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6EY26L	1300 - 1720kW

Model	Generating Capacity
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8N330L	2600 - 3300kW

Generating capacity varies depending on generator efficiency.

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THE NAVAL ARCHITECT

Freedom of the Seas - construction of ever larger cruiseships prompted International Maritime Organization administrations to undertake a full review of the guidelines governing their design in order to meet safety requirements. Results flowed from December's MSC 82.

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Mutual recognition needs collective thinking

URGENT action is needed to heal the rift that has developed between class and equipment suppliers over EU plans for the mutual recognition of class certificates.

Latest soundings from the International Association of Classification Societies suggest a way forward can be found, if a form of words can be arrived at that is acceptable to both sides for inclusion in a revision of the EC's proposed Class Directive 94/57 on the contentious issue.

The EC's Transport Committee will vote on the proposals in February, with a plenary vote in the Parliament due for April, after which the European Council of Ministers will make its pronouncement.

At the turn of the year, IACS pointed to wide-ranging maritime support for its opposition to EU plans to harmonise equipment certificates issued by class. However, hackles were raised at certain of Europe's ship owner associations after IACS cited the International Chamber of Shipping as among those supporting its efforts to head off EU plans for the mutual recognition.

The statement, which also cited support for class from INTERTANKO, INTERCARGO, the Committee for Excellence in Shipbuilding Standards, International Union of Marine Insurance (IUMI) and International Group of P&I Clubs, came after Rapporteur and MEP Luis de Grandes Pascual's report on the Draft Classification Societies Directive revised a key passage. Instead of urging class societies to 'work towards' harmonisation, it instructed 13 classification societies, as European Union Recognised Organisations, to introduce mutual recognition of certificates based on equivalent standards.

EMEC points out that allocation of class society, dictated by the hull work that represents 30% of a ship's value, also governs the 70% of value contributed by ship's equipment

In its opposition to such moves, IACS argued that consistency and the liability chain could only be ensured by continuing the single class society certification approach.

Mutual recognition of certificates would lead to 'dilution and fragmentation of the certification responsibility,' which would lead to 'reduced, not improved, safety of ship construction and operations. This fragmentation of responsibility is a major concern whenever something goes wrong.'

IACS gained public backing from Norway's Central Union of Marine Underwriters in January, which insures 40% of ocean going tonnage. CEFOR managing director Tore Forsmo said: 'The classification of vessels is a systematic and holistic exercise where integration and interfacing of components, structural elements and systems are vital to ensuring the right quality and inherent vessel integrity and safety. I fear that a fragmentation of responsibilities will invariably be detrimental to the work and reputation of classification societies and the shipping community at large. In the end there will be no winners if this motion is carried, and marine insurance will be paying for it all!'

However, Europe's maritime equipment suppliers unequivocally support the EU proposals, in part seeing themselves as the 'cash cow' of the classification societies.

The European Marine Equipment Council argued that the way individual class societies were allocated ship projects on the basis of hull work, which represents 30% of the ship's value, only to then have control over certifying the 70% of value afforded by ships' equipment, represented a 'monopoly' position.

EMEC suggested that the EU proposal 'will guarantee the application of the fundamental principles of the internal market, which represent the core of the EC Treaty, to the marine equipment sector'.

Certification of marine equipment is reckoned to earn class societies €1 billion a year.

Repeating the lengthy and costly certification process ('sometimes up to 10 times for the same piece of equipment', according to EMEC) before a product can be placed on the market generated no added value but siphoned off 5%-6% of the sector's turnover – money that could have been spent on, for example, research and development aimed at enhancing safety.

EMEC added that it recently assessed crank relief valve rules across the main classification societies. It found that, while technical rules were more or less identical, costs for equivalent certification ranged from €300 to €3,000.

The Danish Shipowners' Association has gone on the record as agreeing with its Danish Maritime Equipment counterpart in support of the harmonisation.

Hans Henrik Petersen, the Danish Shipowners' Association's head of nautical department said that, in the real world, the mutual regulation of certification provided the 'backbone' for how ships operate. 'Every IMO member state accepts certificates issued by others. If mutual regulation is not accepted, we see great problems. We fully understand the concerns expressed by IACS that you may get a recognised organisation too low in quality for IACS but that is something that should be solved by some other means – it is to do with being appointed as an RO in the first place.'

The European Community Shipowners' Association and ICS declined to comment further on the issue at time of writing, indicating that this is a live issue.

But, as this issue was going to press, IACS looked to be in more conciliatory mood. According to Lloyd's Register's Robert Smart, who is coordinating the IACS position, class accepts that the indirect costs associated with separate certification is a burden to European industry.

'We believe that 75%-80% of costs associated with certification are indirect costs and we need to look at the process and make it more efficient without compromising safety,' he said. 'By improving the process we can bring down the cost of certification holistically and, in that way more money can be put into R&D by the equipment suppliers.'

CEFOR shares this view, where Mr Forsmo said: 'To have a number of class surveyors running around approving the same items for their societies' individual standards is an unacceptable duplication of work that class will need to deal with on an urgent basis in cooperation with the industry.'

(However) 'What we need now is for class itself to rise to the challenge and meet demands for efficiency rather than a political diktat in the form of new regulations. I believe that class has proved capable of working with legislators in the past and should be given this opportunity now.'

Mr Smart said IACS was willing to set up an expert group in collaboration with EMEC to see what could be done.

Hansen changes hands

WELL known ship design consultant Knud E Hansen, of Denmark, has been bought by private company ML Group after a change in strategy by former owners Semcon.

The new parent, also of Denmark, has paid SKr10 million to take over the consultancy and its 30 employees, which will work alongside ML Group's offshore and marine design business, whose 100 staff have hitherto focused on ship automation systems.

Where Knud E Hansen had formerly been seen as a 'third leg' of Semcon's development strategy after its acquisition as part of the purchase of Permatic by the Swedish group six years ago, Semcon chief executive Henrik Sund said the business no longer fitted into the group's future investment plans, which are now focused on the telecoms and automotive sectors.

ML Group is headed by chief executive Claes Fog Bølge, who has worked on a number of prestigious automation systems projects in the cruise and passenger sector, including participation in the *Queen Mary 2* build. Mr Bølge said: 'Knud E Hansen's sharp focus on innovative design will play an important role in our increased investment in new marine design technology.'

It is understood that ML Group is also on the verge of purchasing another Danish ship automation company, as part of a strategy to grow its marine-related business.

Knud E Hansen, which turned over SKr24.5 million in 2005, welcomed the sale. Managing director Finn Wollesen Petersen said the new parent would be able to offer services that the design consultant had previously had to outsource. Knud E Hansen is currently working on a new design of ro-ro ferry for Stena, as well as drill ship design, a new pipe layer and a windmill maintenance vessel.

***MSC Napoli* grounded east of Sidmouth.**

Napoli cracks unsolved

AS this issue of *The Naval Architect* went to press, the stricken containership *MSC Napoli* (4419 TEU) lay grounded east of Sidmouth, on the UK's south coast, with The Maritime & Coastguard Agency estimating that it could take up to a year to recover.

The 53,409gt ship, built in 1991 by Samsung Heavy Industries, lost power on January 18, in force 8 gales after ingress of water to the engineroom, with the 26 crew airlifted to safety. Once grounded (intentionally), initial efforts focused on pumping out the ship's fuel oil and, subsequently, unloading over 2000 containers still onboard.

Speculation over the cause of cracking to both sides of the ship's hull initially focused on repairs carried out on the ship in March 2001 when, then trading as *CMA CGM Normandie* in Bureau Veritas class, the ship sustained a full-speed grounding in the Malacca Strait, after which 3000 tonnes of steel renewal work was required.

However, *MSC Napoli's* current class body Det Norske Veritas pointed out that the latest cracks were some 100m distant from the repaired section.

Since taking over class in 2002, DNV said it had conducted nine different surveys onboard the vessel, while an intermediate annual class inspection ran from late 2004 until early 2006 that included extended hull compartment tests, pressure tests and ultrasonic thickness inspections. A DNV inspector was aboard the vessel as recently as January 13, 2007, days before the ship left Antwerp.

None of these tests or inspections threw up any concerns, according to DNV.

DNV's own magazine *Container Ship Update* recently recognised fatigue cracking as a problem of which operators of long, narrow containerships should take heed, due to the ship type's inherent flexibility and vulnerability to torsional stresses in a quartering sea or with a swell on the bow.

Fatigue life on some ships operating in harsh conditions was found by the class body to be less than 10 years.

For the record, DNV conceded that it had concerns specific to containership structures but, its inspectors not having boarded the ship, declined to speculate directly on the causes of the cracking of the 275m long, 37.1m wide *MSC Napoli*.

ALERT investigates tanker repairs

A NEW research study is underway to establish the cumulative effect on structural integrity of repairing a tanker throughout its life.

The Assessment of Life-cycle Effect of Repairs on Tankers' (ALERT) research project follows the high profile cases of structural failure witnessed in the cases of the tankers *Erika* and *Prestige*. The report into the loss of the latter by the Bahamas Maritime Authority made a number of recommendations concerning the survey, inspection and repair of tankers. These recommendations are now the basis for a new European Commission funded study.

The two year project will investigate the effect of joining new steel to old steel, the additional stresses put into a ship's structure during a repair and whether fatigue in the structure is affected when part of the structure is replaced. It will also ask how any adverse effects of repairs be detected and minimised.

The study is being undertaken by a consortium of European partners plus the Bahamas Maritime Authority and will be coordinated by Newcastle University, with technical coordination by the University of

PEOPLE

New chief for Lloyd's Register

RICHARD Sadler has been appointed as Lloyd's Register's new chief executive, in line with executive chairman David Moorhouse's long-held intention to relinquish executive responsibility for the Lloyd's Register Group by the end of June 2007.

The appointment will come into effect on July 1, 2007, with transfer of day-to-day operational responsibilities to Mr Sadler beginning immediately. Mr Moorhouse will remain as chairman of the class body.

Mr Sadler, who currently holds the position of director of Lloyd's Register EMEA, first joined Lloyd's Register in 1976, working in the marine, industrial and offshore sectors before moving on to a number of overseas postings. He has a BSc in Naval Architecture and a Post-Graduate Diploma of Welding Technology. He is a Fellow of the Institute of Marine Engineers and a Member of the Royal Institution of Naval Architects.

Richard Sadler, Lloyd's Register's new chief executive

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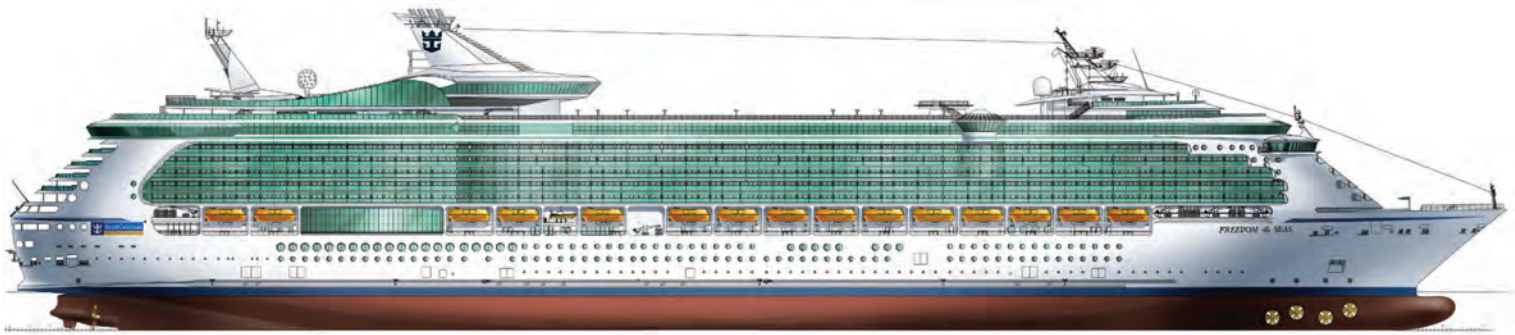

DNV congratulates Royal Caribbean with *Freedom of the Seas.*

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MANAGING RISK

DNV

Strathclyde and includes owners, represented through Intertanko, a classification society and ship repair yard Lisnave Estaleiros Navais.

Key areas of focus will include the means of detecting fatigue cracks and recording the presence of fatigue cracks prior to repairs or renewals, the means of predicting and monitoring rates of corrosion particularly in spaces adjacent to heated cargo tanks, the importance of close-up inspections during surveys and inspections by crew and the requirement for the annual close up examination of a tank that is able to carry ballast water where the tank is uncoated or where the tank coating is in poor condition.

The European Commission is providing €600,000 to fund the study, which is scheduled to finish October 31 2008.

Aker into Asia

AKER Yards has unveiled plans to set up its first Asian outpost, after announcing a new joint venture to establish a yard in Vietnam. The new yard, which will initially target regional demand for offshore vessels will be controlled 70% by Aker and 30% by Singapore-based Amanda Group. It will be located in Vung Tau, in the heart of Vietnam's growing offshore operations.

Aker Yards said it would invest US$16m over a period of three years in the venture, with the first vessels expected to be delivered in 2009. Once full operations are underway, the facility will have an annual capacity of 3-4 vessels, dependent of vessel type and size, with early output likely to focus on anchor handling tugs of between 60tonnes and 140tonnes bollard pull, as well as small to medium sized platform support vessels. Larger vessels may feature later on.

Wärtsilä backs gas scrubbing

WÄRTSILÄ has established a two-year project to develop exhaust gas scrubbing in order to remove sulphur oxides (SOx) from marine diesel engines and oil-fired boilers. It is the first engine manufacturer to become directly involved in investigating the reduction of emissions through gas scrubbing.

The aim of the venture is to analyse the equipment's performance in realistic applications, identify any difficulties, and to design a complete exhaust gas cleaning system. For engines burning typical grades of heavy fuel oil, the effects of scrubber design on performance, lifetime and economy, as well as the effects of scrubbing equipment on installation requirements, discharge water criteria, and ecological impact will be investigated.

Sulphur contents of these oils is usually 1.5% to 2.5%, with no method of designing diesel engines or boilers to reduce SOx emissions. The two options to decrease the emissions are either to burn lower sulphur fuels or treat the existing exhaust gases with a scrubbing system. However, low-sulphur fuel oils can increase bunker costs.

Wärtsilä said exhaust gas scrubbing seemed to offer the most economical solution, balancing investment, bunker, and operational costs. A selection of technical solutions may be required for different demands and applications, geographical areas, and routes. Reduced scrubber efficiency in low alkaline waters could be compensated for, the manufacturer said.

Silicone fouling release for ULCCs

BELGIAN tanker company Euronav has ordered a silicone fouling release system from Hempel, for two ultra-large crude carriers (ULCC). The Hempasil branded coating will be applied to the *TI Asia* and the *TI Europe* in drydocks later this year. The tankers are 380m in length, with a deadweight of more than 440,000dwt.

Traditionally, silicone coatings have only been applied to smaller, high speed craft. However, Hempel's Torben Rasmussen, product manager, group marine marketing, said that, working closely with Euronav, the breakthrough had been accomplished by virtue of ULCCs' fairly swift operating speeds of up to 16knots, which fits the Hempasil product profile.

Mr Rasmussen also claimed that the initial cost expense of silicone fouling release systems was offset by a reduced need for maintenance, enabling a purchaser to break even, compared to coatings using copper leeching, in around two and a half years. He said that the lifetime of the Hempasil system could also be extended, "By blasting back to bare metal and applying a high-quality anticorrosive coating system, the fouling release performance can be brought back to standard and reactivated by applying a fresh layer of topcoat."

Nexus tiecoat technology was claimed to give strong adhesive properties to Hempasil, ensuring a chemical bond between the epoxy anticorrosion layer and the silicone-based topcoat. Reduced drag resulting from the smoother topcoat was said to save fuel as well as decrease the number of biocides released into the sea.

BG opts for dual fuel

WHAT are believed to be the largest liquefied natural gas carriers to be specified with the dual fuel diesel electric propulsion solution have been ordered by BG Group from Samsung Heavy Industries Co, of South Korea. The two newbuild LNG carriers will each have a cargo capacity of 170,000m^3 and are scheduled to be delivered in 2010.

Martin Houston, BG executive vice president and managing director, North America, Caribbean and Global LNG, said the pair would replace chartered ships, and would provide 'increased flexibility in meeting the growing demand by our customers for clean burning natural gas'. Samsung will build, equip, launch and deliver the ships using the GTT Mark III membrane cargo containment system.

Samsung is already building four 145,000m^3 capacity LNG carriers for BG at the Geoje Island Shipyard in South Korea, with deliveries scheduled for 2007 and 2008.

At 170,000m^3 (cargo capacity), the latest order represents a new design for BG, requiring hull modifications over their forerunners. BG said the larger ships would provide flexibility for access into re-gasification terminals around the world.

The deal represents a first break with steam turbine propulsion for BG, in line with market developments. Each ship will be equipped with three 12 cylinder and one six cylinder Wärtsilä 50DF engines, to be delivered direct from Trieste, where the smaller engines will be for use during low load conditions, for example in-port.

The 50DF engine offers thermal efficiency of around 48%, falling to around 43% once losses in the electrical drive propulsion unit are taken into account.

Motia takes type II

VENICE-based tanker operator Motia Compagnia di Navigazione has taken delivery of two state of the art 35,000dwt IMO Type II chemical/product tankers. The vessels, named *Alice* and *Aurora*, were built by Korea's STX Shipbuilding Co and will enter service with the Handytankers pool.

Antonio Zacchello, managing director of Motia, said the new ships were 'visible evidence of our commitment to provide top quality charterers with the safest, cleanest and newest tonnage available. Our $700m newbuilding programme includes nine more product tankers from China, ranging from 38,000dwt up to 74,000dwt, two panamax bulk carriers from Japan and three more aframaxes from China - all due for delivery between 2007 and 2009.' At the end of the newbuilding programme the Zacchello Group will be controlling about 62 ships including a fleet of 16 long-term time chartered ships, in addition to 50% of the ten SynerGas gas carriers.

The 180m LOA vessels have six pairs of coated cargo tanks with a total cargo capacity of 45,000m^3 served by twelve single stage submerged hydraulic self-stripping centrifugal pumps providing a total discharge capability of 2700m^3 with six segregations. The STX MAN B&W 6S50MC-C main engine provides 10,965BHP at 85% MCR to give a service speed of 14.6knots.

***Alice*, one of two state of the art tankers delivered to Motia.**

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The ship promising copper, zinc and gold

A HIGHLY specialised deep sea mining vessel for the Solwara Project in Papua New Guinea offers new opportunities to exploit offshore deposits of hard to reach commodities

NAUTILUS Minerals Inc in Vancouver in Canada has entered into a Heads of Agreement with Jan De Nul in Belgium, one of the world's leading international dredging companies, for the construction of a highly specialised deep sea mining vessel for Nautilus's Solwara Project in Papua New Guinea.

The 191m vessel, to be named *Jules Verne*, will be built at Jan de Nul's expense and chartered by Nautilus Minerals and is expected to be completed in 2009 in order to meet Nautilus's targeted commencement date for mining operations of the end of 2009, which is subject to PNG government approval.

David Heydon, chief executive of Nautilus Minerals, said the agreement with Jan de Nul was a major milestone for the mining project, and noted that Nautilus plans to be the first company in the world to mine deep oceans for copper, gold and zinc. 'Such a move represents the dawn of a new era in mining,' said Mr Heydon, 'the creation of a whole new industry.

'We have seen how the offshore oil and gas industry has evolved since its early days - to the point where society is now reliant on offshore oil/gas to meet its needs. Likewise, seafloor resources may one day be critical for society to meet its future needs for copper and zinc.'

Jan De Nul is committing significant capital to build what will be a highly specialised vessel. *Jules Verne* will be a dynamically positioned ship capable of deploying mining equipment, pumps and riser pipes for the operations at Solwara 1, which lies on the seafloor in up to 1700m of water.

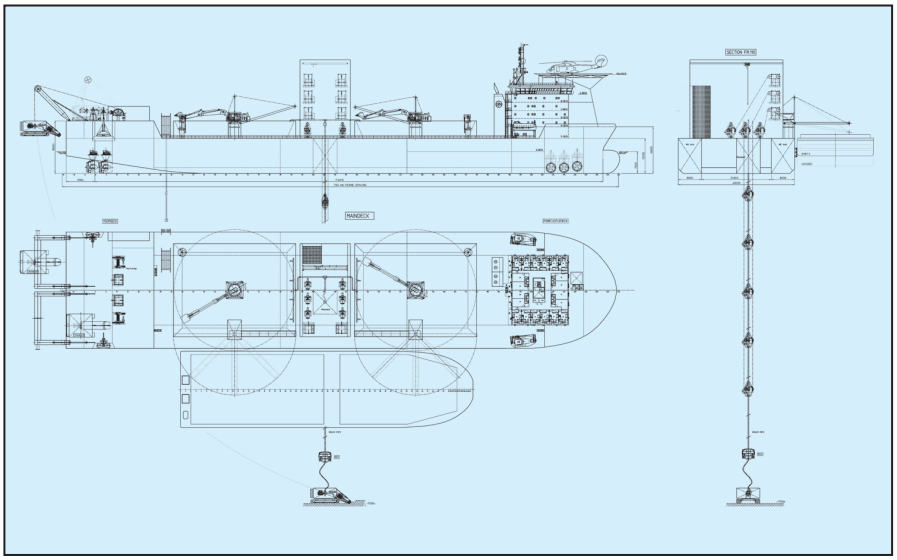
The plan calls for the copper/gold/zinc-bearing material to be dredged from the seafloor and pumped to the mining vessel, where it would be transferred to barges for transport to a land-based concentrator which would produce a gold-rich copper concentrate for dispatch to copper smelters.

Jan De Nul will build, own and operate the mining ship, and will provide barges, tugs and operational capability in its role as mining contractor for the Solwara 1 Project. Nautilus will provide the capital (budget estimate US$120 million) for two sub sea mining systems, power umbilicals, pumps, 1800m riser pipe and related handling equipment. Jan De Nul will reimburse Nautilus over time for this capital by rebating 6.5% of each monthly contract mining invoice, effectively purchasing the equipment from Nautilus.

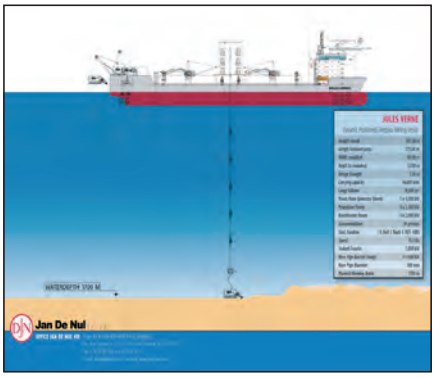
Ore production rates and consequently mining costs will vary due to natural variations in material hardness across the deposit, and the Heads of Agreement anticipates a per ton

TECHNICAL PARTICULARS

Length, oa	191.30m
Length, bp	175.00m
Breadth, moulded	40.00m
Depth of main deck	12.00m
Design draft	7.50m
Hopper capacity	24,000tons
Cargo volume	16,000m^3
Main generators	5 x 4500kW
Propulsion power	4 x 3300kW
Bow thrusters	3 x 200kW
Accommodation	70
Speed	15knots
Seabed crawler	1850kW
Riser pipes booster pumps	5 x 600kW
Riser pipe diameter	300mm



General arrangement drawing *Jules Verne.*



***Jules Verne* will be a be a dynamically positioned ship capable of deploying mining equipment, pumps and riser pipes for operations in up to 1700m of water.**

rate of €58 (US$75) for mining and delivery of the ore to the concentrator, based on an annual production of 1.8 million tons per annum or 6000tons per day allowing for two months annual service and maintenance of the offshore mining spread.

The contract mining costs are fixed at 2009 with a one per cent compounding escalation for 2010 onwards. The fuel price component of the above mining costs is based on an August 2006 price and the terms provide for a variation, both up and down, from this level. It is proposed to formalise a detailed Works Contract by July 1 2007 and the Heads of Agreement contemplates that the term of the Works Contract could be for an initial 8 million tons, renewable thereafter annually at Nautilus's election.

'Having Jan De Nul involved not only removes a major capital item for Nautilus, but importantly provides the operational expertise for the project, avoiding the learning curve and gradual ramp up of the mining rate Nautilus would face if it had chosen to mine itself. It allows Nautilus to concentrate its expertise and capital on discovering and proving up further deposits in the western Pacific,' said Mr Heydon.

Outline engineering of the new vessel is due to be completed in March and a construction contract awarded later this year.

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Super trawler to harvest krill

AN advanced fishing vessel will enable Aker Biomarine to increase the volume of krill it harvests in the Arctic significantly, writes David Foxwell

Aker BioMarine's planned krill harvesting vessel will be among the largest, most technically sophisticated, and expensive fishing vessels ever built.

Towards the end of 2006, Aker BioMarine and Aker Yards in Norway announced that they had agreed an option to build a highly specialised vessel, designed to harvest and process krill for the production of krill oil.

The value of the contract for the vessel, which is due to be delivered in November 2009, is approximately US$170 million (including onboard processing and extraction equipment).

With a length overall of 144m, and breadth of 27m, the massive trawler is based on a design from Skipsteknisk in Ålesund, Norway, and will be built by Aker Yards' Søviknes shipyard.

The order for the advanced fishing vessel, which was expected to be confirmed by the end of February, will enable Aker Biomarine to increase the volume of krill it harvests in the Arctic significantly, and produce large quantities of krill meal and oil onboard.

Aker is the first company to produce high quality krill based products on an industrial scale to capitalise on the potential of krill in the aquaculture and human nutrition industries.

Production of high-value krill oil in the first full year of operation of the vessel is projected at approximately 1200tonnes, and over the next two years, annual production will gradually increase to more than double that volume.

'The targeting of krill will change the make-up and direction of Aker BioMarine's activities,' said Helge Midttun, Aker BioMarine president. 'For many years, vessel operations and the development of innovative harvesting methods have been the company's focus. Tomorrow's Aker BioMarine will produce valuable, advanced bioactive ingredients derived from marine fauna, for additives to pharmaceuticals, foods, and specialised feed for fish farming.'

Aker recently completed a major refurbishment of another of its vessels, *Saga Sea*, equipping it for Krill based products. With two vessels in operation, Aker BioMarine will harvest about 200,000tonnes of krill annually.

Traditional marine lipid extraction processes are based on significant thermal exposure of the krill material, dramatically reducing the therapeutic effects by reducing the bio-activity of the components. However, working in partnership with Alfa Laval, Krill A/S has recently developed and patented a novel onboard extraction process with low levels of thermal exposure.

Tests show that the indicated thrombosis-related therapeutic properties of krill oil can only be achieved with fresh krill raw material – which will be made possible with Aker's 'Eco Harvesting' technology, and Krill A/S' extraction process, in respect of which patent application has recently been filed (Alfa Laval was recently awarded a turnkey contract for the delivery of the pharma-grade process plant to be installed on-board the *Saga Sea* for the 2007 season).

Ever since the great abundance of krill became apparent there has been speculation that it might form a suitable target for a fishery.

The catch of krill gradually increased during the late 1970s as the fishery moved from its experimental phase reaching a peak in 1982 when 528,201tonnes were harvested, 93% of which was taken by the Soviet Union. The current catch is approximately 100,000tonnes.

Aker's Eco Harvesting technology prevents the krill from enzymatic degradation and contamination from birds. No harmful bacteria such as salmonella have been detected. Volatile nitrogen is at a very low level and biogenic amines, compounds like cadaverin and histamine typically found in fish meal as a result of bacterial degradation are below levels of detection in our krill meal.

Harvesting krill in a commercially viable and environmentally sound way is challenging because traditional trawling methods where the catch is hauled up on deck and emptied into holding tanks before processing is unsuitable, as the krill contains highly digestive enzymes and basically self-destructs before it can be processed.

The Eco Harvesting continuous trawling system allows the net to stay underwater during the entire operation. Instead of heaving a trawl to get the catch on board, a conveyor hose is attached to the net. The krill is filtered at the end of the trawl and flows upwards in a flexible hose, with air injection creating the upward lift. The equipment stays underwater while a continuous stream of water flows through the hose, bringing the krill live and fresh directly into the ship, which allows for processing of fresh raw material with superior product quality.

The new harvesting equipment provides control over the amount and timing of bringing catches onboard as it can synchronise the pace at which the catch is brought onboard with production capacity. The system also reduces net retrieval to once a day – rather than ten to 15 times a day for conventional krill fishing – thus reducing unwanted by-catch, such as seals.

Buoyant orders boost Finnish building

Last year saw a record number of deliveries, new orders and development work among Finland-based maritime companies. Henrik Segercrantz reports.

THE Finnish economy grew at a swift pace in comparison with the rest of Europe during year 2006, particularly within the metal industry. The large scale shipbuilding industry, primarily consisting of Aker Yards, with newbuilding construction in Turku and Rauma, as well as assembly in Helsinki, did exceptionally well, with a large number of suppliers to the maritime industry in Finland and some globally active designers and consultants benefiting.

Offshore constructor Technip Offshore Finland in Mäntyluoto on the west coast also proved successful in building Spar-type offshore rigs.

Including Turku Repair Yard, three companies together employ some 4500 staff and some 3100 external subcontractors working at the yards, with Aker Yards' Turku yard the biggest, with a staff of about 2200.

***Tallink Star*, a fast 27knots passenger-car ferry for the Helsinki –Tallinn route with a capacity of 1900 passengers was launched in Helsinki in November last year.**

Sea trials with the second Freedom-class cruise ship *Liberty of the Seas* took place in December. *Freedom of the Seas*, the first in a series of three 158,000gt vessels for Royal Caribbean International was delivered last April.

Aker's cruise & ferry boom

In 2005 Aker received a record 12 newbuilding orders, resulting in an accumulated orderbook of €3.3 billion at the beginning of 2006, with deliveries stretching into 2008. The orderbook included seven ship conversions. A year ago Finnish Aker President Yrjö Julin was appointed head of the entire Cruise & Ferries business area of Aker Yards, including the cruise shipbuilding at the Saint-Nazaire shipyard of Aker Yards France (formerly Chantiers de l'Atlantique), the business which merged with Aker Yards in Spring 2006. Consequently, 2006 has seen active coordination of shipbuilding organisations, as well as sales in Finland and France, as part of the new member's consolidation with Aker Yards.

By the end of 2006, the newbuilding orderbook at Aker Yards consisted of three cruise ships, eight ferries and one ro-ro container ship. The total gross tonnage of the orderbook was 896,200 corresponding to 991,064 cgt. Although only two newbuilding orders were received in 2006, one of them was for the record-breaking 220,000gt cruise ship that will emerge from Project Genesis for Royal Caribbean International. The other order was for a ferry for Brittany Ferries.

Last year saw the first cruise ship in a series of three vessels for Royal Caribbean International (RCI), *Freedom of the Seas*, delivered in mid-April (see *The Naval Architect* July/August 2006). This spectacular series of 158,00gt ships - today the world's largest operational vessels in the market - is a 339m long extended version of the previous five successful 138,000gt Voyager-class ships built for the same client in 1999-2003.

Two Freedom-class sisterships (*Liberty of the Seas* and *Endeavour of the Seas*) are due in May 2007 and April 2008 respectively. *Liberty of the Seas* had its sea trials in December.

The Turku yard is also busy building the even more spectacular 220,000gt Project Genesis. This ship, valued at some €900m, is the most expensive ship order ever placed in the world and is due for delivery in October 2009. With a length of 360m and breadth 47m the cruise ship will be able to accommodate 5400 passengers. The order was received in February 2006.

In April 2006 the 48,900gt 2800 passenger cruise ferry *Galaxy* was delivered to Tallink. Also the first two in a series of three ro-ro/containerships for Swedish Transatlantic/Baltic Container Shipping were delivered in August and December 2006. The Arctic container/cargo vessel *Norilskiy Nickel* was officially handed over to MMC Norilsk Nickel in April 2006, having concluded successful ice trials in Russian Arctic waters. The order for four more vessels was placed in July, not to be built in Finland, but by the Merchant Vessel Division in Germany.

The third quarter order backlog of the whole Aker Yards Group consisted of 150 vessels and was valued at NKr77.5 billion (approx. €9.4b). The EBITDA margin was 4.7%, pushed down by a negative result of the three ro-ro container vessels for Transatlantic/Baltic Container Shipping by some NKr60 million, and by capacity costs related to low utilisation in France of NKr90 million.

Having acquired the Florø yard from Kleven and Okean Shipyard in Ukraine in a joint venture with Dutch Damen Shipyards Group and a shipyard in Vietnam, Aker Yards now comprises 18 shipyards in eight countries with approximately 20,000 employees.

Color Line's cruise ferry *Color Magic* being towed from the Turku shipyard to the Rauma yard for final outfitting. An increasing number of Aker Yards' vessels are built at several locations.

Name/client	type	GT	delivery	approx. price
TransPulp/Transatlantic	ro-ro/container	23,128	2007 (R)	€50m
Liberty of the Seas/RCI	cruise ship	158,000	2007/ spring (T)	$720m
Contentin/Brittany Ferries	trailer ropax	22,000	2007/ autumn (H)	€80m
Color Magic/Color Line	ferry	75,000	2007/10 (T)	€325m
Tallink Star/Tallink	fast ferry	30,000	2007/spring (H)	€110m
Color Superspeed I /C. Line	fast pax-car ferry	33,500	2007/12 (R)	€116m
Viking Line	fast ropax ferry	34,000	2008/01 (H)	€125m
Endeavour of the Seas/RCI	cruise ship	158,000	2008/spring (T)	> $800m
Color Superspeed II/C. Line	fast pax-car ferry	33,500	2008/04 (R)	€116m
Luxury/Tallink	cruise ferry	48,900	2008/summer (H)	€165m
Armorique/Brittany Ferries	ropax ferry	28,500	2008/10 (H)	€110m
Project Genesis/RCI	cruiseship	220,000	2009 (T)	€900m

Place of delivery: T= Turku yard, R = Rauma yard H = Helsinki yard

Table1: Newbuilding orderbook at Aker Yards Finland (January 2007)

In January 2007, Aker Yards announced its latest new shipyard joint venture, to be set up in Vietnam for offshore vessel construction for the Asian market (Seeps). This is the first shipyard in Asia to be established by Aker Yards. The shipyard will be a joint venture between Aker Yards (70%) and Singapore-based Amanda Group (30%).

In November the orderbook of Aker Yards' business area Cruise & Ferries alone amounted to some €5.9 billion, consisting of 20 newbuildings some of which are being built in France and in Germany. Aker Yards France is building two big cruise vessels for NCL, four cruise vessels for MSC Cruises and a small French ropax ferry. Two 62,000gt ferries for Swedish Stena Rederi AB are designed in Finland but will be built in Germany for delivery in 2010, as the yards in Finland and France were fully booked. In addition, there are options worth further vessels with RCI, MSC, NCL, Color Line and Stena. Viking Line cancelled its options at Aker Yards Finland, in the wake of Tallink's acquisition of Silja Line. The newbuilding orderbook of Aker Yards Finland is presented in Table 1.

Split shipbuilding

The trend of designing and building the vessels in the orderbook at several locations seems to be an ever growing trend at Aker Yards. The Norwegian yards have had their supply ship hulls successfully built in Romania and Poland, and now also in Ukraine, where the labour costs are lower. Aker Yards Helsinki is today only capable of assembly and outfitting, and has to rely on other facilities for block construction, primarily the Turku yard, the capacity of which is stretched with today's orderbooks. For example Viking Line's, Tallink's and Brittany Ferries' newbuildings are having their blocks built in Turku, Rauma, partly in Gdansk (*Tallink Star*) or France (the entire hull for Tallink's *Galaxy* sistership). *Color Magic*, on the other hand, had 15% of its outfitted blocks built at the yard in Wismar, with the remaining blocks built at the Turku Yard, where assembly also took place. In December the vessel was towed to the Rauma yard for final construction and outfitting. The hulls of Transatlantic's ro-ro/container vessels are being built at Aker Yards Ostsee (Wismar) and partly by Stocznia Gdansk and Wisla in Gdansk, with outfitting at the Rauma yard.

While this type of split work arrangement works well for handling peak loads, it is not considered optimal as a permanent solution.

MacGregor expands on three fronts

STRONG orderbooks across the board see MacGregor investing in production, after sales and electrically-driven systems

SUSTAINED high order levels for container vessels have been reflected in high demand for the hatch covers, cargo cranes and lashing equipment supplied by MacGregor. Orders for pure car and truck carriers have also been forging ahead, generating significant business for the company's ro-ro access equipment operations.

Last year, the company also took over shoreside and shipboard dry bulk handling equipment supplier BMH Marine, renaming it MCG Bulk. Given sustained high demand for dry bulk tonnage, the move looks particularly opportune.

During the first nine months of year 2006, MacGregor's net sales totalled €343.5m, 29.1% above the corresponding figure a year earlier. The business unit received orders for nearly €535m, up 63%. The orderbook stood at €798.2m at the end of September, up 59.7% from a year earlier, a considerable part of which will be delivered in 2007, 2008 and 2009. Now heading a company employing 1100 people globally, MacGregor president Olli Isotalo told *The Naval Architect*: 'The boom within the maritime businesses has been unexpectedly high and long, which has reflected also in our results and activities. The containership boom, which seems to peak next year, has been strong. The need for bulk carriers has been growing with the need for raw materials particularly in Asia.'

MacGregor's sustained growth has been fostered through its willingness to enter partnership agreements overseas, not least in China, to boost production capacity.

'We operate through a real partnership,' said Mr Isotalo. 'We have our own people based at the factories for supervising the production, the technology and processes of which are typically our know-how. This type of operation provides a win-win situation for both parties.' Mr Isotalo said that the group has not experienced much difficulty with delivery times, caused by lack of raw materials or sub-supplies due to the shipbuilding boom. 'We have been able to keep our partners well informed on coming orders, which has made them prepared. We have some 15 strategic partners, of which a little less than ten are in China, plus a good network of sub-suppliers. In China alone, we directly and indirectly provide work for some 2500 people.'

The service market, which today represents a third of MacGREGOR's revenues, has for some years already been a strategic growth sector within the group. Mr Isotalo said that acquisitions of companies providing services would continue. 'We sell availability, not service hours only,' he noted. 'We are strongly focused on lifetime cost savings, where service represents one part.'

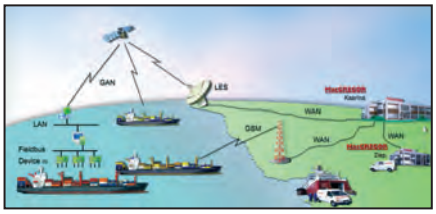
In August last year, MacGregor signed an agreement to acquire the business of Scottish Grampian Hydraulics, expanding its service offering for offshore support vessels in the North Sea. MacGregor also signed a cooperation agreement with China Shipping Industry Co (CIC) to establish seven service stations at CIC repair yards. Four service stations will be established in the Shanghai area and three in Guangzhou, China.

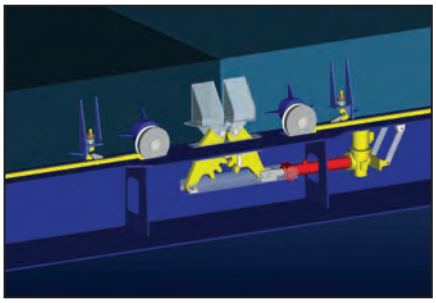
'There are already a big number of clients who have opted for MacGregor's Onboard Care service concept,' Mr Isotalo noted. This is the company's most comprehensive category of service provided and combines planned preventive maintenance with knowledge about actual equipment condition. The Onboard Care service programme was launched in 2004 and now covers more than 350 vessels.

Electrically driven

If service provides one platform for growth, MacGregor remains attuned to the need to evolve products to meet market requirements. In this vein, the company said it clearly saw a trend towards electrically driven cargo handling and access equipment and away from today's dominant hydraulic systems.

MacGregor recently introduced environmentally-friendly engineering solutions in a range of electrically driven products. These include cranes, rolling hatch covers, a hatch cover stacking device and ro-ro cargo access equipment. In addition to the requirement of equal or better performance, the systems developed should provide equal or lower initial cost to hydraulic systems.





The E-Roll side-rolling electrically-driven hatch cover.

The electric-drive side-roll hatch cover began as a three-year project in 2002. Electric-drive hatch covers have progressed from single-pull covers with the wheels lifted by hydraulic cylinders; 'piggy back' covers, again with the wheels lifted by hydraulic cylinders; and sliding covers for tweendecks.

Last year, the first electric drive side-roll hatch covers were sold to Japanese Universal Shipbuilding Corporation. Twelve 207,000dwt bulk carriers will receive the E-Roll type rolling hatch covers developed together with the yard.

Last year MacGregor also secured the first order for the new generation of electrically driven cranes and continued its efforts to develop the next generation of control system for ship cranes. Other new electrically-driven equipment include various items of ro-ro cargo access equipment and the 'MacPILER' liftaway hatch cover stacker, a new type of hatch cover lifting device.

First orders were placed last year for a series of four 4400dwt multipurpose cargo ships ordered by Intership Navigation. The ships are being built at Rongcheng Shipbuilding Industry Co in Shandong, China for delivery between December 2007 and December 2008.

The MacPILER is a gantry crane that travels the length of the weatherdeck of the vessels, hoisting, carrying and stacking lift-away hatch cover panels. It is guided by rails and spans hatch widths of up to 12.65m. The lifting capacity is 18t and the gantry crane can carry two lift-away hatch cover panels at a time to either end of the hold opening where it stacks them up to six panels high. The MacPILER gantry crane can carry two hatch cover panels, one in an uppermost position, mechanically supported, and the second panel on the hoist.

The MacPILER gantry crane is driven from the port side by two electric motors. On the opposite side, there is a stand for the operator. The panel hoist is located on top of the MacPILER, also powered by an electric motor.

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Energy audits bring significant savings

FINNISH engineering company Deltamarin and its clients have come to realise the potential for combined energy audits and efficient training as tools for securing the most fuel-efficiency.

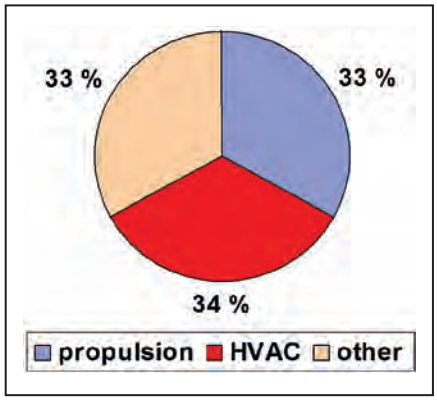
DELTAMARIN is now utilising its in-house know-how in offering energy audits for ship owners as well as training for the crew targeted at energy efficient operation of the rather complicated systems onboard cruise ships. Energy audits are carried out during the design and building period of a newbuilding and during operation.

In today's search for fuel cost savings, there is bigger potential for savings in operational solutions than in the hydrodynamic and related design aspects of the vessel, which are already becoming rather optimised.

Deltamarin has built eight training programmes, held at its own offices, comprising 10-day courses to train operators about the principal sources of fuel consumption onboard cruise ships, such as propulsion, air conditioning and energy production, and how to operate the vessels and their systems so that energy consumption is minimised. It is also offering shorter training sessions, lasting three to four days.

Several cruise and ferry operators are taking up these training programmes, which began with Royal Caribbean Cruise Line and Celebrity Cruises two years ago. To date, about 120 persons have been trained. Deltamarin's head office is based near Aker Yard's Turku Shipyard, which allows for convenient crew training while cruise ships are being finalised at the yard. Training is also arranged at the client's premises, onboard or ashore.

Simulations and calculations are done of the operation of the ship and its systems in real operational conditions, in order to learn how to operate them at maximum efficiency.



Measured fuel consumption on a 70,000gt cruise ship. The energy consumed by the HVAC systems was found to be 34%, even more than the 33% share of fuel consumption required to fulfil the particular itinerary of the vessel.

Surprisingly, much energy can be saved by this. Energy audits of complete fleets are being carried out, and in most cases they are combined with efficient officer and superintendent training.

According to Deltamarin, typically 10-15 fuel saving actions can be found and recommended, with the audit paying back in two to six months. Deltamarin has found that a typical fuel saving potential has been between 5%-12%, but even higher figures have been achieved.

The main areas where fuel savings have been recouped in the case of cruise ships has been in HVAC, desalination and heat recovery plant, in addition to traditional propulsion and hull optimisation. Deltamarin notes that theoretical calculations at project and design stages, as done today, do not show the main consumers onboard. Efficient use of heat energy can generate substantial fuel savings.

Vacon turns up the power

VACON is continuing its strategy of boosting capacity, following a recent extension of its facilities in Vaasa, Finland to handle the increased production of AC drives.

The liquid-cooled Vacon NXP drives are available in a power range of 0.75MW to 5MW

IN 2005, some 7% of the €149.9 million turnover generated by Vacon was ploughed back into the company's R&D spend. Clearly, the company has little intention of sitting back on its global market share of the AC drives sector of 3.5%, built up since its founding in 1993.

Instead, it is investing in module factories in Finland and China and the 'mini-factories' in Finland, China, India, Italy, and Mexico that serve local regions. The factories in Finland and China have a production capacity of respectively 200,000 and 100,000 units per year. The company employs some 620 persons, 160 of which are active in production.

Vacon's AC drives in the power range of 0.25kW and upwards include what were the first ranging from 2.2kW to 3000kW in the voltage range from 380V to 690V AC. And, last year, the company extended its unit power range up to 5MW, with all AC units of above 2MW being liquid-cooled, whereas the smaller units can also be air cooled.

Landmark orders in 2006 included a contract in April 2006 to supply Vacon drives for 16 vessels from its Norwegian partner Scandinavian Electric Systems AS (SES), with a combined power totalling 150MW. Most of the AC drives were for the control of main propulsion and thrusters, but also ordered were some high-power drives for the control of seismic compressors.

Vacon is also delivering AC drives for a series of five ST-610 patrol vessels for the Norwegian Coast Guard. The first in the series designed by Skipsteknik S is *KV Nornen*. The vessels are being built at Szczecin, Poland. Here, the propulsion system of the diesel-electric vessels are two azimuthing thrusters, each controlled by an active front end (AFE) liquid-cooled harmonic-free Vacon drive of 1640 A/1100kW (480V), giving the vessels a speed of approximately 16knots. The vessels also feature dynamic positioning capabilities.

One of the other major single propulsion drive orders, announced last year, was the diesel-electric propulsion system specified for *Geo Celtic*, so far the world's largest purpose-built seismic research vessel, which is to be completed by mid-2007. The order, arranged by SES, comprises four generators of 16,800kVA, electrical main and emergency switchboards, liquid-cooled active front-end AFE units, two electrical main propulsion motors of 4200kW each and two thrusters of 1500kW and 1200kW.

Also notable last year was an order covering seven 2400kW liquid-cooled Vacon drives for *Sapura 3000*, a heavy-lift crane and pipe-laying vessel presently under construction at Sembawang Shipyard in Singapore.

With orders flowing, Vacon continues to invest in product development, recently introducing the ATEX-certified thermistor input which is fully integrated in the drive. Certified and compliant with the guidelines set by ATEX 94/9/EC, the integrated thermistor input is specifically designed for the temperature supervision of motors that are placed in potentially hazardous areas. If overtemperature is detected, the drive immediately stops feeding energy to the motor and thus further heating of the motor is avoided. A thermistor input can be fully integrated in the Vacon NXP drive, in contrast to a typical system that features a separate thermistor relay and contactor. The thermistor input is available for the Vacon NXP drives in the power range of 0.75MW to 5MW in voltages 380V-500V and 525V-690V.

Vacon has to date delivered more than 4000 drives for marine applications: more than half used in fan applications and some 25% as winch drives. Other typical drive applications include cargo pumps, compressors, steering gear and propulsion.

Wärtsilä grows capacity and capability

WÄRTSILÄ'S businesses continue to thrive amid the surge in the shipping and shipbuilding industries worldwide and the company has taken advantage of the trend by expanding rapidly over the last 12 months.

The first 14-cylinder Wärtsilä RT-flex96C marine engine is the biggest ever built. It has a maximum continuous power output of 80,080kW (108,920bhp) at 102rpm, measuring 27.3m in length and 13.5m in height, with an overall weight of 2300tonnes.

THE operating income of all Wärtsilä's businesses has grown by 29.3% over the past year. According to the company, 1720 newbuilding ship orders had been placed by the end of September 2006, 33% of them in China, 29% in South Korea, 16% in Europe and 12% in Japan.

The growth figures of sales and order intake within the Ship Power business increased 16.4% and 35.5% respectively in the third quarter compared to the figures from a year before. In the period from January to September order intake amounted to €1.651 billion, 54.3% ahead of the position a year earlier (€1.07 billion). The orderbook within Ship Power was €2.8 billion.

A licence agreement with the Brazilian company NUCLEP to strengthen Wärtsilä's position in South-America's low-speed engine market was signed in January 2006. In February Wärtsilä acquired Aker Kvaerner Power and Automation Systems, which supplies power and automation systems for the oil and gas, marine and industrial markets. It operates mainly in the North Sea region with major oil and gas companies and Norwegian shipyards. An alliance was also formed between Wärtsilä Automation Norway and the US company Emerson Process Management, increasing Wärtsilä's capabilities in process automation for floating production storage and offloading vessels.

Also in February 2006, Singapore-based Total Automation was acquired. In addition to general marine automation, Total Automation has a strong foothold within the offshore and LNG sectors. The company focuses on refit projects and service work, enabling Wärtsilä to provide comprehensive automation services.

Wärtsilä also acquired the machining capacity of Diesel Technology Solutions BV (DTS) in The Netherlands.

Other investments in the service sector in 2006 included a joint venture with Estonian BLRT Grupp operating in the Baltic area. The Ciserv service companies within Wärtsilä were also integrated into the company's worldwide service organisation. In July Wärtsilä acquired the German service company INTEC Injectortechnic. The acquisition enhances Wärtsilä's capabilities in fuel injection technology and services.

Schiffco boosts system integration

If all this were not enough, in December Wärtsilä announced it would acquire German ship design group Schiffco.

The Hamburg-based, previously privately owned company has annual net sales totalling about €4m and a staff of 25 plus a network of external designers. Schiffco is specialised in designing container ships, research vessels and various offshore vessels and provides consultancy services and project management and supervision tasks for shipowners and shipyards. It has a strong market position and reputation in these segments.

The acquisition supports Wärtsilä's strategic focus to grow as a systems integrator and provider of total solutions to the shipping and shipbuilding market, according to Jaakko Eskola, group vice president, ship power, Wärtsilä Corp. He said that the acquired business added ship design expertise to Wärtsilä's wide product and service offering and supported the development of Wärtsilä's low-speed engine business in Asia and especially in the Chinese market.

As a part of Wärtsilä, Schiffco's design business, its customers and employees will be able to offer enhanced opportunities, according to Berend Pruin, chairman of Schiffco and chief representative of its shareholders.

With its 50 years experience in the marine field, Schiffco has been involved in more than 2500 ship design projects globally. The group of companies acquired by Wärtsilä includes Schiffco GmbH Forschung und Entwicklung maritimer Systeme and Schiffco GmbH Multifunktionales Ingenieurbüro als Maritimes Innovationszentrum.

Albrecht Delius, managing director of Schiffco told *The Naval Architect* that the typical tasks of the company related to newbuilding projects, starting from initial designs up to the supply of complete design documents for fabrication, and sometimes even the finding and selection of suitable building yards. For these tasks Schiffco prepared the full set of technical and commercial tender documents and made neutral evaluations of incoming shipyard bids. 'Apart from our design work we today perform also extensive design optimisation to owner's and user's requirements on designs done elsewhere, plan approval work, construction supervision, acceptances and project management on behalf of the owners,' he said. As recent examples, Mr. Delius mentioned a seismic survey vessel designed on behalf of an Indian customer under construction in Far East Russia, eight 6800TEU container vessels for a Middle East Liner company to be built in South Korea, and five offshore support vessels for a government organisation in UAE being built off Singapore.

Currently Schiffco is also designing for and consulting an Italian offshore company and a Dubai construction firm for two different high-performance pipe laying vessels. It is also providing consultancy and conceptual design support to a state owned offshore company in the Middle East Gulf for a new 4400t heavy lift/pipe laying vessel, to be constructed under its supervision in China.

On the commercial ship side, Mr Delius said that more than 120 ships have been constructed or are on order to the Schiffco CV 1100 PLUS container feeder vessel design. 'We are most proud that the type has become the most common container vessel ever,' he said. The company is now working on new container ships ranging between 1300TEU to 7300TEU and is also making design studies for even bigger vessels of up to 12000TEU. The intention is also to penetrate markets with various other types of dry or liquid cargo vessels.

Schiffko has closely collaborated with Wärtsilä in the past on many different projects integrating large 2-stroke engines, various 4-stroke main engines or auxiliary sets, thrusters or propellers, or complete solution packages into the ship designs based on owners' requirements.

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With the trend growing among ship owners to head for developing shipbuilding countries where labour costs are low and design and planning skills lacking with ready-made designs, the need is also increasing to be able to offer complete design and material packages together with building advice and quality support. Of coming joint tasks, Mr. Delius said that there would be the need for close market observation and analysis to create an attractive new type of dry or liquid cargo vessel that would successfully incorporate the broad Wärtsilä product range of in-house machinery and equipment as a comprehensive solution to their common clients.

Production surge

Wärtsilä has also been expending considerable energies in boosting its production in Asia. Its Auxpac factory for marine generating sets in Shanghai was inaugurated in June 2006. The assembly factory is a joint venture with Shanghai Marine Diesel Engine Research Institute. It manufactures Wärtsilä Auxpac 20 and Auxpac 26 diesel generating sets for the shipbuilding market in China and elsewhere and is expected to reach full capacity in 2007.

In September Wärtsilä, China Shipbuilding Industry Corporation and Mitsubishi Heavy Industries announced a new joint venture to manufacture large, low-speed marine engines in China. The joint venture will develop, manufacture and sell a new generation of energy-saving and environmentally-friendly low-speed two-stroke marine engines under licence from Wärtsilä and MHI. The factory will be built in the Qingdao area, where CSIC is setting up a marine industry cluster. Production is expected to start at the end of 2008.

The investments in Trieste and Vaasa to raise production capacity are also proceeding as planned in order to increase the production capacity as of mid-2007. Engine assembly and testing capacity has already been increased, and the manufacturing processes are being streamlined.

Wärtsilä continues to broaden its 2-stroke engine and common rail (RT-flex) portfolio. The newest versions of the RT-flex84 and RT-flex68 respectively have been successfully delivered to customers. The development of the RT-flex82 engine in cooperation with Hyundai Heavy Industries is proceeding according to plan, meanwhile. The start of the first engine on the test bed at Hyundai is scheduled for the end of 2007.

Renewable fuels technology

Wärtsilä Corporation is leading a consortium aiming at developing the use of methanol-consuming fuel cells to provide electrical power to marine vessels. The other members are Wallenius Marine, University of Genoa and the classification societies Lloyd's Register and Det Norske Veritas. The project is entitled "Validation of a Renewable Methanol Based Auxiliary Power System for Commercial Vessels" (METHAPU). The entire project will take 2.5 years, will costs €1.9 million, of which EU grants represent €1m.

The main purpose of the project is to develop renewable-fuel-based technology for cargo vessels in international trade. Wärtsilä's role in the project is to study the suitability of a methanol-based fuel cell system. Other goals include that of achieving technical regulations necessary to allow the use of methanol as a marine fuel. Methanol fuel bunkering, distribution, storage system and a solid oxide methanol fuel cell system will be validated including safety and reliability aspects of the technology.

The consortium's research will be focused on a 250kW Solid Oxide Fuel Cell (SOFC) unit. A smaller 20kW unit will be installed onboard a Wallenius Marine car carrier. A lifecycle assessment and an operational safety assessment will be made. The results of the validation run and the tests will contribute to the second part of the research – the marine-compatibility of a 250kW unit.

According to Erkko Fontell, general manager, fuel cells, at Wärtsilä, the construction and operation of this research unit running on renewable methanol would open up attractive opportunities for using sustainable fuels for fuel-cell-based distributed generation and auxiliary power units in large ships. 'In particular, this is an interesting option for reducing ship emissions when harbouring,' he said. 'Operation of the unit will also provide us with very important experience related to both the system's design and its performance parameters such as electrical efficiency and stack durability.'

Ultimately, the goal is commercial use of methanol-consuming fuel cells on vessels.

Since 2004, the company has been testing the functionality of Solid Oxide Fuel Cell technology for fuel cells up to 5kW. A 20kW fuel-cell application is now being tested at the company's fuel cell laboratory. According to Mr Fontell, who is responsible for fuel cell technology development, moving to a 20kW power range is a concrete step towards commercialised application.

The prototype of a 20kW fuel cell using SOFC technology is the first of its kind in Europe. 'This is an integrated power system which uses natural gas,' said Mr Fontell.

SOFC systems are fuel flexible. Wärtsilä focuses on methanol, natural gas and a variety of biogases in its development programme, but there are also a number of other fuels suitable for SOFC-systems, such as diesel, biogases, landfill gas, coal bed methane and waste gases, as well as ethanol and other alcohols.

The next goal of the development programme will be units up to 50kW, and in the long term fuel cells with a power rating of 250kW, for use in combined electricity and heat production applications. Wärtsilä plans to commercialise the units in a number of marine and stationary applications. The former includes marine auxiliary power generation uses, and the latter commercial buildings like hotels, supermarkets, service stations, data centres, etc.

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Nupas-Cadmatic offers remote solution

THE potential to develop a design tool that is efficient for remote ship design, drawing on the work of several designers at different locations has increasingly become the focus for the Nupas-Cadmatic's 3D CAD/CAE/Cam software suite.

IT has been two years since the joint venture partners Cadmatic (of Finland) and the Dutch software design company, Numeriek Centrum Groningen, began to exploit a new data handling structure.

In its version 5 form, Nupas-Cadmatic Piping began to use a common database called COS (Cadmatic Object Storage) which can be logged into from anywhere, making the entire system architecture very straightforward and logical.

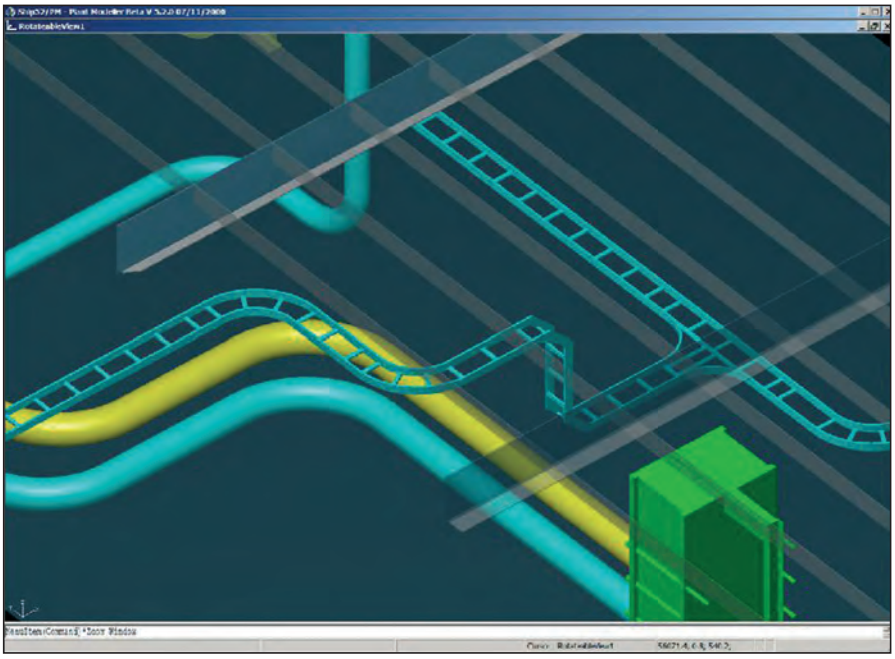
Since the introduction of version 5, the partners have been steadily extending its reach. The introduction of COS was followed by features which further enhance productivity, including a Basic Designer module and the Hull Work Preparation Manager.

The Basic Designer module is used for 3D design of the ship's basic layout with outfitting and components built up in a modular way during the early and basic design stage. It uses wizard-type tools to reserve space quickly and parametrically and to create areas for cabins, staircases, elevators, etc. Temporary space reservations can be made for main piping routes, casings and equipment not yet determined or found in the component library. Previous design data from earlier and similar projects can easily be transferred to a new ship project, using N-C's built-in Design Modules capabilities.

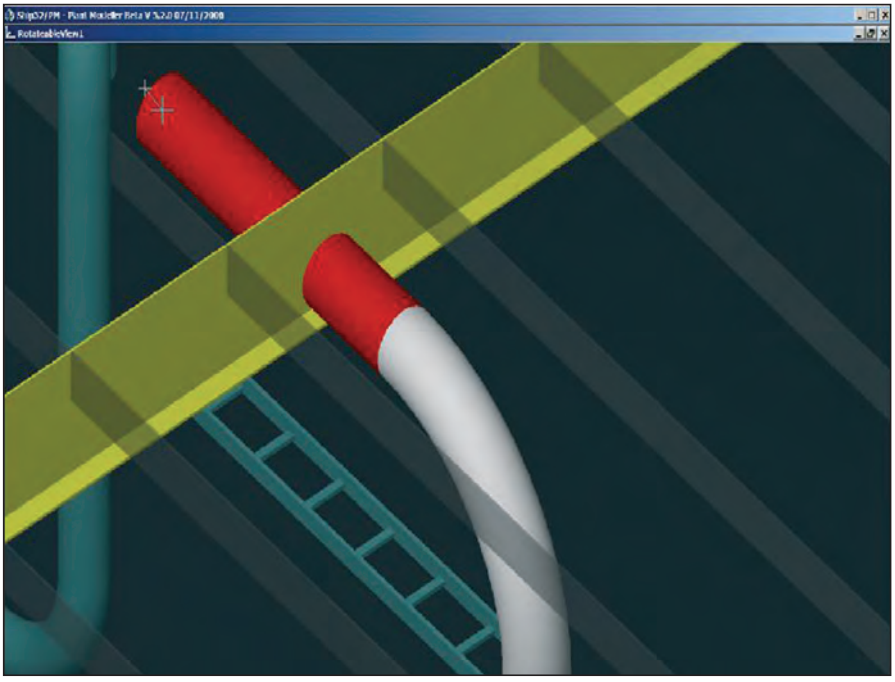
The Hull Work Preparation Manager (WPM) module, meanwhile, has been developed to handle the information flow for hull design and construction between planning, engineering, work preparation and the workshop, speeding up the work preparation process significantly. It includes a set of unique tools for automatically detecting and assigning numbers and workshop process coding to assemblies, panels and parts. Parts like profiles, brackets and collar plates are automatically assigned to the correct panel. The module is part of Nupas-Cadmatic's 3D Hull Engineering, used for modelling of the hull structure from the early design up to the detailed and production engineering of hull blocks, panels and parts.

In the latest vesion 5.2 of Nupas-Cadmatic, introduced at Nupas-Cadmatic's user meeting last autumn, several new features have been added, some presented below. A new module for cable tray design and routing has been developed as part of the software's 3D Plant Modeller module. Earlier, cable trays were designed by simple space allocation using the HVAC module features. Now a visually real ladder-type cable tray is modelled, based on the use of a material specification. The designer does not have to think of materials when looking for the best route for the cable tray, which makes design work more efficiently.

The module has been designed for simple and efficient cable tray modelling. Standard parts, such as branches can be easily included. Cable tray routing has, in fact, come to resemble pipe routing in its methodology.



A new module for cable tray design and routing has been developed as part of the 3D Plant Modeller module.



The collision detection check procedure in the Plant Modeller has been improved with immediate collision detection.

Collision plant modelling

The collision detection check procedure in the Plant Modeller has also been improved. Earlier, this was done by checking collisions between two selected component groups, as a batch calculation, with the idea to plan first, then check for collisions. With version 5.2, pipe collisions can be modelled immediately when doing the routing, as an on-line collision detection. The designer can immediately see where the pipe collides with other components, as the colliding objects change colour, when a collision occurs when routing the pipe. Batch calculation is still possible, as an option.

In Nupas-Cadmatic, Nupas-Cadmatic Hull is used for hull design and the Plant Modeller for designing the layout, piping, HVAC, outfitting, etc. Until now, when a layout designer has needed

a hole in the hull, bulkhead or deck, the request has been made to the hull designer, who is responsible for hull strength, and this request has been either accepted or rejected by the hull designer.

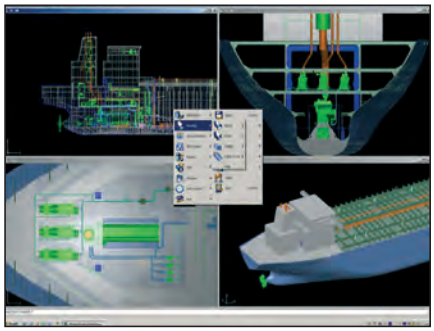
In a globally distributed project things get more complicated. The hull design and piping and layout design can be done at separate satellite design sites of the project. In version 5.2 a new object type has been implemented in the Plant Modeller - the 'hole request' object. The request objects carry the information of the new hole to be made until the Hull module sends the hull geometry with the true hole implemented. Having a separate object type for these tasks makes it possible to manage hole requests in a separate process, by using a query or by using visualise, hide etc. functions.

The processing speed of the visualisation of shaded views in the Plant Modeller and the visualisation speed in the eBrowser have been increased remarkably. Now bigger 3D models can be handled by computers with mainstream graphical cards.

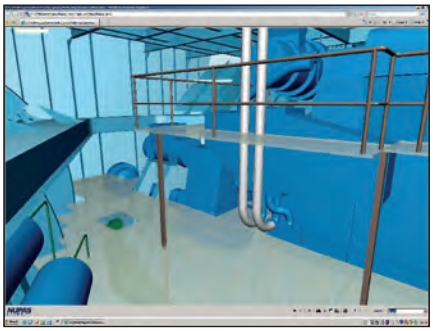
Nupas-Cadmatic has also taken up the challenge of producing a 3D Basic Design tool which is fast in use but the results of which can be utilised in the detailed design phase. A built-in two-way integration of the Plant Modeller and the software of the Napa has been introduced. Hull geometry and other information from both Napa Steel and Design Napa can be imported and geometry and product data can be exported to Napa applications.

The Design Modules function, which was introduced earlier, allows importing of a system or a selected part of a system from an existing 3D model to a new project. There is also an interactive phase when importing, where the product information can be renewed according to the requirements of the new project. For example, pipeline or valve coding, specifications, materials, wall thickness etc. can differ in a new project in such a way that this 'information mapping' feature is important.

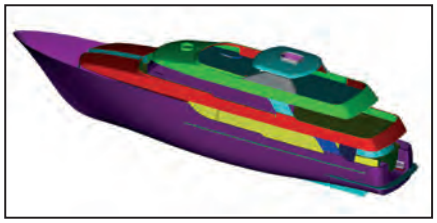
New capabilities of eBrowser and eXchanger have been developed for even more efficient remote reviewing and project filing. The visualisation processing has been remarkably improved allowing for faster handling and bigger more detailed models. AutoCad 3D models can be directly imported and exported using the Nupas-Cadmatic eXchanger conversion module. The eXchanger now also supports AutoCAD 2007.



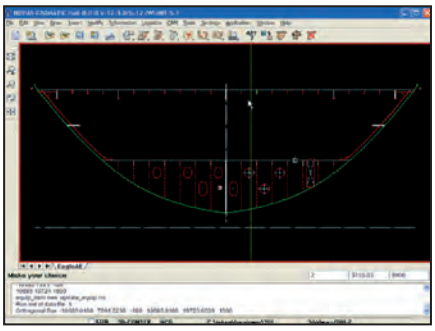
Engineroom design made with Nupas-Cadmatic's Basic Designer module.



eBrowser engineroom model basic design made by Basic Designer.



Version 5.2, Nupas-Cadmatic also introduces the 3D Hull Library, a tool to store any kind of structural part, or group of parts, in a library.



The user interface in version 5.2 of Nupas-Cadmatic's Hull Engineering has also received a major face lift.

Hull engineering improvements

The user interface in version 5.2 of Nupas-Cadmatic's Hull Engineering has also received a major face lift. All of the menu bar options and the toolbar options are logically reorganised. A 'recently used' function is now provided, and the toolbars are now floatable, but they can be docked where preferred in the graphic window.

The 2D drafting functions have been redesigned and re-implemented for more flexible use. Interactivity has also been sought by using dynamic inputs, as witnessed by a new undo/redo functionality and from the possibility of switching between functions by using function keys.

3D Hull construction data can now be exported in a format that can be used as input for Finite Element Method (FEM) software. The export data can be collected from several blocks based on geometric and logistical selection criteria. The user has the potential to add 'policy' information to 3D Hull construction items which are general or specific rules that control the contents of the output data.

The 3D Hull construction data is modified by the export process in a way which is suitable for FEM calculations. For example plates, brackets etc. no longer have a geometrical thickness in the FEM model but the thickness information is added as an attribute together with the material type information. Small holes, cut-outs or other small objects are left out of the FEM model.

If necessary, the thickness attributes of base objects like plates, brackets etc. are adapted to counteract the effect of these neglected holes, cut-outs etc. Profiles close together with parallel directions are represented by one object with some adapted properties. Apart from general export format, export to the IGES format makes wide use of the data possible.

In version 5.2, bracket functionalities have also been improved. Again, plate relations have been extended. If a curve does not fit between two relations, it is now possible to have it added. Plates can be related to face plates and flanges on plates in plan view, and bent profiles and pillars can be created.

Version 5.2, Nupas-Cadmatic also introduces the 3D Hull Library, a tool to store any kind of structural part, or group of parts, in a library. The stored structural parts can be retrieved and positioned freely within the current ship model or another ship model, increasing efficiency in the pre-design phase but also bringing the potential to add small parts in to the normal construction work phase. It can be used for both small and large constructions, from foundations to complete deck arrangements. The part data retrieved from the 3D Hull Library includes the part information such as cutting data, logistic data, weights etc., directly available for production.

In addition to supporting the hull shape data formats of NAPA, Fairway and the import of 3D DXF to the standard hull shape database, version 5.2 of Nupas-Cadmatic's 3D Hull Engineering also supports the import of several common CAD formats like IGES. A new import tool converts surfaces and curves from IGES or Rhino 3DM to the hull database.

Nupas-Cadmatic has won over many new users recently among shipyards and engineering offices. These include shipyards like Japanese Sasebo Heavy Industries Co, Kyokuyo Shipyard Corporation, and Shitanoe Shipbuilding Co, Fukuoka Shipbuilding Co now also uses the design software in its own design departments after its good experience from an engineroom designed by the yard together with NYK Engineering's branch office in Sasebo. Recent clients in Turkey include the Yardimci Shipyard, and Proteksan-Turquoise, a shipyard producing mega yachts and, in Vietnam, main shipbuilding research centre Vinashin Shipbuilding, Science & Technology Institute (SSTI) uses the software in its own design projects. The first Vietnamese shipyard to implement the Nupas-Cadmatic software was Nam Trieu Shipbuilding Industry Corporation (NASICO), part of Vinashin Corp. The yard has recently successfully built the first 53,000dwt Diamond 53 Bulk Carrier, the biggest vessel launched so far in Vietnam. The engineroom of the ship was designed using Nupas-Cadmatic software. The Consulting & Design of Transport Industry Co (CDTI) is another big ship design office in Vietnam which also uses Nupas-Cadmatic as well as the Bach Dang Shipyard in the Haiphong area.

Azipod from ABB pushes forward

EXPANDING production capacity and product ranges show the Azipod technology rising to demand.

The new assembly and testing facility of Azipod propulsion units as well as ABB Marine's Centre of Excellence for Cruise & Ferries will be operational in September this year.

ABB Marine is building a new production facility for its electric podded Azipod propulsion units in the Vuosaari Port business area east of Helsinki. The new facilities for ABB Marine's Centre of Excellence for Cruise & Ferries, will be operational in September 2007.

The existing facility in Vuosaari will have to give way to the new port, which is under construction. In Vuosaari, ABB assembles and tests the Azipod units, after which they are shipped to the client shipyards. The casts, propellers, the assembly blocks, hydraulic and mechanical turning machinery, bearing arrangements, lubrication arrangements, AC unit modules and other various parts are produced by a well integrated international supplier network. The electric systems, such as the rotors, stators for the Azipod units, and generators, switchboards, transformers and frequency converters, are produced at other ABB units located in Finland and in other European countries.

According to Jukka Kuuskoski, vice president sales at ABB Marine, the volume of the new facility is aimed at a throughput of some 40 units per year in a few years time, nearly doubling current volumes.

'When a higher volume is needed we just have to move to double working shifts,' he told *The Naval Architect*. 'In practise, year 2008 is though fully sold out, with just a few production slots available.' The current orderbook of ABB Marine exceeds US$1 billion.

The company is chiefly aiming to produce larger Azipod propulsion units at its new facility, but it will also be able to manufacture lower-power Compact Azipod units there. Units of this type have been sold for the second and third Chinese Yantai-Dalian train ferry and for one chemical tanker for Swedish Rederi AB Donsötank under construction in China, as well as for one luxury yacht and some spare units.

To date, some 170 Azipod units have been ordered for 81 vessels (123 Azipod, 45 Compact Azipod, 2 CRP Azipod). Of these, 129 units on 59 vessels are already in operation and 41 are in the orderbook.

ABB Oy Marine and Turbocharging employs some 180 people in Finland, whereas the workforce at assembly and testing is some 20 own staff plus a number of sub-suppliers.

Cruise ship volumes

Azipod propulsion is used aboard more than 35 cruise ships in operation today. Recent landmark deliveries for cruise ships include the three 14MW units for the world's biggest cruise ship, Royal Caribbean's *Freedom of the Seas* delivered last year.

Azipod propulsion units on order for cruise ships include the units for Aker Yards' second and third Freedom-class cruise ships and three units for the huge *Project Genesis* cruise ship. These deliveries will also include medium voltage generators, main switchboards, transformers, frequency converters and bow thruster motors.

From Fincantieri, ABB also received orders for a pair of 17.6MW units for a Vista-class cruise ship for Holland America Line, including auxiliary systems plus bow thruster motors, as well as the 17.6MW propulsion units and systems for the seventh and eight Signature-class cruise ships, for HAL and Costa Cruises. Two 19.5MW Azipod units for Norwegian Cruise Lines' *Norwegian Gem* and four 20.5MW Azipod units for two Celebrity Cruises Solstice-class cruise vessels have, meanwhile, been ordered by Meyer Werft. The ships will be delivered in 2008 and 2009.

The propulsion units for the Freedom-class vessels and HAL are still based on the 1000V fed cyclo-converter technology, whereas all the other newbuildings are of the new synchronous ACS 6000SD drive type, with a transformer voltage output of 3000V.

Arctic activities

Last year, the company announced the order for 2x10MW Azipod units for three 70,000dwt Arctic tankers for Lukoil/ConocoPhillips Varandei terminal transports from the Pechora Sea. 'Arctic ship propulsion is a demanding sector, but we can see that this is a growing market for us,' Mr. Kuuskoski said.

The 70,000dwt ships are being built at Samsung Heavy Industries for delivery to Sovcomflot in 2007, 2008 and 2009. The first pair of Azipod units for these ships is due to leave Finland in late March. Concurrently, Sovcomflot is also building two Arctic shuttle tankers at Russian Admiralty Shipyards for oil transportations from the Prirazlomnoye field under construction in the Eastern Barents Sea. ABB received the orders for Azipod propulsion units for the double-acting ships, built under licence from Aker Arctic Technology, which also is involved in their design. These vessels will be equipped with two 8.5MW Azipod units of LU6 -ice class each.

As for the Samsung vessels, ABB also delivers the medium voltage generators, main switchboards, transformers, and frequency converters. This contract is the first Azipod system delivery for ABB Marine to Russian Shipyards and the ship deliveries are scheduled for 2009. ABB recently also received the orders of four 13MW LU7 class Azipod units, including auxiliary systems, for the sisterships of *Norilskiy Nickel*, ordered from Aker Yards in Germany, delivered last year.

Other Arctic Azipod deliveries include 2x6.5MW units for FESCO's Sakhalin icebreaker and recent Azipod units for Sevmorneftegaz's multi-purpose icebreaking offshore vessels for the Prirazlomnoye oilfield in the eastern Barents Sea. ABB's delivery for these two vessels, delivered by Havyard Leirvik shipyard, included (for each ship) two 7.5MW Azipod units of ice class Ice 15, one 6.6kV main switchboard, six 8500/2000/900kVA transformers, two frequency converters, two 883kW tunnel thruster motors plus frequency converters.

Another recent delivery has been the 2x5MW propulsion units plus electrical systems for *Polar Pevek*, an offshore vessel and icebreaker for the DeKastri oil terminal on the coast of Sakhalin Island in Fareastern Russia. This vessel was built at Aker Yards, Langsten.

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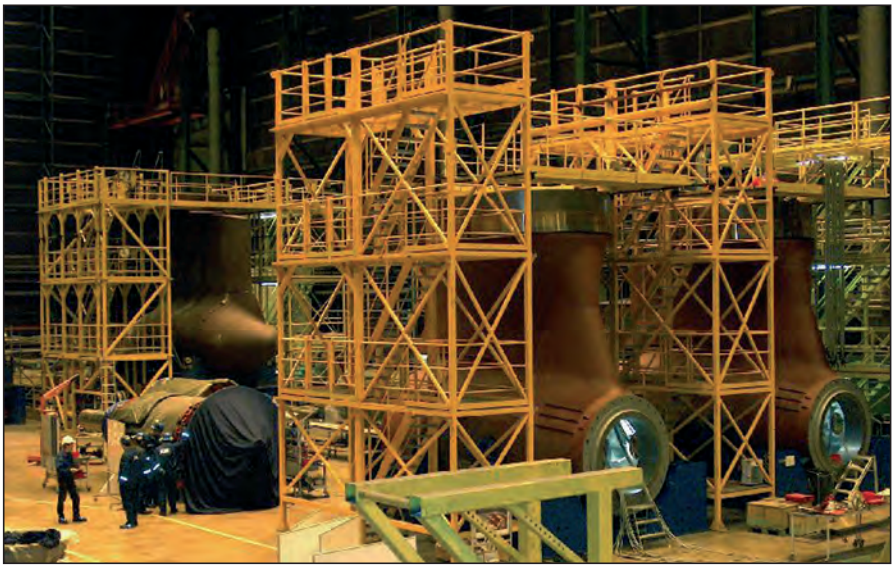
Accumulating advantage

Accumulated Azipod operating hours now exceed 2.6 million and there is experience from some nine years of continuous operation for a 14MW installation and some six years for 20MW units. 'The quality control of the whole supply chain from sub-supplier, own manufacturing to the shipyard and owner is one of our main focuses today,' Mr. Kuuskoski said. 'Quality control is instructed, implemented and monitored according to very strict practices.' All knowledge gained from production and operation is utilised and is available for the customers.

ABB Marine has also in close cooperation with major bearing suppliers developed a strict quality control system, where the latest knowledge on bearing design is applied. ABB is continuously working with ship operators in order to extend the bearing life time beyond industry standards by applying the recent technologies with systematic reliability methods. The Azipod shaft bearing achieves more running hours per year than a roller bearing on an average car achieves during its whole lifetime. The company has launched a heavily insulated easy-to-change thrust bearing for applications that are powered by the new medium voltage drives as well as the cyclo-converter driven units. To record the bearing's operating status, bearing temperatures, oil temperatures and vibration levels are all continuously monitored as are the oil cleanliness levels and oil filter status indications, on latest models. These can be read from the screen with warnings, should an abnormal situation occur.



The first pair of (V23 Ice type) 10MW Azipod units for the Arctic Double-acting Varandei shuttle tankers is due for delivery in late March from ABB Marine's assembly and testing facility. In the background, a pair of type V23 19.5MW units for a cruise ship.

ABB is now also actively promoting Azipod propulsion for LNG carriers, particularly when it comes to ice-going LNG carriers and LNG carriers with re-gasification capabilities (LNG RV). These propulsion solutions were already on the drawing board in the mid 1990's when LNG carriers were built in Finland. The possibility of further increased efficiency and added safety from improved manoeuvrability are benefits that pioneering owners will sooner or later exploit. The most rational alternatives would be two Azipod units, especially for ice-going LNG carriers, also making energy saving double-acting operation in ice possible, or a combination of Azipod propulsion behind a traditional shaft-driven propeller resulting in a contra-rotating drive (for LNG RV).

ABB takes a slice of LNG

ELECTRIC propulsion for LNG carriers offers benefits in terms of overall efficiency, as well as fuel savings, according to ABB.

ABB's power and propulsion solutions are well suited to safety and reliability requirements for the high availability demands of LNG carriers.

In 2002, ABB delivered the first 6.6kV medium voltage power solution for the cargo handling plant for three BP LNG carriers built at Samsung Heavy Industries in 2002-2003.

However, the true breakthrough came in 2005 when ABB was the first to supply electric propulsion systems for the two 153,500m^3 LNG carriers ordered from Chantiers de l'Atlantique, one apiece for Gaz de France (*Provalys*) and NYK Line/Gaz de France (*Gaselys*). These ships were the first large LNG carriers to take advantage of electric propulsion with a dual-fuel diesel electric (DFDE) engine concept. Also in 2005, Samsung Heavy Industries ordered electric power and propulsion systems for nine 153,200m^3 LNG carriers, of which six will be delivered to A.P. Møller and three to "K" Line. The ships are being built by Samsung for delivery in 2008. Each ship will receive 2 x 6.6kV medium voltage switchboards (main and cargo), four generators, 4 x three-winding propulsion transformers, 2 x ACS 6000 frequency converters, 2 x 12,650kW medium speed synchronous propulsion motors, MV distribution transformers, and a propulsion control system.

In 2006, ABB received orders for diesel electric propulsion systems for two 162,400m^3 LNG carriers being built for BW Gas ASA at Daewoo Shipbuilding and Marine Engineering (DSME) in South Korea, with first vessel's delivery due by the end of 2008. These will be the first LNG carriers at DSME to be equipped with an electric propulsion system. Also, in 2006, the company received orders for diesel electric propulsion systems for two 157,000m^3 LNG carriers being built for MISC at Mitsubishi Heavy Industries' Nagasaki shipyard, with the first vessel due delivery in December 2008. These will be the first LNG carriers in Japan to be equipped with an electric propulsion system.

High voltage switchboards and transformers have also been ordered for five LNG carriers for China LNG at Hudong-Zhonghua Shipbuilding Co.

ABB can thus claim to be the leading supplier for electrical power- and propulsion systems for LNG carriers, with systems for some 30 LNG carriers already delivered and nearly 30 on order.

Dual-fuel diesel engines producing electricity for the ship's propulsion, pumps and other consumers is becoming a preferred solution for many LNG carrier owners. Compared to steam turbines, the propulsion efficiency is significantly higher, some 48% according to ABB. Less fuel from the cargo is thus needed, and significant savings can be achieved. With diesel-electric machinery the efficiency when running at lower power is easily optimised, and high torque and operational flexibility is achieved over the entire rpm rate. Also, when comparing dual-fuel electric propulsion (DFEP) with slow speed diesel propulsion with a reliquifaction plant (SSDR), the overall efficiency is better for the DFEP according to ABB. This is owing to the fact that the reliquifaction plant has to be run simultaneously with the propulsion plant. With DFEP there are less harmful emissions than with steam- and slow speed diesel propulsion resulting in better environmental friendliness.

ABB uses ACS 6000 Marine Drives-type variable speed drives for the electric propulsion systems. They use DTC - direct torque control - motor control technology for accurate and smooth speed and torque control. This results in minimum torque ripple at the propeller shaft and low vibration and noise levels. According to ABB, another benefit of the ABB 24-pulse drive solution is that the harmonic distortion from the propulsion system is kept within classification limits without use of harmonic filters in the main switchboards.

The ACS 6000 drive is available in four base modules of 3, 5, 7 and 9 MVA. With four sizes of inverter modules available, the optimum configuration for a specific application can be reached by combining the modules with minimum engineering effort. By linking modules in parallel, the power can be increased to 27MVA.

Pemamek automation saves shipyards time

ONE way to increase shipyard productivity is by automating the manufacturing process of subassembly-panels.

FINNISH welding automation specialist Pemamek Oy has deepened its cooperation in heavy robotics applications with Yaskawa Electric Corporation subsidiary Motoman, after arriving at a system partnership agreement.

The move is the latest step in rolling out Pemamek products, perhaps the best known of which is the Pema Vision robot - a unique technology based on machine vision programming (see *The Naval Architect* September 2006) - already to be seen at Aker Yards in Finland, Fincantieri Riva Trigoso, Croatian 3 Maj and Spanish Navantia El Ferrol shipyards.

Pemamek focuses on offering industrial work-piece handling, welding mechanisation and automation for improving its clients' productivity. Automation in steel block fabrication is an important part of increasing efficiency within shipbuilding as well as in other industries. The privately owned company's sophisticated products can today be found in over 50 countries.

It produces welding automation solutions for large flat panels and parts production, production of profiles and T-beams including also pre-treatment, cutting, grinding and metal grid blasting. The work done with shipyards is often based on partnership agreements, through which material flow management solutions are tailored.

As pointed out by Pemamek, one way to increase productivity is by automating the manufacturing process of subassembly-panels. The company supplies production lines with a varying degree of automation, from manual assembly lines to fully automated systems.

New developments have focused on robotised profile cutting. Profile cutting is typically a labour-intensive task, which often causes bottlenecks.

The PEMA RCL -robotised cutting line offers a newly automated solution of this process including flexible material handling. It is an automated production line for the manufacturing of shipbuilding profiles. A large variety of profiles can be processed using the cutting line, from small flat bars to large H- and T-beams.

Unprocessed profile bars are fed to the line's beginning (in-feed buffer) by an overhead crane or a lifting truck. The end result is a marked and cut profile, ready for the next production phase.

The process is divided into edge cleaning, profile cutting and optional cut edge bevelling.

The edge cleaning cell includes a transport device, an edge blasting unit and an optional grinding unit. Edge grinding is used when an optimised profile edge shape is needed by removing the slight chamfer, in order to achieve a better welding result. One operator controls the assembly work and devices within this cell, which operate fully automatically. The devices in this cell are completely sealed from dust and noise. The user-friendliness is enhanced by graphical user interfaces.

Profile in-feed and length measurement system at Aker Yards Turku yard.

Profile processing line.

Typically, a profile cutting line comprises in-feed and out-feed conveyors, a robot cutting cell and a control system. A buffer storage or a text and bending curve marking device can be added to the in-feed side as well as a sorting system to the out-feed conveyor. Profiles can be automatically sorted based on their code or length.

Important mechanical features of a cutting cell include profile positioning, speed of measurement equipment and reliability in operation. The actual cutting can be done, depending on the thickness of the profile, by traditional oxygen gas cutting, powerful plasma cutting or a combination of these, using automated tool change.

An integrated cut edge grinding system can also be added to the cutting cell, using a tool exchanger. This feature finishes the edges for the next production stage.

The profile cutting can be an off-line program based on the yard's CAD information. The process control of the PEMA cutting cells is handled by the MasterCut control system, which is an easy-to-use macro-based cutting control system.

The generic files used by PEMA cutting cells can be made by the yards' typical CAD programs, such as Tribon, Foran, AutoCAD etc. In a work preparation control system, such as NESTIX 2, CAD files containing profile, parts can be amended and nested before they are put into the cutting cell's control unit. Also, the yard materials storage management systems can be included, when required. In producing the software for part production management, Pemamek cooperates closely with another Finnish specialised company, Nestix Oy.

Using an overhead crane the operator loads the selected profiles onto the in-feed buffer according to a pick-up list. The loading is done in the correct position, i.e. with the flange facing downwards and web bottom facing towards the operator. The profiles are fed to the in-feed conveyor by means of chain driven sideways conveyor. Before the feeding material and dimensions are checked, in-feed order, profile size and type are confirmed, to correspond to the job files on the computer. The profile automatically runs through cutting cell guided by a Cell controller, which checks the cutting code. The profile position is accurately measured using a laser sensing device, and the cutting is done according to the cutting program. Before cutting, the profiles are typically marked using an inkjet text marking device. After cutting, the out-feed roller conveyor transfers the profiles to the out-feed buffer storage.

Navis takes dynamic position

ADVANCED mathematical models that provide faster and more accurate corrections are widely used in the Navis IVCS dynamic positioning system. High accuracy is achieved through Kalman filter technology, which constantly optimises the mathematical model for changing environmental conditions or vessel conditions.

Helsinki-based Navis Engineering, whose research and development work is done in St. Petersburg, Russia, offers high-quality automation and control systems for ships. Its products include dynamic positioning (DP0 - DP3) systems, joystick control systems and ship automation systems. The latter include autopilots, steering and thrust control and survey control systems. The products have DNV, ABS and Russian Maritime and River Register approvals.

On the DP side, modern optimisation methods such as frequency domain techniques and three degrees of freedom modelling serve to provide good performance. Simplicity and reliability of the design is achieved through various levels of redundancy. Another unique feature of Navis IVCS is the real-time thrust capability plot calculation. It means that the DP operator has the ability to know, at any time, the amount of thrust available even if one or several thrusters fail.

The Navis IVCS system uses a touch-screen soft key display that automatically reconfigures depending on the mode selected, thus reducing potential operator confusion. The reduced quantity of visible keypads ensures safe and easy operation. Every alert message produced by the system is doubled by a voice alarm.

Navis IVCS operator station uses touch-screen soft key display

The DP control screen is ergonomically designed to reduce the amount of training needed and adaptation to the operation of the Navis IVCS system. Every alert message needs to be confirmed via a touch-screen or on the panel, which provides an additional level of security.

Recent IVCS systems supplied include a DP0 for Estonian Maritime Administration's new multi-purpose icebreaker *EVA-316*, a converted buoy-tender, which entered service in March 2006. Also the Canadian research icebreaker CCGS *Amundsen* (former *Sir John Franklin*), received an IVCS 11 +01 system last year. Recently Beier Radio, Navis' OEM partner in the USA, has been contracted by a new customer, Bourbon, to supply 36 Navis DP2 (as Beier IVCS 2000) systems for twenty-six anchor handling tugs and ten platform supply vessels under construction for Bourbon in China.

To date, the company, established in 1992, has delivered dynamic positioning systems for more than 130 oil & gas tankers, supply vessels, tugs, fishing boats, research and other special application vessels, as well mega yachts. Clients of Navis' include Rigdon Marine Corporation, AMT Marine, Hornbeck Offshore Service, Candy Fleet Corp, Atlas Boat and NOAA.

Other systems have until now been delivered for more than 250 vessels. The company also supplies its DP simulators for technical and maritime schools and training centres. Clients include Satakunta Polytechnic School in Finland, Admiral Makarov State Maritime Academy in Russia, LPM Concearneau in Germany, Texas A & M University, Delgado Community College and Louisiana Tech College/Young Memorial in the US and SINDMAR in Brazil.

Guidance towards design alternatives

CRUISESHIP designers can look forward to a newly flexible regulatory regime when it comes to meeting safety requirements set out by the International Maritime Organization but, as ever with developing guidelines, certain fine details remain to be seen.

***Freedom of the Seas* – construction of ever larger cruiseships prompted administrations to undertake a full review of the guidelines governing their design in order to meet safety requirements. Results flowed from December's MSC 82.**

DECEMBER'S 82nd session of the Maritime Safety Committee meeting in Istanbul concluded with significant revisions in passenger ship safety standards.

The package of amendments to SOLAS adopted at the session were the result of a comprehensive review of passenger ship safety initiated in 2000 with the aim of assessing whether existing regulations were adequate, in particular for the large passenger ships now being built.

They envisage a mechanism for the approval of alternative ship designs and arrangements that deviate from the prescriptive requirements of SOLAS chapters II-I and III.

An IMO statement said that the work had based its guiding philosophy on the dual premise that the regulatory framework should place more emphasis on the prevention of a casualty from occurring in the first place and that future passenger ships should be designed for improved survivability so that, in the event of a casualty, persons could stay safely onboard as the ship proceeded to port.

Although these are guidelines only, they serve to outline a new methodology for the engineering analysis required by SOLAS regulations II-1/55 and III/38, applying to a specific engineering or life-saving system, design or arrangements for which approval of an alternative design deviating from the prescriptive requirements of SOLAS chapters II-1 and III is sought.

The amendments require the consideration of new concepts, such as criteria for the casualty threshold (the amount of damage a ship is able to withstand, according to the design basis, and still safely return to port).

They have also been framed to provide flexibility, with a view to allowing ship designers to meet any safety challenges the future may bring.

The amendments, which are expected to enter into force on July 1, 2010, include:

- alternative design and arrangements for a range of measures, including shipboard structures and systems based on novel or unique designs, as well as traditional shipboard structures and systems that are installed in alternative arrangements or configurations.
- safe areas and the essential systems to be maintained while a ship proceeds to port after a casualty, which will require redundancy of propulsion and other essential systems;
- on-board safety centres, from where safety systems can be controlled, operated and monitored;
- fixed fire detection and alarm systems, including requirements for fire detectors and manually operated call points to be capable of being remotely and individually identified;
- fire prevention, including amendments aimed at enhancing the fire safety of atriums, the means of escape in case of fire and ventilation systems; and
- time for orderly evacuation and abandonment, including requirements for the essential systems that must remain operational in case any one main vertical zone is unserviceable due to fire.

Furthermore, the MSC adopted amendments to SOLAS chapter II-2 and to the International Code for Fire Safety Systems (FSS Code) to strengthen the fire protection arrangements in relation to cabin balconies on passenger vessels. These particular amendments were developed specifically in response to the fire aboard the cruise ship *Star Princess*, while on passage between Grand Cayman and Montego Bay, Jamaica, in March of last year. A fire began on an external balcony and spread over several decks. They are aimed at ensuring that existing regulations 4.4 (Primary deck coverings), 5.3.1.2 (Ceilings and linings), 5.3.2 (Use of combustible materials) and 6 (Smoke generation potential and toxicity) are also applied to cabin balconies on new passenger ships.

In view of the urgency that such amendments are required, they are expected to enter into force on 1 July 2008.

However, it is in the over-arching shift in the approach to ship design that the true significance of the new guidelines lies. They envisage all interested parties, including the Flag State, owners, operators, designers and classification societies being in continuous communication from the outset over any specific proposal to use them for alternative design solutions. 'This approach usually requires significantly more time in calculation and documentation than a typical regulatory prescribed design because of increased engineering rigour,' according to an IMO circular.

Not all proposed amendments to SOLAS were agreed at MSC. For example, amendments regarding stability were not accepted and were sent back to the Sub-Committee on Stability and Load Lines and on Fishing Vessels Safety for further debate and refinement.

However, Capt Ted Thompson, senior vice president for Cruise Lines International Association, was in no doubt as to the profound nature of the change. 'Future passenger ships will be built to the newly adopted probabilistic damage stability regulations that were developed over a time frame of about 12 years,' he said. 'Additionally, IMO recently adopted regulations requiring new passenger ships to survive and return to port while providing essential life services after a fire that disables an entire main vertical zone (providing for separation, redundancy and protections or vital systems passing through that zone) and to provide similar redundancy, separation and protections of systems to return to port.'

Survivability meant the ability to return to port under own power while providing essential life services after disabling any one main vertical fire zone or flooding of any one watertight compartment, he said.

Capt Ted Thompson of Cruise Lines International Association broadly welcomes the new guidelines on alternative designs for cruise vessels believing they will enhance safety levels significantly.

'We believe that these requirements, arrived at after much discussion and refinement, are technically achievable and will significantly improve survivability and safety. There is a continuing need however to develop explanatory notes and unified interpretations for some of these complex requirements.'

IMO's rewrite of Chapter II-2 some years ago included a new Regulation 17 that first introduced the principle of safety level equivalence for alternative designs in the context of fire protection, using risk assessment techniques as its underpinning approach. Now, SOLAS Chapter I Regulation 5 makes it clear that legislators envisage an equivalent level of protection as permissible for just about every regulation.

Requirements are performance based and allow designers to meet safety levels through any number of design alternatives, where performance criteria are measurable quantities to be used to evaluate the adequacy of trial designs.

Casualty or operational scenarios are to provide the basis for analysis and trial alternative design evaluation and, therefore, are seen as the backbone of the alternative design process.

'The trial alternative design should also take into consideration the importance of human factors, operations and management,' says IMO's agreed text. 'It should be recognised that well defined operations and management procedures may play a big part in increasing the overall level of safety.'

Over and above the new flexibility, there are specific amendments which will have some direct impact on ship design. Capt Thompson said that a number of amendments had been aimed at refining the construction of the boundaries of atriums. However, he added: 'We believe these can be incorporated into atrium designs without any large impact on the overall design layout of an atrium and that the changes will be transparent to our guests.'

Still developing is the mathematical modelling to analyse passenger distribution in the case of evacuation, a matter which is also likely to have an impact on ship lay-outs in the future (see pp43-44). Current guidelines for evacuation and abandonment have been required to comply with very rudimentary or simplified time limits, where the mathematical models for the great number of elements that go into evaluation of 'evacuation' and 'abandonment' are still being developed and refined for the more complex computer simulations of this complex safety element.

'In general, we are satisfied with the amendments that were adopted at MSC 82,' concluded Capt Thompson. 'We participated in their development over the years and while not perfect and while maybe not totally justified in all instances, we are satisfied that they are technically achievable and achieve the stated safety goals. There are however, a number of areas that need interpretation and explanatory notes so that designers and shipyards can get on with designs that will be acceptable to the various administrations. This is not necessarily further debate but rather an agreement as to the exact meaning of certain wording.

'Despite the implication by some that passenger ship safety has not been significantly improved, my opinion is that it has been dramatically enhanced and I believe that a close look at the new amendments will hold that to be true.'

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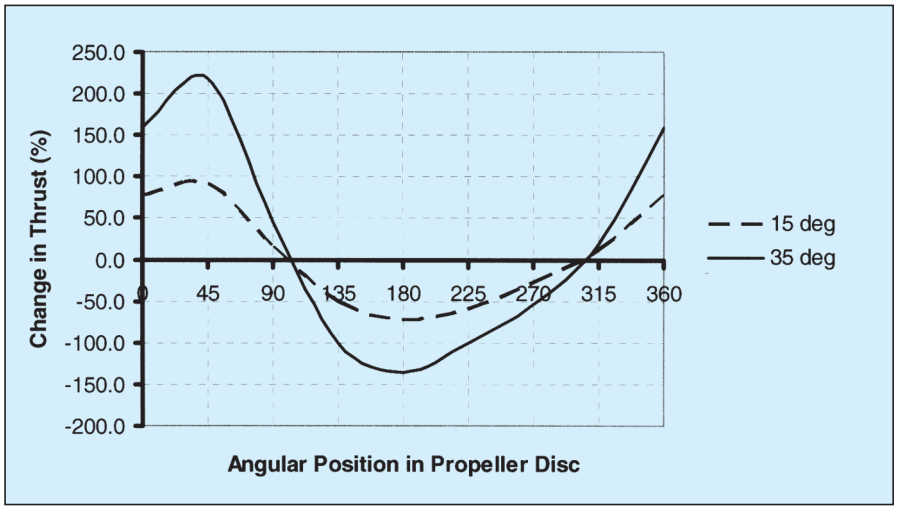
Podded propulsors: learning from experience

A November technical presentation at the Institute of Marine Engineering, Science and Technology by John Carlton, of Lloyd's Register*, and attended by *The Naval Architect*, outlined some of the problems experienced by high-power podded propulsors – partly, the author suggested, resulting from too rapid a rise in power output. He proposed ways in which operators could achieve the designer's intention and how a unit could be correctly maintained to the best advantage.



Loads on pod components are a most important aspect of design and operation. Shown here is a typical variation in thrust generated at different azimuthing angles as a propeller rotates through one revolution. This should be contrasted with nearly constant thrust and torque signature produced at a zero azimuthing angle.

AZIMUTHING propulsors have revolutionised some sectors of our industry, most notably cruise ships, where they are now commonly fitted to many new vessels. As many readers will be aware, it has not been roses all the way, despite the fact that azimuthing technology has been known since 1878. The mini crisis has largely arisen as a result of a massive jump in output during the latter half of the 1990s allied to the inclusion of an integral motor in the hub; up till then, powers generated had been quite modest, being mainly in operation on smaller types of ship such as ferries and workboats using mechanical Z-drive configurations.

As early as 1992, Finnyards – as the company then was – was able to install twin 7500kW Aquamaster Rauma mechanical steerable thrusters in the new dual-role icebreaker *Fennica* and her sister. However, that volume of power was probably around the maximum for mechanical trains. From that point, in association with integral electric motors, the power curve increased rapidly – perhaps too rapidly, believes Mr John Carlton, from Lloyd's Register, although he was careful not to criticise individual designs, and indeed experience has apparently shown no special distinction between models.

For the record, the success of ABB's Azipod design with icebreaking tanker retrofits, followed by a trial installation of two 14,000kW ABB Azipods on Carnival's *Elation* (a member of an already successful series of cruise ship hulls, the *Fantasy* class) boosted prospects and led to larger units and other designers entering the market; these included Alstom/Kamewa with its Mermaid design; two 19,500kW Mermaid units went to sea on *Millennium* in 2000 and four Mermaid pods on *Queen Mary 2* (4 x 21,500kW) in 2003.

Such rapid increases in power have led to several technical problems, including some early seal failures (seal problems generally show a very low incident rate). To investigate the causes of these, and particularly the loads on various components, Lloyd's Register undertook a major study, although several national and international programmes had been completed years earlier. The results have been used to update that society's propulsor rules, originally published in 2003, and to develop procedures for surveys which embrace the practical problems of initial manufacture and assembly as well as drydocking maintenance activities – the latter, Mr Carlton notes, can sometimes take place in very undesirable conditions.

Hydrodynamists and metallurgists would have found Mr Carlton's presentation highly instructive; many of the problems seem to be common, regardless of manufacturer, however, mechanical failure numbers appeared to be higher than electrical ones. Possibly the most important lesson, suggested the speaker, was that designers perhaps lost track of industry experience in the rush to build ever-larger units.

A factor of great interest for twin-pod and quadruple-pod designers was the interaction that occurred at large manoeuvring angles and the increased mechanical and bearing loads that can result at these angles – different for each pod. Sea trial manoeuvring programmes should therefore be carefully planned. Crash-stop operations must also be carefully considered, likewise sailing in poor weather when shaft bending moments can be significant. Mr Carlton said that CFD techniques can help in these matters but were not totally reliable, and more effort was still needed to examine the scale effect.

Other problems have occurred with roller bearing raceways in the thrust bearings (damage can be partly generated by bearings having to absorb bending moment loads while a pod is turning) when failure damages such as morphology, cracks, and so-called butterflies were apparent, including subsurface cracking. Normally, sterntube bearings can be expected to last out a ship's life, but roller bearings in a pod probably have to be changed after 65,000hours. Here, correct lubrication – allied to careful regular monitoring of oil quality – and avoiding the creation of debris is considered of the utmost importance.

In connection with cleanliness, it is most interesting to note that ABB, designer of the Azipod, has built special enclosures for wrapping about pods during drydock maintenance, so that work can continue in a clean atmosphere. An innovative technique that could be useful in detecting impending bearing failure is what is known as acoustic emission technology; however, care has to be taken to avoid confusion with other noise such as that generated by cavitation and boundary layer turbulence.

Finally, Mr Carlton predicted that in approximately five years' time, design and manufacturing technology will have caught up with the dramatic service experience of the last few years. Oh, and he also noted that pods on icebreakers were much stronger than those on cruise ships. Maybe there is a lesson to be learned there.

* 'Podded propulsors: some results of recent research and full-scale experience', by J S Carlton, from Lloyd's Register, presented on November 7, 2006 at the Institute of Marine Engineering, Science and Technology, London.

Readers may also like to know that two associated papers, both by Wendy Ball, from QinetiQ, and John Carlton, were, at the time of writing, in the process of publication, to appear in the *Journal of Maritime Engineering* as transactions of The Royal Institution of Naval Architects. These are: 'Podded propulsor shaft loads from free-running model experiments in calm-water and waves', and 'Podded propulsor shaft loads from model experiments for berthing manoeuvres.'

Further, readers may like to know that John Carlton and N Rattenbury presented a paper at the T-Pod conference, held on October 3-5 2006 in Brest, France; this was entitled 'Aspects of the hydro-mechanical interaction in relation to podded propulsor loads'.

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Hi-Fog hits the heights on Genesis project

MARIOFF'S high pressure water mist system Hi-Fog is once again the preferred fire protection choice for the very largest of cruiseships.

The Hi-Fog 2000 system has been selected for the Genesis project. The system will include more than 13,000 sprinklers and cover all accommodation, public and service spaces.

In the machinery spaces Hi-Fog will offer a significantly higher level of fire protection than required by the regulations of the International Maritime Organization, at RCCL's request.

In addition, Hi-Fog nozzles will be installed to protect the laundry and galley ducts as well as the deep fat fryers.

As a special feature, the Hi-Fog system will be commissioned into use as the ship is being built.

As soon as a section has been completed, it will be connected to the active HI-FOG system. Thus the system will provide fire protection for the ship during construction.

Marioff said its current order book included multiple orders from all four major shipyards building cruise vessels in Finland, Italy, Germany and France.

The Hi-Fog approach involves millions of water droplets and uses up to ten times less water than a conventional spraying system, increasing the capability of the system to fight fires, while at the same time minimising damage.

13,000 Hi-Fog sprinklers will be installed on the ship that will emerge from the Genesis project.

Lifts for world's largest cruise ship

A CONTRACT has been won by Kone, from Aker Yards, for the design, supply, and installation of all lifts on the 220,000gt Genesis project ship, which is building at Turku for Royal Caribbean International (RCI). Finland-based Kone will supply the giant cruise ship with a total of 41 customised models, serving the vertical transportation needs of both passengers and crew.

The units will be hoisted and lowered by Kone EcoDisc machinery and based on either the Kone MiniSpace or the machine-room-less Kone MonoSpace platform. Delivery of all lifts is scheduled for autumn 2009.

Meanwhile, in the second quarter of 2006, production of lift doors for the North American market got underway in Kone's purpose-built facility in Torreón, Mexico. Kone has now decided to transfer the current lift component manufacturing activities in McKinney, Texas, to Torreón by the middle of 2007.

Koja's landmark deal

HEATING, ventilation and air conditioning systems aboard the ship being developed under Project Genesis will be supplied by Finnish company Koja Marine.

The supplier said the vessel would feature numerous innovations in its HVAC and HVAC automation systems, without going into further detail.

Koja will deliver air handling units, technical space cooling units, a new type of integrated cabin fancoil and public area fancoil, all air devices, HVAC pumps and heat exchangers, as well as undertaking electrification, HVAC automation and commissioning.

NCL adds super-luxury ship

AT the end of November, the leading German builder Meyer Werft handed over to Norwegian Cruise Line the 93,500gt *Norwegian Pearl*. This is the third of a series of four sisters for this owner and is once again based on the so-called free-style cruise concept combining 'event gastronomy' with highly luxurious and extravagant interiors and state-of-the-art technical standards.

Some 70% of the cabins (792) face the sea, with most of them having their own balconies. Total passenger capacity is 2394, served by 1100 crew.

As is fairly standard today, *Norwegian Pearl* is powered by a diesel-electric plant featuring azimuthing propulsors, in this case twin ABB Azipods, each of 19,500kW. Primary power is supplied by a bank of five diesel-alternators; these comprise 14,400kW MAN 12V48/60B medium-speed engines driving 11,000kVA ABB alternators. The newest environment-friendly features are included in the engines: these incorporate invisible-smoke technology, claimed to result in no exhaust smoke being shown when under load, and oil/water-emulsion fuel injection, which is expected to give significant reductions in exhaust-gas NOx levels.

The hull lines have been carefully refined using computer analysis and are expected to result in outstanding seakeeping and manoeuvring, with low levels of vibration. A redundant and de-centralised control and monitoring system is employed with numerous workstations for retrieval of technical data.

An integrated navigation and command system is included, based on a SAM Atlas Marine Electronics NACOS 65-4 integrated system, with high-resolution colour monitors on the bridge. Three tunnel bow thrusters can be linked to the Azipods by joystick for manoeuvring, and in addition the ship can be controlled by a dynamic positioning system for automatic berthing or when it is in the vicinity of sensitive coral reefs, which can be damaged by anchors.

Lifesaving equipment comprises ten enclosed lifeboats mounted on each side of the hull (six of these are designed to act as passenger tenders for shore operations), also two fast rescue boats. *Norwegian Pearl* is additionally installed with four marine evacuation systems (MES).

Water supply and disposal

An extensive desalination plant, including a reverse-osmosis system, supplies all the liner's normal fresh water, although it is also possible to take on water from shore. To ensure economic use, condensed water from the airconditioning system is collected and re-used in the laundry. Steam is used to heat water.

All black water from toilets is led to four vacuum-collection tanks, and from here both black and grey water (the latter from basins and showers) are processed in a biological-chemical plant which includes a bio-reactor. Cleaned water is piped to a storage tank for further use as service water. Remaining sludge is dried and burned in an incinerator. *Norwegian Pearl's* classification includes a Det Norske Veritas ECO CLEAN notation.

The 93,500gt *Norwegian Pearl* is the third of four new cruise liners for Norwegian Cruise Line (NCL) ordered from Meyer Werft. She follows the current trend in having hull decorations.

Among a host of super-luxury amenities on board is the Summer Palace restaurant (the design is based on a Russian tsar's palace). Here, up to 600 guests can be seated, and six-course menus are offered; a full-width window overlooks the ship's stern.

One of the incredibly luxurious suites of various grades.

Super-luxury accommodation

The super-luxury accommodation includes two Garden Villa suites, each of 311m^2 and including a garden and sundeck; six 77m^2 Owners' suites with two balconies (both these grades have direct access to the exclusive Concierge Lounge on Deck 14, where there is a swimming pool, jacuzzi, and sundeck).

Also offered are 38 Penthouse suites of 51m^2, and the Courtyard Villa with dedicated balcony, dining area, separate bedroom, separate children's room, with butler and concierge service, also access to the Concierge Lounge. Further possibilities are 132 mini suites (26m^2) and of course, for mere mortals 'ordinary' cabins (which include 27 for disabled passengers).

As might be expected with such a grand collection, there is an excellent selection of restaurants and cafés, including the 600-person Summer Palace restaurant, with six-course menus and a full-width window overlooking the ship's stern. Next to this is Le Bistro for 300 guests, while on Deck 12 is La Cucina Italian restaurant, also the Garden Café and Kids Café; and on Deck 13 is Cagney's Steakhouse. All these are supplied by seven galleys and various pantries and bars. Allied to all these are a wonderful collection of lounges and bars, as well as a library, card room, Lifestyle room, Aqua Kids Club, Metro Centre, and many other attractions.

Mini cruise liners for the discerning traveller

AN unexpected shipyard is to join the list of builders of cruise liners, with the announcement that Irving Shipbuilding (formerly Halifax Shipyards, now part of the Irving Group), at Halifax, in Nova Scotia, Canada has secured an interesting contract from a new operator, Pearl Seas Cruises. This company is based in Connecticut, USA, and is an offshore affiliate of American Cruise Lines; the latter was formed to operate coastal and river cruises in the USA. Pearl Seas is the 20th member to join the Cruise Line International Association.

Pearl Seas: An artist's impression of the new 9000gt mini cruise liners ordered in Canada at Irving Shipbuilding by Pearl Seas Cruises.

The yard is to build two 9000gt mini liners designed for worldwide service. Passenger capacity in the first ship will only be 165, accommodated in 88 cabins, all of which will have private balconies; for the second vessel, accommodation will be increased so that 210 passengers can be carried.

Pearl Seas is aiming at the luxury end of the market, and plans to take its new ships into smaller harbours and destinations larger vessels cannot reach – a classic aim of the smaller operator.

Initial cruises are planned around the Canadian east coast and Newfoundland, followed later in the year by voyages to the Caribbean.

The new designs will feature large cabins ranging from 22m^2 to 47m^2, all with large picture windows, flat-screen satellite TV and DVD player, individual climate control, internet access, and many other modern luxuries. A spacious restaurant to seat all passengers at once has been specified, and this will have windows offering panoramic views. Several lounges and a spa will also be installed, together with three observation decks, all served by lift. Roll stabilisation equipment will be fitted, and a twin-screw propulsion plant will be fitted for an unspecified service speed.

Plans envisage the first ship being delivered in July 2008 with the second to follow in June 2009.

TECHNICAL PARTICULARS
PEARL SEAS MINI LINERS

Length	92.00m
Breadth	15.90m
Draught	3.10m
Gross	9000gt
Passengers	165 (first ship)
	210 (second ship)
Main engines	2 x 4700kW
Speed	-
Flag	Marshall Islands
Classification	Lloyd's Register

Recessed sprinkler heads for improved safety

LAUNCHED at last September's SMM exhibition in Hamburg by Minimax GmbH & Co KG, from Bad Oldesloe, was a new sprinkler for shipboard use. This is the second of two innovations from this company; in our January Trade and Equipment News section, we reported on a new arrangement for extinguishing cruise ship balcony fires.

The most interesting new Undercover sprinkler, which is planned for use wherever a classic sprinkler system is specified, features a head that is fully recessed into a ceiling, hence the name. The new model consists of proven components from the Sprinkler 21 range, allied to a new type of enclosure which can be set into suspended ceilings. The unit is recessed to meet EN12259-1 standards and integrates discreetly into the overall appearance of a ceiling. This should protect against false activation following mechanical damage.

The cost of cleaning is said to be less than for conventional sprinklers, and the lower ends can be finished with either decorative rings or covers with fine-mesh faceplates which are almost flush with a ceiling. Both are available in white, chrome, and in any desired colour tone.

Extra safety should also result because the unobtrusive covers, which when closed resemble loudspeaker grilles, are held in place by magnets, whose strength has been precisely defined. When activated, spray force is sufficient to remove the faceplate but since the designers wanted to avoid any delay in activation of the sprinkler, Minimax also equipped each faceplate with a 'drop' system which clears the sprinkler head even before the latter reaches its activation temperature.

This patent Coverdrop design consists of a dissolvable link, which releases a feather spring when its activation temperature is reached. The impulse of the spring should therefore release the faceplate of the Undercover sprinkler on time.

The interesting new Undercover marine sprinkler head from Minimax is designed to be recessed into a suspended ceiling. It is fitted with special components to ensure automatic removal of the faceplate and speedy activation.

Carnival returns to Fincantieri twice

ITALIAN shipbuilder Fincantieri has once more benefited from its close relationship with Carnival Corp, securing orders for two more luxury ships and extending its order backlog to 15 cruise vessels, including one option.

Carnival exercised an option for a further large 130,000gt vessel, to be operated under the Carnival Cruise Lines brand. The new ship will have 3652 lower berths and will be assembled at Fincantieri's Monfalcone yard near Trieste. The inclusive cost is believed to be around €565 million.

When delivered in the spring of 2011, the ship will be a sister to a similar first-of-class hull scheduled to enter service in the autumn of 2009. They are the largest ships yet contracted by Carnival.

The 2011 delivery time was revised from summer 2010, after Carnival followed up by taking the original slot at the Monfalcone yard through another order for its P&O brand, in a €535 million deal covering a 116,000gt ship, to feature 3100 lower berths. This ship is scheduled for delivery by Spring 2010.

Essentially, the new P&O ship will be a sister to *Ventura* – due to enter service in April 2008 – although Fincantieri said that yard and owner would look to develop a new ship interior design for the latest vessel.

Launch for the sea's latest Queen

FINCANTIERI'S Venice-Marghera yard launched the cruiseship *Queen Victoria* in mid-January, ordered by Carnival Group for its British brand, Cunard Line.

Queen Victoria, to be delivered at the end of 2007. will become one of the largest panamax ships ever built. At 295metres long, and with a gross tonnage of around 90,000, the ship will feature 1007 cabins – including a high proportion of luxury suites and mini suites – of which 864 will have a sea view, the majority with an external balcony. The ship is being presented as the natural evolution of the concept of Cunard's long-standing tradition.

With 16 decks (12 for passengers), the ship will offer a passenger capacity of 2000 and a crew of 900, and will be the second largest passenger ship ever to be built for Cunard. It will lead to a 40% increase in the passenger capacity of the owner's fleet.

It will be equipped with six diesel engines, four 16-cylinder and two 12-cylinder Sulzer ZA40 engines, from Wärtsilä, offering total power of 63.4MW, to achieve top speeds of 23.7knots and cruising speeds of around 18knots.

The ship will also feature podded propulsion, in the shape of twin 17.6MW Azipod units from ABB, which will be able to rotate through 360 degrees. It will have three bow thrusters, which will each absorb a maximum power of 2.2MW. It will also feature one pair of 20m^2 folding fin stabilisers.

The design of the ship has been fundamentally reconfigured since Cunard stepped in to take up a building slot originally intended for a Vista class ship, identical to the P&O *Princess Arcadia*. Lengthened by 11.5m, adding 5000gt to the original design, the *Queen Victoria* will also feature a modified stern designed to open up more deck area. At 32.3m across the beam, the ship will be 62.5m high (keel to funnel).

The redesign will facilitate delivery of a ship with 718 of 864 outside cabins featuring balconies and superstructure innovations that will include the first theatre boxes at sea in its three-deck theatre; the first floating museum, housing Cunard artefacts and memorabilia; the first two-storey library at sea and a grand British colonial-style conservatory with a central fountain and a retractable glass roof.

The bridge, located on deck eight, 26m above sea level, features a span of 34m. The bridge system itself comes from SAM Electronics which has scored another success for its Nacos 65.5 system.

In addition to the *Queen Victoria* the order book of Marghera shipyard also includes the construction of a further four ships for three different brands in the Carnival Group: the 110,00-ton *Carnival Freedom* for Carnival Cruise lines, due for delivery at the end of February, the 86,000-ton *Eurodam* (prototype of the 'Signature' class) for Holland America Line, due for delivery in summer 2008 (the owner also has an option for a sister ship) and two 92,700-ton ships for Costa Crociere, due for delivery in spring 2009 and 2010.

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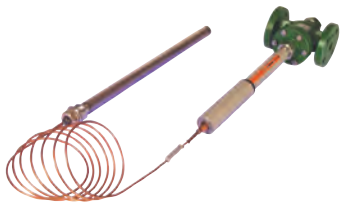

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Time to respond on ship evacuation

IN the first of two articles, S Deere, E R Galea, P Lawrence, L Filippidis and S Gwynne, of the University of Greenwich, UK highlight the problems with the current IMO response time distribution covering evacuation from large passenger ships. In next month's issue, the same authors will present their proposed solution

HOWEVER remote the possibility or difficult the task, passenger ship evacuations do occur and they are usually the result of fire, collision, equipment failure, grounding or mal-operation.

To arrive at coherent requirements for passenger evacuation from passenger ships, the International Maritime Organization is re-evaluating its thinking on response time distribution among passengers in the case of evacuation from large passenger ships.

In recognition of the development of sophisticated evacuation simulation techniques the IMO developed a set of Interim Guidelines that set out the standards on how evacuation simulation should be undertaken for certification applications. These guidelines define two benchmark scenarios (along with two variants) that must be simulated as part of the certification process. These are 'night' and 'day' scenarios, establishing a baseline performance for the vessel and crew allowing comparison with both the set target time and alternative designs.

The scenarios only address the mustering or assembly phase of the evacuation and involve conditions of dead calm and do not explicitly take into consideration the impact of fire. To allow for these omissions a safety factor is added to the predicted muster time.

The resulting analysis should allow identification of areas of congestion that develop during an evacuation and demonstrate that escape arrangements are sufficiently flexible to account for the loss of particular parts of the evacuation system. The difference between the 'night' and 'day' scenarios consists of the starting locations of passengers and the simulated passenger response time distribution exhibited by the passengers.

During an emergency, passengers will not respond immediately to the call to assemble. Even when an individual decides to react to the call to evacuate, their situation often prohibits immediate flight. Individuals may decide to perform a number of tasks before actually evacuating, such as collecting belongings, reuniting family members, complete a financial transaction, finish a meal etc. Not everyone will react at the same time. As each passenger will have a unique response time it is necessary to define a response time distribution to represent this inherent variation.

If the response time distribution is set to zero or near zero, then all the passengers will react (almost) immediately and so considerable unrealistic congestion is likely to develop in many locations. If the response time distribution is too wide then there will be a considerable gap between the starting times of passengers and so potential choke points in the geometry will not be detected. Furthermore, as the process is inherently non-linear, it is not possible simply to set a zero response time distribution and then apply a scaling factor to produce an estimation of the total evacuation time. Understanding and quantifying the response time is a key component of the entire evacuation process.

Deck	Fire Zone 1	Fire Zone 2	Fire Zone3	Total
6	-	75	175	250
7	-	50	200	250
8	120	24	130	274
9	91	210	-	301
10	-	225	-	225
Total	211	584	505	1300

Table 1 – Distribution of passengers for day Scenarios.

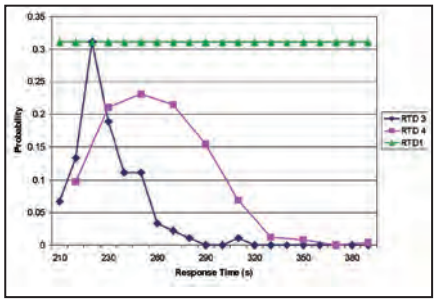


Figure 1 – The three response time distributions, IMO (RTD1), modified retail (RTD3) and modified library (RTD4).

In building applications, occupant response time can in fact be longer than the actual evacuation travel time. As a result considerable effort has been expended in the building industry in attempts to quantify and understand occupant response time for particular situations. Unfortunately little or no data relating to passenger response time in maritime environments exists.

Due to a lack of data, the passenger response time distribution in MSC 1033 has been arbitrarily set to a uniform random distribution of 210–390 seconds with a mean of 300 seconds for the 'day' case scenario and 420–780 seconds with a mean of 600 seconds for the 'night' case scenario.

This involves two key assumptions. The first is that the response time distribution assumes the form of a random uniform distribution. Evidence from studies in the building industry suggests that this is not the case with response time distributions typically following a skewed or log-normal distribution.

The second key assumption concerns the actual range of response times. The range of response times adopted in the day case is 210 to 390 seconds. This range of numbers is not actually based on real measurements but represents values derived by committee. Evidence from the building industry suggests that typical response times in day situations range from 4 to 110 seconds in retail environments, 8 to 200 seconds in university library environments, 30 to 66 seconds in hospital waiting room applications, etc.

The importance of the response time distribution can be demonstrated by applying the MSC 1033 guidelines to a hypothetical vessel using the ship evacuation software maritimeEXODUS to compare simulation results generated using the arbitrary MSC 1033 response time distribution with what is arguably more plausible response time distributions generated from the building industry.

A large hypothetical passenger ship consisting of ten decks divided into three vertical fire zones has been defined within maritimeEXODUS using CAD drawings. The vessel has a capacity of 1734 passengers and a maximum berthing capacity of 950 passengers. Only the top five decks (Decks 6-10) are occupied by passengers.

The assembly areas are located on Deck 8 and there are two for each fire zone. The assembly deck also contains six LSA's (Life Saving Appliances), each having a capacity of 400 passengers.

Each deck of the first fire zone is serviced by four staircases located within the far corner of the fire zone connecting each deck. The second fire zone possesses a single staircase centrally located within the fire zone.

All the stairs are similar in construction and are narrow, capable of allowing only a single lane of passengers to use the stairs. The only exception is the dual lane staircase in fire zone 2. Passenger cabins are located on both decks 6 and 7 in fire zones 1 and 2 and both decks 9 and 10 in fire zone 3.

The population used in these simulations consists of 1300 passengers representing 75% of the maximum capacity of the vessel as specified by the IMO guidelines.

The primary purpose of this investigation is to examine the impact that the response time distribution has on the overall evacuation performance. Thus several scenarios are considered which are identical with the exception of the response time distribution imposed on the passenger population. The base scenario investigated in this paper is the IMO 'day' scenario. Here, all passengers are initially distributed throughout the service areas of the vessel; i.e. around the bars, dining areas etc and passengers are not located in their cabins. The population is divided amongst the three vertical fire zones as shown in Table 1. The sections of the vessel with no passengers are typically cabin sections or parts of the vessel that passengers cannot occupy. At the start of the simulation, once the passengers' assigned response time has expired they move off to the assembly deck (Deck 8) via the shortest route.

Several different response time distributions were investigated. The first was the standard IMO specified response time distribution. This consists of a uniform random distribution of response times with a lower limit of 210 sec and an upper limit of 390 seconds. This response time distribution is referred to as Response Time Distribution 1 or RTD1.

To demonstrate the consequence of using more realistic non-uniform distributions several other response time curves derived from the building industry were also implemented.

While the actual response times may very well be different for sea based applications, it is possible (and indeed very likely) that the shape of the distribution may be similar for land and sea based applications. Response times varied from 4 seconds to 110 seconds. As can be seen most people respond within 60 seconds of hearing the alarm. The range of response times is very different to that found in the IMO day case distribution. To gauge the impact of the shape of the distribution on the evacuation performance, the land based response time distribution was modified to fit the response time range specified in the IMO day case. Effectively, 210 seconds was added to all of the times recorded in the land curve and an extra point was then appended to the curve in order to make the curve fit exactly the same range as the IMO response distribution. This point extended the curve from 320 seconds to 390 seconds.

The modified land based curve is positively skewed. This means that the majority of people move during the first 50% of the range of response values, whereas in the IMO distribution, an equal number of people move in each time interval.

As set out in the MSC 1033, this and other scenarios were simulated 50 times in order to generate a distribution of results. After every five simulations the passengers' starting locations were swapped.

The Cumulative Congestion time for each person in a particular simulation can be averaged to produce the Average Cumulative Congestion time. This then is a measure of the average amount of time wasted in congestion for a particular simulation.

When the simulation is repeated a number of times, the average of the Average Cumulative Congestion time can be determined.

In the first scenario, the average congestion experienced by an occupant is significantly greater for all the cases examined when compared against the IMO day case. On average, the response time (298 seconds) accounts for approximately 78% of a person's personal assembly time (382 seconds) while the time spent in congestion (12 seconds) accounts for approximately 3% of the assembly time. Thus on average, only 19% of a person's assembly time is spent in free walking (i.e. travelling freely to their destination).

It is noted that most of the time spent in congestion results from the congested areas around the stairs. Analysis of the four main congestion areas reveals that there are no areas of congestion considered significant i.e. areas with 4 persons/m^2 for more than 10% of the total simulation time.

Using the artificial IMO response time distribution the hypothetical ship design is deemed to pass the IMO day scenario. However, using the more realistic response time distributions, the same vessel is deemed to fail the IMO day scenario due to a number of regions of unacceptable local congestion. This brings into question the suitability of the IMO response time distribution.

In the example cases examined using the maritimeEXODUS software and the standard methodology and response time distribution specified in MSC 1033, a hypothetical passenger ship design was deemed to have satisfied both day scenario acceptance conditions relating to time to assemble and congestion. However, when the vessel was tested using two more realistic response time distributions, the same vessel was deemed to fail the benchmark test on both occasions due to excessive levels of congestion, even though similar overall assembly times to that found in the standard IMO case were produced.

The benchmark evacuation simulations specified in MSC 1033 to certify the evacuation performance of passenger ships utilise an unrealistic mathematical form to describe the passenger response time distribution, a key evacuation parameter. From land-based evacuation experience, the response time distribution associated with a multitude of day time evacuation scenarios assumes a characteristic skewed or log-normal distribution. The IMO specified response time distribution is artificially set as a uniform random distribution. This unrealistic mathematical form can lead to serious congestion issues being overlooked in the evacuation analysis.

In light of these results, it is vital that IMO undertake research to generate passenger response time data suitable for use in evacuation analysis of passenger ships. Ideally, these experiments should be conducted using real passenger ships under realistic conditions, preferably at sea. The authors, as part of the European Union Framework V project FIRE EXIT (grant: G3RD-CT-2002-00824) have started to collect such data.

Until this type of data becomes readily available, it is strongly recommended that rather than continuing to use the artificial and unrepresentative uniform random distribution, IMO should adopt plausible and more realistic response time data from land-based applications.

Scenario	Average response time (sec)	Average cumulative congestion (sec)	Average distance travelled (m)	Average individual assembly time (sec)	Assembly time (sec)
1 (RTD1)	298.2 [298.1 – 298.4]	12.1 [9.8 – 14.6]	51.5 [51.2 – 52.1]	382.4 [377.7 – 392.5]	670.3 [633.2 – 703.2]
2 (RTD3)	244.6 [244.6 – 244.7]	32.1 [30.3 – 35.0]	53.3 [52.9 – 53.5]	351.4 [349.4 – 354.6]	630.5 [592.7 – 659.0]
3 (RTD2)	33.4 [33.4 – 33.5]	35.7 [34.0 – 38.6]	52.1 [51.8 – 52.3]	141.0 [139.4 – 143.4]	428.3 [402.6 – 455.0]
4 (RTD4)	268.7 [268.6 – 268.8]	23.5 [21.3 – 25.7]	52.3 [51.9 – 52.6]	365.0 [362.5 – 367.6]	659.0 [640.5 – 689.1]

Table 2: Average results (over 50 repeat simulations) for each Scenario.

Deck gear focus on efficiency, environment, and cost

IN recent years, the focus of development on deck machinery has been on enhanced operation, improved safety, increased environmental protection, and ease of both maintenance and installation. This has tended to lead manufacturers in the direction of features such as enclosed/protected hydraulics; enclosed/protected electrics; and the addition of safety functions such as double-drive systems; independent switchboards; double brake systems; and integrated cooling. David Foxwell reports on some of the newest designs.

Today's focus of development on deck machinery has been on enhanced operation, enhanced safety, increased environmental protection, ease of maintenance and ease of installation.

THE market for anchoring and mooring winches tends to be dominated by a few well known manufacturers, among the leaders being Kocks, in Germany (acquired recently by the Norwegian company TTS and today known as TTS Kocks), which claims more than 50 years of experience developing and manufacturing anchoring and mooring winches.

Many significant examples of improvements in winch technology have been introduced by the company over the years, a notable example being self-contained winch systems, introduced several years ago and which have since proved popular on certain types of vessels, such as LNG carriers.

As company spokesperson Jens Meldal explained, TTS Kocks currently has in its portfolio of winches the CSH, or Central System Hydraulic; the CEH or Central Electro Hydraulic system; and the E Type, a range of electrically driven winches, being either of the three-step pole-changeable type or frequency-converted type.

Compact designs

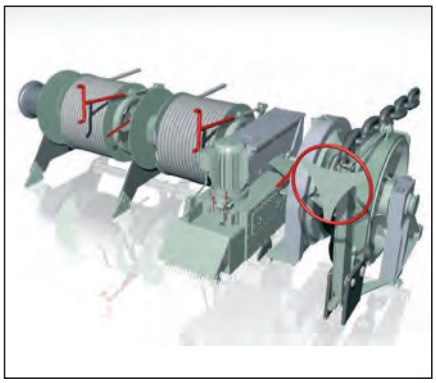
Describing the E Type, Mr Meldal said the electric winch systems are of compact design and thus require minimal space on deck. Offering three-step or stepless frequency converted speed control, the E Type has automatic load detection by means of an electric load measuring bolt for mooring operation whilst in port, and a high level of automation and thus safety for anchor operation and protection against inappropriate operation. A self-aligned foundation option ensures easy and time saving installation of the winch on deck and provides the best access for maintenance of the deck area below the winch.

The CSH system is also of compact design, ensuring minimum required space on deck, and features a mono-lever control block regulating speed as well as torque. The CSH has stepless speed control, and automatic load measuring integrated into the hydraulic system for mooring control whilst in port. The hydraulic power pack is located below deck, and the self-aligned foundation option ensures easy and time-saving installation of the winch on deck and provides the best access for maintenance of the deck area below the unit.

The CEH system has been selected by a number of well known owners including BP, Shell, A P Møller, Teekay, MISC, Chevron, Exmar, NLNG, British Gas, OSG, and others, and offers owners independent operation of each winch and has a fully enclosed hydraulic system ensuring low maintenance requirements and protection against any external impact and weather.

There are no oil pipes on deck – which means minimum risk of oil spillage – and the only interface needed for installation and operation of the winch is an electric power cable. A mono-lever control block regulates speed as well as torque, and the CEH offers stepless speed control.

From a purely environmental point of view, perhaps its most important attribute is, as Mr Meldal emphasised, there is no risk of any oil on deck, but the CEH also has a number of other important benefits, including automatic load measuring integrated into the hydraulic system for mooring control whilst in port. Also, the electric switch cabinet is integrated into each winch, and an optional redundant drive and brake system consists of disc- and band-brake for safe anchoring. As with the other TTS Kocks products mentioned above, the self-aligned foundation option should help to ensure easy and time-saving installation and provide access for maintenance below the winch.



Artist's rendering of CEH electrohydraulic anchoring winches from TTS Kocks.

New trends at Rolls-Royce

Asked about any trends in the market for winches, Rolls-Royce spokesperson Arve Toven said there were few obvious innovations in the market since the introduction of self-contained winches. However, as he explained, there is increased interest in low-pressure hydraulics for winch systems on crude oil tankers and LNG carriers, which he attributed to the type of owners who are active in the market at the moment. There are, as he also explained, fewer speculative owners ordering such vessels currently than there have been.

'For several years now, we have waited for Electrical Frequency Converter (ELF) systems to take-off in the market, but only a few ships have installed them to-date. It seems that ELF still is too new for many owners, so we are waiting for an increase in demand for this kind of system from the container vessel market,' Mr Toven explained, noting that Rolls-Royce has recently developed a high-pressure self-contained hydraulic system to compete with TTS Kocks and is looking forward to the market's response, particularly in South Korea.

As Mr Toven also explained, tanker owners have been slower to adopt the technology – they are said to be more conservative in their outlook – and by and large have been happy with the reliability of older style pole-change technology, particularly as winches on larger tankers are not used as frequently as on some other ship types.

Describing the various options available today and their advantages and disadvantages, Mr Toven noted that the major advantage of low-pressure hydraulic drives is the dynamic performance and high speeds possible, and the high level of safety that low-pressure hydraulics afforded. Low-pressure winches have also proved to be reliable in service, and have a 30-40 year working life.

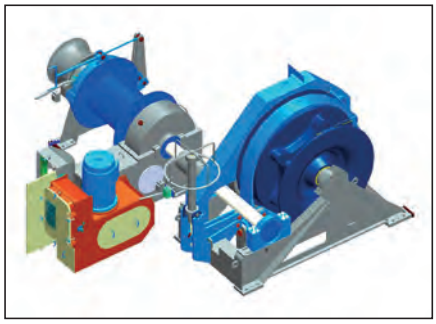
High-pressure systems are also inexpensive, but do not offer the high speed and dynamic performance provided by low-pressure equipment. With high-pressure units, operating at or around 350bar all the time, there is also a risk of leakages occurring and of environmental problems; whereas with low-pressure units, which, in the case of Rolls-Royce low-pressure designs, might operate at around 5bar until they actually start working, leakages are less likely. Pole-change technology is also reliable and relatively inexpensive but the disadvantages include the fact that the technology does not offer stepless control, does not offer the same high level of dynamism as low-pressure hydraulic systems, and braking is therefore required.

Frequency-control benefits

More recently developed electrically driven options include the frequency-controlled systems mentioned above. These have proved popular in the cruise ship market, notes Mr Toven, particularly on the new generation of very large cruise vessels, primarily because they are extremely quiet compared with conventional hydraulic machinery, and there is no possibility of environmental problems through leakages. The newer technology is, however, more expensive to acquire, and maintenance is less straightforward; whereas a conventional hydraulic system might have an operating life of 30-40 years, a frequency controlled system might only have a lifetime of 10-20 years, and as Mr Toven noted, whereas most owners feel comfortable with the maintenance requirements of hydraulic machinery they are less familiar with electric drives.

TTS Kocks' assessment of the advantages and disadvantages of the various types of system available broadly concurs with that of Rolls-Royce. However, when comparing low-pressure hydraulic and self-contained systems, TTS Kocks notes that with a low-pressure system the oil supply is 'in line' for several winches and that, this being the case, one failure may affect all of the winches in line. Typically, in a low-pressure system, one anchor-windlass requires two pumps (and/or a boost device) if exceeding a certain anchor-length, and it is not possible to run a mooring winch with more than one pump. Switch-over valves – if not adequately maintained – can also be problematic, claims the company.

In a TTS Kocks self-contained system, each winch works completely independently, and failure on one winch does not affect any of the other winches onboard. An anchor-windlass can be operated by a single motor/pump unit, with a second in standby mode, each motor being connected with two independent power-supply lines. Another advantage of this kind of arrangement is optional simultaneous operation for high anchor heaving speed or deep-sea operation.



General layout of a Rolls-Royce self-contained hydraulic winch/windlass.

TTS Kocks says it believes self-contained winches are more reliable, safer, more environmentally friendly, and easier to install.

Comparing stepless electric drives and self contained systems, TTS Kocks has the following observations to make. Firstly, because stepless control is required by terminal-operations, this means that a frequency controlled drive or electric slip-ring type system is required. TTS Kocks claims that these types of devices are susceptible to breakdown due to overheating of different components, particularly boosters, in lowering-mode.

The second drive in such systems can be very complicated, claims TTS Kocks, and an additional interchange control and blocking device are required, which may cause confusion in operation because combined mechanical/electrical controls are necessary.

In some applications, such as onboard gas and oil tankers, electrical components are, of course, safety critical, because of the risk of explosion, and electric remote controls are not generally available or are extremely expensive if explosion-proof equipment is required. Compared with stepless electric, the self-contained systems have easy and efficient heat control by air cooler for the hydraulic oil; integration of a second drive is straightforward by means of a hydraulic connection; and offering an explosion-proof system is simple.

The CEH type also has several important environmental advantages, notes Mr Meldal, including: a significant reduction in the total amount of oil required, by around 80%-90%, whereas, claims TTS Kocks, any low-pressure equipment sooner or later shows leakages, particularly at flange-joints (there are around 150 flange-points

on a 200m-long vessel). Also, leakages can cause immediate pollution - leakages on low-pressure pipelines are difficult to repair properly due to the large quantity of oil inside; whereas the CEH has no external piping or flange-joints; and on the CEH, even in a case of failure (such as pipe or hose-bursting) no oil spill can occur outside the winch and there is no risk of oil pollution.

Comparing the installation issues associated with the low-pressure systems and with the CEH, TTS Kocks highlights the following. With the CEH, it claims, there is a reduction in the overall number of parts; there are no extra switch cabinets; electric remote control is possible; and no additional room is required. The self-aligned foundation leads to cost savings during installation in terms of materials for the foundation, labour costs, and the time required for the installation.

In terms of preparation, installing a low-pressure system requires design (including models/patterns); material purchasing/storage/handling; plus manufacturing of the piping and acid cleaning, flushing and inspection of the pipes. Installation of a low-pressure system requires transportation and handling; mounting components and fittings; bulkhead penetrations; expansion devices; air bleeding points; gaskets and bolting (stainless); oil filling; air purging, flushing and testing, flushing without winches, checking and cleaning of filters; and operational testing.

Compared with installation of a low-pressure hydraulic system, the installation of the self-aligned CEH requires design of the foundations; and the actual installation process requires only placement of winches on site; alignment of plates to deck structure and welding; connection of power cables; and installation of remote controls; followed by oil filling.

As Mr Toven highlighted, Rolls-Royce has recently introduced its own self-contained hydraulic deck machinery for merchant vessels, continuing the policy of providing a full range of drive systems to suit the needs of particular ship types and owners' preferences. Since the mechanical elements of these mooring and anchor winches are modular, they can be put together in many configurations with the selected drive system, giving the advantages of the tailor-made solution without the costs of custom design and manufacture.

Self-contained for LNG carriers

Rolls-Royce's self-contained hydraulic deck machinery has been engineered to suit the tough requirements of LNG carriers in particular, but is also applicable to other ship types, for example, container vessels when the auto-tension option is specified. Mooring and anchoring systems of this type are being offered with a 25–30tonne rating and with cable lifters for 102–127mm chain.

At the heart of this type of winch is a hydrostatic drive. Here the hydraulic pump is immersed in the oil tank forming part of the winch and is driven by a weather protected electric motor. The pump is connected back-to-back with the hydraulic motor to give an integrated variable speed power input to the winch gearbox. The result is smooth, stepless control over the whole speed range either by a single lever on the winch itself or on a remote control stand. A hydraulically released brake prevents creep under load, and fails safe in the event of electric power blackout. All the hydraulic equipment is located at the winch, with filters in the integrated valve cabinet, a protected oil-to-air heat exchanger, and no exposed pipe work.

These self-contained winch systems are designed with safety and the environment in mind, and each unit is physically independent, requiring only an electric power supply, but they provide all of the advantages of hydraulic drive while having only a small volume of oil in circulation.

A double power unit is offered as an option which provides extra power and redundancy, and components requiring periodical service such as filters are easily accessible, and if necessary the complete drive systems can be exchanged as a unit.

For a shipyard, the self-contained solution has the merit of being simple to install. The hydraulic transmissions are flushed and sealed at the factory, and complete winches are factory tested and adjusted under working conditions, so commissioning work is therefore limited to connecting up the power supply in addition to an alignment check.

Hatlapa building new factory in Korea

GERMAN deck equipment and steering-gear manufacturer Hatlapa, and 15 year standing afoot Dong Sung, of South Korea, have become partners in a new manufacturing facility in Korea, in which the companies will jointly invest US$4 million. The factory will be located in the Busan Science Park in the Busan-Jinhae Free Economic Zone (BJFEZ) and construction is now underway.

With an area of nearly 8000m², the new facility will have an assembly shop and an office building, and construction is due to be completed by end of February 2007. Production will commence in March, focussing initially on Hatlapa Korea's range of ram-type steering gear, followed by deck machinery assembly.

Outdated mooring winches replaced

Hatlapa has provided details of automated mooring winches it recently provided for *Baltiysk*, a 9985dwt passenger/train/vehicle ferry owned by JSC Baltic Transport Systems, in St Petersburg, Russia. Built in 1984 at Schichau Seebeckwerft in Bremerhaven in Germany as one of the Railship class, this ice-strengthened ferry, formerly known as *Rider*, was in use on the Travemünde-Turku route for the owner Finnlines until it was sold to its new Russian owner in June 2006.

The vessel was converted in Bremerhaven at Lloyd Werft over a period of three months,

with the rail tracks widened to suit the Russian standard gauge. The owner also decided to automate the mooring winches.

In a short time Hatlapa was able to supply new electrically driven winches for automatic mooring operation, with a nominal pull of 100kN.

Uetersen-based Hatlapa has now supplied more than 500 winches with frequency inverter controlled AC motors, and notes that this feature provides the winches with creation of nominal pull even at zero speed. 'This is a decisive advantage for mooring winches in their holding function and is also applicable as ex-proof design for all kinds of tankers and gas carriers,' said the company.

The company also noted recently that, following concentration in the Norwegian market, Hatlapa is now one of two manufacturers of large low pressure hydraulic high-torque motors with pressures of 65bar.

In April 2006, the managing partners at Hatlapa decided to take over the core assets of the ship technology and cargo handling division of KGW, creating a new company with a maritime focus in the form of KGW Marine GmbH. Cruise lines, navies and many customers in the US have been among KGW's preferred clientele. Hatlapa has also recently joined forces with Oil States Skagit Smatco, a well known US offshore service company, with whom Hatlapa will produce large towing winches of circa 2000kN capacity.

In doing so, Hatlapa is to some extent 'returning to its roots' in the offshore industry of the 1980s. Its know-how – especially with regard to the high power low pressure Hatlapa hydraulic motor – was taken into consideration by Oil States when looking for a partner.

Frequency control for simpler installation

WHILE many LNG carriers specify hydraulic drives for their deck machinery, some yards and owners are favouring electrically-driven winches with frequency converter control, and Rolls-Royce is providing systems to meet their requirements. Electric deck machinery has benefits related to its installation, and in a modern shipyard the crucial installation lead time can be shortened due to the easier cable work, and for the owner this system offers benefits in the form of reduced maintenance costs.

DSME (Daewoo Shipbuilding & Marine Engineering) is a well-known builder of LNG carriers, and two ships for Korea Line Corp being built by that company will be equipped with Rolls-Royce frequency-controlled electric deck machinery. Hull 2260 is a 145,700m^3 ice classed ship and Hull 2261 a 151,800m^3 vessel.

Rolls-Royce's scope of delivery includes two combined anchor and mooring winches and seven mooring winches. The mechanical elements of the winches and cable lifters are built-up on the modular concept, designed for easy mounting, and the electric motors are controlled by frequency converter systems to give stepless speed control of mooring lines and anchor chain. In this case, the windlass handles 107mm chain and the split type mooring drums store 275m of 42mm line with an 11m-long nylon tail rope.

Frequency-controlled electric winches – such as these Rolls-Royce models - can be an attractive solution.

On mooring winches speed is variable from zero up to 15m/min under a 30tonne load, and 45m/min on a light line. The mooring brakes are of fail-safe type applied by spring and released hydraulically, and the speed of the winches can be controlled both locally and at either side of the ship. Windlasses are equipped with remote anchor lowering system. With this fully automatic electro hydraulic system the smooth and accurate lowering of anchors is controlled by push button.

Crane suppliers struggle to meet demand

MANUFACTURERS of cranes for all types of vessel report that they are currently fully booked and are struggling to meet demand, writes David Foxwell.

Owners and shipyards report that, as is the case with engines for their vessels, crane manufacturers have become 'bottlenecks' in the supply chain.

Manufacturers have had to seek new ways to try to meet demand, sub-contracting work elsewhere and producing parts for cranes in countries as diverse as South Korea, Poland and the Baltic States, but report that their efforts are being hamstrung by limited capacity in their supply chain, particularly, some report, for the slew bearings on which a crane rotates.

Capacity in this particular part of the supply chain is limited to a few well known manufacturers, themselves experiencing a very high level of demand for similar bearings for the fast-growing wind turbine market.

Against this background, manufacturers also report increased demand for larger, high capacity cranes, particularly in the heavy lift market and for offshore vessels.

Liebherr said it held orders for heavy lift cranes stretching into 2008 for cranes with lifting capacities ranging from 120tonnes to 350tonnes, the cranes being destined for German and Dutch shipowners.

A notable example of a vessel fitted with Liebherr cranes is *Deo Volente*, an innovative coaster built for the account of Hartman Seatrade in The Netherlands that is designed to carry project cargoes and heavy lifts. Operated by Wagenborg Shipping of Delfzil in The Netherlands, the flexible new design has, suggested Hartman Seatrade, set a record for the fastest cargo vessel of less than 3000tons GT in the world.

Hartman Seatrade specialises in transporting smaller types of heavy lift cargo, working mainly in northwest Europe, the Mediterranean and the US East Coast, and *Deo Volente* has been designed to carry such cargoes and to do so at higher speeds than would be the case with a vessel of conventional design. In addressing the design of the newbuild, the company concluded that high speed would provide more revenue earning capacity than simply carrying more tonnage, and has therefore settled on a high speed design that has a deadweight of approximately 3500tonnes.

The ship is fitted with a pair of hefty Liebherr cranes (each of 120tonnes capacity, for heavy lift work, which will be able to lift 240 tonnes in tandem), and has a large, obstruction-free hold – thus enabling the ship to transport lengthy items of cargo – complemented by a tanktop with loading capacity of 15tonnes/m^2 and the ability to carry 240 containers.

Four heavy lift vessels being built in India for German owners are to be equipped with three Liebherr cranes each, two type CBB 350(200)/18(33) cranes with capacities of 350tonnes at 18m and 200tonnes at 33m, and one type CBB 120(50)/15(33) crane with a capacity of 120tonnes at 15m and 50tonnes at 33m.

***Deo Volente* is equipped with a pair of CBB 120(81)/16(24) cranes with Liebherr's proprietary crane control system Litronic.** (photo: Bloemberg)

The complexity of cargoes and the high capacity required of the cranes fitted to heavy lift vessels demand reliable equipment which enables heavy lift vessels to load and unload without assistance from quayside cranes in all ports of call.

Harren & Partner Ship Management have, meanwhile, ordered a total of six cranes scheduled for delivery in 2007 and 2008. Two vessels will each be equipped with two CBB 350(200)/18(31) cranes of 350tonnes at 18m and 200tonnes at 31m, and one CBB 200(80)/14(31), capable of 200tonnes at 14m and 80tonnes at 31m.

Dutch owner Zadeko has also selected Liebherr to supply the cranes for a quartet of new ro-ro/lo-lo vessels it has commissioned, each of which will be equipped with two Liebherr CBB 350(200)/18(33) cranes. Deliveries for these vessels are scheduled to take place beginning later this year and through 2008.

Liebherr's CBB type electro-hydraulic heavy lift rope luffing cranes are based on a proven design which has been enhanced to include features that the company believed were unique to Liebherr equipment.

As standard, these cranes have the following advantages, noted Liebherr:

- A low centre of gravity, thanks to a reduced distance between the jib pivot and the slew bearing, thus ensuring increased vessel stability.
- A spacious slewing column for easy access for maintenance purposes.

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MacGregor cranes reduce environmental impact

MacGregor's new GLE electric cranes are based on proven designs but combine improved operability with less environmental impact. They inherit the characteristics of the established GL series, except that all movements – luffing, slewing and hoisting – are electrically driven.

By avoiding the energy transfer between electric drives and hydraulics the new all-electric system offers lower power consumption. In turn this means lower running costs, less vibration and much lower noise levels.

For the operator the new all-electric crane offers significant benefits in terms of improved operational efficiency. Operations are more precise, with smoother acceleration and decelerations. Under part loads, line speeds are notably faster and it is easier to achieve faster cycle times.

Improved load cycle performance can be summarised as:

- The ramp-time for each motion will be based on the load, optimising crane response time
- Crane operation will be step-less with maximum speed based on the load and outreach only
- The electric crane can keep the load in an exact position even with the brake open which makes it easy to handle the load.
- In extreme high temperatures the crane system will automatically de-rate the performance to avoid downtime due to overheating
- Optimum power control and lower power consumption.

Other improvements include the fact that no starting current peak will occur – this results in lower generator requirements; overload protection is more accurate, based on load cell and measurement of the torque of the electric motor; and it is possible to measure the load constantly even if the hoisting brake is closed.

By using a frequency controlled drive solution on all motions it is possible to monitor data that is helpful for predicting the 'health' of the crane system. With this information it will be possible in the future to predict the 'health' of the crane at any time.

'The benefits of improved operational efficiency will result in an overall through-life economic benefit,' said Hans Sahlin, cranes sales manager.

Scan Brasil **– an ice-classed multipurpose ro-ro/lo-lo carrier has two 240tonne Liebherr cranes that can combine to handle loads of up to 480tonnes. The models in question are a pair of CBB 240(75)/11(33) cranes with Liebherr's Litronic control system.**

- An unobstructed view of the working area thanks to the improved position of the first jib bracket.

- These cranes also have Litronic, Liebherr's proprietary crane control and management system, which controls crane motion to ensure the best possible performance and protection for the crane.

The Litronic control system also records data about all of the individual components in loads handled by the crane, along with alarm signals and failures as well as peak values, and the lifetime of components can thus be analysed, preventative maintenance undertaken, and spare parts supply can be established.

The Litronic control system also has a number of optional features, including an anti-collision mode, automatic tandem operation, and remote control of crane operation for improved operational safety.

As Liebherr also noted, the operation of anti-heeling systems onboard a vessel can be supported through the control system whereby the total moment of all cranes can be calculated in relation to the vessel's longitudinal axis, depending on the load and working radius of each crane. This information is displayed on the vessel's bridge.

Huge mast crane for DP

Perhaps the most notable recent delivery made by well-known heavylift crane maker Huisman-Itrec, of the Netherlands, was a 3000 short ton heavy lift mast crane for *Sapura 3000*, a DP pipelay and heavy lift vessel that is being built for Malaysian company Sapura Crest Petroleum in Singapore.

Huisman Itrec in The Netherlands is supplying a huge 3000ton crane for *Sapura 3000.*

In August 2005 offshore contractor Acergy and SapuraCrest Petroleum entered into an agreement to form a 50:50 joint venture to own and operate the *Sapura 3000* jointly. The vessel is designed to be the most advanced deepwater construction ship in the fast-growing Asia Pacific offshore market.

The vessel was built in China and following outfitting in Singapore is scheduled to be in service mid-2007. With a length overall of 151m, a mast crane with a 3000 short ton lift capacity and a large clear work deck area, this dynamically positioned vessel is ideally suited to conventional shallow water pipelay, very deepwater construction projects and topside installations. Its capabilities will include conventional S-lay for shallow water and steep S-lay or J-lay for deepwater and steel catenary riser installation, into water depths beyond 2000m, depending on pipe specification.

Huisman Itrec is supplying all of the lifting and pipelay equipment for the vessel and is, in part, responsible for the design of the automation and drive system for the ship itself, onboard which almost all key items of equipment will be electrically driven.

Traditionally, cranes and winches have been driven by hydraulics or direct current, mainly in order to be to be able to generate high levels of torque, but due to advances in electro-technology a rapid change is taking place with more frequent use of frequency-controlled motors.

Nowadays, almost every Huisman crane is driven by asynchronous three-phase motors, controlled by a frequency converter. To distribute energy properly and to suppress the inevitable harmonic distortion a 12-pulse transformer is used with a rectifier of 3000kVA, which creates a direct current bus of 930Volts out of the ship's net, and virtually all drive systems are fed from this bus.

One particularly special feature of this crane is that the boom can rotate full circle, unlike other mast cranes built until now, all of which have a fixed winch frame. This being the case, a smart

Rolls-Royce wins crane service contract

Rolls-Royce has secured a major contract from MACS Maritime Carrier completely to overhaul the five cranes onboard each of two multipurpose containerships – without the need for docking the vessels.

Both the 1978-built vessels, *Algoa Bay* and *Stellenbosch*, acquired by the German owner about a year ago, had their original Fukushima cranes, but after closer inspection and a detailed condition assessment by Rolls-Royce it was proposed that the cranes should be completely overhauled to give them an extra ten or 15 years of operation.

'We discussed how the ten cranes could be overhauled without having the vessels alongside for long periods at a time and agreed it best to remove the 43t, 8.4m high cranes one-by one,' said Rolls-Royce after-sales manager Walter Eller, based in Hamburg.

'After landing the crane at our workshop, work begins immediately. We get all the hydraulic equipment out, overhaul the components or exchange them for new and then do all the necessary repair work on the mechanical equipment, brakes and couplings and other components. The work is intricate because we're working on a variety of systems; we're overhauling or upgrading hydraulic drives, pumps, motors, the electrical control system and we also do some repair work to the steel structure and the crane jib,' Mr Eller explained.

'After four weeks the crane body is empty, we take everything apart. But four weeks later, we deliver the overhauled crane back to the ship and remove the next one. It's as good as new.'

Following full scale testing of the hydraulic and electrical components, the crane is returned to the ship, where it is mounted in pairs on a common platform; this, so that the Rolls-Royce team can set the cranes up for twin-mode operation. Each crane has a lift capacity of 22.5t but in twin mode it will be possible to lift 44t, with both cranes operated by a single driver.

Rolls-Royce has already completed the overhaul work on two cranes, one from each ship. The entire contract should be complete by April next year.

The boom on the crane on *Sapura 3000* can rotate full circle, unlike other mast cranes built until now.

way had to be found to transfer an enormous amount of energy and signals to the rotating parts.

Direct current is generated in the fixed crane pedestal and transferred through four 1200A slip rings to the main winch frame inside the pedestal. All large winches for main, auxiliary and topping hoist are on this enormous winch frame that rotates along with the slewing movement of the boom. The frequency converters controlling

Deck cranes for offshore support vessels and construction vessels – such as a 60ton AHC Hydramarine crane for McDermott for use in the Caspian Sea on behalf of BP, shown here being loaded into a transport aircraft - are getting larger and more powerful all the time.

the drive motors of these winches are also on the rotating winch frame.

A review of some of the key features of the massive crane highlights its size and complexity: the main lower block weighs 100tons; the boom is 90m in length; the electrical diagrams run to 1143 pages; the energy supply is 3 x 6.6kVAC/3000kVA; the back-up supply is 3 x 400VAC/900kVA; the crane has a total of 2.5km of cabling; the three-phase motors have 43 components of up to 200kW a piece; the frequency converters consist of a total of 21 separate items, four brake choppers, and four 500kW brake resistors. The PLC I/O comprises six remote I/O stations; a redundant Profibus; and has 600 digital inputs, 50 analogous inputs, and 200 digital outputs.

Deepwater challenges

With the current boom in the offshore market and a level of exploration and production activity not seen for many years has come a demand for larger and more powerful offshore cranes, as construction vessels and related ships move into deeper water.

Operators of construction vessels are not just requesting cranes that are capable of working in ever deeper water – the new generation cranes also need to be capable of handling ever heavier loads, and manufacturers report that they have been benefiting from a high order intake.

Manufacturers such as Hydramarine in Norway have particularly benefited from the offshore boom, and have secured significant orders for large, active heave-compensated (AHC) subsea cranes. They also report that demand for knuckle-boom cranes has been running at a high level at yards such as Ulstein Verft and Aker Langsten that build larger types of offshore vessel.

Hydramarine ended the year 2006 with an order backlog that exceeds Nkr1.1 billion, with deliveries secured well into 2010. 'During the fourth quarter of 2006 the company played host to several large delegations from major international customers visiting engineering, assembly, test and installation facilities in Kristiansand to discuss and finalise projects with us,' said Hydramarine. 'Demand for our cranes stretches over our entire product line, including large AHC cranes, ROV/subsea handling systems and rescue equipment.'

Describing recent developments in the market, Hydramarine said the trend continues to be 'bigger and deeper' and the company has also noted a trend for more flexible solutions in which cranes are self-contained and equipped with a bolting flange in the lower end of the pedestal, enabling a crane to be easily installed or removed, depending on available charter for the vessel. 'On the other side, some of the larger systems are integrated into the vessel structure, with winch and HPU mounted beneath the deck, and we have also delivered cranes equipped with a two-winch system, a crane-mounted subsea winch and a second winch mounted below deck, routed up through the crane centre and on to the crane jibs.'

One notable recent delivery saw a 60tonne 3292 Series AHC subsea knuckle jib crane designed and built by the company transported via air using a heavy lift aircraft in order to minimise the delivery time. The jibs and operator cabin were disassembled from the rest of the crane in Kristiansand and transported by truck to Oslo, loaded into an Antonov 124-100 cargo plane, and flown to their final destination in Asia.

Another recent highlight is what Hydramarine believes is the world's most highly specified AHC knuckle boom crane. 'The design and performance of these cranes far exceeds similar cranes in the market and represents a technological development towards larger and more powerful cranes,' said the company.

The first example of these type HMC 4840 LKO cranes has now been delivered and is in operation with an unspecified customer. The crane is equipped with a 106mm non-rotating steel rope spooled onto an underdeck winch. The maximum operating depth of this crane is 2600m and maximum single line crane load is 320tons. Heave compensation is of the semi-active type, on the winch, operating at speeds exceeding 2.0m/s.

TTS back into offshore

January saw the emergence of Norwegian ship equipment supplier TTS Marine as a significant force in the offshore cargo crane market with the launch of a comprehensive range of cranes. The company, which, until its withdrawal from the offshore market five years ago had a strong presence – especially for seabed cranes able to operate in 400m-3000m of water – has already secured a number of new orders.

Norwegian owner J Hagenaes Shipping is among the first tranche of TTS customers to take advantage of the new venture, and has ordered six 60tonne cranes, each equipped with 2000m of wire, for a series of multi-purpose subsea vessels building in India.

Dutch maritime supplier Vroon Offshore Services has ordered two 50tonne cranes with 20m outreach and 500m wire capacity for subsea operations. The cranes will be mounted on two new dive support vessels to be constructed for Vroon in India.

Other orders have come from Riise Underwater Engineering AS (RUE) and an unnamed Norwegian operator. Several TTS customers, including RUE and Hagenaes, will also be supplied with a TTS Marine Active Heave Compensation unit, a system which is able to cancel the influence from the vertical heave motion on a vessel, enabling the crane driver to place the load safely on the seabed regardless of the motions of the vessel.

'Demand for cranes for use in offshore operations is currently very high, so we are delighted to be back in this market,' said Kjetil Roksvåg of TTS Marine. 'We are also adding a wide range of other products for offshore cargo handling, including winches for seabed operations, remote operated vehicle (ROV) handling equipment, and deep sea deployment systems.'

Another Norwegian manufacturer, National Oilwell, said it had been contracted to supply large offshore cranes for well known contractors such as Solstad in Norway, and Boa/Taubatkompaniet, for whom it was contracted to supply a pair of huge 400-tonne cranes for a construction vessel.

As the winches for these 'super cranes' have grown in size and weight, so they have to be accommodated in new locations, usually on the tank-top, rather than above deck.

National Oilwell's scope of supply for Boa's multi-purpose construction vessel includes a 400-ton 'Hydralift' pedestal-type knuckle-boom crane, with an external, active heave-compensated winch of the type described above.

The lifting capacity of this huge crane is 90tons (81.6tonnes) at 42m, 300tons (272tonnes) at 18m, and 400tons (362tonnes) at 15m. The lifting capacity of the auxiliary winch is a healthy 40tons (36.3tonnes) at 45m, and the winch itself has capacity for 3000m of wire. The active heave compensation system is of such a size that it is placed below deck and has a 90-degree spooling system that routes the wire into the crane at its axis of rotation.

MacGregor for all sectors

Meanwhile, MacGregor says orders received recently by its crane division reflect continuous activity in most vessel segments.

In recent months, Indian shipyard ABG has ordered three K2526-4 four-rope bulk handling cranes for each of two ships being delivered to Finnish shipowner ESL during 2007 and 2008.

Singapore-based Sembawang Kimtrans is installing three heavy-duty K3035-4 cranes on barges, primarily to be used for scrap handling, and the company has also ordered two GL4028-2 cranes to be retrofitted to an existing ship.

Four container feeders on order at Chinese shipyard Yangzijiang for German interest will each feature one GL4528/4034-2 and one GL4528/4037.7-2 crane. MacGregor has also contracted to deliver cranes for another eight ships at the yard for Vancouver-based owner Seaspan. Each of these will be equipped with two GL4525/4028/3629.6-2, one GL4525/4028/3630.3-2 and one provisions crane. Delivery is scheduled for end 2007 and beginning 2008.

In August Bohai SY in China ordered cranes for two container feeders for Singaporean owner PIL to be delivered during 2007. Each ship will be equipped with one GL4522-2 and one GL4528-2 crane.

MacGregor reported that it has recently received orders for 84 of its GL and GLB cranes with a total order value of €25 million from different Chinese yards, including a recent order for 30 of its GL units with an order value of approximately €10 million, to be installed on a total of 15 containerships.

The company has secured an order at Guangzhou Wenchong Shipyard for the supply of its type GL-2 MacGregor deck cranes for 15 containerships being built for various owners. The cranes – two on each vessel – will be installed on thirteen 1700TEU and two 1400TEU container ships.

For the 1700TEU vessels, MacGregor will supply one of its GL4528/3237,2/2541,5-2 and one GL4528,8-2. And for the 1400TEU ships shipsets, one GL4030/3338,5/2641,3-2 and one GL4028/3628,8-2.

The vessels have been ordered by: Leonhardt & Blumberg Reederei GmbH & Co KG - 2 x 1400TEU; Reederei Gebr Winter GmbH & Co KG - 2 x 1700TEU; Norwest Management Co Pte Ltd - 3 x 1700TEU; Schoeller Holdings - 4 x 1700TEU; Thien + Heyenga GmbH - 2 x 1700TEU; Bernhard Schulte GmbH & Co KG - 2 x 1700TEU.

From the Jiangxin shipyard, German owner Reederei Eugen Friedrich has ordered four multi-purpose vessels. MacGregor will equip each of the new ships with two GL 80-tonne and one GL 45-tonne lifting-capacity cranes, with delivery scheduled for the end of 2008 and the beginning of 2009.

Orders for four shipsets of MacGregor type GLB3024.5-2/2424.5gr units have been received from the Shan Hai Guan shipyard in China for the Greek shipowner Navarone. Each vessel will be fitted with three cranes, and an order for the same type of cranes has also been placed by the Jiangsu Eastern shipyard, calling for two shipsets of the GLB crane, with three units specified for each vessel.

From Carisbrooke Shipping, MacGregor has received an order for its GLB2526-2 cranes to be fitted to six vessels on order at Yangzijiang Shipyard. Each vessel will have two units, and the Nanjing Huatai shipyard is building six 7600dwt multipurpose vessels for German owner Hartmann Logistik.

Each of these vessels will be fitted with two GL3626-2/2826gr cranes, and also feature MacGREGOR's CC2000 control system, which provides excellent control of the cargo and can easily be adjusted, with a laptop computer, for different parameters such as speed and ramp times to optimise the cargo handling operation. All crane movements are smooth and fast, with stepless speed control.

More deck safety features for containerships, please

THE Royal Institution of Naval Architects' recent containership conference* introduced several innovative technical features but also raised some key issues, particularly those relating to lashing and un-lashing of deck-stowed containers. Additional effort needs to be made by both owners and shipyards to provide better safety features.

A PICTURE of a dead person on the screen during a conference presentation is guaranteed to hush an audience, and sure enough it achieved the required effect at The Royal Institution of Naval Architects' November conference on Containership Design and Operation. A final joint lecture by Brian Sherwood-Jones, a human factors consultant for Lloyd's Register, and Roy Smith, safety manager (operations), for Hutchison Ports (port of Felixstowe), brought the conference to a suitable close, with a sobering reminder of just exactly what we, as naval architects, should be trying to achieve.

The pair made no apologies for the picture – it showed a crew member crushed under a container on a ship during port operations – and once again revealed the difficult and dangerous nature of shipping. The authors attempted – and succeeded in – making the point that naval architects and shipbuilders have not yet perfected the finer points of deck structures and fittings to ensure that stevedores (or crew members, should stevedores refuse to do the job, which apparently they sometimes do) can carry out their dangerous day-to-day work safely and efficiently.

Roy Smith was a stevedore for 22 years before being promoted to Felixstowe's chief safety officer, so he knows precisely what he is talking about. He claimed that sometimes ships even left port with lashing rods not tightened securely because there was physically no room for a man to work between box bays to carry out the job. A speaker from the floor even alleged that on a brand-new series of large containerships, only just delivered, the first bay behind the accommodation block was not being used because it was impossible to lash containers properly at that position!

Mr Smith told his audience that he had listened carefully for two days as naval architects expounded on the theory of containership design; now it was time for them to enter his world – the real world of ship operation! It was a penetrating comment, which we fervently hope was not lost on those attending.

What the speakers were requesting – reasonable access space, modest platforms, or small extensions – could be achieved for a very limited cost, in terms of the expense of an overall ship. Some owners have made commendable modifications but access problems remain particularly acute when securing the outboard deck boxes, which, as readers know, are generally supported on substantial stanchions, and it is almost impossible to reach these safely.

Revealing what can easily be achieved: four illustrations showing a typical outboard lashing station on a containership before improvements (top) and the same area following successful safety modifications (bottom).

This is a subject that we have touched on previously (*The Naval Architect* April 2004, page 6, while another paper on this subject was presented at RINA's 2003 containership conference), but the message still does not seem to have fully reached those most concerned – naval architects, shipbuilders, and owners.

Mr Smith did add a throwaway line that perhaps hatchcoverless ships might be one answer but naturally did point out that fewer jobs for stevedores would result! It might be useful to establish how many box-handling accidents have occurred on hatchcoverless vessels; perhaps Nedlloyd or another operator could also tell us how many containers have been lost overboard from such ships, taking into account the substantial lashing bridges that are often included - but that is another story!

Super mega liners

Hopefully, these messages will be taken on board by those designers and builders of a class of containership which is still evolving: the super mega liner. While the conference

was attended by a most useful number of delegates from leading Japanese and South Korean companies, it was disappointing to note that none from that country most likely to be building such giants in the future – mainland China – was represented.

Emma Maersk – the newly completed and largest container liner yet built (by the Odense Steel Shipyard, in Denmark) with a nominal 11,000TEU but probably capable of carrying more – featured in several papers. A trio of authors from ABS, the society that classed *Emma Maersk*, discussed some of the technical challenges that arose with hulls of this size and similar designs, pointing out along the way that the enlarged Panama Canal will enable ships up to 48.80m wide (and 366m length) to navigate that waterway. This could give rise to a new breed of vessel. Interestingly, *Emma Maersk*, when she called at Felixstowe on her maiden voyage, was moored in only 45 minutes compared with an anticipated 1.5 hours.

New breed large hulls

Meanwhile, Jan-Olaf Probst, Germanischer Lloyd's containership expert, gave an interesting exposé on the proposed 13,400TEU design, conceived jointly with Hyundai Heavy Industries (*The Naval Architect* November 2005, page 4). More than one author noted that these new very large breeds of hull (397m x 56m for *Emma Maersk*) meant that the lessons of the late 1960s/early 1970s, when the prototype epoch-making cellular container fleet was being created, are having to be re-learned.

Such ships included Sea-Land's 33-knot twin-screw steam-turbine SL7 class - still in operation today with the US Military Sea Lift Command - and, although not mentioned, also Overseas Containers' Encounter Bay class designed by Marshall Meek and his team. If the planned 18,000TEU Malaccamax ships come to pass, even more midnight oil will have to be burned.

Elsewhere in this issue and on another subject (podded propulsion, page 35), we report on the dangers of not learning from the past when too large steps are taken too rapidly. At this conference, Jan-Olaf Probst also carefully told his audience that the container itself is actually the limiting factor on ship size; although the current test load on a standard TEU box is 96tonnes, many early weaker boxes are still in service, and it will be 10-15 years before pictures of collapsed container stacks can be eliminated.

As reported in our November 2006 issue, Japanese steelmaker Nippon Steel, in association with ClassNK, has developed a new YP47 grade of steel (47kgf/mm^2) for use primarily in the hatch coaming structures of very large new containerships. This material, designed to overcome the loss of toughness in ever-thicker plates, was presented in an interesting paper by Y Yamaguchi and T Matsumoto, from ClassNK and H Yajima, from Nagasaki Institute of Applied Science; it discussed innovative grades designed to avoid moving beyond current thickness levels of 70mm (YP40 grade).

Some graphic and startling full-scale tests on steel plates were shown to the audience, as the high-tensile material was stressed to breaking point to develop a composition that would avoid brittle fracture, and particularly catastrophic brittle cracks. The authors noted that correct welding was a key element of YP47's use. Mitsubishi's Nagasaki yard is the first to apply the new steel.

As important a factor to parallel hatch coaming strength is proper design of the bow area of a large containership, and L Zhu, from Lloyd's Register, discussed on-going work to improve structure design to avoid the continuing problems of forecastle stiffener and web buckling in heavy seas. Further examples of this unfortunate phenomenon, which once again illustrate the huge power of the sea, were revealed by the author.

Some interesting work by the Finnish consultancy Napa was discussed by C M Ridgewell, J Furustam, and A Metsä, concerning the development of a useful new technique, using well-established NAPA software, for creating a 3D model of a containership prior to contract stage. The object is to generate a model that can be used for fast and reliable assessment of the key details needed before a contract.

It is noteworthy that the method starts off with individual containers and builds on from that point rather than using a hull structure or rough general arrangement. By starting there, many useful factors can be ascertained early on – maybe including some useful safety features for stevedores! Remarkably, Napa claims that a new design with all results can be generated within one man-day.

Reducing resistance

A further evolution in the forward march of ship design was the InSAC concept of the German Friendship Systems suite, presented by Stefan Harries. This most interesting philosophy aims to reduce resistance while still increasing payload. InSAC is an acronym for 'innovative sectional area curve'; its main feature is a delicate 'pinching-in' of the underwater forebody. This new hull line is already being employed on a series of 3400TEU/3700TEU ships being built by the German shipbuilder Thyssen Nordseewerke.

Possibly even more evolutionary is the inclined-keel concept proposed by three authors from the University of Newcastle. This unusual format for a large ship could, the trio claimed, allow an 11% larger propeller to be fitted; the propeller could turn at a 17.5% slower speed to give a 2% power saving, without any adverse penalties. It is indeed good news that enquiring brains are still at work around the world – partly driven today by the urgent need to contain fuel costs. We have come a long way since Malcolm McLean first launched the container revolution but by the looks of it, there is still a long way to go. Perhaps if somewhere along the line, more effort on safety could be inserted, we might reach the ultimate containership.

* Design and Operation of Containerships, held on November 22-23, 2006, in London, and organised by The Royal Institution of Naval Architects.

Growing attention to alignment

WITH the advent of ever larger and more powerful container vessels, it has become necessary to pay greater attention to shaft alignment design and propulsion shafting installation*.

A good shaft alignment is one in which all the supporting bearings are well loaded in the static condition and the system is flexible enough to withstand hull deflections and imposed forces so that the bearings remain well loaded in all operating conditions.

For containerships, this requirement has historically been easier to fulfil than for other commercial vessel types such as oil tankers and bulk carriers. This has been due to the inherent flexibility of the shafting systems on container vessels as a result of the mid-position of the main engine and the subsequently long shaftlines.

It is somewhat counterintuitive that long shaftlines with many bearings are in fact easier to align than short shaftlines with few bearings. However, theory and practical experience demonstrate that the short, stiff systems found on vessels with high-powered machinery placed as far aft as practicable are the most problematic.

With the advent of ever larger and more powerful container vessels, propeller and intermediate shaft diameters are increasing, with some single-screw ULCS designs now incorporating a propeller shaft diameter in excess of 1metre.

In conjunction with the larger drive shafts, main engine designs are also incorporating shorter cylinder spacings and larger crankshaft diameters.

These design trends make the coupled propulsion shaft and engine system more sensitive to changes in bearing position.

In order to prevent bearing failures, it has become necessary to pay greater attention to shaft alignment design and propulsion shafting installation on containerships.

The design stage is crucial in establishing a suitably flexible shafting system. It is important for the designer to minimise the value of the bearing influence numbers (the measure of shaft stiffness). It is also important to keep the static bearing loads high enough to prevent them from unloading during operation.

As a rule of thumb, the length/diameter ratios of the bearing spans should be kept above 10:1. To achieve this it may be necessary to omit the sterntube forward bearing in place of an aft plummer bearing located on the propeller shaft, immediately inboard of the engineroom aft bulkhead seal.

Table 1 compares the parameters of several selected containership and oil tanker designs and shows the theoretical influence numbers. As a measure of sensitivity, the downward offset from the design position required to unload the sterntube forward bearing or, where no forward bearing is fitted, the aft-most plummer bearing is shown.

Of the containership designs studied, the 4500TEU vessel has the most sensitive system, comparable to that of the oil tankers. An important aspect of the particular 4500TEU design studied is that the shaft span between the forward and aft sterntube bearing supports is only 6.5metres. This produces an L/D ratio of only 8.2:1 with a subsequently high influence number of 13.6tonne/mm.

When combined with a design bearing load of 12tonnes, it only takes 0.88mm of downward displacement for the sterntube forward bearing to unload.

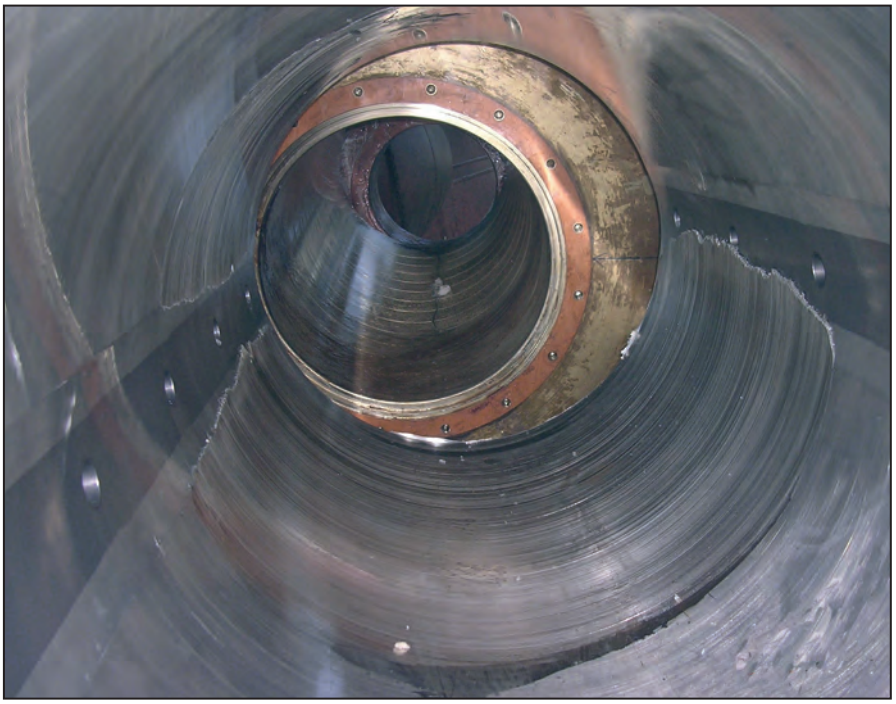
A better design is the 6000TEU vessel, which has a span of 11.0metres between sterntube bearings, producing an L/D ratio of 11.3:1. Despite the larger shaft diameter, the sterntube forward bearing's influence number is kept down to 6.7tonne/mm.

The 6000TEU design also has the advantage of a longer shaftline with more plummer bearings (six, compared to only three in the 4500TEU design), which helps to reduce the influence number at the sterntube forward bearing.

The need to achieve a good static load on the sterntube forward or aft plummer bearing has been highlighted in recent investigations undertaken by Lloyd's Register's Technical Investigations. Measurements conducted on container vessels demonstrated how the bending moments imposed upon the propeller shaft change significantly during manoeuvring turns, causing the sterntube forward bearing to unload and the propeller shaft to run cross-axis in the aft bearing. This typically occurs during turns to starboard. The measurements additionally confirmed that successful sterntube aft bearing performance is dependent on achieving a static slope mismatch between the journal and bearing surfaces to within Lloyd's Register's limit of 0.0003radians (0.30mm/m).

These results are in line with the findings of numerous sterntube aft bearing failure investigations conducted by Lloyd's Register's Technical Investigations team.

The most common forms of propulsion shaft bearing damage are wiping or overheating at the aft end of the sterntube aft bearing. In a number of cases, such damage has occurred during



The most common forms of propulsion shaft bearing damage are wiping or overheating at the aft end of the sterntube aft bearing

Vessel type	Prop. shaft diameter *(mm)*	Bearing static load *(tonne)*	Influence number *(tonne/mm)*	Downward offset to unload bearing *(mm)*
2000TEU container	640	11	3.9	2.82
4500TEU container	792	12	13.6	0.88
6000TEU container	975	31	6.7	4.63
8000TEU container	971	30	12.5	2.40
150,000dwt oil tanker	706	8	16.1	0.50
310,000dwt oil tanker	801	18	27.4	0.66

*This article was originally published in the November issue of *Container Ship Focus*, a technical publication produced by Lloyd's Register for the containership industry.

starboard turns when increased bearing load and slope mismatch between the journal and bearing surfaces has adversely affected the development and maintenance of a satisfactory oil film.

Although the shaft alignment design calculations normally consider the hydrodynamic forces and moments generated by the propeller, Lloyd's Register has found that overly simplistic assumptions are often made which have led to poor alignment designs being submitted for class approval.

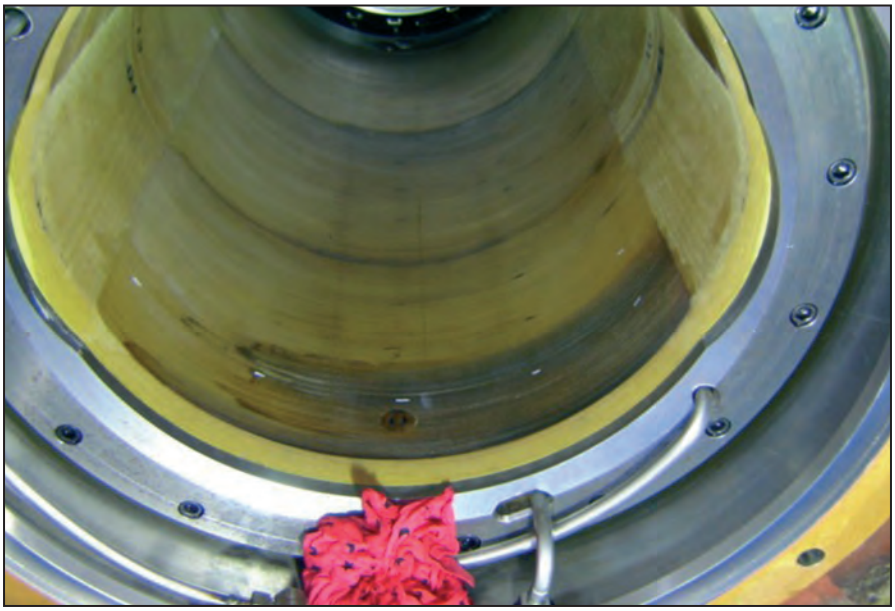
It must be remembered that the propeller hydrodynamic forces and moments are predicted for the zero rudder condition only and often at one vessel draught condition. When the vessel turns or operates in different ballast conditions, the propeller hydrodynamic forces and moments can change significantly due to wake field variations. This causes the centre of propeller thrust to move from its predicted position, thereby invalidating the values assumed in the calculations.

Lloyd's Register has recently amended its shaft alignment to require a sufficient static load on the sterntube forward bearing to prevent it from unloading in all operating conditions, including the transient conditions experienced during manoeuvring turns.

The amended Rules also introduce formal requirements for bearing load measurements to be performed at the verification stage of the alignment process.

When applied to container vessels, this will mean that shipyards will need to conduct jack-up load tests on the sterntube forward bearing, all the plummer bearings and the aft three main engine bearings at acceptance sea trials.

Final adjustments to the plummer bearing height will be made, where necessary, to optimise the alignment. The final bearing load measurements required by Lloyd's Register are to be conducted in a sailing draught condition, with the engine warmed through in order to minimise the uncertainties of hull deflections, machinery thermal rise and propeller buoyancy effects.



In a number of cases, overheating damage has occurred during starboard turns due to increased bearing load and slope mismatch between the journal and bearing surfaces.

Schiffko offers innovation as standard

AS it launches its latest containership design, Schiffko argues that there are advantages of having a ship design prepared before the contract is signed

SHIP design has traditionally been a core business for shipyards, whose focus on low initial cost allows them to make an attractive offer.

The ship owner's focus, however, will be on minimum total costs. These depend both on initial costs and on running costs. Fuel consumption and maintenance costs strongly affect running costs, while being of lesser interest to the shipyard.

For the owner it sometimes pays to invest more in certain equipment, if fuel savings and easy maintenance can be achieved.

Design costs are marginal if compared with the ship's overall price, but for a single vessel, efforts equalling a man-year or more can easily be needed to take a conceptual design to the point of a signed contract specification. These efforts have to be pre-financed by the shipyard, and ultimately will need to be compensated by the owner.

For specialised vessels, such as those used in the offshore sector, the alternative 'architect's' approach has increasingly been followed: the owner hires a designer then invites shipyards to bid for the vessel according to the design. In this case, the design has to be pre-financed by the owner, but it can be more tailored to his/her interests. Shipyards are still free to use their standards and optimise the detailed engineering to their needs, but performance parameters and key equipment are predetermined.

More recently, the same approach has been seen in the commercial vessel sector, especially where ships have been built to high specifications in emerging shipbuilding countries with no track record.

Other stakeholders have also observed the advantages of having a design prepared before the shipbuilding contract is signed. Some examples are:

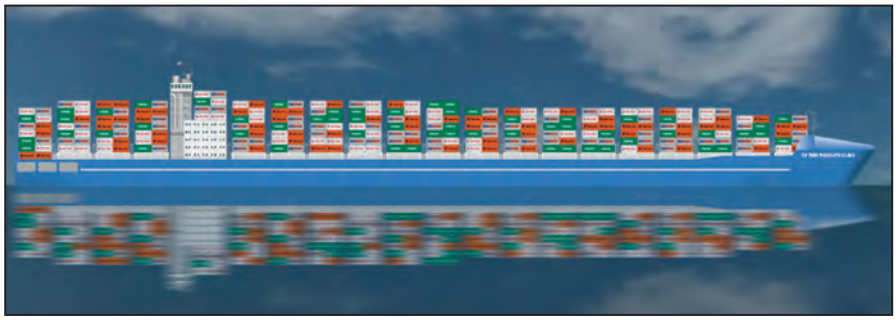
- Integral design and material packages supplied by one company: e.g. by Rolls Royce group, including the products of Ulstein, Aquamaster, Bergen Diesel.

- Design and vessel newbuildings offered by South Korean shipyards with strong preference on their in-house design and using equipment manufactured within the same group (other solutions being penalised by high additional costs).

- Classification societies supporting design developments for new markets, e.g. Germanischer Lloyd developed a 12,000 TEU Container vessel jointly with Hyundai Heavy Industries.

- Shipowners developing innovative designs, like Maersk or others, with large in-house design resources.

- Shipowners and design companies jointly developing new designs: Graig Shipping created the Diamond class bulkers jointly with design company CarlBro and introduced these to the market.



Schiffko's new 'Resolute' class of 7000 TEU capacity containerships.

Independent Hamburg-based design house Schiffko says that commercial shipowners are increasingly calling in designers at the starting point, with the company becoming involved in project management, plan approval, construction supervision and inspections as well.

Schiffko's flexible and operationally economic CV 1100 PLUS container vessel design, for example, has led to the construction or contracting of more than 130 ships at a wide variety of yards.

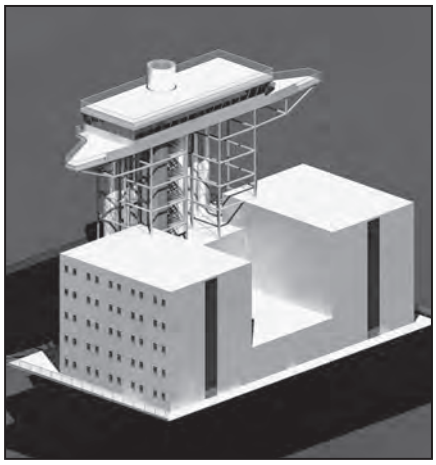
Now, the company is offering the new 'Resolute' Class as the next generation of container vessel in the 7000TEU range. This integrated design includes a number of environmentally-driven aspects as standard, including the separation of all bunker and oil storage tanks from the ship's double hull, to minimise the risk of oil spillage. To allow operation of the vessel in Sulphur Emission Control Areas, low sulphur heavy fuel oil tanks have been strategically located in the centre of the vessel.

Also adopted has been the flow through ballast water exchange method which, compared to the less flexible sequential method, has a lower impact on cargo weight capacity. A space provision has also been made within the design for the incorporation of ballast water treatment technology, when that becomes available.

The design also envisages installation of electronically controlled engines, featuring lower NOx and SOx emissions and, as an option, using either steam turbine or exhaust gas turbine technology for waste heat recovery.

In view of the fact that the 6700TEU variant of the Resolute design would accommodate up to 1000 refrigerated containers, with a 7300TEU version accommodating up to 1300 slots, a significant part of the reefer plant requirement would draw on the waste heat system, which recovers around 10%-11% of the energy generated by the 60MW engine proposed. For vessels with a lower reefer requirement, part of the energy recovered could be fed back into the propeller shaft.

The design also includes an innovative deckhouse, presented by Schiffko but actually the result of a long-running, publicly funded research project that also involved makers of prefabricated accommodation units and HDW. The resulting proposal is for a strong, modular, light-weight structure, easily combining accommodation and service units, built up by self-supporting cabin modules, rigidly interconnected, and provided with supplies through centralised service systems.



Schiffko's innovative compact deckhouse.

Here, piping, ventilation, A/C, electric and communication are easily accessible in an open duct between the cabins, which reduces the work for mounting, cabling, commissioning, and inspection. Areas for accommodation, service, maintenance and storage can be allocated independently. The system gives considerably reduced construction cost and time savings as production is largely independent from the hull erection schedule.

The deckhouse itself offers container stacking space. Critically, such a deckhouse would be adaptable across a range of vessel designs and sizes. It envisages bridge, accommodation and communal areas as separate modules that can be arranged and sized in accordance with the specifications of the ship. The main deck level contains technical spaces in the aft part, storage, galley and mess rooms in the centre part and deck offices and Suez crew accommodation in the wing parts. Sophisticated high standard crew accommodation is located in the upper decks of the SB and PS wings, all of them with daylight, and most of them with superb outside views not obstructed by container stacks.

Using the full width of the vessel, the deckhouse reaches up to five decks only, but the wheelhouse is located far above, supported by two rigid framework pillars that also support at its rear end exhaust pipes and ventilation ducts.

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Evolution of a tanker

SEVERAL months in operation affords an opportunity to review the design principles behind Lindenau's new 40,500dwt tankers, which feature optimal hydro-dynamic characteristics

German Tanker Shipping has now taken delivery of two of the four newbuildings - hull numbers S272, S273, S274 and S275 – that represent an evolutionary step in tanker design.

The newly developed 40,500dwt vessels offer loading volume capacities of 47,000m³. The general design and shape of the vessel were developed in close co-operation with the shipowner and the Hamburg Ship Model Basin (HSVA). The aim was to create a strategic advantage for the owner in a specific ship operational area by realising the following technical attributes:

- low design draught for light load transport
- balanced trim for homogenous loads
- increased service speed
- improved manoeuvring characteristics
- improved sea-holding
- improved behaviour during ice operations

In order to secure the contractually guaranteed characteristics, comprehensive simulations, calculations and model tests were carried out at HSVA in March and April 2005.

During resistance and propulsion tests the vessels' shape, optimised using a number of modern CFD design loops, demonstrated an excellent wave profile and very good propulsion characteristics right from the start.

Contractually guaranteed speed of 15.5knots on a design draught of 10m with main engine capacity of 8200kW, in accordance with the results of the resistance and propulsion tests, was expected to be exceeded by 0.5knots.

Although deadweight was increased by about 25%, the new tanker type required almost the same engine output in sea trial conditions as its smaller predecessors to reach the guaranteed speed.

TECHNICAL PARTICULARS SEATROUT

Length overall	188.33m
Length between perpendiculars	179.50m
Breadth moulded	32,20m
Side height to main deck	17.05m
Draught, design	10.00m
Draught, max	11.00m
Deadweight min	40.500dwt
Loading tank volume	47.270m³
Main engine output	11.200kW
Service speed	16.00kn
Classification	Germanischer Lloyd: GL 100 A5 E3 PRODUCT CARRIER OIL TANKER ESP ERS COLL 3 + MC E3 AUT INERT

Although deadweight was increased by about 25% over its predecessor newbuilds, the new tanker type finding first form in *Seatrout* required almost the same engine output in sea trial conditions to reach its guaranteed speed.

The annual transport capacity of the Lindenau newbuildings, depending of course on sailing profile, is said to be 10-15% higher than comparable modern newbuildings from Far East shipyards.

In contrast to previous newbuildings, deployed largely in the North European area, the newly developed types are seeing mainly global service, preferably in the Trans-Atlantic trades.

Thus, special attention has been paid, in the design of the bow sections, to the way in which the ships behave in heavy seas, both in respect of the forces exerted on them during bow-flare slamming and also in terms of speed lost during heavy sea operation.

To complement CFD calculations and simulations, tests were also carried out, using the free floating ship model, in irregular long-crested Force 4 seas (with significant wave heights of 2.8m) and in Force 6 seas (with significant wave heights of 5.4m).

Compared to their smaller predecessors, the number of 'deck wetness events' on the newly developed ships in the sea conditions tested could be significantly reduced.

Additionally, the use of an optimal bow shape reduced the danger of bow flare slamming. Compared to predecessor ships, the forces playing on the bow sections were reduced by about 40%.

In the same way, it could be shown that, because of the optimal bow shape, loss of speed in heavy seas, despite a 15% wider beam (32.2m instead of 28m), was no greater than with narrower predecessors.

To improve manoeuvrability, the newbuildings are equipped with high-performance flap rudders from Becker Marine Systems.

Compared to the units in their predecessors, the capacity of the lateral thrusters in the latest ships has also been increased by about 20% to 1250kW.

Because of the danger that the ships' main dimensions and the speed required of them might cause yawing, a special stern section shape was designed to improve the yawing stability of the newbuildings.

Manoeuvrability tests demonstrated that the yaw stability criteria were significantly below those laid down by the IMO.

The newbuildings comply with GL Ice Class E3 and Finnish/Swedish Ice Class 1A.

In designing the underwater fore-ship lines, meanwhile, attention was paid to ensuring that the ship's form was suitable for ice operation both at ballast draught and in the range between design draught (draught = 10m) and fixed draught in fresh water (draught = 11.25m).

In order to verify required engine performance while operating in ice, tests were carried out in brash ice in the HSVA ice tank both at ballast draught and fixed draught.

Compared to conventional newbuildings and because of their special bow forms, these ships are not only able to break through relatively thin ice themselves, but also need considerably less installed power to be able to operate in icy waters.

Indeed, because of their special bow shape and controllable pitch propellers these newbuildings need only about a third of the capacity stipulated by Finnish and Swedish authorities for operation in ice at a speed of 5knots.

Thus, the required ice operation performance of these newbuildings is about 20-25% less than that needed for comparable modern newbuildings built in the Far East.

Getting the electrics right first time

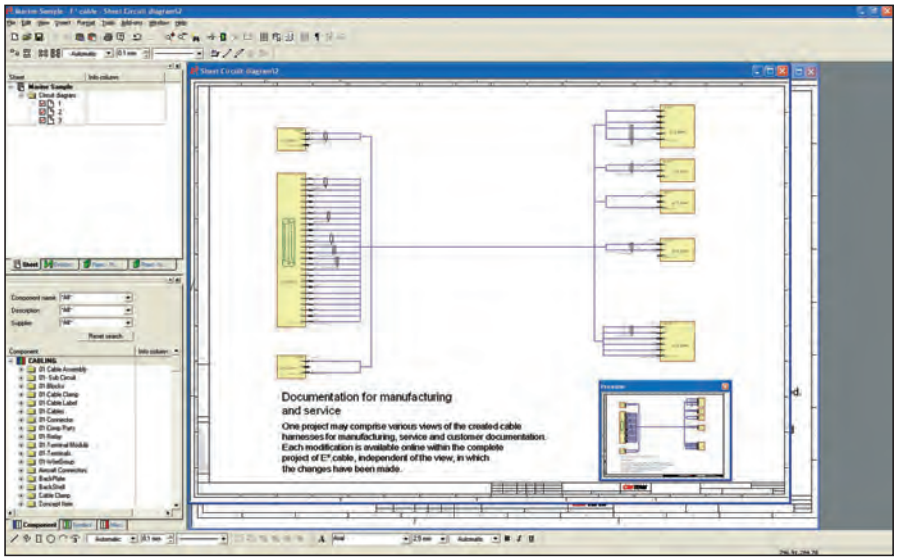
TECHNICAL developments that have occurred over recent years across all disciplines of the marine industry have created electrical system integration challenges that are more akin to the world of complex building design.

THE humble pen and paper is struggling to keep up with the demands set by electrical system integration challenges and naval engineers are increasingly turning to CAD software as the solution.

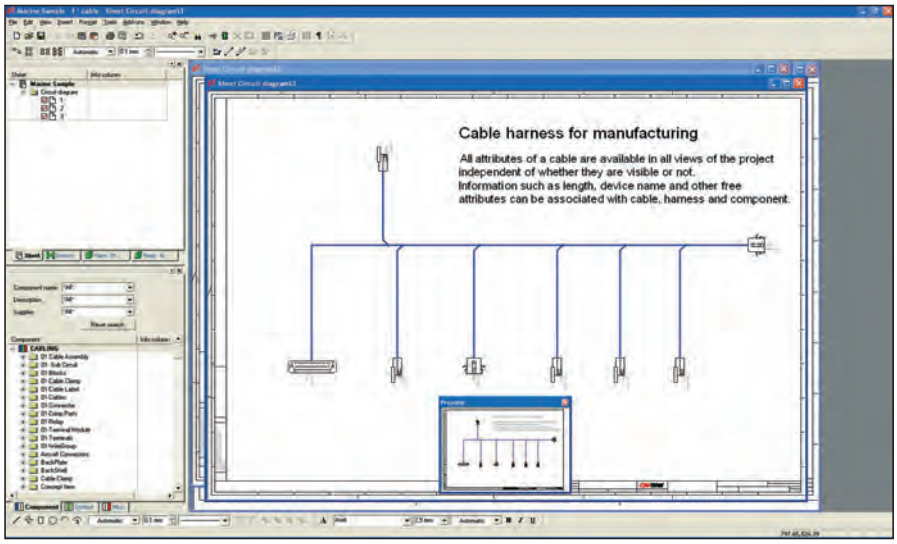
The extensive use of automated computer control systems for machinery controls, navigation, radars and passenger/crew safety systems, along with the return to electric propulsion systems, are just some of the stimuli for using new technologies; creating increased complexity and driving the requirement for integration management onboard.

The majority of all boats now need some form of electrical integration, the extent of which is magnified as the size and complexity of the vessel increases. Additionally it is unlikely that all the equipment for any sized project will be sourced from a single manufacturer; and this means that there are many electrical and electronic products working to different standards that need to communicate – be connected together – and all this involves a complex cabling network and panel design.

The increase in electrical power required to feed all these applications has also spurred a rise in higher voltages being transported around the vessel which, in turn, requires cabling that performs to the highest of safety standards. In addition; these compatibility, consistency and new technology challenges have driven the rise in international standards, which requires full traceability and documentation of electrical systems.



Zuken documentation for manufacturing and service.



E³. Cable harness for manufacturing.

Complexity and cabling

The use of more technology and more power ultimately results in more cable that invariably has to span longer distances, resulting in some common issues:

- Defining the proximity of different cables to each other to avoid signal interference issues and the required segregation of wiring to avoid problems with susceptible wires.
- Establishing the required gauge of a cable (the external diameter of the cable related to the copper conductor width).
- Integrating new technology that is introduced late in the project; equipment specified at day one on a complex vessel project may be obsolete by the time it comes round to being built. The knock on effect of this is that technology will need to be replaced and cabling layouts redesigned to ensure compatibility.

While complex cabling structures are becoming commonplace, so too is the presence of distribution panels loaded with automated control units, circuit breakers and contactors associated with every aspect of the vessel; from safety and mechanics through to comforts and luxuries. Designing these for full reliability is vitally important to ensure the safety of the craft. For instance, critical systems must be separated and connected to a system that will supply back-up power. Should power be lost from the main engine, critical applications like radio communication and radars need to remain in full operation.

CAD for cables and panels

CAD software is used in many instances for boat design, particularly when it comes to modelling parts of the structure like the hull; but only recently has such software's potential been harnessed for electrical system design onboard. One software suite, which has been used in many industries including aerospace, automotive, railway, and machinery manufacturing, comes from Zuken and is called the E³.series.

This integrated Windows-based suite is for the design and documentation of electrical control systems, and has various individual modules including E³.cable and E³.panel.

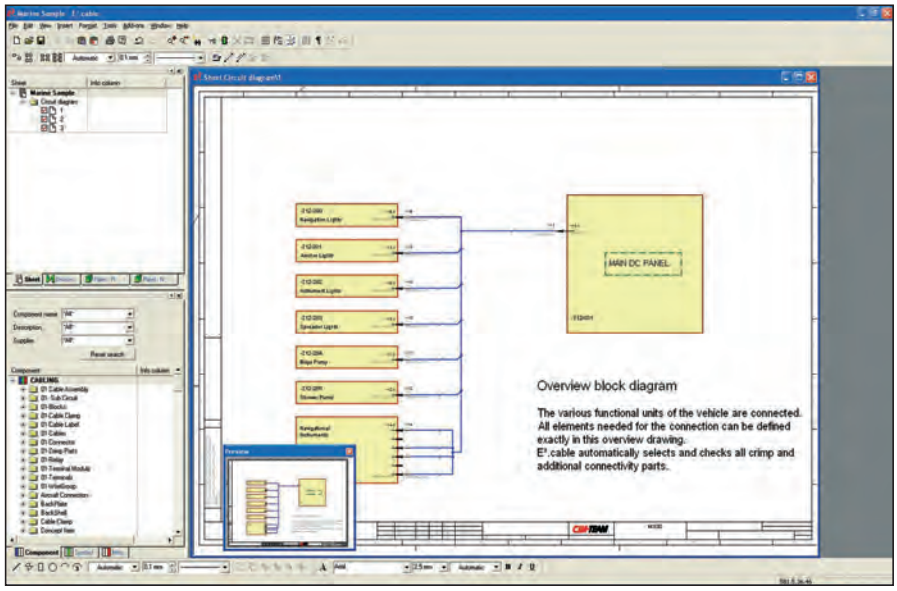
E³.cable allows engineers to create block diagrams under logic control, which provides an overview of all electronic and electrical elements. With this defined, the user can go on to connect all the functional modules using single wires, shielded or twisted cables and bundles. It will automatically select correct connectors, identify collisions, and deal with susceptible wires. Engineers can view cables and connectors in various formats on different sheets and output assembly drawings or signal tables to supply to manufacturing.

Consider a large vessel, such as a 350metre long oil tanker which has a cable that needs to run down the length of the deck and deliver a defined voltage. E³.cable will calculate the most efficient route for this cable while achieving electromagnetic compatibility. The type of cable used in different environments and situations can also be simply managed within E³.cable. In an engine bay for example, cables that can withstand higher temperatures are essential. When choosing a cable within E³, the user can specify the name, diameter and gauge, or pick from a predefined drop down list of industry-standard cables.

There are day to day efficiency and productivity gains to be had when using E³ or any CAD solution for that matter, but one of the most significant benefits not yet covered is the ability to deal with the changing technology and client requirements at any stage within the development and build process.

The introduction of a new satellite navigation system two years into the design of a large complex vessel would normally result in extensive rework of the electrical cable design, but with E³.cable it is as simple as updating a single sheet; other areas within the electrical system will automatically be modified to reflect the changes.

For efficient panel design, Zuken offers E³.panel for the placement and wiring of devices in panels and on mounting plates. E³.panel is fully integrated with all the other E³.series design and documentation tools as standard. This environment enables the naval engineer or system architects to integrate all the physical panel data, and then go on to design the layout and associated wiring.



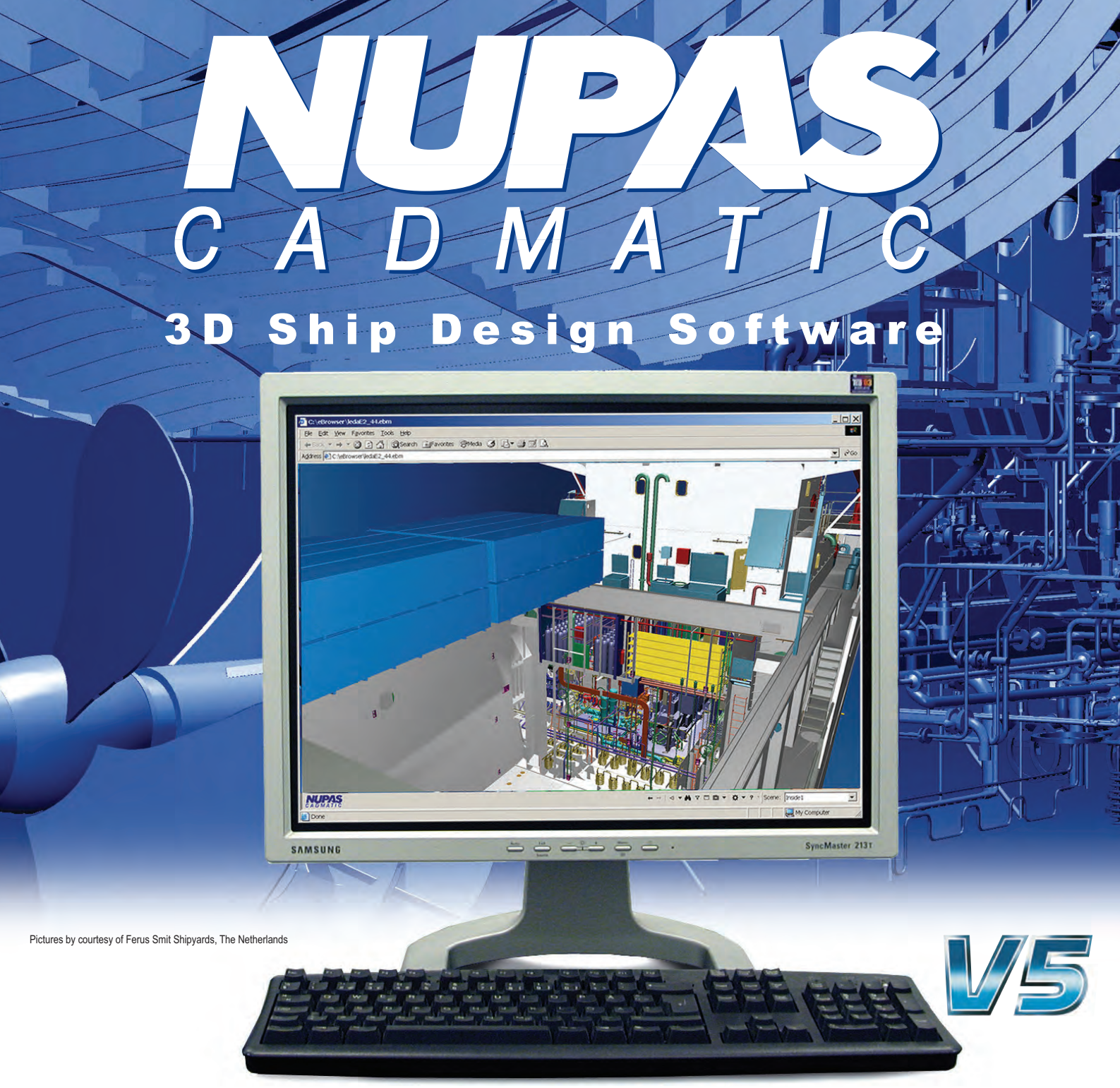
E³. Overview block diagram.

Matching Manufacturing

It is not just about quick and efficient design. Naval engineers want to work with a tool that is easy to use and can reliably supply accurate purchasing and manufacturing data. E³.cable and E³.panel's ability to deliver the essential details in a format that can easily be interpreted by manufacturing engineers takes this tool suite to the next level, according to its developers. For example, engineers can automatically calculate wire and cable lengths and attributes, details about cable duct requirements, as well as placement.

NUPAS CADMATIC

3D Ship Design Software



Pictures by courtesy of Ferus Smit Shipyards, The Netherlands

V5

Nupas-Cadmatic V5 is the ultimate 3D ship design software solution for ship designers and shipbuilders. Nupas-Cadmatic is a concurrent engineering software tool for ship hull-, machinery-, piping-, HVAC- and outfitting engineering. It really saves time and money for you. The open software is database-driven and utilizes advanced 3D modelling technology, providing the necessary information for accurate pre-outfitting and production.

The informative and easy-to-use 3D modeling capabilities can be used for the basic design, detailed engineering, and the production of workshop drawings and generation of ready-to-use production data for production machinery.

With Nupas-Cadmatic you can successfully carry out the entire ship design project, right from the early start, up to the deck outfitting and final production phase. It improves engineering quality and shortens construction time. It also enables globally distributed engineering between several sites and effective communication between the project partners. With the Nupas-cadmatic eBrowser all parties involved can view and check the 3D model and other design information via the Internet. The eBrowser adds value to the entire ship project, easing communication and providing everybody access to the relevant information.

Design and engineering of:

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- Machinery & piping, HVAC
- Accommodation & interior
- Outfitting
- Virtual 3D models
- On-line Walk Arounds
- Windows AVI Video files

Comprehensive information for:

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- Plate and profile bending
- Pipe spools and isometrics
- Pipe cutting and bending
- Other material lists
- Weights
- Centers of gravity
- Logistic data
- Data for production robots
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SOFTWARE DEVELOPED BY:

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We improve your shipbuilding

In the second part of this special report, Partick Couser browses the host of new products available in the market

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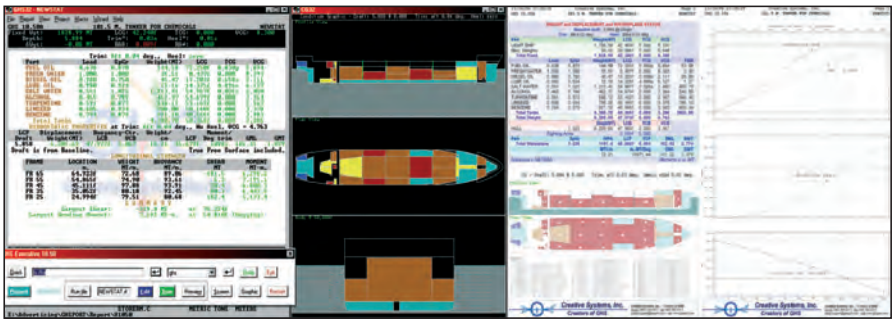

A menu interface has been added to the general hydrostatics programme which is more user-friendly.

GHS (or General HydroStatics) is a very capable program that has been in development since the early1980s. It is fundamentally command-driven, which lends itself to scripting (using 'run files') and this can add to the power of the program. A menu interface has been added and provides a more user-friendly interface than the command scripting language. Recently, a COM interface has been added, which allows GHS calculations to be scripted from other programs such as Microsoft Word and Excel.

The capabilities of GHS can be extended with a number of additional modules. For those on a smaller budget, the reduced capability BHS (Basic HydroStatics) is available. The majority of the additional GHS modules are also compatible with BHS.

Like the majority of the software described in this review, vessel (and tank/compartment) geometry is built up of components. Each component is made up by a number of transverse sections. A component may have either a positive or negative contribution to the vessel's volume. Thus a bow-thruster can be 'removed' from the main hull by defining a bow thruster component of the appropriate geometry but making its contribution negative.

Results are sent to a text file and this can be read into Microsoft Word or Excel. Alternatively, the built-in report generator can be used. A fairly wide range of stability criteria calculations can be selected to define custom sets of stability criteria.

Of the software reviewed, GHS is unique in being able to analyse the interaction between multiple, independent floating bodies and in the ability to find and compute 'GZ' about the minimum stability 'heel' axis – this can be especially useful for non-ship-like structures. It also provides IMO probabilistic damage analysis.

Naval architects using GHS are able to easily generate the necessary data for the GHS Load Monitor onboard stability system using a special GHS Load Monitor configuration wizard.

The third-party software, Deadweight, (available free) is able to produce 3D rendered images of the GHS model and is a useful visualisation tool.

Documentation available with the demonstration version was limited. A web-based FAQ is available.

HST – Wolfson Unit offers user choice

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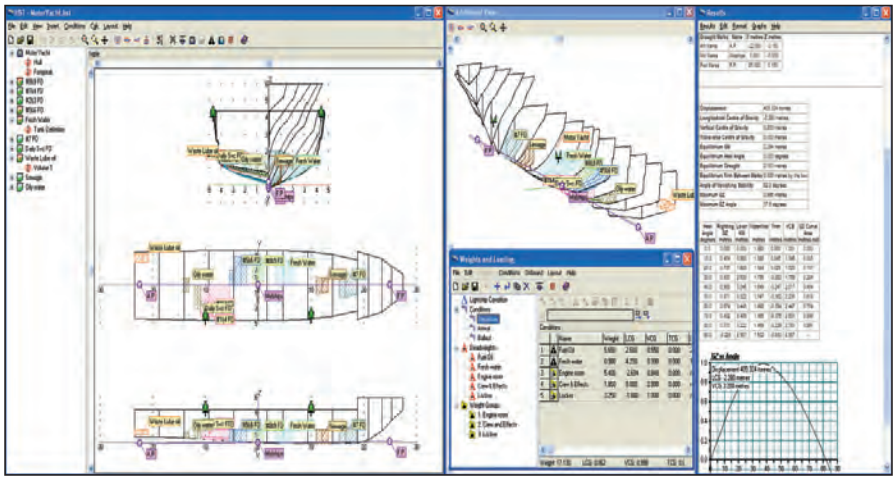

Users of Wolfson unit's hydrostatic analysis have the choice of linear or parabolic integration.

THE Wolfson Unit's hydrostatic analysis program traces its heritage back to the early 1970s and has been in continuous development since then. The latest offering - HST- provides a full Windows graphical user interface, increased functionality, and improved algorithms. When combined with the Loading and Damage modules, HST becomes a comprehensive hydrostatic and stability analysis package, though it lacks some of the more complex analyses such as probabilistic damage and grounding.

As with GHS, the hull and tanks are defined as components made up of transverse sections. The user has the choice of using linear or parabolic integration for the section area and longitudinal volume integration. There are a number of tools to verify and correct any errors with the section data; this is particularly important when the parabolic integration method is used. The tree-control provides rapid navigation of the hull and tank geometry components. Tanks and compartments can be 'carved' to the hull geometry, which facilitates their definition.

Reports are generated in html format, which can easily be pasted into Microsoft Word (with formatting). Graphs can be embedded in the report or plotted at specific scales if required by using the Wolfson Units GoPlot software. The use of hyperlinks facilitates navigation of lengthy reports.

A fairly wide range of stability criteria calculations can be selected to define custom sets of stability criteria. These are in addition to a number of standard criteria sets, such as the IMO HSC and IS codes.

Naval architects using HST are able to generate the necessary input data for the Wolfson Unit's onboard loading and damage stability system, HST Onboard, using the HST Onboard Editor module.

Documentation and online help are comprehensive.

PIAS – SARC BV offer a full suite of options

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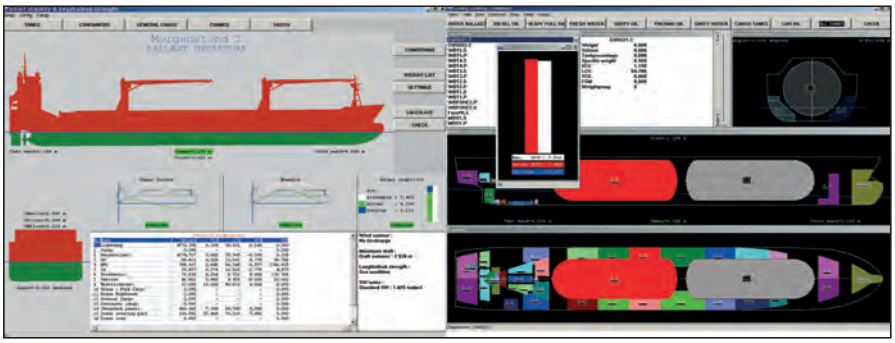

PIAS has the capability to read a Fairway surface model

OF the software reviewed here, PIAS probably offers the greatest range of analyses. There are a very large number of modules, and this allows the user to customise the software to his/her exact requirements. Prices quoted are for typical 'professional' and 'entry-level' packages, though even the 'professional' does not contain all the modules, as it is extremely unlikely that a single user would require them all. As well as stability analysis, there are modules available for resistance and powering.

PIAS includes probabilistic damage analysis, according to SOLAS 1992, SOLAS 2009 (HARDER harmonised method), IMO A265 & dr-67 (for hopper dredgers). Given the processing requirements for damage stability, the multi-threading capabilities in PIAS will make the most of computers with dual-core, hyper-threading processors (which effectively have four processors available); most other software runs in a single thread and so is only able to use one quarter of the available processing power of these computers.

PIAS has the capability to read a Fairway (SARC's line fairing and hull modelling program) surface model. Otherwise, geometry can be defined as sections. PIAS can build up the geometry from multiple input files, which can be linearly scaled as required.

SARC's onboard hydrostatic system, LOCOPIAS, loads model files created with PIAS directly for use onboard ship.

Documentation is comprehensive and available in both Dutch and English.

Rhino Marine calculated direct from surface geometry

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Alion Science and Technology Corp, Proteus Engineering Division, 345 Pier One Road, Suite 200, Stevensville, MD 21666, USA.
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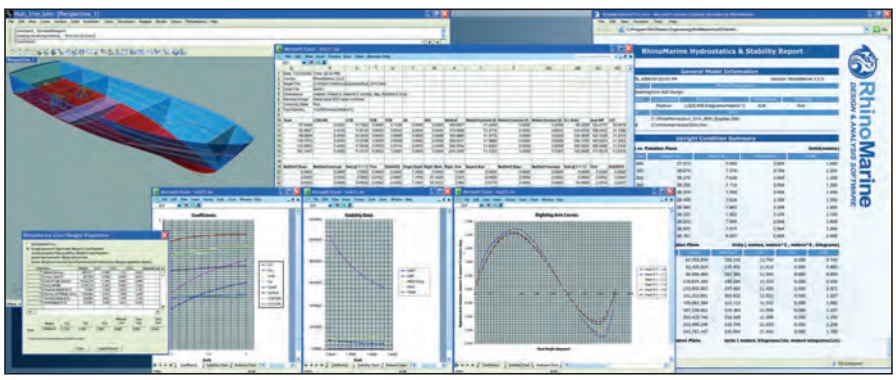
RHINOMARINE is a plug-in to the modelling environment Rhinoceros, meaning that it runs within Rhinoceros. Thus, any changes to the model geometry can be immediately assessed. RhinoMarine's ancestry derives from FastShip, which has been in development for more than 20 years. RhinoMarine is unique in the software tested, in that the hydrostatic properties are calculated directly from the surface geometry without the use of sections through the model. As has been discussed earlier in this review, the main advantages of this approach are that the hydrostatics are equally accurate for any vessel orientation and that complex geometries, such as foil-assisted multihulls and offshore platforms, are more accurately dealt with than by sectioning techniques.

The drawback of the direct surface integration is that interior surfaces and portions of surfaces inside a vessel's watertight envelope need to be excluded from the calculations. Use of Rhino's layering capabilities can greatly assist with selection of the correct surfaces for analysis. Because the calculations are performed on user-selected surfaces, tank volumes can be calculated by selection of the appropriate surfaces (calibration tables can be generated by calculating the tank volumes at the required soundings).

RhinoMarine can provide hull and tank geometry in GHS-compatible format.



RhinoMarine extracts all results to Microsoft Excel and html (with customisable style sheets), facilitating post-processing and report generation. RhinoMarine should be considered to be complementary to some of the more costly software reviewed in this article, though for some users it may provide sufficient analysis capability on its own. It is essentially an intact stability tool for quick and accurate evaluation of a vessel's hydrostatics during initial design. Its surface integration method will be attractive to users dealing with complex geometries and/or large angles of trim.

Some features, such as cross-curves and bonjean curves, are not available directly, though the data can be extracted if required. However, it is arguable whether this type of data is relevant to intact stability analysis since it is just as simple to calculate an accurate GZ curve, taking into account the actual displacement, centre of gravity, and full 3D rotation of the vessel.

RhinoMarine is able to provide the hull and tank geometry in GHS-compatible format. Using the GHS or Hydromax COM interfaces, it is even possible to drive GHS or Hydromax from within Rhino.

The capability to evaluate stability criteria is under development and expected in version 4.

Online help is comprehensive.

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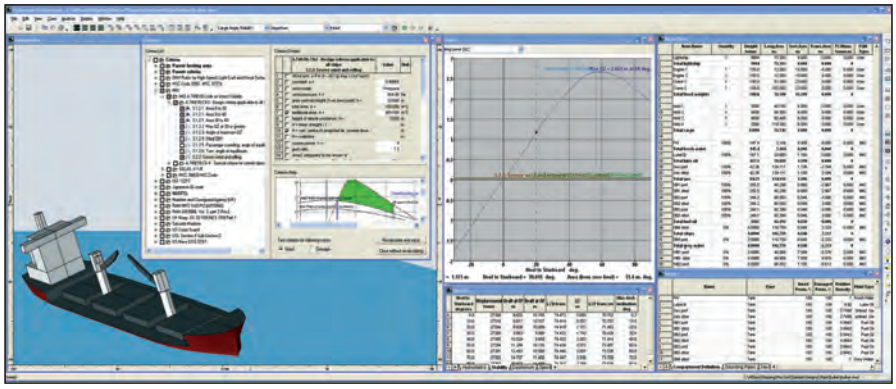

Hydromax will automatically identify intersecting tank/compartment components.

HYDROMAX is a comprehensive ship stability analysis program that has been in development since the mid-1980s. Originally developed for the Macintosh and ported to Windows in the mid-1990s, Hydromax has always been a graphical-user-interface driven program. However, the latest version provides a full COM interface enabling custom analyses to be defined and standard tasks to be scripted.

Like the majority of other such software, calculations of vessel hydrostatics is done by dividing the vessel into a number of sections, typically 100 to 200 sections. Vessel geometry is loaded directly from a Maxsurf hull design file – requiring that a NURB surface model be available. Direct input of section data is not currently supported, though this is to be implemented for monohulls in the next version.

The principal advantage of having a coherent surface model is that tanks and compartments can be 'carved' directly from the hull surfaces with the minimum of input data (bulkhead and deck locations). Complex tanks (such as spherical LNG tanks) require the appropriate surfaces to be defined in Maxsurf and then these may be selected as tank boundaries. Unlike the majority of the software tested, Hydromax will automatically identify intersecting tank/compartment components and generate any required negative components (for example, where a tank is defined inside a compartment). This speeds up the processes of defining the complete vessel compartmentation model. The other software reviewed places this requirement on the user.

Hydromax provides a highly interactive interface, with full copy and paste supported from all tables and interactive measurements from graphed results. Results are accumulated in a Rich Text Format window which can be read by Microsoft Word or printed directly. Hydromax provides visual feedback of the model during analysis and this may also be saved as an 'avi' file for later playback.

Hydromax provides a comprehensive set of criteria calculations (approximately 45). From these, it is possible to define virtually any stability criterion. A large number of predefined criteria sets, such as IMO, RAN, US and UK Navies, and MCA are included. The criteria are organised in a tree, which facilitates editing and selection for analysis.

Documentation and online help are comprehensive. A web-based knowledge base is also available for registered users.

New version of hydrostatics and stability software

THE latest update of Autohydro has recently been launched by Canadian company Autoship Systems Corp (ASC). Version 6.1, of the hydrostatics and stability software, along with Modelmaker, its vessel model editor module, has numerous new features.

Additions include downflooding angle curves production for protected, unprotected, and critical points; FSM definition improvements which meet specific class requirements; draught mark report generation; resolution 14 improvements (*Estonia*); FSM improvements (combined user-defined calculated, and MaxFSM for selected tanks); one-hold damage for bulk carriers; corrected shear force at bulkheads; new wind area definition; and visible length, propeller immersion, and air draught.

Modelmaker 6.1 now includes features that allow DXF to import hull model sections (from both 2D or 3D DXF); DXF export of hydrostatic model (gf) (2D and 3D); parallel inserts mid-body section; a pre-defined frame table that allows input of longitudinal position by frame number; and PartPlot of large gf hydrostatic model files.

An Autohydro 6.1 main screen display. The system now features the ability to import hull model sections.

Partnership for Martec and ShipConstructor

A NEW strategic partnership has been formed by two Canadian-based companies. Martec Ltd (headquartered in Halifax, Nova Scotia), developer of the Trident suite of structural analysis and seakeeping software, and ShipConstructor Software Inc (formerly Albacore Research), based in Victoria, British Columbia, developer of the ShipConstructor suite of 3D product-modelling and production planning software, have joined forces to combine the capabilities of their products for the marine industry. The ShipConstructor user community will now be able to easily conduct detailed finite-element stress, hydrodynamic, and other specialised analyses in Trident, directly from existing ShipConstructor models.

The combined ShipConstructor and Trident system aims to create a powerful, integrated solution for 3D modelling, design, and analysis of both commercial and naval vessels. Martec's arsenal of analysis software specifically designed for ship structures will complement ShipConstructor's 3D product modelling and production planning software.

Leading ship designers, owners, and operators often seek software tools that extend ship modelling applications beyond design and construction to include complete lifecycle management of a vessel. Such tools can eliminate the time-consuming and costly production of separate analysis models required as input to the growing number of lifecycle maintenance analysis tools. This offers significant savings in operation and maintenance costs as well as improved understanding and confidence in vessel safety.

As part of this move, Martec has joined the ShipConstructor Developer Network (SCDN) program, which provides technical resources and support for integrating with ShipConstructor. Martec's Trident Group has established that company as a leader in the field of naval architecture and marine engineering technology and services. Developed in partnership with Defence Research & Development Canada (DRDC), Trident software is claimed to be used today by navies, ship registries, shipyards, naval architects, and ship designers around the world.

New technical 'blog' for marine professionals

TO help with its philosophy of providing valuable technical information in a more candid format, HydroComp Inc has launched a new 'blog', which can be viewed at www.hydrocompinc.com/blog. The company has noted that there are few credible technical blogs available to the marine professional, and this weblog (on-line diary) offers to open a dialogue with the industry beyond customers, to provide an experienced perspective, and to provide a medium where visitors can converse with either HydroComp's development team or a director, on the same level.

Among the many articles already posted to the blog is a featured editorial from HydroComp's technical director, Donald MacPherson. Twice monthly, Mr MacPherson posts 'Miscellaneous Monday musings', which include commentary about industry trends, technical advice, and various aspects of naval architecture.

Mr MacPherson says that HydroComp wants to reach out to people interested in hydrodynamics, propellers, and powering. It is important, he says, for web visitors to know how the company perceives the evolution of the marine industry and what can be offered in the future.

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Second Announcement

The design of Passenger Ships is an area that continues to gain international attention. The changing mix of vessels and capabilities in the world fleet has created a range of new challenges for the Naval Architect. Recent developments in International regulations, such as IMO revised stability standards and the results of the 'Large' Passenger Ship debate at IMO will also have a significant effect on future design.

Recent and proposed vessels in the cruise ship market are setting new records for gross tonnage and passenger capacity. The ferry market is undergoing a change in the face of competition from low cost airlines and the new designs of ferry must be suited to the new economic environment in which they operate.

This conference will bring together Naval Architects, Shipbuilders, Owners, Operators and Regulators to discuss the various issues related to the Design, Construction and Operation of Passenger Ships.

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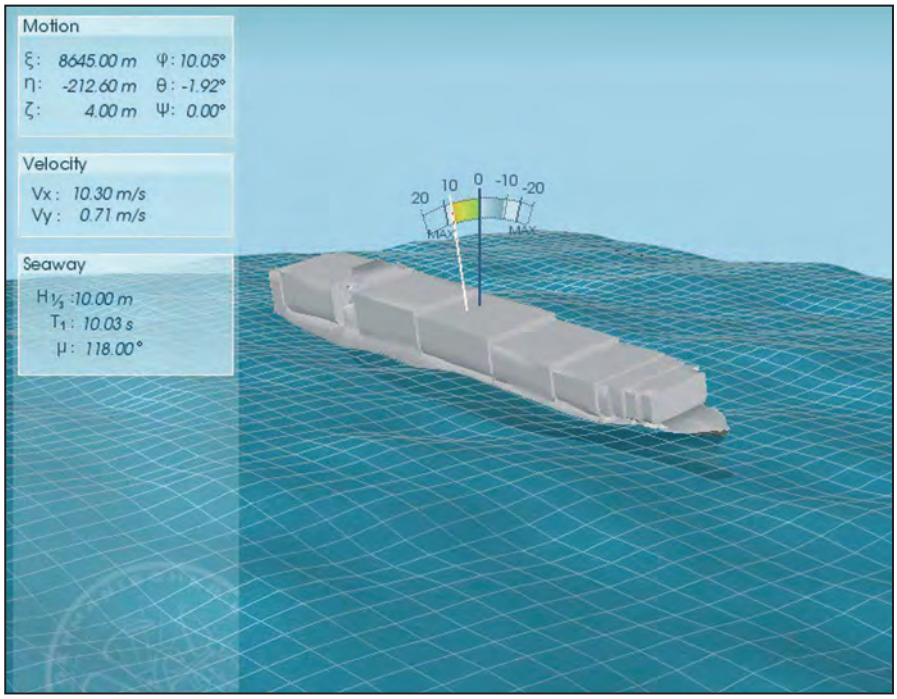
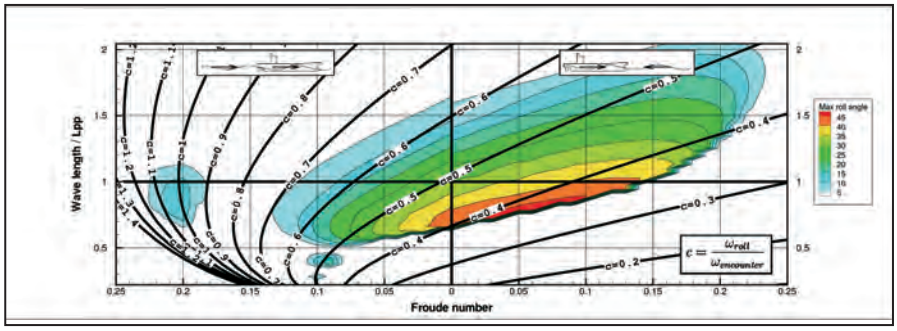
State-of-the-Art Simulation

THE work of classification societies on design assessment increasingly relies on the support of computer based numerical simulations. This review has been prepared by Ould el Moctar, Karsten Fach, Christian Cabos, Holger Mumm, of Germanischer Lloyd, and Volker Bertram, Dept Mech Eng, Stellenbosch University.





Simulations were carried out to predict parametrically induced roll motions that were then compared against model test measurements performed at the Hamburg Ship Model Basin.

ALTHOUGH design assessments based on advanced finite-element analyses have long been part of the services of a classification society, the scope and depth of development of applied simulation methods has been so rapid that it is time to take stock.

Shipyards frequently outsource the extensive analysis associated with simulations in the design process of ships. The trend of modern classification society work also tends towards simulation-based decisions, both to assess the ship's design and to evaluate its operational aspects.

To assess the safety of modern ships, it is vital for Germanischer Lloyd to have available numerical tools to investigate the dynamic stability of intact and damaged ships in a seaway. Large amplitude motions may lead to high accelerations. In severe seas, ships may also be subject to phenomena like pure loss of stability, broaching to, and parametric rolling.

Linear seakeeping methods are unsuited to predict such phenomena, mainly because they do not account for stability changes caused by passing waves. Furthermore, linear methods are restricted to small amplitude ship motions, and hydrodynamic pressures are only integrated up to the undeformed water surface.

Two simulation tools, ROLLSS and GL SIMBEL, are available at GL to simulate large amplitude ship motions. Depending on the extent of the nonlinearities accounted for, simulation methods tend to be cumbersome to handle and unsuitable for routine application. Therefore, the numerically more efficient method ROLLSS is used to identify regions of large amplitude ship motions quickly, while the fully nonlinear method GL SIMBEL is then employed to yield more accurate motion predictions.

To validate these tools and to demonstrate their practical application, extensive simulations were carried out to predict parametrically induced roll motions that were then compared to model test measurements performed at the Hamburg Ship Model Basin.

Propulsion and movement

Diagrams to estimate rudder forces were customary in classical rudder design. These diagrams either extrapolate model test results from wind tunnel tests, or they are based on potential flow computations. However, the maximum lift is determined by viscous flow phenomena, namely, flow separation (stall).

Potential flow models are not capable of predicting stall, and model tests predict stall at too small angles. CFD is by now the most appropriate tool to support practical rudder design.

The same approach for propeller and rudder interaction can be applied for podded drives. RANSE solvers also allow the treatment of cavitating flow. The extensive experience gathered in the last five years resulted in a GL guideline for rudder design procedures.

Aerodynamic issues are also increasingly of interest for ships and offshore platforms. Potential applications include smoke and exhaust tracing, operational conditions for take-off and landing of helicopters and wind resistance and drift forces. The traditional approach to study aerodynamic flows around ships employs model tests in wind tunnels. These tests are a proven tool supporting design and relatively fast and cheap. Forces are quite easy to measure, but insight into local flow details can be difficult in some spaces.

Computational fluid dynamics (CFD) is increasingly used in related fields to investigate aerodynamic flows e.g. around buildings or cars. CFD offers some advantages over wind tunnel tests: The complete flow field can be stored and allow evaluation at any time in the future. There is more control over what to view and what to block out. CFD can capture more flow details. CFD also allows full-scale simulations. Despite these advantages, CFD has so far rarely been employed for aerodynamic analyses of ships. This is due to a combination of obstacles: the complex geometry of superstructures makes grid generation labour-intensive. The flows are turbulent and often require unsteady simulations due to large-scale vortex generation.

Recent progress in available hardware and grid generation techniques has allowed a re-evaluation of CFD for aerodynamic flows around ship superstructures. Hybrid grids with tetrahedral and prism elements near the ship allow partially automatic grid generation for complex domain boundaries. The resulting higher cell count is acceptable for aerodynamic flows because the Reynolds numbers are lower than for hydrodynamic ship flows and thus there are fewer elements needed. In 2002, GL performed RANSE simulations for a ship superstructure to investigate aerodynamic problems and smoke propagation.

Fire Simulation

SOLAS regulation allows the consideration of alternative designs and alternative arrangements concerning fire safety. The requirement is to prove (by engineering analysis) that the safety level

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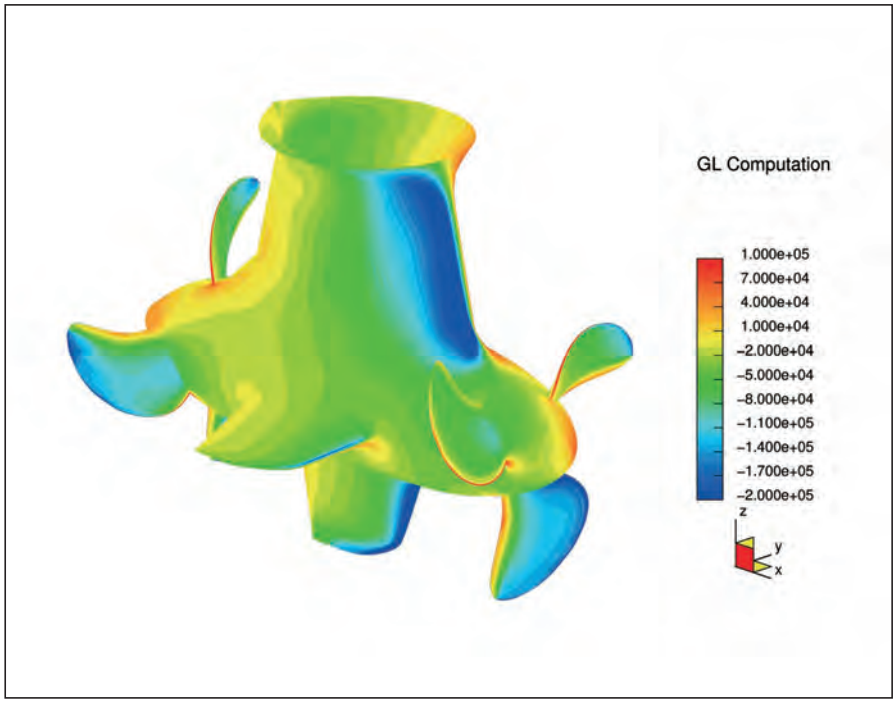
of the alternative design is equal to that based on prescriptive rules. The main benefit of these regulations is expected for cruise vessels and ferries, as the alternative design approach allows large passenger and car deck spaces beyond what is possible with the prescriptive rules.

In principle, 'engineering analyses' could also mean fire experiments, but these are too costly and time consuming to support ship design. This leaves computer simulation as a suitable option. At present, zone models and CFD tools are considered for fire simulations in ships. Zone models are suitable for examining more complex, time-dependent scenarios involving multiple compartments and levels, but numerical stability can be a problem for multi-level scenarios, for scenarios with Heating, Ventilation and Air Conditioning (HVAC) systems, and for post-flashover conditions.

CFD models can yield detailed information on temperatures, heat fluxes, and species concentrations; however, the time penalty of this approach currently makes CFD unfeasible for long periods of real time simulations or for large computational domains.

While reproducing several typical fire characteristics, fire simulations are not yet mature, and more progress can be expected in the next decade. For example, results are not grid-independent with the currently employed typical grid resolutions, but finer grids appear out of reach for present computer power and algorithms. Despite such short-comings, fire simulations already appear suitable as a general support both for fire containment strategies and for design alternatives.



CFD is by now the most appropriate tool to support practical rudder and podded drive design.

Structural analyses

The reliable computation of loads is crucial for an accurate global FE strength analysis of a ship. In its "Guideline for the global strength analysis for container vessels" (2006), GL used the design wave approach to find those load combinations which were most relevant for the dimensioning of the structure. In contrast to the loading approaches in the common structural rules for bulkers and tankers, the hydromechanic pressure and the ship accelerations were taken from first principle hydrodynamic computations for regular waves. As an aid in applying the loading procedure, the software GL ShipLoad has been developed.

GL provides a user-friendly computer application for the efficient load generation for global FEA of ship structures. The graphical user interface facilitates the convenient application of ship and cargo masses to the FEA model. Hydrostatic and hydrodynamic computations are integrated into the program. GL ShipLoad supports the generation of loads from first principles (realistic inertia and wave loads for user supplied wave parameters), but the program also aids in the selection of relevant wave situations for the global strength assessment based on bending moments and shear forces according to Germanischer Lloyd's rules. The result is a small number of balanced load cases that are sufficient for the dimensioning of the hull structure.

Until 1998, the SOLAS regulations on subdivision and damage stability specified damage stability requirements only for cargo ships longer than 100m. Since 1998, this limit has been lowered to 80m for new cargo ships. Additional transverse bulkheads to fulfil damage stability requirements are costly and restrict operations.

However, new SOLAS regulations permit for some ships alternative arrangements, provided that at least the 'same degree of safety' is achieved. This notation allows some flexibility of structural designs supported by advanced simulations. E.g. a structural design having increased collision resistance thus reducing the probability of penetration of the inner hull could eliminate the need for additional bulkheads.

Based on extensive FEA simulations for ship collisions, GL developed an approval procedure which provides the first such standard for evaluation and approval of alternative solutions for design and construction of these ships. The basic philosophy of the approval procedure is to compare the critical deformation energy in case of side collision of a strengthened structural design to that of a reference design complying with the damage stability requirement described in the SOLAS regulation.

Vibration prediction

Ship vibrations are increasingly important due to several design trends: lightweight construction (with low stiffness and mass), arranging living and working quarters near the propeller to optimise stowage space, high propulsion power, small tip clearance of the propeller (to increase propeller efficiency), and fuel-efficient, slow-running main engines. It has become standard practice to regulate vibration aspects for a new building on a contractual basis. Therefore, vibration predictions are performed already during the preliminary or structural design stage for many ship types. As complex structural arrangements can be reflected comfortably, 3-d FEA is today the standard tool used for this purpose.

However, modelling of the stiffness distribution is all but trivial and requires a certain amount of experience. This is specifically true if the dynamic properties of large deck panel structures, as often met on cruise ships or mega yachts, shall be considered in a realistic way. It must always be kept in mind that this represents one paramount prerequisite for an accurate prediction of the vibration level distributions to be expected on the deck structures.

However, the mass distribution must also be accounted for carefully. This includes the light ship weight, the cargo and the hydrodynamic 'added' mass, which reflects the effect of the surrounding water. The matrix representing this hydrodynamic mass effect typically couples all wet degrees of freedom and is therefore complex to compute and handle. For a long time, the approach of Lewis (1929) – a frequency dependent diagonal matrix simplification – was used.

To account for 3D effects accurately, in particular in the case of appendices, a boundary element method can be used to compute the full matrix. A comparison of this procedure with the Lewis approach and full-scale measurements indicates superior results when using the full mass matrix.

Use of empirical methods is still considered justified for the determination of the propeller vibration excitation forces in the early design phase. However, with progressing design more accurate methods should by used, i.e. cavitation tank tests and CFD computations.

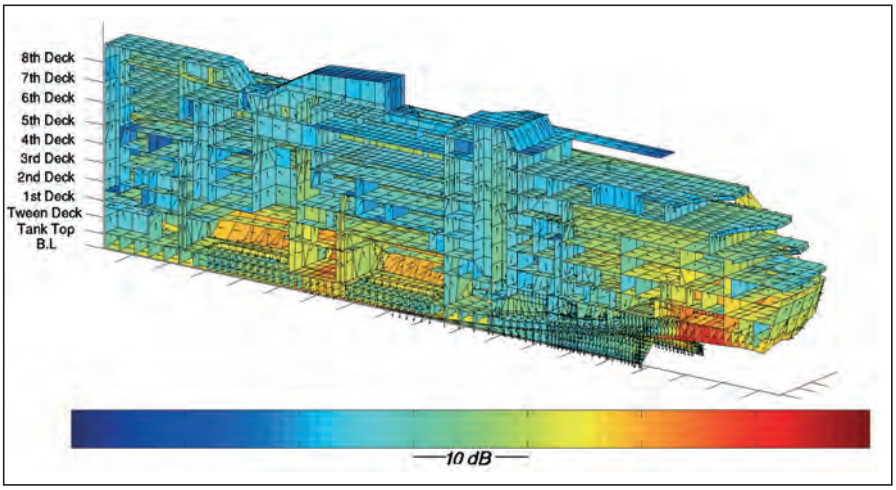
In the last decade special software has been developed to simulate the vibration excitation forces stemming from slow and medium speed diesel engines. By integrating a model of the engine frame into the FE-model this allows for the computation of the coupled vibration of hull and main engine structure.

Direct calculation methods come to their limits in calculating the vibration of local structures such as plate fields and stiffeners. Despite modern pre-processors with parameterised input possibilities and graphic support the required mesh density, the number of structural details to be considered and structures to be analysed makes the use of FEA methods more or less impossible for this purpose. Consequently, Mumm (2005) recommends a 2-step approach. At first the local vibration design is checked by calculating the natural frequencies of the local structures and comparing them to the relevant excitation frequencies. If resonance is likely, the scantlings of the local structures are changed. These

calculations can be done with the aid of simple estimation formulae but should be supported by graphical user interfaces to ensure that the work can be done within a reasonable time frame. In the second step the global vibration design is optimised by FEA methods as described above. FEA methods are also used for substructure vibration analysis, e.g. masts and lashing bridges, and components of the propulsion plant, as shafts, gears and pod units, for instance.

Noise prediction

The prediction of structure-borne sound propagation in ships is difficult for a number of reasons. The large number of modes participating in any state of high frequency vibration makes it impossible to treat the global sound propagation problem as a vibration problem today. For a typical passenger vessel for a frequency of 1000Hz, an FEA vibration model would lead to several million degrees of freedom. Since predictions for the mean propagation of structure-borne noise are usually required in a particular frequency band, vibration computations would have to be repeated for many frequencies. However, the very fact that information is required averaged only over a frequency band allows an alternative, far more efficient approach based on statistical energy analysis. The Noise Finite Element Method (NoiseFEM) of Germanischer Lloyd is based on a related approach. NoiseFEM predicts the propagation of noise by analysing the exchange of energy between coupled subsystems, Cabos et al (1999). Validation with measurements on full-scale mock-ups show that the accuracy of NoiseFEM is sufficient for typical structure-borne sound predictions for the frequency range between 80Hz and 2000Hz, Wilken et al. (2004). Typical 'coarse' FEA models as used for global vibration analysis of ships have been proven as well suited for NoiseFEM simulations.



Typical 'coarse' FEA models as used for global vibration analysis of ships have been proven as well suited for NoiseFEM simulations.

By way of conclusion, it is to be reiterated that technological progress is rapid, both for hardware and software. Simulations for numerous applications now often aid the decision making process, sometimes 'just' for qualitative ranking of solutions, sometimes for quantitative 'optimisation' of advanced engineering solutions.

Continuous validation feedback not only improves the simulation tools themselves, but it also builds confidence in their use. However, advanced simulation software alone is not enough. Engineering is more than ever the art of modelling and finding the delicate balance between level of detail and resources (time, man-power). This modelling often requires intelligence and considerable (collective) experience. The true value offered by advanced engineering service providers lies thus not in software or hardware, but in the symbiosis of highly skilled staff and these resources.

Genfer Lloyd: a new Polish consultancy

FOLLOWING our short November article about the formation of the Baltic Design Centre in Gdynia, we have also heard about another new Polish ship design office. This is Genfer Lloyd, set up in 2004 but with its ship design office established in 2005; the consultancy is still developing.

Currently around 50 people are employed, with the largest concentration of employees in hull structures (21 employees) and machinery/piping (18 people). The headquarters are in Szczecin, close to Stocznia Szczecinska (Szczecin Shipyard), and many years of experience are embodied in the workforce, which comprises both Polish and European personnel, mostly with MSc degrees; some are former employees of Stocznia Szczecinska.

They are able to handle all naval architectural and shipbuilding tasks, including technical assistance with selecting equipment, document approval, and sea trials. A range of quality software is employed, including Nupas Cadmatic, Autocad, Napa (starting January 2007), DNV Nauticus (starting January 2007), and GL Poseidon (also starting in January 2007). Rhino and Expander are also used, and Tribon is available, if required.

Genfer Lloyd has already been working with Skipsteknisk, in Norway, preparing workshop documentation for a research ship, and with another Norwegian company, the shipbuilder BMV, preparing workshop documentation with outfitting 3D coordination, for a seismic ship, and similar work for an ROV/construction vessel. Staff have additionally been supervising hull construction and piping of a ship at Gdansk Shipyard.

Technical staff at work in the Genfer Lloyd office.

Estonia still holds lessons

FOLLOWING last month's insight into the new research into technical aspects of the *Estonia* disaster, SNAME offers its summary regarding the inquiries into the loss.

THE Forensics Panel SD-7 of the Society of Naval Architects and Marine Engineers under the Chairmanship of Mr W H Garzke Jr has been re-analysing past ship casualties to assess whether there are lessons to be drawn today that may not have been concluded at the time.

It has been concerned by inconsistencies in reports of the loss of the Passenger Ferry MV *Estonia*, and has been supporting a new research study of the sinking sequence.

In September 2005 Mr John Graffman of VINNOVA (Swedish Governmental Agency for Innovation Systems) outlined a schedule of a proposed study into the loss of the *Estonia*:

- March 17 2005, Swedish Government authorises study
  - Swedish Military admitted that *Estonia* had been used to carry military equipment from Russia to Sweden prior to fateful voyage.
- May 19 2005, Pre-announcement by VINNOVA
- July 1 2005, Request for Proposals for Study
- August 29 2005, Closing date for RFPs
- October 10 2005, Complete Evaluation of RFPs
- Prepare Detail Proposals by Selected Parties
- December 15 2005, Submission of Detailed Proposals
- January 31 2006, VINNOVA announce successful bidders.

The objectives of this study are to determine the sequence of the sinking of the MV *Estonia* and to develop important knowledge that will improve maritime safety for ships in Swedish and international waters. However Paragraph 5 of the RFP prohibits the visitation of the wreck per an agreement between the governments of Sweden, Finland, and Estonia and later co-signers of this agreement of Denmark, Russia, United Kingdom, and Latvia.

The expected outputs and outcomes include:

- The most probable scenario for the sinking sequence of *Estonia*
- Recommendations on products, methods, and services that will improve the safety of passenger ferries
- A better understanding of possible sinking sequences in distressed passenger ferries.

The organisations submitting proposals included:

- A joint proposal received from HSVA and TuTech Innovation GmbH of TUHH (Germany)
- Krylov Shipbuilding Research Institute, St. Petersburg (Russia)
- MTAB (Sweden)
- Joint proposal from SSPA AB (Sweden), SSRC at University of Strathclyde (UK), MARIN (Netherlands), and Chalmers University, Gothenburg.

Any new study not based on a detailed forensic study of the wreck will be meaningless, inconclusive, and a waste of money.

Previous Studies included:

- The Joint Accident Investigation Commission's (JAIC) Final Report (Issued in December 1997)
- The National Board of Psychological Defense (SPF), Pilot Study of the Sinking Sequence (Issued in March 2003).

***Estonia's* History:**

Shipbuilder – Josef L. Meyer Shipyard GmbH, Papenburg, Germany
First Owner – Rederi Sally of Mariehamn, Aaland, Finland, managed by Viking Line as *Viking Sally*
Maiden Voyage July 5 1980
Second or Third Owner – Silja Line, as *Silja Star*, late 1980's
Fourth Owner – Interests in Vasa, Sweden, February 1991, as *Wasa King*
Fifth Owner – Joint Estonian-Swedish venture, October 1992, as *Estonia*
Owned by Estline Marine Co as of January 15, 1993
Classification Society – Bureau Veritas.
Vessel was operated as a joint venture by the Estonian Government and a longstanding Swedish company, Nordstrom & Thulin (Est. 1849)

Last Voyage

Departure: Tallinn, Estonia on September 27 1994 around 1915
Scheduled Arrival: Stockholm, Sweden, September 28 at 0930
Vessel departed with 988 or 989 persons (~186 crew/803 passengers)
Vehicles:
40 trucks/trailers (some dispute)
25 passenger vehicles
9 vans
2 buses

There is a need to examine this cargo manifest with an inventory of vehicles onboard; and how the vehicle cargo was loaded and secured. There was a list of one degree to starboard with port list (heeling) tank filled when the vessel departed from Tallinn.

Vessel Accident

Sea Conditions – Estonian Coast – moderate
Baltic Sea – Wind SW at 18-20m/s (about 35-40knots)
Waves 3.5-4.5metres
Possibly borderline sea state 6
Significant wave height undetermined

September 28 (past midnight) – stabiliser fins extended followed by banging noises in bow.
At 0102 vessel listed 40-50 degrees to starboard.
At 0122 distress call sent.
Around 0145 vessel capsizes to starboard.
Vessel sank between 0153-0204 with the loss of 852 persons, only 136 persons saved.

Conclusions of a 1995 study by German experts:

Vessel vehicle ramp and bow visor were poorly maintained.

Was the one degree list due to leakage by corrosion in ship's hull; port list tank filled to compensate for entrained water. Was this list recorded with or without vehicles?

Repairs in Turku in 1993 on bow ramp and visor included:

- Strengthening locking devices
- Overhauling hinges
- Renew bushings
- Renew 15metres of bow visor rubber packing
- Renew 10metres of bow ramp rubber packing

Nordstrom & Thulin would not authorise these repairs.

Swedish Maritime Board found that the vessel could not pass inspection due to problems with bow ramp, safety plans, damage

The Royal Institution of Naval Architects

HUMAN FACTORS IN SHIP DESIGN, SAFETY AND OPERATION

21-22 March 2007, RINA Headquarters, London, UK

Second Notice

Naval architects and marine engineers have a direct influence over ship design and consequently how their designs are used by seafarers. In recent years, there have been increasing efforts to gain an awareness of human element issues and to improve understanding of how designs influence human behaviour. Design has an important role to play in improving habitability, occupational health and safety, and contributing to seafarer recruitment and retention. Good design of working and living conditions is likely to receive increased emphasis following the adoption of the ILO Maritime Labour Convention - a key theme for the conference.

The traditional view that human error is the major cause of all accidents is being challenged by some who consider human error to be a symptom of deeper problems within a system. Indeed, some argue that modern technology has reached a point where improved safety can only be achieved through a better treatment of human / system interaction. It is necessary to not only design ships and equipment for safe and effective operation, but to also align design and training. The wider context of management, culture, procedures and regulation also has a vital role to play in safe and effective operation.

This conference aims to bring together international specialists and professionals including designers, ship operators, seafarers, equipment manufacturers and regulators to highlight how the sensible application of ergonomics can reduce costs and improve safety.
RINA invites papers in all related topics:

- Design for occupational health and safety
- Habitability
- Survivability, escape and evacuation systems Integration of human factors into the design process
- Practical applications of human factors engineering
- Feedback from the users into the design loop
- Design of navigation & control systems for safe operation
- Safety performance and management
- Maritime operating organisations and teamwork

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

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Company:

Address:

Postcode:

Telephone: Fax:

Email: **(W2004)**

Please return to: Conference Department, RINA, 10 Upper Belgrave Street, London SW1X 8BQ
by fax on +44 (0)20 7259 5912 or by email: conference@rina.org.uk

control calculations, stability booklet, stability calculations. Estonian authorities would not concur and allowed vessel to sail.

Meeting with Mr John Graffman, Program Manager of VINNOVA and Members of SNAME Forensics Panel SD-7

There was a meeting on September 19 2005 with select members of Panel SD-7. Mr Graffman discussed the study to be done on the loss of *Estonia*. The Panel members voiced concern that the wreck needed to be accessed and photographed as part of any investigation to the cause of sinking.

On September 20 2005 Mr Graffman attended Panel SD-7 Presentation of Paper, "Marine Forensics, Historic Shipwrecks, Determination of Root Cause," at the Oceans 2005 Conference in Washington, DC. After the paper presentation he attended a Panel SD-7 Meeting at the headquarters of Phoenix International in Landover, Maryland where he outlined the study that VINNOVA intended to conduct.

SNAME Panel members included: William H Garzke, Jr Chairman; Kenneth Smith, ESI; Richard Fiske, former Supervisor of Salvage, USN; Robert Dulin, Sparta; F Gregg Bemis, Jr; Owner of Lusitania, Steven Saint Amant, Phoenix International; William Cleary, Naval Architect; Philip Sims, NAVSEA; Siu Fong, NSWC, Carderock; Charles Young, Phoenix International; Bruce Johnson, Consultant.

Determination of the Circumstances of a Ship Casualty Incident

- What happened (ship sequence of events, environmental conditions)
- Survivor testimony (including new interviews)
- Chain of decisions and events
- Time line
- How the accident chain was set up
- Records and reports
- Recorded data
- Pictures
- Drawings and specifications
- Cargo manifest
- Examination of Trim and Stability Book
- Simulation to determine sensitivity of list from humans aboard and cargo shifts
- Condition of bilge and ballast system
- Lifesaving equipment
- Examination of visor (Already recovered)
- Re-examination of recovered metal samples
- Possibly recovery of additional metal samples near bow.

Panel SD-7 Conclusions on Proposed Study:

- Survivor testimony in JAIC report is inconclusive.
- *Estonia* could not be classed as a passenger ferry in Holland, France, UK, and the Mediterranean for short international voyages.
- The *Estonia* wreck needs to be thoroughly examined and photographed. A study of the wreck will assist in how the accident chain was set up.
- A photo mosaic of the wreck needs to be done.
- State of internal water tight closures (down flooding paths).
- Fault tree analysis needs to be done to determine all sinking possibilities.
- The choice of one event in the fault tree analysis without confirmation from a shipwreck survey is unsatisfactory. This was done in JAIC Report.
- A thorough study of lashing gear used in the ship to secure vehicles is a necessity. Stresses set up in lashing gear due to ship motions need to be examined and the possibility of a cargo shift.
- The cargo manifest and vehicle locations need to be thoroughly examined.
- State interference of not allowing access to the wreck could be overcome with government presence during wreck survey.
- The car deck and bow ramp needs to be surveyed and photographed.
- Any new study not based on a detailed forensic study of the wreck that also includes an exhaustive photographic analysis and ship internal observations is meaningless, inconclusive, and a waste of money.

In January 2006 it was announced that two research studies of the sinking sequence will be funded by VINNOVA. By using computer simulations and model testing the research results will provide ideas of how to improve maritime safety for passenger ships. The projects will be going on for approximately two years.

One consortium will be coordinated by SSPA Sweden AB in Gothenburg, Sweden, with partners being the Ship Stability Research Centre at the University of Strathclyde in Glasgow, MARIN at Wageningen and Chalmers University, Department of Shipping and Marine Technology in Gothenburg. The second consortium will be coordinated by HSVA at Hamburg. Their other partners are Technische Universität Hamburg-Harburg and the company TraffGo HT in Duisburg.

MacGregor adds China venture

MACGREGOR Group has formed another joint venture in China. The Cargotec subsidiary has come to an agreement with Shanghai Goodway Marine Engineering, aimed at improving the Finnish group's competitiveness in the domestic Chinese market. The deal involves the joint offering of locally available, qualified design and project management services.

Once finalised, the alliance will see Goodway's eight staff employed by the joint venture company, with plans to increase staff numbers in the near future. Training to meet the advanced technical skill levels will be provided by MacGregor.

The latest cooperation follows MacGregor's agreement with the ship repair arm of China Shipping Industry Co (CSIC) in August 2006, to establish service stations at CIC repair yards in the Shanghai area and around Guangdong province. That agreement was designed to increase the volume of shiprepair activities for both companies.

Contact: Pertti Vilhonen, sales manager, conversions and modernisations, MacGREGOR (Finland).
Tel: + 35 82 4121 360.
E-mail: pertti.vilhonen@macgregor-group.com
www.macgregor-group.com

Wärtsilä expands in Manaus

ENGINE builder Wärtsilä plans to invest R$3.5 million (€1.2 million) in its services workshop in Manaus, Brazil.

The investment covers the construction of a new workshop and the purchase of new equipment to meet regional demand.

'We want to expand our offering in the northern part of the country and to do this we are investing in machinery, equipment and human resources,' said Marcos Macedo, Wärtsilä services manager in Manaus. 'In Manaus and the Amazon the roads of the region are its rivers, through which approximately 30,000 small, medium and large ships sail every year. We provide service for many of these vessels.'

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

Water lubricated Thordon

THORDON Bearings has introduced Composite EF, a newly designed water lubricated rubber bearing. Its bronze backing facilitates installation, and it is supplied in a single 3:1 L/D length, with finished inside diameter to standard shaft sizes from 152mm to 305mm. Overbuild on the outside diameter accommodates various housing sizes, also being lighter in weight compared to metallic bearings. The product eliminates the need for heavy rigging.

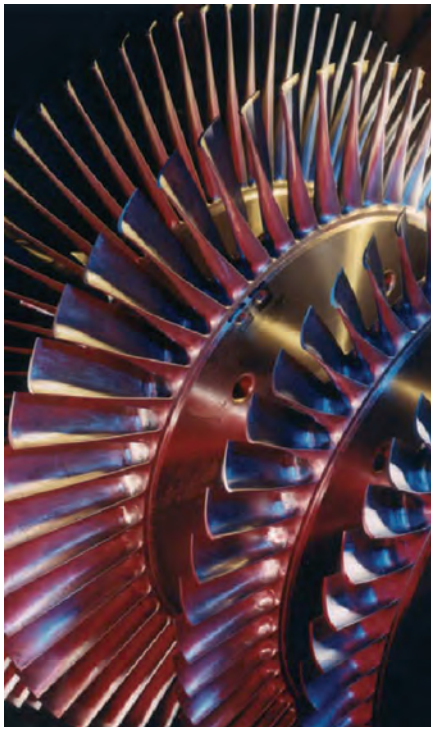
It is claimed that Composite EF has a low wear rate in very abrasive water conditions, with estimated 0.075mm to 0.1mm of wear in 6000 to 7000 hours of annual use.

Contact: Thordon Bearings Inc, 3225 Mainway Drive, Burlington, Ontario L7M 1A6, Canada.
Tel: +1 (905) 335 1440.
Fax: +1 (905) 335 4033.
www.thordonbearings.com

Brotherhood's new service

UK-BASED engineering company Peter Brotherhood has opened a new purpose-built engineering service centre dedicated to providing after sales services.

The new centre based in Peterborough, will service, repair and refurbish stationary and marine reciprocating and rotating plant manufactured by Peter Brotherhood as well as by other companies.



Steam turbine supplier Peter Brotherhood is expanding its after-sales operation

The 500m^2 building has been equipped with new light machine centres as well as lifting equipment and assembly.

'The aftermarket business has increased in recent years and we have seen an influx of orders that has prompted us to set up a dedicated service centre,' said Bob Paterson, aftermarket director at Peter Brotherhood.

Contact: Andy Ashcroft / Bob Paterson project manager / aftermarket director, Peter Brotherhood Ltd.
Tel: +44 (0)1733 292317 / 292206.
E-mail: aashcroft@peterbrotherhood.co.uk / bpaterson@peterbrotherhood.co.uk

Dasic into Singapore

TANK cleaning machines and portable gas freeing fan supplier Dasic Marine has signed an exclusive distribution agreement with Singapore-based LFA Global. The representation agreement, covering Singapore, formalises a relationship built up over the past eight years between the companies.

As part of its recent expansion, LFA Global has rebranded itself, having formerly been known as Little Ferry Agency, to reflect the global emphasis of its business. The company has also moved to new purpose built premises in Gul Lane, Singapore.

LFA Global will carry stock of the full Dasic Marine product range, including portable gas freeing fans and ancillaries, tank washing machines and ancillaries. It will also offer a full repair and maintenance facility from its workshop. Dasic Marine said the new arrangement would save customers time, since all tank cleaning machines and portable gas freeing fans could be sent for maintenance and repairs to LFA Global in Singapore.

Contact: LFA Global Pte Ltd, 36 Gul Lane, Singapore 629430.
Tel: +65 6861 9998.
Fax: +65 6862 0003.
E-mail: sales@lfaglobal.com
www.lfaglobal.com

Nexans scoops Japan

CABLE manufacturer Nexans has been awarded two frame contracts by Japanese shipyards to supply Japanese industrial standard (JIS) type cables, used for power, control and communication shipboard. Headquartered in Paris, the company will produce cables for Mitsubishi Heavy Industries (MHI) and Ishikajima Harima Industries (IHI) with contracts totalling €16 million. The cables will be installed in 39 vessels under construction in five Japanese shipyards.

A single cable supplier under a frame contract is unusual for Japanese shipyards and the aim of these contracts is to improve supply reliability and compatibility.

Nexans subsidiary, Kukdong, in South Korea will provide JIS cables at MHI's Nagasaki, Kobe and Shimonoseki shipyards, for installation on 23 vessels including containerships, pure car and truck carriers, plus LPG carriers. The three-year agreement is worth around €11 million, and delivery is due between June 2007 and October 2009.

Nexans also has a one-year commission valued at €5 million with IHI, as supplier to Kure and Yokohama shipyards for 16 containerships and bulk carriers. The cables should be delivered between March 2007 and March 2008.

Contact: Nexans, 16 rue de Monceau, 75008 Paris, France.
Tel: +33 (0)1 56 69 84 00.
Fax: +33 (0)1 56 69 84 84.
www.nexans.com

Star for dry-docking

FLEET management software provider Star Information Systems (SIS) has introduced a new purpose-built solution for repair, conversion and dry-docking projects.

The 'Star Project' module aims at reducing costs related to dry-dock activities, which represent one of the largest expenses associated with technical management of a vessel. The module's project management solution covers generation of specifications, requests for quotes, receiving of quotes, comparisons of quotes, awarding of contracts, settlement with yard, and reporting to PMS module.

Rochem systems make black and grey water clean in the extreme

The Polarstern research vessel uses Rochem Bio-Filt®
to protect the fragile environments of the Arctic and Antarctic waters.

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Using the system, superintendents gain access to clearer information and the ability to maintain greater control over vessels in dry-dock, the company claims.

'Star Project aims to help operators reduce costly changes to their orders, and retain lessons learned from project to project,' said Star Information Systems sales director Martin Karlstad.

Star Project comes in a complete onboard and office version. Information flow between ship, office and yard is automated. It can be either integrated with other Star solutions like maintenance, purchasing, document and budget, or used as a stand-alone program onboard or ashore.

Contact: Star Information Systems, Martin Karlstad, Sales Director, Stortorvet 5, 0155 Oslo, Norway. Tel: +47 22476910. Fax: +47 22476919. E-mail: martin.karlstad@sismarine.com www.sismarine.com

Emerson snaps up Damcos

ST. LOUIS-based Emerson has acquired Damcos Holding from the 3i Group in a deal that includes Danfoss, of Nordborg, Denmark, and the Damcos management team. Terms of the agreement were not disclosed.

Damcos supplies valve remote control systems, tank monitoring equipment, and complete marine tank management solutions to the global marine and offshore markets. It will immediately become part of Emerson's Process Management business, working alongside its marine measurement and valve actuation brands, which include Saab Rosemount TankRadar, and Bettis, El-O-Matic, Hytork, Shafer, and Dantorque actuators.

Since 2004, Damcos has had a strategic partnership with Emerson to sell Saab Rosemount TankRadar systems to the tanker market. Damcos has production facilities in Naestved; Ry, Denmark; Busan, South Korea; and Shanghai, China. The acquisition includes all Damcos' technologies, manufacturing facilities, and employees.

Contact: Jerry Moon, Emerson Process Management, Tel: +1 (512) 832-3089. E-mail: jerry.moon@emersonprocess.com

TEAM America adds capacity

TECNOLOGÍA Europea Aplicada al Movimiento SL (TEAM) has opened a new office in Coral Gables, Florida, USA. TEAM designs and manufactures boarding bridges for the cruise and ferry industries and is headquartered in Barcelona, Spain.

The American expansion is aimed at serving the growing client base in the Americas. Orders for passenger boarding bridges have already been taken in New York, Puerto Rico and Virginia.

Contact: TEAM Port Services Inc, Le Jeune Road, Suite 810, Coral Gables, FL 33134, USA. Tel: +1 305 422 4018. Fax: +1 305 442 1676. E-mail: teamportservices@teamcompany.com www.teamcompany.com

Solar solution for Maersk

SOLAR Solve Marine has received an order from Maersk Ship Design to supply ten ship sets of its Solasolv anti glare roller screens, for a series of 308,00dwt crude oil tankers on order at Dalian New Shipbuilding Heavy Industries in northeast China.

Solar Solve Marine's Solasafe roller screens will be installed at the wheelhouse windows to reject glare, heat and UV light and act as a navigation safety aid, enhancing the navigator's ability to view electronic charts as well as see clearly outside in sunny or icy conditions.

Synthetic from DSM

DSM Dyneema has launched Dyneema, a range of synthetic ropes for mooring and tugging lines. DSM Dyneema consulted rope manufacturers and end users through the research and development phases in order to produce an ultra strong polyethylene fibre.

Mooring lines made with Dyneema

Dyneema is claimed to have an increased strength-to-weight ratio compared to traditional steel wire ropes, which would allow manufacturers to engineer lighter and more flexible ropes, without compromising strength.

Contact: Nathali Donatz, DSM Dyneema. Tel: +31 46 476 7931. Fax: +31 46 476 7913. E-mail: nathali.donatz@dsm.com www.dyneema.com

Reduced recoil gets patent

ROPE manufacturer, Samson, has been awarded a patent (US #7127878) for the construction and performance of its Mooring Defender reduced recoil rope. 'Snap back' can be harmful to rope handlers and equipment in ship mooring operations, so these ropes are designed to absorb energy released by the rope if it breaks. Mooring Defender is a 12-strand high-modulus fibre, and is claimed to be high in strength, with abrasion resistance and low elongation.

When subjected to excessive loads, the lower elongating fibres of this design are supposed to break first, transferring the load to the remaining control fibres and therefore indicating when the rope is about the fail before it happens. Mooring Defender could help to improve safety and may aid in the development of other products where reduced recoil properties are required.

Contact: Joe Mazzacano, Samson, 2090 Thornton Street, Ferndale, Washington 98248, USA. Tel: +1 360 384 4669. E-mail: jmazzacano@samsonrope.com www.samsonrope.com

Samson's stronger pull

ALSO receiving a US patent is Samson's latest DPX technology. The company said that the new technology represented a significant advancement in rope design, involving a unique process using a textured fibre on the surface of a high modulus fibre-like Dyneema. This created a yarn with the high strength and light weight of Dyneema, but with the higher coefficient of friction of polyester.

This technology used in a suite of high performance jacketed and single braid rope products, producing ropes with a higher coefficient of friction than traditional high performance ropes, while still maintaining excellent abrasion resistance and superior strength.

The result was a light-weight rope that would withstand wear and grip a surface without slipping.

Contact: Jackie Davison, Marketing Coordinator, Samson, 2090 Thornton Street, Ferndale, WA 98248 USA. Tel: 360.384.4669. www.samsonrope.com

Bronswerk drops Stork

HVAC and refrigeration systems supplier Stork Bronswerk Inc has changed its name to better reflect the role the marine and offshore sectors play in its business.

The rechristened Bronswerk Marine Inc will take forward the company's continuing bid to expand its global operations.

The company said it intended to accelerate its growth through aggressive sales, quality design and after sales support. Recent contracts awarded in China, Europe and North America had generated US$13m of new turnover.

Contact: Stork Bronswerk Inc 3755 - C Boulevard Matte, Brossard, Quebec, Canada, J4P 2P4. Tel: +1 450 659-6571. Fax: +1 450-659-1035. E-mail: info.sbi@stork.com

Propulsion training update

AN updated version of the 'Marine Propulsion' training initiative will begin in February 2007. It is a joint initiative of Holland Marine Equipment Association, Bakker Sliedrecht Electro Industrie, Wärtsilä Propulsion Netherlands, and Delft University of Technology.

Set up in 2005 to offer the global marine industry an opportunity to gain in-depth knowledge on matching ship propulsion components and systems, the 2007 version includes a separate module on the characteristics of electrical drives, following market developments.

Each of the five modules can be enrolled in separately, and collectively cover propulsion plant concepts, basic ship hydrodynamics, diesel engines, gas turbines, and marine propulsors. The modules take place over the course of the first half of this year, in Vlaardingen, The Netherlands.

February 21-22, 2007, Historic Ships, international conference, London, UK. Contact: Conference Department, RINA, 10 Upper Belgrave Street, London SW1X 8BQ, UK. Tel: +44 20 7235 4622. Fax: +44 20 7259 5912. E-mail: conference@rina.org.uk

March 12-15, 2007: Seatrade Cruise Shipping Convention, exhibition and conference, Miami, USA. Contact: CMP Princeton Inc, 212 Carnegie Centre, Suite 203, Princeton, New Jersey 08540, USA. Tel: +1 609 759 4700. Fax: +1 609 759 4774. E-mail: info@cruiseshipping.net www.cruiseshipping.net

March 14-15, 2007: International Superyacht Symposium (part of the Seatrade Cruise Shipping Convention), Miami, USA. Contact: CMP Princeton Inc, 212 Carnegie Centre, Suite 203, Princeton, New Jersey 08540, USA. Tel: +1 609 759 4700. Fax: +1 609 759 4774. E-mail: info@cruiseshipping.net www.cruiseshipping.net

March 21-22, 2007: Human Factors in Ship Design, Safety, and Operation IV, international conference, London, UK. Contact: Conference Department, RINA, 10 Upper Belgrave Street, London SW1X 8BQ, UK. Tel: +44 20 7235 4622. Fax: +44 20 7259 5912. E-mail: conference@rina.org.uk

April 2-4, 2007, SeaAsia, Singapore. Contact: Seatrade Ltd, 42 North Station Road, Colchester, Essex CO1 1RB, UK. Tel: +44 1206 545 121. Fax: +44 1206 545 190. E-mail: ghardy@seatrade-global.com

April 3, 2007: Design and Construction of Floating Production Units, international conference, Suntec, Singapore. Contact: Conference Department, RINA, 10 Upper Belgrave Street, London SW1X 8BQ, UK. Tel: +44 20 7235 4622. Fax: +44 20 7259 5912. E-mail: conference@rina.org.uk

April 6-7, 2007: High-performance Marine Vessels China 2007, international conference, Shanghai, China. Contact: Conference Department, RINA, 10 Upper Belgrave Street, London SW1X 8BQ, UK. Tel: +44 20 7235 4622. Fax: +44 20 7259 5912. E-mail: conference@rina.org.uk

April 11-13, 2007: Fundamentals of Contract and Change Management for Ship Construction, Repair, and Design, course, London, UK. Contact: Conference Department, RINA, 10 Upper Belgrave Street, London SW1X 8BQ, UK. Tel: +44 20 235 4622. Fax: +44 20 7245 6959. E-mail: conference@rina.org.uk

April 24-26, 2007: Cruise and Ferry 2007, international exhibition and conference, Excel, London, UK. Contact: Lloyd's List Events, London, UK. Tel: +44 207 7017 4406. E-mail: alex.vonstempel@informa.com www.cruiseferryex.com

April 25, 2007: Annual Dinner, Royal Institution of Naval Architects, London,UK. Contact: The Chief Executive, RINA, 10 Upper Belgrave Street, London SW1X 8BQ, UK. Tel: +44 20 7235 4622. Fax: +44 20 7259 5912. E-mail: hq@rina.org.uk

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Nalfleet launches Permaclean

NALCO subsidiary Nalfleet has launched a new range of cleaning products for wastewater membrane separation systems. The new Permaclean range mainly comprises three types of treatments: antiscalants; cleaning products; and biocides. Antiscalants prevent deposits building up on the membrane, while cleaning products remove foulants such as mineral scale or organic fouling and biocides minimise the impact of biogrowth.

If reduced membrane performance is not solved by these treatments, Nalfleet offers a chemical, physical and microbiological analytical service to determine the cause. Nalco is the world's largest water and process treatment provider and Permaclean products are available for black, grey, and oily water applications.

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LEAP to agreement

LEADING Engineering Application Providers (LEAP), Australia, has reached an agreement with Beasy, a software applications producer, to distribute Beasy's program simulating the life and performance of products. Applications include mechanical analysis (stress and thermal), durability and crack growth analysis, corrosion and cathodic protection, corrosion related electric and magnetic fields, and acoustic design and noise control.

Dr Robert Adey, managing director of Beasy, said the deal would benefit customers of both companies. His counterpart at LEAP, Greg Horner, said that Beasy software complemented LEAP's existing offerings and strengthened its capabilities in areas such as fracture mechanics and signature optimisation.

Contact: Dr Robert Adey, computational mechanics, Beasy, Ashurst Lodge, Ashurst, Southampton SO40 7AA, UK.
Tel: +44 (0) 23 8029 3223.
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SAM's precision GPS sensors

SAM Electronics has introduced two high precision R4 GPS and enhanced Differential GPS sensors. Designed for worldwide navigation and hydrographic survey support, both units are approved by EC Wheelmark, the United States Coast Guard, and the International Maritime Organization. The design features two interface channels, and compact shock resistant systems, with small receivers and antennas to facilitate installation. Both units are compatible with satellite augmentation services such as Wide Area Augmentation System (WAAS), European Geostationary Navigation Overlay Service (EGNOS), and Multi functional Satellite Augmentation System (MSAS) from Japan.

Dual Station capability and Receiver Autonomous Integrity Monitoring (RAIM) ensure GPS accuracy, and units have sunlight-readable displays. Antennae are designed to reduce onboard transmitter interferences, plus the Differential GPS version supports International Association of Lighthouses (IALA) beacon signal corrections.

Contact: SAM Electronics, Behringstrasse 120, 22763 Hamburg, Germany.
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BOOK REVIEW

50 Years a Shipbuilder

By Patrick G Martin. Published by The Memoir Club, Stanhope Old Hall, Stanhope, Weardale, County Durham DL13 2PF, UK. 454 pages. Softback. ISBN: 1 84104 156 4. £19.50 or €25.00. Available from the RINA bookshop: £19.45 for RINA members (UK, including postage).

In recent months and years, we have published several reviews of both autobiographies and biographies of prominent personalities in the marine world, and this new publication is equally fascinating. For those closely associated in the various subjects and events discussed, the text could even be said to make gripping reading.

Patrick Martin counts himself among that relatively select band who are members – or in his case, Fellows - both of The Royal Institution of Naval Architects and what is today the Institute of Marine Engineering, Science & Technology; he will perhaps be best remembered when he was chief naval architect at the now sadly closed Verolme Cork Dockyard. Here, he was responsible for several interesting projects, including a bulk carrier for Irish Shipping powered (against his judgement) with medium-speed engines geared to a single CP propeller – considered revolutionary in the early 1980s. This arrangement was subsequently confirmed to be less efficient than if a standard two-stroke, direct-coupled machinery had been specified. The Irish dockyard also built an interesting series of passenger/vehicle ferries for British & Irish (B&I) Line, including 'the most difficult and most worrying ship design projects' of his career – the sisters *Connacht* and *Leinster* of 1979 and 1981, as well as some smaller naval vessels.

Nevertheless, for this reviewer, it is the other sections of the autobiography that are most intriguing, especially since the author appears to have kept a meticulous diary throughout his career!

Patrick Martin served his apprenticeship at an old-style Scottish yard, Burntisland Shipbuilding, where all contract negotiations were handled by the chairman and managing director, Sir Wilfrid Ayre, and design information was sometimes passed to the drawing office on the back of an envelope. He also recounts, among many fascinating details, the day when a ship was accidentally launched in advance when an apprentice dropped a spanner onto a bell push which would signal to the shipwrights that it was the moment to release the launch triggers…

The author was clearly a determined man: at the end of his apprenticeship, he chose, on his own initiative, to spend several years at sea – as a marine engineer – in order to gain valuable experience of design work. This will be music in the ears of those today (including *The Naval Architect*) who still believe that all trainee naval architects should serve some sea-time, as indeed members of the Royal Corps of Naval Constructors did, including this journal's regular reviewer, Eric Tupper.

Mr Martin succeeded in persuading Alva Steamship Co to allow him to serve as seventh engineer on a tanker Alva Star and later on a cargo ship *Pearlstone* ('I wanted experience, not tickets') and with Alfred Holt's Blue Funnel Line passenger/cargo ships *Atreus* and *Anaeus*; his stories make absolutely fascinating reading – both technical and general. After this intriguing episode, the author was seconded to Caledon Shipbuilding, in Dundee, where a new Alfred Holt ship was under construction. His text records, in passing, the sad decline of Britain's (and Ireland's) once proud shipbuilding industry.

When Verolme Cork Dockyard closed in 1984, Patrick Martin thought his shipbuilding days might be over, but he found re-incarnation in life as a consultant. He was particularly involved in a revolutionary concept that was being proposed at that time: the hatchcoverless containership. He became intimately involved in the creation of the 301TEU prototype *Bell Pioneer* (*The Naval Architect* July/August 1990, page E313) for the Irish owner Bell Lines; he travelled extensively to Australia, where the hatchcoverless concept had been created by Commodore Tom Fisher and Fred Ellis, of Advanced Ship Design, also to China, where the models were tested at then little-known Wuxi basin, and to Japan, where *Bell Pioneer* (and a sister) were eventually built, at the modest Teroaka Shipyard on Awaji Island. The protracted negotiations with authorities prior to contract, and details of both construction and sea trials are all faithfully recorded.

There is a good selection of mainly black-and-white general illustrations, plus some highly interesting detailed ones – including a few of ships negotiating heavy weather, with extensive captions in an appendix. This whole book makes totally absorbing reading and can be highly recommended.

Tim Knaggs

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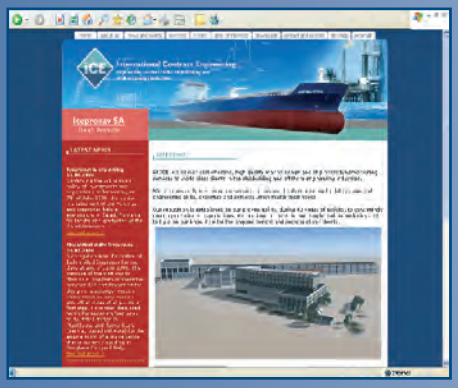

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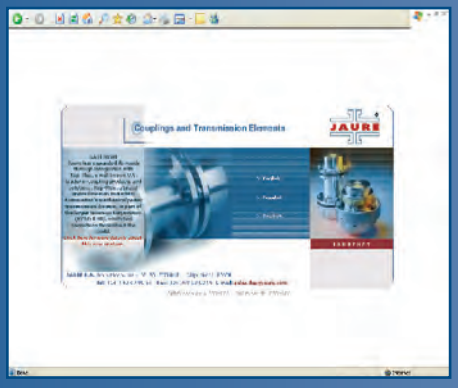

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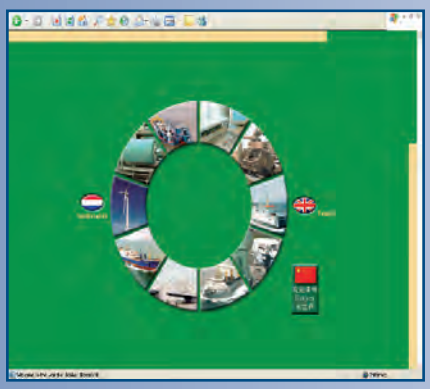

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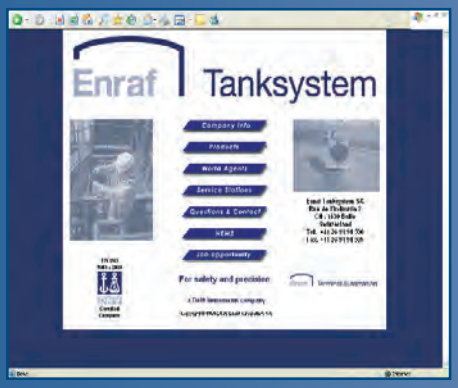

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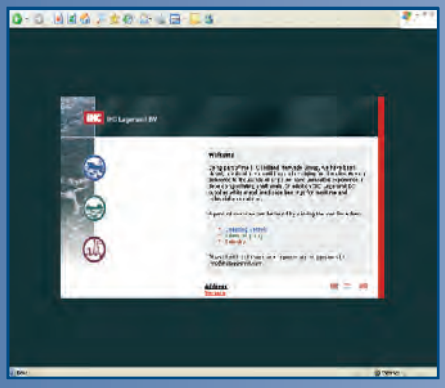

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