes/4343tonnes, with cargo capacity (sea/river) given as 6325tonnes/4100tonnes. The multi-purpose dry cargo ship is at the maximum for Volga-Don route operations and is fitted with four cargo tanks of total capacity 10,800m^3. Sea endurance is 4000miles, while laden speed is 10.5knots, the crew is 13/16 people.

MNP Group said it was now engaged in construction of chemical tanker project MNP 4450, ordered by Svithoid Tankers AB (Sweden). The lead tanker project MNP 4450 was laid down in October, 2006. Here the design of the tanker was worked out by Volgo-Caspian Design Bureau for class +100A5 E2 ESP NAV-O RSD ERS BWM Chemical Tanker (Type 2)/Oil Tanker Environmental Passport; + MC E2 AUT INERT of Germanischer Lloyd (GL).

***Elektra*, one of three 5600dwt tankers built for Pietro Barbaro S A (Italy).**

The tanker is intended for crude oil, oil products, vegetable and tallow oil, and chemical cargo transport. It is of the IMO Type 2, with maximum density of cargoes to be transported 1.5tonne per m^3 at preheated temperatures of up to +65 °C. Up to seven types of cargo can be carried in any one voyage.

This is a 4500dwt, all-welded, self-propelled, single-screw tanker with controllable-pitch propeller, one continuous deck, and a closed vented longitudinal trunk (cat walk) from fore part to the aft. Its basic characteristics are 91.9m length, 16.0m breadth, 7.8m depth, and 5.75m draught. The capacity of cargo tanks is given as 5150tonnes, while sea endurance is 20 days, and speed at 85%. SPP power is given as 11.5knots at loaded draught 5.75m, and 12.5knots at ballast draught 4.05m.

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Krylov Institute breaks the ice

AS Russia stakes new claims to Arctic waters, what are the criteria for the future of ice-breaking ships?*

IN 2000, Varandey offshore terminal in the Pechora Sea started to export oil on a year-round basis. Meanwhile, the Prirazlomnoye ice-resistant platform is in the final stage of construction. In the years to come, the volume of oil shipment from Varandey oil field will reach 5m–6m tonnes a year, while the Prirazlomnoye field it is expected to export 6m tonnes annually.

Active developments are underway to secure production and transport of gas and gas condensate from Shtokman field in the Barents Sea, as well as from Yamal peninsula and Ob-Yenisei region.

The nuclear icebreaking fleet is the basis of the Russian Federation's national safety in the Arctic and it is playing the key role in the provision of all-year-around shipping along the Northern Sea Route. Nuclear icebreakers are federal-owned and their development is financed from the state budget.

The main areas of Russian nuclear fleet development for the near future have been stated in the Russian Federation's Ministry of Transport resolution No 4 of 15 May 2001:

'Powerful nuclear icebreakers of up to 3m icebreaking capability should be the hardcore of the Arctic icebreaking fleet to provide for secure navigation in the Western area of Arctic.'

These main requirements should be implemented during the design of a new general-purpose nuclear icebreaker. The new generation icebreaker is presently under preliminary design conducted by the leading Russian companies headed by JSC 'Iceberg'.

The Krylov Shipbuilding Research Institute is participating in preliminary design. First of all, these relate to development of the optimised hullform to ensure unique icebreaking capabilities never achieved before by any other icebreaker in the world.

The Institute is also studying issues like determination of propulsion and manoeuvering qualities of the ship under various ice conditions and in open water, including critical shallow waters, seaworthiness, and structural strength of the hull structures, including the reactor compartment and other important problems of nuclear safety and electric power.

Along with unprecedented requirements to icebreaking capability, the first priority is given to achieving a non-traditional requirement – provision of icebreaker operations in essentially different service conditions including very wide variations of water depth and hence changes in the ship's draught. During the design process, one has to increase the quantity of ballast water artificially. During operation in shallow water it will be necessary to pump ballast water overboard, to ensure the value of the icebreaker's minimum draught.

Depth limitation defines the hullform, especially in the cases of the aft, the ship's draught, the level of efficiently absorbed power, and the characteristics of propulsion system.

Therefore, the basic task of preliminary design for the universal icebreaker is to identify technical solutions that would enable minimum losses in service qualities through changes from one draught to another.

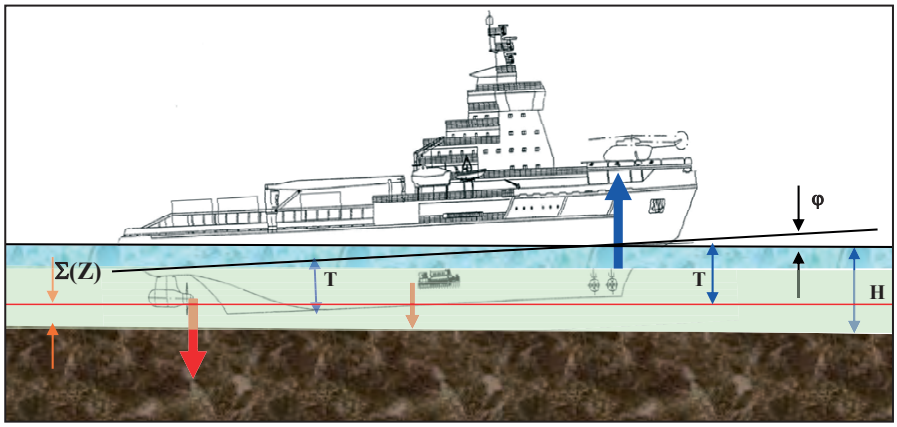


Fig 1. Allowable ship draught in shallow-water.

Ice conditions on the assumed routes of the icebreaker operating in the Arctic are very much different from ice conditions in the inland freezing seas, not only due to considerably thicker ice but also due to a greater variety of ice formations. The thickness of flat ice in the Kara Sea can reach 2.0m-2.5m. When the ice conditions are tough, the maximum ice thickness on the Yenisei by the end of winter reaches 2.3m. Under the same conditions, the fast ice thickness in Ob Bay may reach 2.6m.

It should be noted that ship traffic in the Western Arctic regions is affected by frequent ice nips and snow cover. The stated ice parameters are taken as a basis for icebreaking capability specified for the new general-purpose nuclear icebreaker. The design basis specifies ice 'trafficability' of a general-purpose icebreaker for ship pilotage in the Western Arctic regions as 2.8m-2.9m.

The basic requirements for the new generation nuclear icebreaker are:

- reduction of resistance in ice through hullform optimisation and achievement of high icebreaking capability - at least 2.9m
- change from deep to shallow draught for icebreaking operations in shallow waters, ensuring escort of ships to the port of Dudinka on the Yenisei river and extension of icebreaker operational range on the Arctic shelf including Ob Bay
- escort of advanced ships, primarily supertankers and LNG carriers, within time-limited navigation periods
- maximum efficiency of powerplant horsepower utilisation to achieve the highest thrust of propeller system under severe ice conditions typical for prospective areas of ship operation
- enhanced manoeuvrability and astern operation capability in ice conditions
- appropriate seaworthiness.

The above requirements should be satisfied by a 60MW general-purpose nuclear icebreaker designed to carry out icebreaking operations in the western sector of the Arctic in the winter season, including escort in shallow parts of the Yenisei and Ob rivers, as well as escort of ships on all required routes including the entire Northern Sea Route in summer season.

The powerplant output itself does not determine the ship's icebreaking capacity. It is known that, with an increase of ice thickness, it is necessary to expend greater power to achieve higher icebreaking capacity.

The analysis of the 'power-icebreaking capacity' relationship indicates that, over the period of development from Yermak to Arktika, the icebreaking capacity of icebreakers has increased only by a factor of 2.1-2.5, while power has increased by a factor of 7.5 times.

It is apparent that a simple increase in the power output is not the only way to achieve greater icebreaking capacity of icebreakers, especially in the specific operating conditions of the Arctic. The level of power should be determined by the optimised hullform, ensuring minimum resistance and sufficient space for required onboard equipment; the performance of advanced nuclear power plants, as well as efficient absorption of power by propellers for conversion into propeller thrust.

Design measures should be incorporated to avoid hull or propeller damage in case of their direct contact with ground in limiting shallow waters.

Optimised hullform

It is known that an increase in power with the same hullform gives a relatively small increase in icebreaking capacity. Therefore, it is a very challenging task to obtain the specified maximum icebreaking capacity of 60MW power delivered at the propellers.

The task was complicated further by the additional requirement for the general-purpose icebreaker to break the ice cover on the Yenisei and Ob rivers, reaching 2.3m in thickness with water depth limit of 11m.

The Krylov Institute has used in-house computational techniques to estimate resistance in ice as well as experimental studies on icebreaker models. The proposed hullform is different from traditional icebreaker hull lines because the new ship has to operate at two draughts imposing specific optimisation constraints.

The Krylov Institute has also developed and tested at laboratory scale, additional systems for enhancement of icebreaking capacity, namely the air and water lubrication systems.

The following principal particulars of the icebreaker were assumed as base data for investigations:

- design waterline length L = 160m
- design waterline breadth B = 32-33m
- design waterline draught T_1 = 10.5m
- shallow water draught T_2 = 8.5m.

In the preliminary design it is of principal importance to estimate the level of power efficiently absorbed by the propeller system from the output delivered by the power plant at the specified draught variations of the general-purpose nuclear icebreaker. The thrust of the propeller system is also characterised as icebreaking performance of an icebreaker.

With more power delivered to the propellers there is a higher risk of propeller blade cavitation and aeration. Considering that the level of power delivered to propellers of the general-purpose nuclear icebreaker is increased to Pe = 60MW and the deepwater draught is reduced from T=11.0m to T=10.5m, the second stage cavitation of heavily loaded propellers and thrust breakdown is a realistic threat.

Cavitation is a well-known phenomenon and it was taken into consideration in the development of the nuclear icebreakers of the previous generation. However, for the general-purpose icebreaker designed to operate not only at a deepwater draught of T = 10.5m, but also at a shallow-water draught of T = 8.5m, the cavitation problem is a more challenging issue. The point is that it is not possible to reduce propeller loads by increasing propeller diameter, because propellers of large diameter cannot be used at such a shallow draught of T = 8.5m.

At this draught, in addition to cavitation, there is a risk of surface air penetration (aeration) to propeller blades operating at such a low depth of immersion. For sea-going icebreakers this is a new phenomenon. It should be noted that heavy hydrodynamic loads on propellers due to a large amount of absorbed power and shallow immersion of propellers results in combined cavitation and aeration effects, ie aeration, gives rise to more intensive cavitation of propeller blades and propeller thrust breakdown may occur earlier.

As yet, no reliable data are available on how the power and immersion of propellers influence the combined cavitation and aeration processes, even in the case of isolated propellers. Needless to say, there is no further information as to how these processes may affect real propellers operating in an icebreaker's multi-shaft propulsion system. Therefore, at the preliminary design stage, it was decided to conduct integrated propeller model tests and self-propulsion model tests of a multi-shaft icebreaker under bollard pull and conditions close to bollard pull at different depths of the propeller axis immersion, corresponding to realistic draughts of the icebreaker both in deep and shallow waters.

The tests were conducted in three phases:

- studies to investigate hydrodynamic characteristics of isolated propellers at various depths of immersion under the free surface at different water depths
- studies to investigate the influence of modelled hull on side propellers
- studies to investigate the three-shaft propeller system of a self-propelled icebreaker model under bollard pull and conditions close to bollard pull.

Analysis of test data obtained for the propulsion system of the general-purpose nuclear icebreaker during the vacuum tank tests under bollard pull and slow speed conditions in deep and shallow water has revealed the main specific features and physical factors that influence the efficiency of power absorption by ship propellers.

The data obtained were used to estimate the maximum possible level of power absorbed by propellers at deepwater draught as well as at shallow-water draught and to find the achievable propeller thrust. These characteristics govern icebreaking performance of the ship in heavy ice in deepwater and limiting shallow-water conditions.

To reduce the risk of propeller aeration, the general-purpose icebreaker has been designed with a specially shaped stern, preventing aeration of the side propellers. Specific draught values have to be determined, taking into account all possible increments in stern draught which may happen during operation in shallow-water areas along prospective navigation routes of the general-purpose icebreaker.

In shallow water, apart from significantly greater hydrodynamic resistance than in deepwater, the ship has a different running attitude with a deeper middle draught and a different trim.

The ship attitude in shallow water is rather different from deepwater conditions, and at certain speeds and low water depth under keel, the ship may touch the ground.

For this reason, in navigation practice there is a so-called transit draught (Fig 1).

The Krylov Institute shallow-water model tank with adjustable water depth was used to conduct shallow-water model tests at ship draught T2 = 8.5 m and water depth H=11 m (full scale).

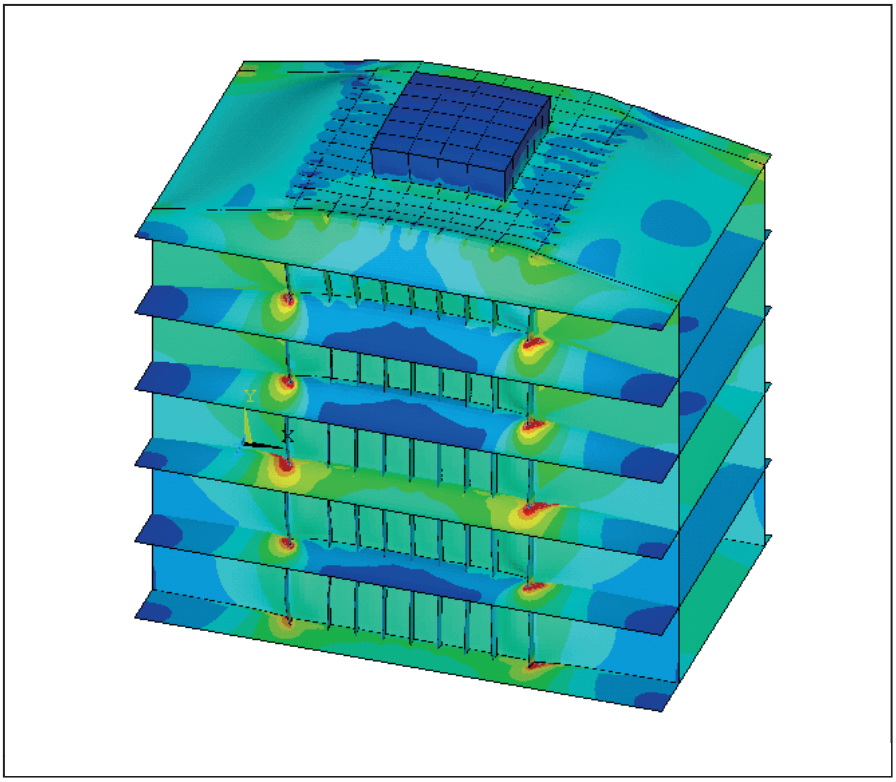
The choice of optimum hull form is constrained by the requirement to reduce the ship slamming in rough seas typical of the Barents Sea. It is known that in the case of icebreaker hullform, in particular, bow shapes are far from optimum for sailing in a seaway. Naturally, seaworthiness requirements are more relaxed than for conventional merchant vessels not designed for operation in ice-covered waters. However, the negative operation experience with icebreakers having a spoon-like bow (icebreaker *Captain Nikolaev*) and a sledge-like bow (icebreaker *Captain Sorokin*) has indicated that absolute negligence of seaworthiness aspects in an effort to achieve record icebreaking capacity in level ice is not a viable approach to design modern Arctic icebreakers.

For this reason, in the design of hullform options for the general-purpose icebreaker, the Krylov Institute has taken measures to reduce the risk of heavy slamming and enhance icebreaker seaworthiness in rough seas.

In the case of the two-draught icebreaker, some unconventional ice interaction scenarios have to be considered, in particular, grounding on stamukha. Stamukha is an ice formation whose tip stands out from the water while the base reaches the bed. Ice strength evaluations should take into account not only the stamukha tip broken by the icebreaker bow, but also the interaction with an ice floe which comes under the icebreaker bottom in shallow water and gets compressed between the ground and the ship bottom.

Since the nuclear powerplant presents a high environmental risk, there is also a need to assess the strength of hull structures in way of the

Fig 2. Results of FEM analysis of reactor shield.



The Royal Institution of Naval Architects

THE MODERN YACHT

17-18 October 2007, Southampton, UK

Second Notice

In October 2007, RINA will be holding an international conference on The Modern Yacht, to provide a forum for the presentation and discussion of all aspects of modern yacht design, construction, operation and survey.

The conference will address all aspects of yacht design including; performance, stability, seakeeping, construction and safety, as well as survey, operation and service experience; applying to sailing yachts, both high performance and cruising and to motor yachts, in private or charter service.

The conference is to present and discuss advances in technology; methods and concepts that have led to or are expected to lead to improvements in design, operation or survey; service experience, problems encountered and their solutions. How classification society requirements and flag Administration regulations are meeting industry needs.

RINA invites papers on any of the following subjects:

- Performance, stability, seakeeping, hull motions
- Structural design, hull, keels, rudders
- Materials technology
- Fire safety and structural fire protection
- Windows, portlights, anchors and anchoring
- Masts and rigging
- Classification society Rules, flag Administration regulations
- Survey, NDT methods for FRP hulls
- Operation in general and helicopter operations
- Service experience

The conference will attract a large international audience and provide a forum and means of professional development for all parties interested in the design, construction, operation and survey of yachts.

☐ I wish to receive details on exhibition space and sponsorship opportunities

☐ I would like to receive a full programme brochure and registration form

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by fax on +44 (0)20 7259 5912 or by email: conference@rina.org.uk

The Royal Institution of Naval Architects

Marine Heavy Transport & Lift II

27-28 February 2008, RINA HQ, London

First Notice & Call for Papers

The marine heavy transport and lift sector is enjoying a buoyant and growing market due to the recent boom in offshore oil & gas and large project cargo work. Current oil & gas prices have led to an increase in the number of offshore project requiring transportation, installation or removal of a wide range of structures and modules. The project cargo transport market has been growing by 8-10% per year, particularly power generation and refineries work in US, South America, Africa, India, Pakistan and China.

As the structures and cargo become bigger and heavier and destinations seemingly more difficult to access the market is looking for more and better equipped vessels. There are also increasing safety and greater environmental concerns for all aspects of marine operations. Currently, there are about 450 heavy lift ships worldwide but of these about 40% are older than 25 years. The new generation of heavy lift vessels designs are responding to the demand for higher lifting capacity and larger outreach. There are also an increasing number of new designs concepts aimed at servicing this increasing demand in the marine heavy transport and lift industry.

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

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

☐ I would like to offer a paper and attach a synopsis of no more than 250 words by 19 October 2007

☐ I wish to receive details on exhibition space and sponsorship opportunities

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reactor compartment under accidental loads. In this connection the following tasks have to be addressed:

- verification of structural strength in case of grounding (design scenarios of 'drying' on bank and contact between submerged boulder and ship's bottom in waves)
- verification of anti-collision protection of nuclear powerplant in case of emergency collision
- strength verification of nuclear powerplant shielding in design and off-design accidents
- implications of helicopter crash on icebreaker deck
- description of deck/bulkhead damage by hydrostatic pressure in case of emergency flooding of icebreaker
- evaluation of structural damage to hull from impact on ground in case of emergency flooding of icebreaker.

For each of the above emergency situations it is required to define specific design scenarios, including description of emergency situation, basic hypotheses and assumptions, governing parameter of the accident and its specified value, characteristics of objects involved in the accident, specification of dangerous state, and formulation of the ship strength criteria for emergency situations. It should be noted that in a number of cases, some problems arising already in the process of design scenario formulation call for special-purpose investigations.

For instance, considering that in the near future the Northern Sea Route will be navigated by large-size Arctic tankers and LNG carriers shipping hydrocarbons from the Arctic shelf and Russian coast, there is a need to examine potential accidents with an icebreaker rammed by a large-size ship with an icebreaker-type stem. In this case, a larger stem angle would reduce the number of deformed structures and, therefore, anti-collision protection capacity to absorb the deformation energy, while the mass of such a large ship is significantly greater as compared to traditional ships.

As these factors are combined in their effect, the allowable ramming speed of ship with respect to the icebreaker (it is also referred to as 'safe speed') is noticeably reduced.

For strength verification of the nuclear powerplant shield in case of design and off-design accidents, it is required to use state-of-the-art FEM software packages to adequately cover such specific aspects as combined effect of internal pressure and temperature fields; interaction of the protective shield with adjacent support structures (longitudinal and transverse bulkheads as well as decks and platforms); three-dimensional structures with specific design features. Based on the FEM analysis (Fig 2) the most efficient fastening arrangement for fixing the shield in the reactor compartment was chosen.

*An edited version of the paper 'Challenges in development of general-purpose nuclear icebreaker of the new generation', given to Arctic Shipping, St Petersburg, April 2007, by V A Belyashov – chief designer, Krylov Shipbuilding Research Institute, V M Vorobyov - chief designer, CDB Iceberg, O P Orlov – deputy director, Krylov Shipbuilding Research Institute, Yu A Simonov – ocean engineering project manager, Krylov Shipbuilding Research Institute, A P Tumashik – chief of the laboratory, Krylov Shipbuilding Research Institute, Yu V Shwaryov – deputy director general, Board of Directors of the State Customer, Ye M Appolonov – division head deputy, Krylov Shipbuilding Research Institute

Dual options for Russian Register

THE Russian class society develops dual class offerings to satisfy demands in ice bound waters.

AS demand for ice class tonnage forges ahead, dual class arrangements are providing shipowners and yards alike with the opportunity to utilise the long experience of the Russian Maritime Register of Shipping in the building of ships for harsh environments.

RS is ideally placed to benefit from the boom in demand for ice class tonnage able to move through Arctic waters. With over 100 years of experience in the research and development of structures for such conditions, and taking into account the construction of the specialised nuclear-powered icebreaker fleet that stretches back to the 1959 delivery of *Lenin*, the class body sees itself as the natural partner for those looking to exploit oil and gas opportunities in Arctic waters.

'Our class rules for nuclear icebreakers extend back almost 50 years,' said RS senior vice-director general Sergey S Koshchy, 'but *Lenin* was only the first generation of ships and nowadays third generation vessels are in operation. This year saw delivery of the first of the fourth generation. It goes without saying that we have had to update and upgrade our rules. Where the third generation can go through very thick ice in northern waters, the fourth generation has been designed for increased speed to facilitate the passage of other vessels – not for one or two vessels, but for a whole convoy. When an icebreaker makes way for the convoy to follow, the problem does not lie with the icebreaker but with the safety of the following ships.'

Mr Koshchy said that RS was working together with other leading classification societies towards the modernisation of the fleet operating in Arctic waters.

Sergey Koshchy, senior vice-director RS: the task nowadays is not only one of making way, but one of speeding up operations.

'The development of the [IACS] rules on Polar Class vessels is only one direction of the cooperation between class societies. A more sophisticated task is the direct cooperation between class societies to construct vessels that will operate in severe conditions through the dual class process. Currently, we have signed agreements covering technical processes with ABS, DNV, LR, and GL. In making these agreements, we secured the opportunity of combining knowledge and resources, so that we could offer shipbuilders updated rules covering ships operating in Arctic waters, and also deliver surveys at all stages of the design, materials, and manufacturing processes all over the world.

'The principal difference of the dual class concept is that the customer works with the class societies as if they were one society. The shipowner and the shipbuilder work as if with one society, but can draw on the expertise of both. The joint efforts and resources of class societies offered in this way lead to a reduction in costs for the customer.'

Mr Koshchy said that RS's dual class agreements currently included three tankers being built in dual class with ABS to LU6 specifications. Also known to be in dual class, in this case with LR, are two double acting tankers under construction for Sovcomflot at the Admiralty Shipyard. Ships in dual RS/DNV and RS/GL class are already being successfully operated.

The IACS harmonised Polar Rules on ice class ships offered a starting point, but individual class societies were working together on a bilateral basis to bring technical issues and procedures into line. 'We are pooling our experience and learning from each other,' he said. 'We are progressively developing special agreements on training to harmonise the knowledge levels of our personnel on a bilateral basis.

'There has been a great deal of mutual work to develop Polar Rules among all of the IACS members, but each society has been allowed to incorporate their own view within the process, and individual societies can differ with others as part of the continuing discussion. The [RS ice class] regulations covering LU7, LU8 and LU9, for example, are very strict and they add to the service offered to shipowners operating in severe climates. An important point is that we are all addressing the challenges of enhancing the standards of safety and security at sea.'

The Royal Institution of Naval Architects

Performance Standards for Ballast Tank Coatings

Seminar by Mr J Hinchley and Dr R Kattan, Safinah

ShipRepair & Conversion 2007 LONDON

10th October 2007

Safinah

being held in conjunction with ShipRepair & Conversion 2007, National Hall, Olympia, London

The new IMO PSPC poses real challenges for Shipyards, owners and classification societies and Maritime Administrations. The requirements raise issues such as:

- What does the paint specification defined mean for shipyards?
- What should the contents of the Coating Technical file be?
- What should owners expect to get on delivery of the ship?
- Who should be the certified inspector?
- What will be the role of Class?
- What are the owners responsibilities through life of the vessel?
- What will the Maritime Administrations need to do to audit the process.

All these challenges are real as there is a shortage of skilled people to meet these needs. The course sets out to make the delegates familiar with the standard and offer solutions to some of these problems and highlight issues that the end-user - whoever they may be are likely to face.

The seminar is practical and uses a non-technical approach to address these problems and so the delegates do not need much of a coatings background. The sessions allow for plenty of time for Q&A and discussion amongst delegates to compare experiences.

Established in 1998, Safinah is a unique consultancy employing naval architects, coatings experts and chemists, which provide it with a comprehensive understanding of all aspects of coatings in the marine and offshore industries.

To register, simply complete all sections of this form and return it with your payment to:

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Payment must be made in pounds sterling by Eurocheques, cheque drawn on a bank with a UK branch address, credit card (VISA/AMEX/Mastercard) or bank transfer. Please note RINA requires payment ***before*** the seminar date.
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The following charges will be made in the event of a cancellation: £60 if received before 10th September 2007. Cancellations made anytime after that date will not be refunded. Delegates may be substituted in writing subject to the consent of the Conference Organiser.

Registration fee: RINA Members: £300+VAT (Total £352.50) Non Members: £350+VAT (£411.25)

Samsung ups software usage

THE application of a solutions suite for the design and manufacturing of ships has been extended by Samsung Heavy Industries (SHI), in what constitutes a new multi-million dollar investment in Intergraph's Marine Enterprise software.

Intergraph's IntelliShip Foundation is due to act as a central information management system for engineering and manufacturing data at SHI. The aim of extending the company's commitment to the Marine Enterprise suite is to gain a 10% productivity increase in design data, which may positively affect manufacturing and fabrication processes as well.

Intergraph claims its engineering and information management solutions for the marine industry are the first completely new software technology for this market in more than 15 years, and believes SHI's expanded commitment validates the industry's acceptance of its technology.

Contact: Intergraph Corporation, 170 Graphics Drive, Madison, AL 35758, USA. Tel: +1 256 730 2000. Fax: +1 256 730 2048. www.intergraph.com

New propulsion from RR

MORE details have emerged regarding the new controllable pitch propellers developed by Rolls-Royce (see p37). The Kamewa CP-A design is based on the existing XF-5 model and is claimed to improve power to weight ratio by about 20%, without compromising its strength, yet comprising greater wearing surfaces for the blade bearings.

The pitch of the blades is set by a hydraulic piston connected to a crosshead in the hub, which carries slide blocks riding on pins in the blade feet. Actuating oil is fed along twin tubes through the hollow-bored propeller shaft. A feedback mechanism ensures that the ordered pitch blade is achieved, and the system gives full control of propeller pitch, providing ahead, neutral, and astern thrust steplessly.

An associated low pressure oil system lubricates the hub mechanism and the bearing surfaces at the root of the blades. Seals at each blade foot prevent oil leakage and sea water penetration, and the hub is maintained at a slight over-pressure.

Propeller hub cut through of Rolls-Royce's Kamewa CP-A.

The Kamewa CP's blade root has been modified, in order to give slightly more space between blades, which is said to increase efficiency by about 1.5%. It is available in two versions; the CP-A standard for vessels up to 30knots and the CP-A/H for faster vessels.

The hydraulic system has also been updated, including a new power pack with load sensing hydraulic pumps to reduce the amount of power required to operate the system, and the amount of oil in circulation has also been reduced.

Another Rolls-Royce propulsion system was also recently introduced. Promas is an integrated bulb, propeller hubcap, and twisted rudder system, which, when integrated at the stern, is claimed to improve a vessel's efficiency, requiring less power and therefore reducing emissions.

The slipstream from the 5.2m diameter Kamewa CP propeller flows on to the leading edge of the rudder, which is twisted so that some of the swirl energy in the propeller wash is converted to useful forward thrust. A bulb is incorporated in the rudder, and a hubcap is attached to the propeller.

A £17 million order has already been placed for four shipsets to be installed on a series of four 33,500dwt bulk carriers to be built by Nantong Mingde shipyard, China, for shipowners Kristian Jebsen. The equipment will be supplied to the yard at the beginning of 2008.

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AVEVA designs for life

A PORTFOLIO of integrated design and production products has been introduced, combined with life cycle management solutions. AVEVA has launched AVEVA Marine with the aim of delivering efficiency for design development in shipbuilding.

The suite covers all design disciplines, and features include a set of life cycle management capabilities that is said to enable all work processes and information networks to be integrated and managed; data management in the ship model database; improved modelling, with full 3D interface; structural design capabilities which allow the creation of the structural model for classification documents; Microsoft .NET-based graphical user interface, and customisation tools using the .NET technology.

The new products within AVEVA Marine are fully compatible with previous releases, and this product will be available for distribution in the fourth quarter of 2007.

Contact: Alison Patey, AVEVA Group plc, High Cross, Madingley Road, Cambridge CB3 0HB, UK. Tel: +44 1223 556653. E-mail: alison.patey@aveva.com www.aveva.com

APC spreads out

MARINE coatings manufacturer Advanced Polymer Coatings Ltd has expanded its facility in Avon, Ohio, USA. The company numbers MarineLine among its product range, a coating specifically for cargo tanks of chemical tankers.

The addition to the company's existing manufacturing operations has more than doubled the previous space, and is intended to allow for the growth needed to meet worldwide demand. Plant capacity is now claimed to have quadrupled.

This year, there are already 121 ships contracted to receive the MarineLine coating, with 101 ships booked in for 2008, and 55 for 2009. Advanced Polymer Coatings believes that the plant expansion has come at the right time for its continuing growth.

Part of its growth is the signing of contracts that will see 64 new chemical tankers coated with MarineLine in Turkey over the next several years. The ships range from 5500dwt to 20,000dwt. The coating has also received the certificate of design assessment from ABS.

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ZF Marine gears up in China

ZF MARINE's new joint venture in China has successfully tested its first transmission at its new factory. ZF Nanjing Marine Propulsion was formed last year by ZF Marine and its partner, the Nanjing Highspeed & Accurate Gear (Group) Co Ltd.

The first product is a ZF W33100 NR with PTO3. It weighs approximately 6tonnes and is designed to transmit 5000hp continuous duty.

The first ZF Nanjing transmission, a ZF W33100 NR.

The new facility comprises a large assembly hall for building and testing gearboxes, and a second hall for assembling controllable pitch propellers. All components are supplied from Nanjing, which receives the propeller blades and hub castings from ZF Faster Propulsion System in Zhuhai, China.

ZF Nanjing hopes to learn from the Chinese culture, combining it with the expertise of its European parent company, ZF Marine, Germany, which is responsible for large transmission

design, and an associated subsidiary ZF Padova, Italy, which is responsible for the commercial craft market segment.

Contact: Peter Herring, ZF Marine marketing, 88038 Friedrichshafen, Germany.
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MacGregor scores big in Asia

SEVERAL contracts for cranes and cargo access equipment have been won by MacGregor Group, with orders coming from China, India, and South Korea. Sweden-based MacGregor now has orders stretching into 2011 and beyond.

Orders placed with MacGregor for 276 GLB-type cranes for bulk carriers total approximately €75 million in value, and this includes orders for 74 cranes to be installed aboard bulk carriers in China and India. The Chinese market is particularly active, with 62 ship orders at five different shipyards.

The deliveries are scheduled to start in early 2008 and will continue until the latter half of 2011. Most of the deliveries will consist of standard GLB-type cranes in the range of 30tonnes to 36tonnes SWL.

Another contract is with Chipolbrok, a joint Chinese/Polish shipping company, for delivery of what are claimed to be the world's biggest twin cargo-handling cranes, with a combined SWL of 150tonnes at 20m, and 90tonnes at 28m. They will feature the CC2000 control system and be able to operate simultaneously when luffing, slewing, and hoisting, in both single as well as twin modes at maximum loading and speed.

The four ships, *Jia Xing*, *Wieniawski*, *Chong Ming*, and *Szymanowski*, will be retrofitted with the twin cranes, starting with the first ship in autumn this year, and due for completion by October 2008. The cranes will be manufactured by MacGregor's partner plant, Nanjing Lüzhou Machine Works in China, and installed and commissioned at a shipyard in the Yangtze Jiang area.

Cargo access contracts have also been won, for 15 vessels to be built at Hyundai Mipo shipyard, Korea. Five ships are 3500-unit deep sea ro-ros for Grimaldi, six are 3500-unit pure car/truck carriers (PCTCs) for Neptun Lines, and four are 3500-unit PCTCs for Vroon BV.

The contracts include the delivery of the design and hardware for the ro-ro equipment, and the design and key components for the hoistable car decks, with an option for the fabrication of the car decks. Equipment is scheduled for delivery between 2008 and 2010.

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Fax: +46 660 29 42 87.
E-mail: kenneth.mellin@macgregor-group.com
www.macgregor-group.com

Hamworthy cargo pump unloading test aboard the FPSO *Stybarrow Venture*.

Hamworthy gets pumped up

HAMWORTHY has snared contracts for four shipsets of deepwell cargo pump systems and two liquid petroleum gas reliquefaction systems, in orders believed to total in excess of £10 million.

Four 49,900dwt product tankers being built at Brodosplit Shipyard in Croatia, on behalf of Concordia Maritime, will be equipped with Hamworthy electric-drive CKL 300 pumps. The shipsets are due for delivery from late 2008 to mid 2009.

The two LPG-RS equipment sets have been ordered by Daewoo Shipbuilding and Marine Engineering Co (DSME), with delivery due for the first six months of 2009. The sets will be installed onboard two very large gas carriers, ordered by Brave Maritime of Greece, which are the last two in a series of 12 ships constructed by DSME. Hamworthy has now received orders for all 12 ships in the series.

Hamworthy in Singapore also recently completed a delivery of 12 cargo pumps to the FPSO *Stybarrow Venture*. All pumps ran simultaneously as part of the commissioning test, and the unloading capacity was tested by seawater through the aft loading hose, pumping nearly 4000m^3/hr.

Contact: Hamworthy Pump Systems AS, Solbraaveien 10, PO Box 53, NO-1371 Asker, Norway.
Tel: +47 815 48600.
Fax: +47 815 48610.
E-mail: pumpinfo@hamworthy.com
www.hamworthy.com

Drillship bags Keppel Sing$150 million

KEPPEL Shipyard Ltd has won a contract for equipment packages to be installed onboard a newbuild drillship worth Sing$150 million. The Singapore yard will supply the equipment, and is expected to complete its work by the fourth quarter of 2009.

The new hull is being built in China, and is designed to operate in deepwater depths of 12,000ft, with DP 2 capabilities fitted.

Keppel's workscope will include installation, integration, and completion of the owner-supplied power generation, as well as thruster and drilling equipment packages.

Contact: Sarah Seah, deputy general manager, Keppel Group Corporate Communications, 1 Harbour Front Avenue, #18-01 Keppel Bay Tower, Singapore 098632. Tel: +65 6413 6420. Fax: +65 6413 6452. E-mail: sarah.seah@kepcorp.com www.kepcorp.com

Complete Wärtsilä for FPSO

A BRAZILIAN well-testing floating production, storage and offloading (FPSO) vessel is to have its entire power, automation, and propulsion system supplied by Wärtsilä Corp. The supplier will provide diesel generating sets, steerable thrusters, and the complete safety system, including topside automation, to the project, initiated by Dynamic Producer Inc.

As part of the contract, Wärtsilä will offer an integrated engineering team which will take care of all engineering related to the delivery of this project, entitled PIPA II. The team will also be involved with the commissioning phase during the conversion of an existing Aframax tanker to the FPSO.

Work is due to conclude in the first part of 2009, and the ship will be deployed offshore in Brazilian waters from 2009 onwards.

Contact: Marit Holmlund-Sund, public relations manager, Wärtsilä Corp, John Stenbergin ranta 2, PO Box 196, FI-00531 Helsinki, Finland. Tel: +358 10 709 1439. Fax: +358 10 709 1425. E-mail: marit.holmlund-sund@wartsila.com www.wartsila.com

Headhunter catches patent

THE USA patent office has awarded a patent for a new method of treating waste water aboard ships. Tidalwave HMX sewage treatment system, designed by Headhunter Inc, Florida, USA, is also claimed to be US Coast Guard certified, and 'IMO approved'.

The units are able to treat up to 189m^3 per day, and provide PLC controlled processing of onboard sewage. The system uses chemical oxidation, hydro-maceration, and cross-flow separation techniques to destroy influent biomass.

An optional electrocatalytic system generates sodium hypochlorite onboard, from seawater or brine, said to eliminate consumables during operation. The four-stage treatment system treats black and grey water, resulting in a sterile effluent for disposal.

The PLC controller allows the treatment technique to be customised after installation, for varying loading conditions, or to meet varying performance standards in different areas. Tidalwave HMX is available in marine grade aluminium or steel construction with a durable, flexible ceramic, epoxy coating for corrosion protection.

Contact: Headhunter, 3380 SW 11th Avenue, Fort Lauderdale, FL 33315, USA. Tel: +1 954 581 6996. Fax: +1 054 587 0403. www.headhunterinc.com

Kelvin Hughes' Danish display

UK-BASED Kelvin Hughes has opened new offices in Copenhagen, Denmark. The producer of display and sensor products said it had established the branch in order to offer a better service to its customers in Scandinavia and the Baltic States.

The company intends to get its products into these markets to help in improving safety and working conditions of the fleets that operate in those areas. The Copenhagen office joins existing facilities in Aarhus, Oslo, and Bergen.

Contact: Barry Morgan, communications manager, Kelvin Hughes Ltd, New North Road, Hainault, Ilford, Essex IG6 2UR, UK. Tel: +44 208 498 1763. Fax: +44 208 559 8892. E-mail: barry.morgan@kelvinhughes.co.uk www.kelvinhughes.co.uk

Noreq Fi-Fi stays cool

NORWEGIAN fire-fighting equipment producer Noreq has won contracts for its portable and containerised units, for installation onboard a pair of the latest Lindenau-built tankers. Noreq is due to supply four portable Fi-Fi I systems, with a 1200m^3/h at 12.5bar pump, for a contract with shipowner Deep Sea Supply ASA. The vessels to be supplied are *Sea Trout* and *Sea Angler*.

Noreq fire-fighting equipment.

Another contract will see the delivery of four containerised FiFi II units, with diesel driven pumps operating at 1800m^3/h in two 40inch containers, for DOF UK. The vessel to be fitted is *Skandi Yare*, which will operate for Petrobras. The outfitting is a tailor made solution, created in close cooperation with the shipowner.

Contact: Kathrine Haugland, office coordinator, Noreq AS, PO Box 144, 5480 Husnes, Norway. Tel: +47 53 46 47 58. Fax: +47 53 46 47 51. www.noreq.no

MAEVIS musters new system

A RECENTLY developed muster and evacuation system, which utilises RFID hardware, is currently undergoing beta testing to be ready for general release in October 2007. MAEVIS, a computer-based programme, aims to quickly and accurately record all passengers present and missing from a muster station aboard a vessel, as well as any passengers present at an incorrect muster station.

Muster station supervisors are immediately notified of passenger information via a handheld PDA, enabling a search for anyone missing to be immediately initiated. The PDAs are configured to work independently of the RFID reader network, and communicate with each other in the event of network failure or loss of AC power.

RFID tags are available in credit card size with a magnetic stripe that could incorporate passengers' cabin access and onboard spending.

Information regarding which exit passengers leave by, or passengers who leave a muster station before the completion of a drill or evacuation, will be recorded and transmitted to a dedicated website. In the event of an evacuation, search and rescue services can be notified of the data, to assist in their situation assessment.

Contact: Richard Leeson, Maevis Ltd. Tel: +44 20 8390 4200. E-mail: sales@maevis.net www.maevis.net

Bruel and Kjaer accelerate test

A SERIES of accelerometers suitable for testing dynamic acceleration effects on marine applications has been launched by Bruel and Kjaer. The low frequency DC Response range measures motion and tilt of objects under constant force, including sea vessels.

The micro electro mechanical systems can withstand mechanical shocks of up to 10,000g, with measurement ranges of 2g, 10g, 30g, 100g, 200g, and 500g. The system has been gas-damped, and is claimed to be resistant to temperatures ranging from -54°C to +121°C.

The accelerometers are claimed to have high linearity and thermal stability, and PULSE conditioning functions. They are available in 36 variants, and are individually calibrated to provide a specified frequency range to suit customer requirements.

Contact: Heather Wilkins, marketing coordinator, Bruel and Kjaer UK Ltd, Bedford House, Rutherford Close, Stevenage SG1 2ND, UK. Tel: +44 1438 739 000. Fax: +44 1438 739 099. E-mail: heather.wilkins@bksv.com www.bksv.co.uk

MARL lights up marine

MARL International has launched a new series of LED panel lamps that are sealed to IP68 for tough, wet, and dirty conditions, suitable to use in marine environments. The Marl 665 series has an 8.5mm mounting indicator, functioning at pressures up to 10psi, and is protected against corrosive fluids such as sea water, as well as against shock and vibration.

Contact: Marl International Ltd, Marl Business Park, Ulverston, Cumbria LA12 9BN, UK. Tel: +44 1229 582430. Fax: +44 1229 585155. E-mail: marketing@marl.co.uk www.marl.co.uk

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Anglo-Eastern (UK) Ltd, The Parks, 107-115 Milton Street, Glasgow, G4 0DN
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Project Managers, preferably with a degree and/or a Combined First Class Certificate of Competency and extensive experience and knowledge of LNG/LPG and Oil Tanker shipbuilding projects. The job involves leading the team responsible for the execution of major marine projects from conceptual design and preparation of outline technical specifications through tender evaluation, design development, plan approval and construction supervision. The successful candidate must have proven Project Management experience and be able to lead their team involved in technical consultancy work, through enquiry evaluation, contracting, delivery and close out of the service requested; working within an ISO 9001:2000 approve management system.

CONTROL SYSTEM ENGINEERS (CSE01)
Control and Instrumentation engineers with a degree or equivalent in control or electronic engineering or in a related discipline. Candidates should preferably have extensive relevant experience gained in the practical application of modern control systems in design and/or operations. Knowledge of systems and software development would be an advantage. The role involves providing specialist knowledge to the development of control systems applications in design and operation and providing input to specifications for newbuild vessels and support when the vessels are in service. There will be opportunities for extended visits to shipyards and equipment suppliers during commissioning and testing of equipment.

PROJECT ENGINEERS (PE01)
Marine engineers, preferably with a degree and/or a Combined First Class Certificate of Competency and extensive LNG and/or Oil Tanker experience in a senior sea-going or shore-based ship management position. The job involves the preparation of outline technical specifications, participation in the evaluation of tenders, design development, plan approval and visits to shipyards and suppliers during construction and commissioning. There may be opportunities for assignments in shipyards in a site managerial role.

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Please either send your application and a covering letter quoting the job code to:

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Shell Centre
2 York Road, London SE1 7NA
Or email STASCOShippingjobs@shell.com

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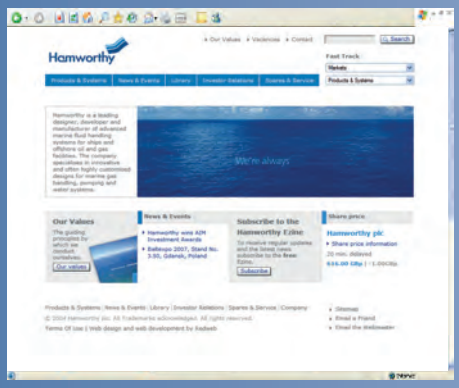

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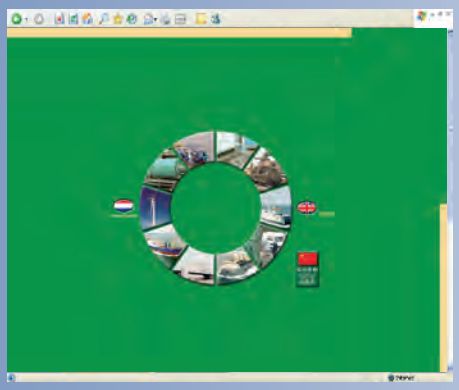

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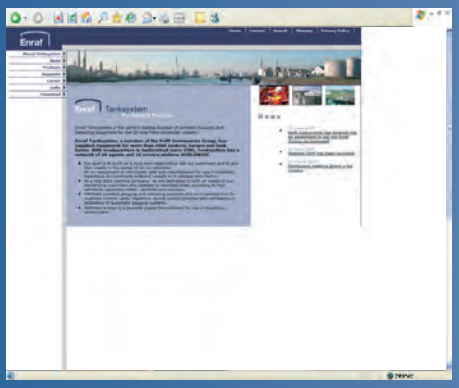

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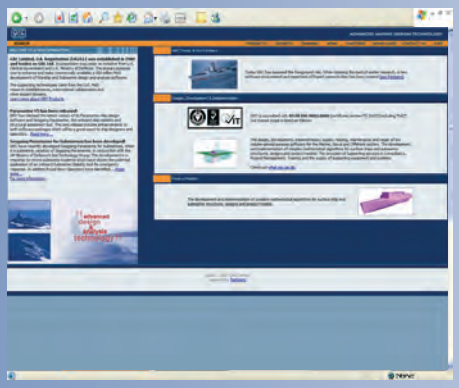

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