THE NAVAL ARCHITECT

NOVEMBER
2005

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THE NAVAL ARCHITECT
International Journal of The Royal Institution of Naval Architects

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THE NAVAL ARCHITECT

This innovative spud carrier has been specially designed by Vosta LMG for the large new cutter suction dredger *D'Artagnan*; in an innovative arrangement, a parallel rope guide, tensioned hydraulically, reduces load peaks and ensures that the dredging process is largely independent of even heavy swells. The system can handle full power on the two spuds in any direction. More details appear in our feature on dredging technology, which begins on page 30.

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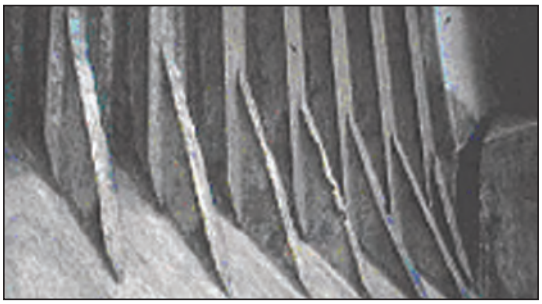
Bulker perfection? Not quite!

NEXT-GENERATION bulk carriers - already discussed in this column last month - continue to generate lively discussion, as delegates to last month's Design and Operation of Bulk Carriers conference*, held at RINA headquarters, will testify - notwithstanding that the event only attracted a very modest number of attendees, which for one day included *The Naval Architect*. Maybe those who did not come, while not forgetting the importance of correctly designed and built bulk carriers (with the ghosts of *Derbyshire* and others still hovering overhead) were mindful that the new joint class rules being drawn up by the IACS were still not completely finalised.

Nonetheless, those who came enjoyed technical stimulation, not least by Clive O'Leary, from International Paint, who reminded his audience - as part of his company's efforts to develop suitable abrasion-resistant coatings - of the punishment meted out to cargo holds from coal, iron ore, and difficult cargoes such as scrap iron (which some operators refuse to carry!), and from port equipment - and including coping with modern conveyor loading rates up to 6000tonnes/h. Naval architects should have re-registered from his illustrations a continuing need for the most robust of hold structures!

A pithy paper by Capt Dennis Barber (forthright, as one would expect from a master mariner formerly sailing mainly in tankers and bulkers) bemoaned some of the continued inadequacies of our profession - as seen from a seaman's viewpoint, of course, such as imperfect water ingress sensors, poor designs of modern forecastle pumping systems, and the author's belief (as reported in the February 2003 issue of this journal) that all bulk carriers should be fitted with float-free lifesaving systems.



Just one of many bulk carrier locations that need careful monitoring. Single side-skin lower hold brackets, seen here damaged by cargo loading and/or discharge equipment. From the RINA conference paper 'Management of a bulk carrier structure', by Peter Bryson, Anglo-Eastern (UK) Ltd.

Amongst the other wide-ranging papers was a presentation by N B L Mortensen, from the Baltic and International Maritime Council (BIMCO), of an useful new guide aimed at better reading and understanding of a newbuilding specification. Just under half BIMCO's owner members are involved in bulk carriers, so the *Bulk Carrier Newbuilding Specification Guide*, produced by the council's marine committee and The Marine Technical Managers' Association (MARTECMA), based in Greece - home to many bulker owners and operators - should be of prime interest.

The guide aims to achieve a sensible balance between what is reasonably required by an owner and what he might reasonably expect from a shipyard! Work has been progressing since 2002. In a pertinent comment, Mr Mortensen notes that, although there are many proven standard bulk carriers on the market, new designs continue to emerge. Orders for these are sometimes booked at yards with little of no experience of constructing these workhorses, whose technical details have taken on a whole new dimension during the last few years.

The evolution of essential classification rules (to run alongside existing class rules) for the innovative elastomer-core sandwich plate system (SPS), introduced by Intelligent Engineering and which is beginning to be used for both new ships and in several apparently successful repair projects, was detailed by Martin Brooking, from IE, and Hasan Ocakli, from Lloyd's Register. SPS has been discussed in several issues of *The Naval Architect*.

Although one or two delegates were concerned that the use of SPS in its Overlay repair version might raise connection stresses at, for example, tanktop/hopper joins, due to the increased depth and the fact that the original connection cannot be seen, the concept appears to have much promise, and already a new inland cargo ship is being built with the complete hold constructed with SPS. Somewhat surprisingly, the presenters did not seem concerned about SPS plates adjacent to ballast tanks, where corrosion might be considered an issue on the underside plating. They do however note that, come ship scrapping time, the elastomer is recoverable and can be ground down for re-use.

Not surprisingly, double side-skins raised their head once again, and the pros and cons of such structures were discussed by Alex Johnston, from Lloyd's Register. As mentioned before, terminal operators are delighted with double skins because cargo handling is much quicker, although long-term prospects are not so clear. However, the Polish Steamship Co has been operating a series of *Solidarnosc*-class Panamax vessels (Burmeister & Wain built BCT70 design) for more than 10 years now (*Solidarnosc* was presented in *Significant Ships of 1991*), so some useful in-service experience should be available.

Mr Johnston noted the well-known fact that up to 5000tonnes of cargo can often be left between the frames of a single-skin hold due to pressure to leave a discharge berth, while No 1 and No 9 holds might suffer excess damage since they are always filled when alternate-hold loading is used. This fact helps to explain why Oshima Shipbuilding introduced the Newbulk compromise design (only fore and aft holds with double skins) in 1998 (*The Naval Architect* October 1998, page 7).

Of course, at the present time, it is up to individual owners to weigh up the benefits or otherwise, amid possible fears that a shipyard might 'optimise' a double-skin design to limit the additional construction costs. A well-thought-out single-skin design could still offer a good middle-of-the-road solution.

An enlightening paper by Raouf Kattan, managing director of UK coatings consultancy Safinah, urged owners and others to insert much more design input at the beginning of a newbuilding project, especially in relation to problematic water ballast tanks. Mr Kattan noted that today's refined scantlings might mean thinner (often high-tensile steel) plating, but that a great many owners pay pathetic attention to their paint requests; 'use what was on the last ship' is often the only line in the specification. They totally ignore the massive costs involved in later refurbishment - far out of proportion to the original.

Coating the ballast tanks of any ship is a difficult enough task already - it is, says Mr Kattan, almost impossible to comply with limits to solvent exposure, while high-speed production techniques in large Far East yards have placed great pressure on the coating operation, and pollution control is a constant hazard - perhaps even more so with new generations of silicone-based antifoulings (discussed in the newly published 4th Quarter 2005 edition of our associate journal *Shiprepair and Conversion Technology*).

An increasing volume of regulations, such as those in IMO DE48/12, is adding to yard pressure, while Mr Kattan claims that only 5% of coating problems are actually chemistry-related. Now, there's a challenge for our industry!

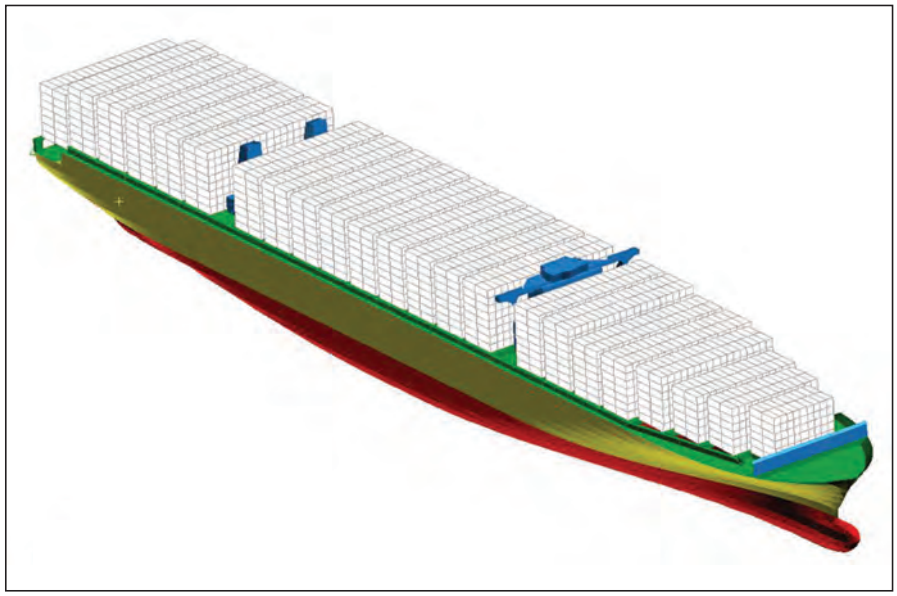
* Design and Operation of Bulk Carriers, held on October 18-19, 2005 in London, and organised by The Royal Institution of Naval Architects.

13,000TEU giant from GL and Hyundai

CLASSIFICATION society **Germanischer Lloyd** (GL) and **Hyundai Heavy Industries** have teamed up to offer a complete and ready-to-order mega container liner able to accommodate 13,000TEU. As might probably be expected for such a giant, a twin-screw configuration has been chosen, with the deckhouse positioned towards the bow. This new proposal is slightly larger than a 12,500TEU concept offered by Bureau Veritas and Knud E Hansen in 2001 and presented in our June 2001 edition, page 3.

The new German/Korean design is 382m long and 54.20m wide, and would have a draught of 13.50m. Up to 6230TEU could be stowed below deck in 10 tiers and 19 rows, while on deck 7210 containers would be stacked in 21 rows.

The question of a suitable propulsion plant was studied in some detail, and amongst the possibilities was a single diesel engine, also one with a pod behind it (such as the ABB/Samsung CRP Azipod concept). The cost estimate for various configurations indicated that a twin-screw plant was only negligibly more cost-intensive than the variant with only one main engine.



An impression of the new Hyundai/Germanischer Lloyd 13,000TEU container liner, which will feature twin screws and a forward-positioned bridge and accommodation.

Twin propellers, with well-proven and readily available main engines (2 x 45,000kW), propellers, and propeller shaft sizes similar to those of a 4000TEU ship, had one important benefit to offer a cautious maritime community: safety and redundancy. The design team noted that a 14-cylinder two-stroke engine - already on offer from both Sulzer and MAN B&W, and specified by one bold owner - was not powerful enough for the required 25.5knots, while a 16-cylinder model would be too large. A single large heavily loaded propeller might also be prone to cavitation; at the same time, Hyundai believes that a maximum propeller size has already been reached: 9.5m diameter and 110tonnes weight (although this journal has reported that Nakashima, in Japan, is building a new factory to cast 150tonne propellers of 12m diameters).

To meet SOLAS visibility requirements, the wheelhouse and accommodation block has been moved well forward; a further useful benefit is that this also permits increased container capacity and reduces ballast, as well limiting bending and increasing hull stiffness. Fuel tanks will be located below the deckhouse.

Model tests were carried out at the Hyundai Maritime Research Institute, with the help of GL software programs, particularly those designed to assess parametric rolling. Exhaust emission tests were additionally used to confirm the position of the two funnels. Hyundai believes it can build such a giant in between nine and ten months, but because of a heavy workload at present, delivery is unlikely to be before 2009.

NEWCASTLE STUDENTS WIN - Students on an MEng course at the University of Newcastle (School of Marine Sciences & Technology), in the UK, have won both first and third place in the 2005 Dr James A Lysnik student ship design competition, run by the Society of Naval Architects & Marine Engineers (SNAME). This accolade marks the ninth time that the school has been placed in the top three places since 1995. The winning ships were a 20,000tonne displacement Transatlantic live food fish carrier and a double-acting CNG carrier. Students used the Tribon initial design suite of CAD programs to develop and evaluate their proposals.

NEW CONTAINER DESIGNS FROM NORDSEEWERKE - A new generation of compact container ships with capacities ranging from 3100TEU to 3700TEU has been conceived by Nordseewerke, at Emden, a member of ThyssenKrupp Marine Systems; and the first two orders have been secured. These are for 3400TEU versions, contracted by German owner GEBAB, an existing customer for the builder. The new 42,250dwt design will include sockets for 500 reefer boxes, and the service speed will be 23.75knots.

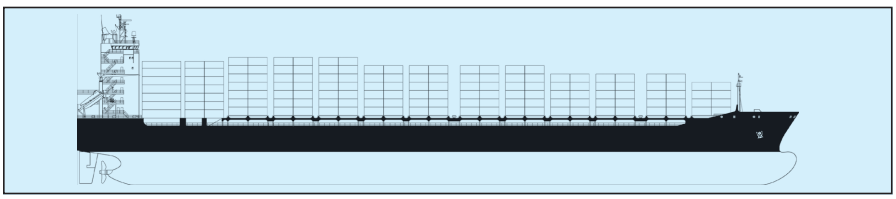
Factors in winning the order include an agreement with the yard workforce whereby employees bear part of the cost of development and construction, and will work additional hours. Employment is thus guaranteed up to mid-2008.

NEW RECORD FOR ABS - Class society ABS has broken the 120 million gt mark to establish a new all-time fleet record - partly as a result of the current active newbuilding market and a steady inflow of existing vessels changing class. With more than 1400 vessels of almost 25 million gt currently on order to ABS class, the fleet is expect to grow further in the short term.

DRAFT BS8450 ELECTRICAL CODE - A public comment draft for a new code of practice for installation of ships' electrical and electronic equipment - BS8450 - which is intended for those involved in the design, installation, and maintenance of electrical equipment on all types of vessel, with the exception of warships, has been published. It has been produced to enhance and preserve certain recommendations and text of the 1990 edition of the Institution of Electrical Engineers' *Regulations for the Electrical and Electronic Equipment of Ships* (The Blue Book).

continued

Profile of the new class of 3400TEU container ship that will be built by Nordseewerke for the German owner GEBAB.



PEOPLE

PETER SIERK has taken over a chief executive officer of Flensburger Schiffbau-Gesellschaft in succession to **FRED GARBE**, who will continue with the German yard a chairman of the board.

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These had been omitted from the (BS) IEC 60092 series of standards which gradually superseded much of the Blue Book during the 1990s.

NEW VERSION OF KR-CON - The Korean Register of Shipping has released a new and enlarged version (Version 5.0) of KR-CON, its international database program of IMO conventions, codes, resolutions, and circulars. The program, which is available in CD-Rom format, was launched in 2000 to help the industry cope with ever-changing regulations. It can be downloaded form the Internet at: www.http://krcon.krs.co.kr/krcon

INTERIORS FOR SUPER-C CLASS - Two Vancouver companies, SmartDesign Group and Lisa Bell & Associates, have been chosen by Flensburger Schiffbau-Gesellschaft to design interiors for the three new Super-C-class double-ended ships that the German yard is building for BC Ferries. Flensburger is responsible or all suppliers and subcontractors.

SmartDesign will develop the interior standards for the passenger accommodation, and Lisa Bell will design the equipment layout for all food service areas. Detailed interior design will continue until January next year, and actual ship assembly will start in September 2006, with the first ferry expected to be delivered in December 2007.

CHINESE PROPULSION PACKAGE - MAN B&W Diesel's Alpha division, at Frederikshavn, is to supply a complete propulsion package, including computer-controlled surveillance, for a new ocean-going training ship to be built for Dalian Maritime University by Wuchang Shipyard at Wuhan, many miles up the Yangtze river. The chosen solution is a 6S35MC slow-speed diesel engine developing 4440kW, with Alphatronic 2000 controls, driving a CP propeller, as well as an alternator through a tunnel-type power take-off shaft.

The 2250dwt ship has been designed by Shanghai Merchant Ship Design & Research Institute (SDARI) to train both ship crew members and scientists - up to 204 can be accommodated on board, plus a crew of 32. Construction will be to China Classification Society standards, and propulsion plant maintenance will be based on MAN B&W's CoCoS in-house-designed computer-controlled package.

STRONG LR PERFORMANCE - Group income for Lloyd's Register for the year ended June 30, 2005, rose by 1.4% to £371.8 million - boosted by excellent performance from the marine sector, where revenues grew by 6%. The classed fleet rose by 7.4 million gt to more than 120 million gt in 2005 - the highest ever recorded.

SWEEP: SHRINKING WAVE DRAG - A new patent-pending technology, known as Sweep (an acronym for a 'ship with wave-energy-engulfing propulsors') is being proposed by Miami-based SeaSpeed Sweep Inc as a solution for faster displacement hulls, such as warships, some cargo ships, and ferries. The object is to reduce wave drag by fitting a unique bulbous bow, immediately behind which is a large in-line-mounted thruster.

An impression of a ferry fitted with a SeaSweep bulbous bow, forward propulsion thruster, and air cavity beneath the hull. Although a forward-raked bow is shown here, the inventor says that a conventional aft rake is acceptable.

Up to 22,650m^3/min of water can be sucked in on a 122m-long hull, claims the inventor, and discharged into an under-hull cavity slightly further aft, using air-lubricated techniques. Since the water is sucked in aft of the bulbous bow's mid point, it accelerates and increases the flow, which would normally comprise wave-making drag.

On a 122m-long ship, a drag reduction between 15% and 20% is claimed at a speed of 20knots, rising to 40% reduction at 45knots. Further analysis and model testing is planned.

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New alliance for risk-based design solutions

THE Finnish marine engineering and design company Deltamarin Ltd and the UK engineering consultancy Safety at Sea Ltd, located in Glasgow, have formed what is claimed as an unique alliance, combining years of ship design experience with front-end R&D and technological innovation, to provide solutions on risk-based design and engineering for the complete lifecycle of ships. The two companies have worked together previously. Innovative designs can be developed by targeting safety and performance in an overall cost-effective configuration.

Services being offered cover concept development and layout optimisation, risk-based specification development and first-principles design evaluation of collision and grounding damages, also fire safety, time-to-flood and evacuation analysis, and system and component redundancies. New regulations of probabilistic damage stability (SLF-47), alternative fire safety design and approaches (IMO Circ 1002), and total safety assessment are being fully utilised to reach optimum capacity configuration.

The new probabilistic damage stability regulations opened the door for possibilities to optimise watertight compartmentation. Instead of having a fixed position of bulkheads, watertight compartmentation can now be optimised utilising transverse, longitudinal and even horizontal watertight subdivision. Such arrangements can be optimised for efficient functionality, simplicity, low costs, and required levels of safey.

The optimisation routine has been developed and already successfully applied by the alliance in the concept stage of several newbuilding projects. The first layout is developed on the basis of functional requirements without any restrictions. A parameterised model of the layout is then prepared, comprising all pertinent variables, including number and position of bulkheads, also length, width and position of side casings, deck heights, tank locations, and other features.

Objectives do, however, need to be carefully defined and balanced; is an owner seeking maximum unobstructed deck area, minimum steel weight, higher safety level, or possibly a combination? Normally, around 1000 to 2000 alternatives are developed automatically, which are then filtered down to a handful of the best. The design team then picks up the most promising ones and develops the final platform or alternatives as a basis for further work.

Typical examples have shown increased capacity, simplified arrangements, less steel structure, and improved safety. Radical arrangements can be developed, such as the cruise liner shown in Fig 1, with machinery located aft and all services on the first deck, with the crew on the second deck, and passenger spaces on the third deck. A better functional arrangement, with higher capacity and deck space, is reached with higher safety and less steel construction.

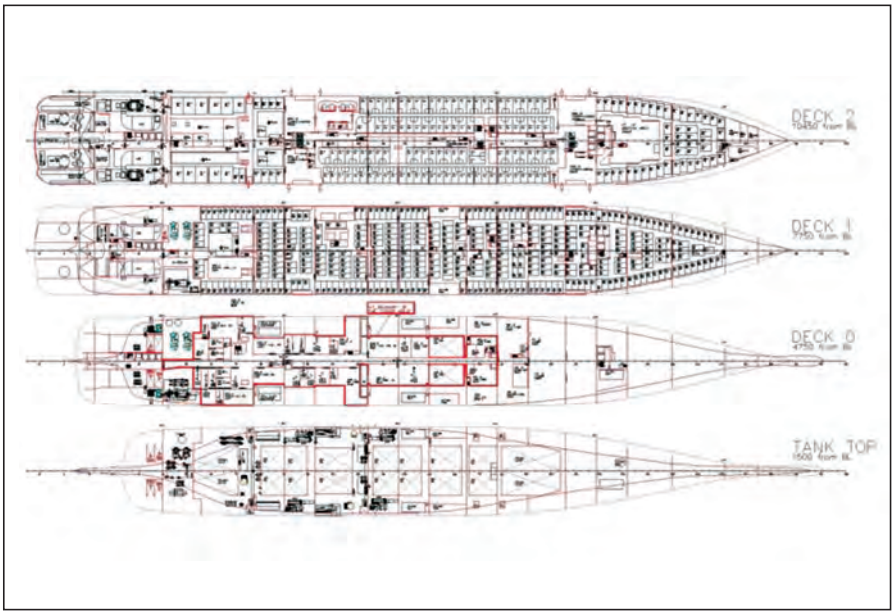

Fig 1. By using risk-based design, local plans for a cruise liner, such as double-hull tank structures also service and crew spaces, as well as all secondary machinery spaces, main passageways, and areas of principal penetrations, can be usefully optimised. A 3D space coordination model can be then defined and designed at the very early development phase of a project, thus saving space and costs, especially in piping.

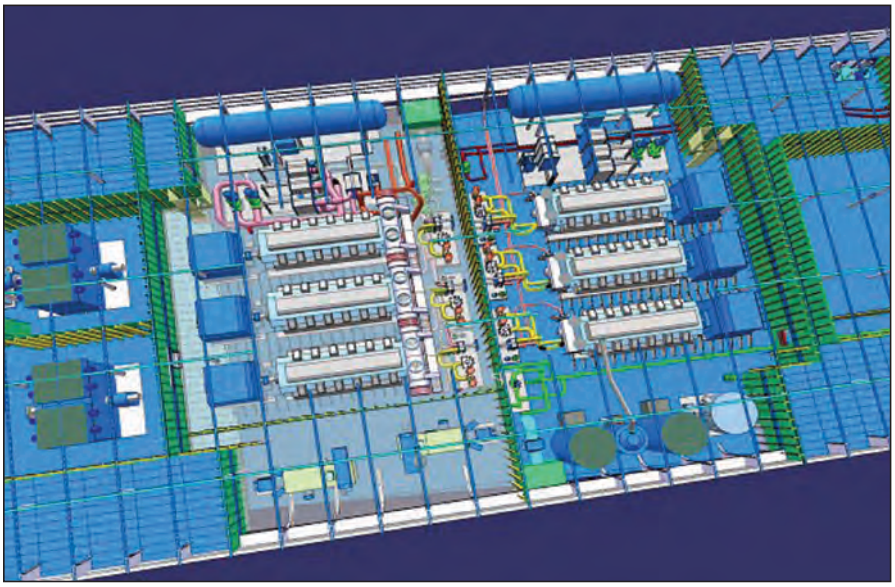

Fig 2. Efficiency, functionality and safety can, say Deltamarin and Safety at Sea, be combined at lower costs than with present design practice. This risk-based approach can be applied to fire safety, lifesaving, structures, hydrodynamic performance, fuel saving, environmental issues, and in specification development to cover full lifecycle. Seen here is a typical space coordination model for a Panamax cruise liner developed prior to contract.

The Royal Institution of Naval Architects

ICSOT 2006 - Design, Construction & Operation of Natural Gas Carriers and Offshore Systems

14 - 15 September 2006, Busan, Korea

First Notice & Call for Papers

There is considerable optimism about the future of the natural gas market. A significant growth in the number of gas carrying vessels is expected, resulting from both an increase in demand and the current programme of scrapping older vessels.

While some companies are looking at the possible economies of scale of larger vessels (in the range of 175,000- 250,000 cu.m.) others are looking to develop options for developing small vessels to exploit shortsea and coastal trades in natural gas.

New alternatives to LNG including compressed/pressurised natural gas (CNG/PNG), where the gas is stored under pressure at ambient or semi-refrigeration temperatures, are also being developed. There is also a growing interest in floating production, storage and offloading systems for offshore oil & gas developments and re-gasification tankers and plants designed to avoid the need to construct huge land-based processing and distribution centres.

RINA invites papers on all aspects of the design and operation of gas carriers & other offshore systems, including the following topics:

- Design of larger capacity vessels
- Design of Shortsea & Coastal Vessels
- Greater flexibility in design to cater for spot market trading
- Floating plants/vessels
- Alternatives to LNG - CNG, PNG etc.
- Optimisation of power plant in gas carrying vessels
- Issues associated with the partial filling of tanks

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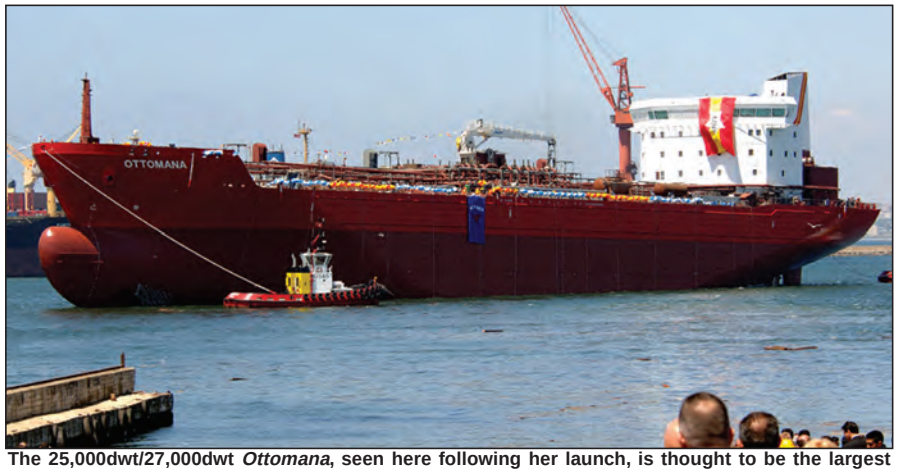
Largest Turkish-built chemical tanker delivered

A DOUBLE-SKIN, IMO II, product oil/chemical tanker, *Ottomana*, built by Celik Tekne Shipyard, for the Italian owner Mediterranea di Navigazione, was delivered in October. She is thought to be the largest tanker ever built in Turkey.

The vessel has a deadweight capacity of 25,000tonnes at design draught and 27,000tonnes at the scantling draught. She has an overall length of 169m and can achieve 15.5knots with her 7860kW Mitsubishi main diesel engine and MAN B&W Alpha 5500mm CP propeller, which turns at 115rev/min. The specification of a Mitsubishi main engine is quite unusual for a European yard today, but the unit was built under a relatively new licence agreement with the Manises engine works in Valencia, Spain. This is believed to be the first-ever European-built Mitsubishi two-stroke engine (an earlier licence agreement had been made with DMR in Germany, but no engines were believed to have been constructed there).



The 25,000dwt/27,000dwt *Ottomana*, seen here following her launch, is thought to be the largest tanker ever built in Turkey. She was scheduled to be delivered to Italian company Mediterranea di Navigazione last month (October).

TECHNICAL PARTICULARS
OTTOMANA

Length oa	169.00m
Length bp	158.70m
Breadth moulded	27.40m
Depth, moulded to main deck	14.60m
Draught, scantling	10.00m
Draught, design	9.50m
Gross	17,782gt
Displacement	33,004tonnes
Lightweight	7920tonnes
Deadweight, scantling	27,000dwt
Deadweight, design	25,000dwt
Main engine	Manises-Mitsubishi 6UEC50LSII
Propeller	MAN B&W Diesel Alpha CP
Speed, service	15.5knots at 90% MCR
Classification	Registro Italiano Navale C +Star, Oil/Chemical Tanker, ESP, Unrestricted Navigation, Green Star, SYS, NEQ-1, IMO II, *and* ABS +A1(E) Oil/Chemical Tanker, +AMS, +ACCU, VEC, SH, SHCM, FL30, ESP, IMO Type II

Designed by Marine Engineering Services, of Italy, *Ottomana* has been constructed and outfitted with sophisticated, modern equipment and systems to enable her to perform her duty safely and in an environment-friendly manner. She is fully-equipped as an ocean-going vessel for worldwide trading, and thus is suitable for both Panama and Suez transits. Tank tests for the hull were carried out in the Vienna Model Basin.

The ship has been constructed with dual class, from Registro Italiano Navale (as first register) to RINA C + Star Oil Chemical Tanker, ESP, Unrestricted Navigation, Green Star, SYS, NEQ 1, - IMO II, and with the American Bureau of Shipping, as her second society, to ABS + A1(E), Oil Chemical Carrier, + AMS, + ACCU, VEC, SH, SHCM, FL30, ESP, IMO II. She will be registered under the Italian flag.

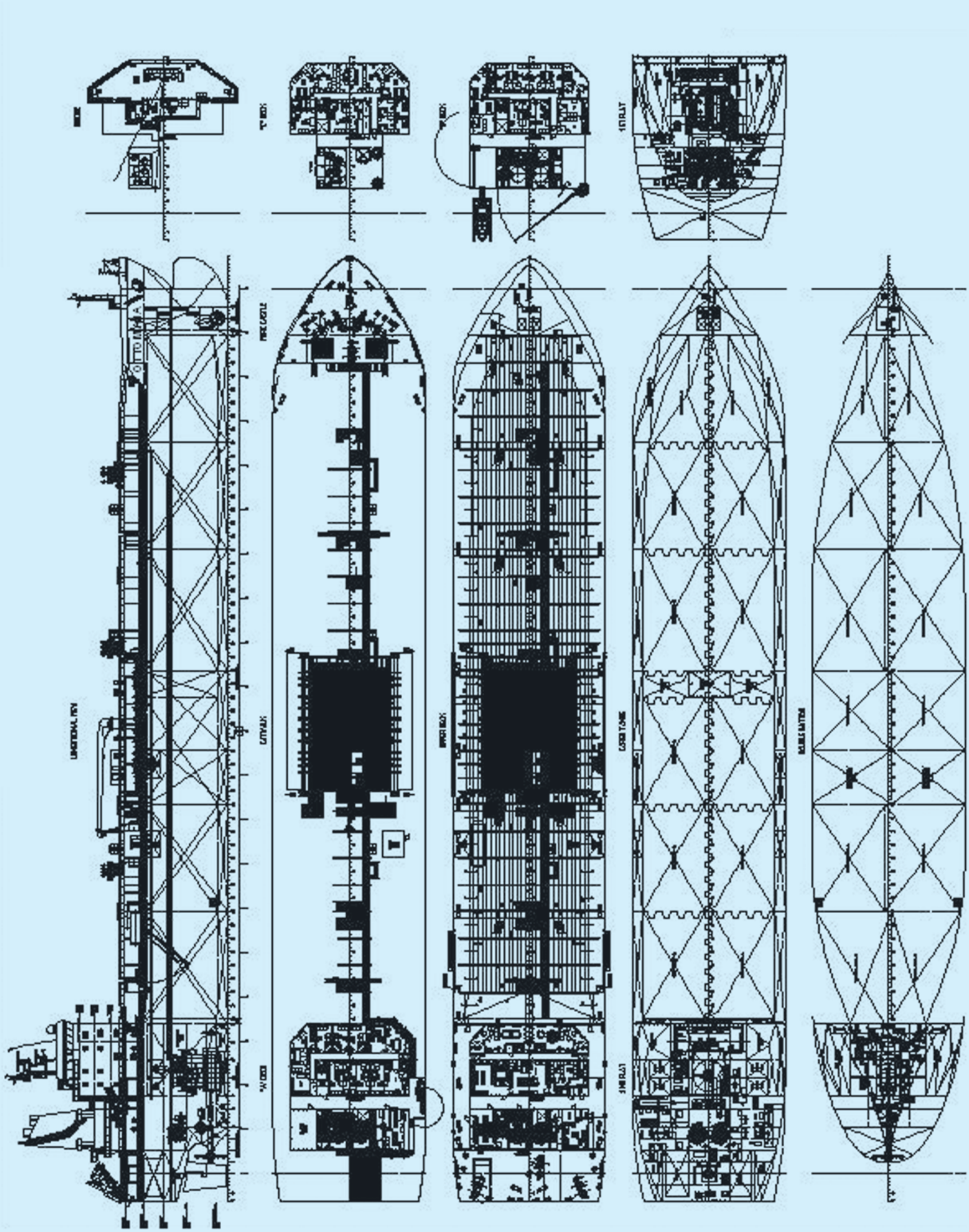
Ottomana has six pairs of cargo tanks and one recovery tank which have been designed to load cargoes having the density of up to 1.025tonnes/m^3, it is also possible to load up to 1.54tonnes/m^3 slack. The flash points of these cargoes are less than 60°C.

The cargo tanks are segregated into nine grades with nine independent cargo lines and a cargo handling system able to discharge and load five grades of cargo simultaneously. Although all tanks are coated with International Paint products, cargo piping is stainless steel, type AISI 316L welded pipe schedule 10, Class 1. Inside each cargo tank is one hydraulically-driven submerged cargo pump from Frank Mohn. Cargo handling is masterminded by a Lyngsø Marine UMS/UCS2100 system, and the cargo tank area is covered by a Svenska Skum foam system, with CO_2 in the machinery spaces.

Ottomana claims excellent manoeuvrability characteristics with her FP hydraulically driven bow and stern thrusters, each of 800kW output. The hydraulic motors of the thrusters are operated by the same power pack that supplies the Frank Mohn submerged cargo pumps. Both bow and stern thrusters have been supplied by Rolls-Royce Kamewa. Electrical supplies for all ship's services come from three 900kW Yanmar-driven Taiyo alternators, running at 900rev/min.

Accommodation has been provided for 12 (plus one) officers and 11 crew in three suites, 22 single-berth cabins, a double-berth cabin, and a six-berth cabin. Mess rooms and day rooms have also been constructed. Provision for a Suez/repair crew of six persons has also been made.

General arrangement plans of the new 25,000dwt/27,000dwt chemical tanker *Ottamana,* built by the Celik Tekne Shipyard, in Turkey.



Collisions as a result of interaction

Sir - Dr Barrass' studies of two cases of ships involved in interacting collisions (*The Naval Architect* September 2005, page 146) brought to mind a similar event, which occurred in October 1942 with, sadly, great loss of life. I refer to the slicing in two of the anti-aircraft cruiser HMS *Curacao* by the Cunard liner *Queen Mary*.

Queen Mary, bound for the river Clyde with 15,000 troops on board, met up with her escort at the approaches to the North Channel - a hunting ground for U-boats. In the course of some zig-zag manoeuvres by the liner, an interaction situation developed, which finally resulted in a catastrophic collision and the sinking of HMS *Curacao*.

Both halves of the cruiser sank rapidly, and although 101 officers and men were rescued, 331 of her complement perished. The forepeak of *Queen Mary* was breached to the level of the cruiser's weather deck but she made port at reduced speed where she received temporary repairs.

After the war, an investigation was carried out, with Professor A M Robb advising on behalf of Cunard. This included extensive tests using models in the experiment tank, which showed, given certain circumstances, the inevitability of collision. The results of these tests were the subject of a paper to the Royal Institution of Naval Architects ('Interaction between Ships', by Prof A M Robb, presented on April 7, 1949 at the Spring Meetings, published in the RINA transactions for 1949).

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History repeats itself

Sir - The article 'BMT tests transom sterns' (*The Naval Architect* October 2005, page 14) reminds me of earlier tests on transoms. In 1919, studies for new battlecruisers envisaged very long hulls (circa 850ft or 259m), and there were few drydocks of that length available. The Director of Naval Construction (d'Eyncourt) suggested that the long slender stern hardly touched the sea and asked AEW Haslar to carry out model tests to find how large the penalty would be if the stern were cut off short.

To everyone's surprise, there was no penalty, and moderate cropping revealed reduced resistance, particularly at higher speeds. Experiments were carried out on other models, and empirical guidelines for transoms were established. Unfortunately, few ships were being built at that date, and the first with a transom was the minelayer HMS *Adventure*.

The transom may have been of benefit to that ship but it made minelaying virtually impossible. Mines dropped into the turbulence behind the ship swung back and broke their detonating horns against the transom.

The stern had to be rebuilt, at considerable expense, in a rounded shape, and transoms developed a bad name. Only in the late 1930s was the transom re-introduced in the *Fiji* class. There are several AEW reports on 'square cut sterns', dated around February 1920, held in the ships' plans collection of the National Maritime Museum, Greenwich, London.

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2000 propellers from Hyundai

RECENTLY, the engine and machinery division of Hyundai Heavy Industries, based at Ulsan, in Korea, completed its 2000th propeller. This was ordered for installation on a 8200TEU container liner, which is being built for the French owner CMA CGM; the 100,000dwt vessel is expected to be delivered next year as one of several ordered by this company from Hyundai.

The newest completion weighs 106.30tonnes and has diameter of 9.10m. It has six FP blades instead of the more normal four or five.

Hyundai first started casting propellers in 1985 and has thus achieved this remarkable number in only 20 years. By 2003, a total of 1500 had already been built, therefore in just two years, 500 have been cast and machined. Hyundai believes that the maximum limit for propellers today is 110tonnes and 9.50m diameter, notwithstanding that Nakashima, in Japan, is nearing completion of a new factory to cast propellers up to 150tonnes weight and 12m in diameter.

Today, Hyundai's engine and machinery division claims to hold a 35% share of the global propeller market, supplying blades not only to Korean domestic yards but also to shipbuilders in Germany, Japan, China, and other countries.

Establishment of a knowledge database to support ship recycling

A Karpowicz, BERTECH, in Poland, G Bruce, University of Newcastle, in UK, and A Sinha, from the UK Shipbuilders and Shiprepairers Association, discuss the use of advanced technology in this emerging industry*.

MOST shipbreaking today takes place in Asia due to the low costs involved, and during recent years demolition of European vessels has also moved from local yards to Asia. In future, the establishment of highly specialised world recycling centres for marine vehicles (including ships and offshore units) will be required in different areas of the world to meet environmental standards. Some of these will be in Europe. For ecological and environmental reasons, in contrast to what happens to-day on the Indian Subcontinent, such ship recycling factories of tomorrow must have at their disposal the most advanced technologies available.

A knowledge database (KDB) is an essential pre-requisite for the concept, and is required, sooner rather than later, through the close collaboration of EU industry, institutions and universities, and by members of CESA.

The KDB should encompass the following key areas of ship recycling, which are discussed in this article.

- EU policy issues and initiatives
- regulations at international, EU and national level, financial aspects, ship decommissioning operations, decision making and afinancial structure, shipbreaking/ship recycling processes, cost modelling
- management and organisation sspects including environment protection policies
- marketing analyses
  - shipbreaking demand forecast on a national, EU and world market basis
  - yard capacities, state-of-the-art and prospects
- human factors
- technical aspects
  - efficient, not labour-intensive, steel processing methods in a high-volume scenario
  - design for recycling concepts, including adoption of new materials
  - environment protection technical measures, facilities, tools, and procedures.

The overall objective is to identify recycling technologies that are potentially available and would help to revive the European ship recycling industry, on an economic basis.

The situation in Asia is generally regarded as unsatisfactory, initially by organisations such as Greenpeace, and subsequently by much of the international community.

In the 1970s shipbreaking was concentrated in Europe. Performed in docks, it was a highly mechanised industrial operation. But the costs of upholding environmental, health and safety standards increased. So the shipping industry moved to poorer Asian states, which have few health and safety standards (Greenpeace, 2004). Firstly to regions such as Taiwan and South Korea, but then moving on to areas within the same region where labour costs traditionally have been even lower (DNV, 1999). The choice of location for the establishment of scrapping sites is based upon some prerequisites. These may be summarised as follows (Andersen, 2001):

- a long uniform inter-tidal zone/sufficient tidal difference allowing vessels of a range of sizes to be dry-beached
- minimum exposure (coastal protection) and stable weather conditions
- availability of low-cost labour
- a certain level of infrastructure.

In 1992 and 1993, half of all ocean-going ships were being scrapped in China (Table1), but a couple of years later, it dramatically decreased to only 1% in 1997 and China was nearly eliminated from the market. On the contrary, India had a growth in scrapping rate during this period, and 7,577,000dwt were being scrapped in 1997 − 55% of the whole world fleet.

According to the statistics for the year 2001, India breaks 42% of the vessels that are dismantled every year, Bangladesh 7%, Pakistan 6%, China 4% and the rest of the world 41% (UNEP, 2001). During the period of 1992 - 1999, on average 363 vessels have been scrapped each year, and 19,570,000 in terms of deadweight; tankers' share was 50% and the bulk carriers' share was 31% (Greenpeace 2004). It represents a high percentage of the scrapping market − about 81% of the total sum of demolition of vessels. Therefore, bulk carriers and tankers are dominant in the scrapping industry.

continued

Nation/Year	1991	1992	1993	1994	1995	1996	1997	1998*
Bangladesh	940	2284	2594	3947	4915	4231	2978	3163
	20%	13%	14 %	19 %	33 %	26 %	22 %	21 %
China	374	8921	9318	3397	676	1331	164	979
	8%	52%	52%	16 %	5 %	8 %	1 %	7 %
India	1079	3140	2949	5917	4868	7851	7577	7427
	23%	18 %	16%	29 %	33 %	48 %	55 %	49 %
Pakistan	1280	1609	1921	5301	3623	2043	1630	1962
	27%	9%	11 %	26 %	25 %	13 %	12 %	13 %
Others	22 %	8 %	7 %	10 %	4 %	5 %	10 %	10 %
Total	4685	17228	17982	20714	14677	16313	13744	15021

Table 1. Ship demolition by location, 1991-1998* (Jan-Sep 98), (000dwt).
Source: Drewry Shipping Consultants, 1998.

Waste Stream	OECD Europe	Geographical Europe
Steel	860,000	1,480,000
Copper	115	197
Zinc	345	591
Special Bronze	345	591
Machinery	161,000	275,800
Electrical/Electronic Equipment	28,750	49,250
Joinery – related products	57,500	98,500
Minerals	5,750	9,850
Plastics	5,750	9,850
Liquids	23,000	39,400
Chemicals and gases	345	591
Other miscellaneous	11,500	19,700
Total	1,154,400	1,984,320

Table 2. Forecasted annual waste stream volumes (tonnes).
Source: DNV, 2001.

* Extracts from the paper' Establishment of a knowledge database to support ship recycling', presented at The Royal Institution of Naval Architects' international conference, Recycling of Ships and other Marine Structures, held on May 4-5, 2005, in London, UK.

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The forecast of annual production for some of the waste materials due to be scrapped over the period of 2001 - 2015 in OECD countries has been shown in Table 2.

Regulations

In addition to national and other statutory regulations, there are numbers of international agencies to monitor the demolition process, and address the topic of ship scrapping, including:

- IMO
- ILO
- United Nations Commission on Human Rights
- United Nations Environment Programme - The Basel Convention
- Commission of European Community.

IMO is responsible for coordinating issues associated with ship recycling and has responsibility for monitoring issues arising during ship design, building and operation which might impact on recycling, including preparations for recycling on board. ILO has the responsibility for establishing standards of operation in shore-based industries involved in ship recycling, concentrating on considering the application of its already existing standards and recommendations to ship recycling, and developing guidance for the ship recycling industry in these and other areas - to take the lead on working conditions in and around vessels once they have been beached (Andersen, 2001).

To tackle the current problem of shipbreaking in a non environment-friendly way and to monitor the safe disposal of hazardous materials, an important international agreement is formed by the Basel Convention, which entered into force in 1992. This convention regulates the international trade in hazardous waste. This convention forms the basis for other regulations, eg, EU regulations. In 1995 the Basel Ban Amendment was added to the Convention, prohibiting the export of hazardous waste from developed (OECD) countries to developing (non-OECD) countries. However, it has always been debated whether a ship can be considered as waste or still referred as a ship when it is scheduled for recycling.

In October 2004 the Basel Convention adopted a decision which notes that: 'a ship may become waste as defined in article 2 of the Basel convention and that at the same time it may be defined as a ship under other international rules'. IMO and the Technical Working Group of the Basel Convention have developed international guidelines for ship recycling; the guidelines identify the Industry Code on Ship Recycling and complement the other international guidelines related to shipbreaking.

Hazardous or Harmful Factors in Ship Scrapping
Asbestos
Polychlorinated Biphenyls (PCBs)
Lead
Chromates
Mercury
Fumes of welding & cuffing
Radiation
Noise
Vibration
Air pollution
Low-level radium sources
Organic liquids (Benzene etc.)
Battery, Compressed gas cylinders, fire fighting liquids, etc.
Chemical materials
Work using plasma and gas torches
Explosive(s)
Work using cranes and lifting equipment
Saws, Grinders and Abrasive cutting wheels
Accident factors: falling, upsetting, electric shock, etc.

Table 3. Identifiable hazards associated with shipbreaking and existing ILO standards.
Source: Bailey, 2000.

Policy issues

In a business which is extremely cost-sensitive, the migration of recycling to regions of low labour cost seems to be inevitable. In a global business which is notoriously difficult to regulate, changing this situation will require a concentrated effort.

The first requirement is that there is a will to improve, by changing the way in which ships are dismantled. It is unlikely that existing locations will change methods, since that implies investment and losing the advantages offered by low labour costs and limited regulations on environmental pollution. An objective should therefore be to create a safe, environmentally friendly ship recycling industry in EU countries.

Technological solutions to reduce costs are discussed below, but it is unlikely at first sight that a competitive and safe business can be developed. If others are able to operate in a way which pollutes and creates a dangerous working environment, then being competitive is almost if not completely impossible.

Possible solutions include legislation, although securing this internationally is often a contentious and time-consuming business. There are also potential issues of enforcement, even if an agreement is reached and ratified by a majority of states.

An EU directive is also a possibility, requiring EU-owned ships to be dismantled within the EU. This could disadvantage EU shipowners and others in the market, where competitors remain free to recycle their ships in the traditional locations.

The solution in the motor car industry, requiring manufacturers to build-in recycling to their cost is not a real option, again because of the international market. This is also a potential cause of competitive disadvantage to shipbuilders who are required to comply with the rules which would be put in place.

Requiring a levy on disposal of the ships, to cover the additional costs of safe recycling in specialised facilities, is also a potential disadvantage to compliant owners.

A solution, or at least a partial solution, might be found in specialised facilities and these are discussed in the next section.

Technical aspects

In principle, the process of scrapping consists of a chain of operations undertaken at different locations (Andersen, 2001).

Offshore: Prior to beaching, tanks are discharged and valuables (uncontaminated oil products, and saleables such as electronic equipment) are removed.

Inter-tidal zone: The vessel is beached under its own power and demolition is initiated (in a certain sequence).

The beach: Further cutting into manageable sizes, extraction of components and sorting for transport to respective receivers. *continued*

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Shore: Supply of second-hand equipment and components to market and remanufacturing/ recycling into new products/components.

Shipbreaking is physically difficult, labour-intensive work, and it has proven to be a risky business. Most of the ship scrapping industry uses manual labour to break ships. Although it is possible to increase profitability by using mechanised shipbreaking methods, it requires special investment which is not easy to manage. There are different shipbreaking methods, including use of drydocks, afloat or beaching. A combination of methods can be used as well.

Drydocks provide somewhat more flexibility and better containment of debris. However, they are also an expensive capital asset and were designed primarily for ship construction and repair. Using the drydock method, workers immediately begin to remove large sections or modules of the ship, transferring them to other project areas for environmental abatement, separation, and cutting.

Both afloat and beaching result in lower facility cost, but present the greatest challenge in containing debris and controlling ship stability. With the ship in the water, workers begin by moving through doors and hatches to extract interior parts and strip out compartments. Then they cut and remove the ship's structure above the waterline. As the work progresses the ship gets lighter and it is gradually pulled onto a beach, or earth ramp, for final dismantling of the bottom hull (Association of Scientists and Engineers, 2000).

In environmental terms the hierarchy of demolition waste is that re-use is preferable or failing that, recycling materials, and if that is not possible, safe disposal (DNV, 2001).

Re-usables are extracted, including pumps, motors and engines, spare parts, electronic equipment, and cables. Scrap steel is the most important of recyclables; Steel production from scrap is a sustainable process in that it achieves a far better environmental performance in the light of energy efficiency and the preservation of non-renewable resources in comparison with the alternative ore-based production. The energy balance between the two approaches may differ by up to 70% (DNV, 1999).

Disposals, including asbestos, batteries, plastics, radiation sources, lead and minerals, can cause a threat to human health and the environment.

Many of the vessels currently designated for scrapping were built in the 1950s, 1960s, and 1970s using materials in their construction, many of which are currently classified as hazardous, eg, asbestos, PCBs, lead, chromates, mercury, and cadmium.

The current practice in dismantling ocean-going ships thus poses serious safety and environmental concerns. In summary these are related to:

- the disposal of and contamination of the environment with toxic and hazardous wastes
- unfavorable, unsafe working and scrapping conditions for the workers involved in shipbreaking and exposure to hazardous waste
- frequent, undocumented technical changes of the ship, in combination with frequent changes of ownership, result in a lack of information on hazards and difficulty in developing a safe and environmentally friendly shipbreaking plan. This is enhanced by the fact that mostly there is no direct contact between the last operator and scrapping yard.

Year	No. DWT Age	Tankers	Bulk Carriers	Combos	Gas vessels	Other dry	All Vessels
1992	**No.**	94	67	11	4	64	240
	DWT	10,22	3,913	1,296	0,011	0,775	16,215
	Age	23,8	23,6	20,8	26,8	24,7	23,9
1993	**No.**	110	50	15	10	129	314
	DWT	10,685	2,557	2,27	0,111	1,398	17,021
	Age	23,1	24,2	21,9	24,9	29,4	25,9
1994	**No.**	87	70	18	7	112	294
	DWT	12,558	4,351	2,421	0,018	1,234	20,582
	Age	22,6	24	21,9	26,3	26,5	24,5
1995	**No.**	93	33	9	1	91	227
	DWT	10,794	2,093	1,229	0,002	1,195	15,313
	Age	25,2	25,2	22,4	30	27,2	25,9
1996	**No.**	72	128	15	5	168	388
	DWT	6,829	7,297	1,904	0,021	1,967	18,018
	Age	25,3	25	23,1	27,9	27,2	26
1997	**No.**	40	161	6	6	187	400
	DWT	3,611	7,707	0,746	0,075	2,596	14,735
	Age	28,3	25,5	23,6	28,4	26,5	26,3
1998	**No.**	52	236	10	6	191	495
	DWT	7,547	11,666	1,416	0,028	3,181	23,838
	Age	25	25	22.8	27.5	25.5	25.2
1999	**No.**	113	194	9	6	226	548
	DWT	17,114	9,385	1,130	0,019	3,185	30,833
	Age	24.9	24.9	24.3	31.4	25.2	25.1
2000*	**No.**	55	29	4	1	45	134
	DWT	7,234	1,353	393	18	641	9,639
	Age	26.1	27.1	25	31.7	25.7	26.2
Average	**No.**	83	117	12	6	146	363
92-99	**DWT**	9,920	6,120	1,550	40	1,940	19,570
	Age	24.4	24.8	22.4	26.9	26.3	25.3

Table 4. Vessels (> 10,000dwt) sold for scrapping 1992-2000* (Jan-Mar), (000dwt).
Source: DNV, 2001.

Future demolition possibilities

The primary requirements are for efficient, not labour-intensive, steel processing methods which can deal with a high volume of materials. Current research (the EU funded SHIPMATES project) is reviewing the methods which are available, considering other industries, but also looking at a reversal of the ship construction process. Handling structures similar to those found in new construction implies a high investment cost, in buildings and particularly cranes and other materials handling. Utilising second hand equipment or even the use of a redundant shipyard may allow this problem to be overcome.

A number of specific technological requirements can be set out. Any steel processing technology must be able to work continuously, to make the investment worthwhile. The technology must be automated, both to reduce labour costs to a minimum and to avoid the presence of human beings in a dangerous environment.

The technology must be flexible to deal with the high variety of structures and shapes. An alternative is to create a technology which is specific to a single ship type, although this will be potentially vulnerable to variations in the recycling market.

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Element	Standard Tanker	Standard Bulk
Steel	74.4	63.15
Copper	0.01	0.04
Zinc	0.03	0.04
Special Bronze	0.03	0.04
Machinery	14	19
Electrical/Electronic Equipment	2.5	5
Joinery - Related products	5	6
Minerals	0.5	2.5
Plastics	0.5	1.2
Liquids	2	1
Chemicals and gases	0.03	0.03
Other miscellaneous	1	2
Total	100	100

Table 5. Percentage of various elements of a standard tanker and bulk carrier (in %).

Solutions being considered include the use of tele-operated cutting systems, semi-automatic devices which move over the ship surfaces and autonomous robots which can operate very much as human recyclers do at present. The robots would be programmed to move over the steel surfaces of the ship, continuously cutting. It is likely that the robots would to some extent have to be regarded as expendable, given the inherent dangers of cutting up a structure which is also being used for support by the cutting system. However this would be a major improvement on the use of people for the same purpose.

Programming of such robotic devices can be achieved using state-of-the-art measurement systems, for example digital photogrammetry, which can establish the precise geometry of large structures and make this information available digitally for a CAD system. Using such techniques, the remotely operated systems may be accurately positioned on the structure.

Design for recycling is a useful concept, which has been applied to motor vehicles and some consumer goods. In principle, it has applications in the marine world, although the issues of standardisation and compliance which have been raised earlier would possibly apply. The concept would clearly only apply to new ships, so for at least twenty-five years the world recycling industry will have to deal with existing ships which have no account of final disposal built into their design.

There is potential for the adoption of new materials, and novel configurations of existing materials. Technical measures must also be taken to provide environment protection during the recycling process. As a minimum, the process will have to take place in a dock, or other enclosed work area which creates a barrier between the waste processing and the environment. Keeping clear of the water is obvious, and it would be preferable to enclose the processing in a building. This raises immediate questions of cost.

Attention will have to be paid to all of the facilities, tools and procedures which may be proposed for the recycling operations.

Human factors

One of the key motivations for an improved ship recycling business is the protection of people. This paper is proposing a knowledge database (KDB), established in a research environment, which will include all the elements necessary to underpin a recycling operation in the EU. The human factors in this are of great importance.

As has been emphasised in the discussion of new technologies, a key requirement is the removal of the workers from the proximity to danger which is a feature of the current recycling processes. Currently the recycling process that takes place in the Far East presents dangers from two sources. First is the danger of accidents, which regularly cause death or serious injury. Second is the longer term danger from pollutants, which affects not only the workers directly engaged in the recycling but also all the people living and working in the area of the recycling facilities.

Working on the open beach is the primary cause, as ships which have not been cleaned sufficiently are cut up and any waste oils and other materials can escape.

Market for scrapping

Ship demolition provides a large amount of recyclable materials. Some 95% of an average merchant ship will be re-used, from the steel to the non-ferrous metals and pipework of the ship. The scrap price of ships is volatile and depends upon the demand for steel from this source (BIMCO).

The ship type is important in determining the price offered by the ship breaker. Large ships with easily accessible surfaces, such as tankers, are easier to cut in pieces and are therefore more valuable and profitable. Steel scrap obtained from the shipbreaking process is of comparatively high quality, especially from tankers that have large flat panels. The price is also affected by the availability of ships for demolition, which itself is governed by the freight market conditions. If, for instance, the freight market is good, a shipowner will be reluctant to take an elderly ship out of service, keeping the ship earning as long as possible.

Only when the freight market has turned will the relatively high operating costs of an old ship make the shipowner decide to scrap the vessel. He will hope that this decision will coincide with a relatively high scrap price as well. This will also be affected by the availability of ships being offered for demolition. If freight rates are high, few ships will be available for scrap, and prices will be at their highest. If there are many vessels being offered at a time of poor freight rates, then the scrap prices will be low. It is all a matter of supply and demand (BIMCO).

Scrap steel provides most of the value of a ship. The percentage of the steel varies and it depends on ship type and size, but there has been an estimate of roughly 74.4% for a standard tanker of 120,000dwt, and 63.15% for a standard bulk carrier of 52,000dwt (Table 5).

Knowledge database for ship disposal

So far this paper has addressed the major factors in the ship scrapping business. It is apparent that the current disposal process has flaws, and there is general agreement that an improved process is required, for all the reasons stated. However, it is also apparent that there is incomplete information on the current business and particularly there are gaps in the technology which might be employed to secure the required improvement. Without technological change, the current processes will remain too dangerous and expensive to allow such operations to be carried out in the European Union.

A KDB is believed to be an essential pre-requisite for the concept, and is required, sooner rather than later, through the close collaboration of EU industry, institutions and universities, and by members of CESA. What is therefore proposed is the establishment of a database, with the structure proposed in Table 6. It would require a multidisciplinary team according to the KDB structure outlined in the table.

EU SHIP RECYCLING KDB STRUCTURE		Profile of Professional Competence Required for KDB Build-up
1st Level Subdivision	2nd Level Subdivision	
1. Relevant EU Policy Issues	1.1 Long term strategies; 1.2 New initiatives and trends.	EU representation
2. Applicable Regulatory Bases	2.1 International regulations (UN, IMO, EU); 2.2 National and regional regulations.	Legal experts
3. Financial Aspects	3.1 Ship decommissioning operations decision making and their financial structure; 3.2 Shipbreaking/ship recycling processes cost modelling.	Shipping/Shipbuilding Economist
4. Ship Recycling Management & Organisation	4.1 Optimisation of yard organisational structure.	Yard Management & Organisation
5. Environment Protection	5.1 Polices; 5.2 Measures.	Ecologist
6. Marketing Analyses	6.1 Shipbreaking demand forecasting on national, EU and world market basis; 6.2 Shipbreaking yards capacities state-of-the-art & prospects.	Shipping & Shipbuilding Marketing / Market Research
7. Human Factors	7.1 Ship Recycling Specialised Yard personnel education and training; 7.2 Safety and Health Executive issues.	Personnel and/or Human Relations
8. Technical Aspects	8.1 Design for recycling concepts, new materials adoption included;	Naval Architect (NA) – Design
	8.2 Specialised Ship Recycling Yard production process definition;	NA – Production Process
	8.3 Theoretical calculations of disassembling process (hull strength, hull stability, risk analysis, etc.);	NA – Design
	8.4 Low labour intensity steel processing methods development; 8.5 Technical measures of environment protection (facilities, tools and procedures).	NA – Production Process
9. IT Issues	9.1 KDB management & maintenance; 9.2 Computer aided cost effective production planning simulation; 9.3 Computer aided simulation of disassembling processes.	IT Specialist + NA – Production Process

Table 6. Knowledge database structure outline.

Conclusions

Ship recycling is an integral part of the life cycle management of ships. Ships have to be recycled at the end of their operational life in a responsible way.

A long-term solution for the ship recycling industry has to be based on an international legal framework, based upon the guide lines set by the International Maritime Organisation (IMO), the International Labour Organisation (ILO), and the Basel Convention.

An effective and economic industry in the developed world, ideally in the EU, is the most suitable route to environmentally responsible recycling.

New ships should be designed in such a way that they can be recycled easily. A knowledge database is an essential means of underpinning responsible recycling

Acknowledgement

The work being undertaken within the SHIPMATES project is addressing some of the issues for the knowledge database, particularly the technologies required which are seen as a major gap. The input of all the project partners is gratefully acknowledged.

The partners involved in SHIPMATES are:

- Association of European Shipbuilders and Repairers, UK
- A&P Tyne, UK
- BERTECH, Poland
- CETENA, Italy
- Cantieri Navali Italiani SpA, Italy
- Estaleiros Navais de Viana do Castelo SA, Portugal
- Lisnave-Estaleiros Navais SA, Portugal
- Instituto Superior Tecnico, Portugal
- University of Patras, Laboratory for Manufacturing Systems, Greece
- University of Hertfordshire, Dept. of Aerospace, Civil & Mechanical Engineering, UK
- University of Newcastle, UK
- Choren Design & Consulting, Poland

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Unusual ferry for Faeroe Islands enters service

ONE of the latest new deliveries from IZAR's San Fernando yard, in Spain (but actually completed by Navantia, the mainly military division set up following recent re-organisation, which today operates the San Fernando yard) is *Smyril*. This 138.00m-long passenger/ro-ro ferry was built for Strandfaraskip Landsins, of the Faeroe Islands, for inter-island services there, including the route from Thorshavn to Suduroy. *Smyril* was delivered in September.

This unusual ferry design was created by Copenhagen-based design bureau Knud E Hansen (*The Naval Architect* April 2003, page 32 and 36) and model-tested by Force Technology - formerly DMI. Hansen's own interior team, which includes Camilla Horn, designed the passenger amenities; they had to take into account that there are a great deal more passengers using the service during summer months, so parts of the ship are planned to be actually closed off in the winter season.

Smyril has a length bp of 123.00m, a breadth moulded of 22.70m, a depth of 8.10m to the main deck and 13.70m to the upper deck. She has a scantling draught of 5.80m and design draught is 5.60m. Gross is 12,650tons, displacement 8882tonnes, and lightweight is 5769tonnes. Deadweight on the scantling draught is 3113tonnes and under design conditions is 2652tonnes.

***Smyril* has been designed to cope with open-sea north Atlantic conditions, hence the long and enclosed forecastle.**

TECHNICAL PARTICULARS
SMYRIL

Length, oa	138.00m
Length, bp	123.00m
Breadth, moulded	22.70m
Depth, to main deck	8.10m
Draught, design	5.60m
Draught, scantling	5.80m
Block coefficient	0.5322 at 5.80m
Gross	12,650gt
Deadweight, design	2652dwt
Deadweight, scantling	3113dwt
Passengers	976
Vehicle lane length	970m
Main engines	4 x MAN B&W 7L32/40
Output	4 x 3360kW
Speed, service	21.55knots at 85% MCR, 15% sea margin
Classification	Lloyd's Register +100A1, Passenger Roll-on/Roll-off Ship, +LMC, UMS, ICC, NAV1, IWS, Helicopter Deck

The new ferry has been classed by Lloyd's Register to +100A1 Passenger Roll-On/Roll-Off Ship, +LMC, UMS, ICC, NAV1, IWS, Helicopter Deck. It should be noted that despite her northern operating latitudes, *Smyril* has not be given any ice classification; however, the hull has been carefully designed for open-sea north Atlantic conditions, hence the long and covered forecastle.

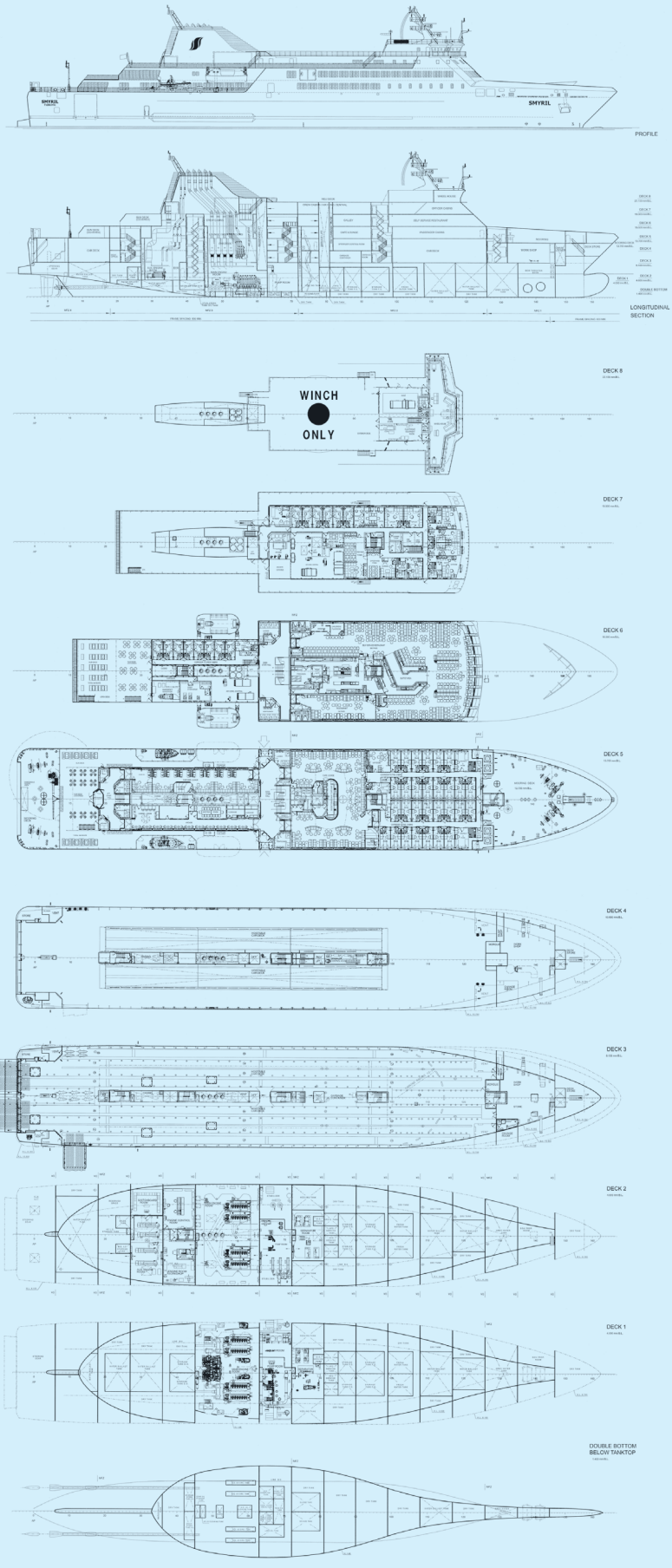
Installed with four MAN B&W 7L32/40 medium-speed main engines, each producing an output of 3360kW, the ferry has a service speed of 21.55knots at 85% MCR. Two twin-input/single-output Reintjes gearboxes, model DLG 5551, transmit power to Rolls-Royce nickel-aluminium-bronze CP propellers of 4300mm diameter, turning at 150rev/min; in addition, a Stamford 1200kW alternator is driven from a power take-off shaft on each box. Further electrical supplies come from a quartet of 515kW alternators driven by MAN B&W 6L16/24 engines. Rolls-Royce also supplied two bow thrusters, of the TT 200 AVX CP type, which each have an output of 1100kW.

Other equipment from the Rolls-Royce group includes two electric windlass/winches on the enclosed forecastle, plus a further two winches aft. A Hoppe Bordmesse-Technik antiheeling system in installed, along with a pair of active folding-fin stabilizers for passenger comfort in the often difficult operating conditions.

Smyril has capacity for 200 vehicles, with a total lane length of 970m, distributed over the main deck and a small section of hoistable platforms. Stern-only access for vehicles is provided but there is a small side ramp on the starboard quarter. Facilities are additionally provided for loading a small number of containers.

Public amenities are arranged for 976 passengers, with 34 cabins, 53% of which are outboard. Facilities have also been provided for a crew of 16 with eight officers. Primary lifesaving apparatus comprises RFD Marin-Ark systems with vertical chutes, one each side of the hull and each capable of handling 430 people. These are supported by two enclosed lifeboats and a pair of fast rescue craft.

Furuno supplied both the onboard radars and the integrated bridge system. There are two radars of FAR-2805/FAR-2805 S type, and the integrated bridge system is of ECDIS FER 2105 type. The bridge control system is also supplied by Furuno and is built to meet NAV 1 standards.



General arrangement plans of the Faeroe Islands ferry *Smyril*, built by Izar and completed by Navantia for Strandfaraskip Landsins. This Knud E Hansen-designed ro-ro vessel has been arranged so that sections of the accommodation can be shut-off during quiet periods.

New 'green' vehicle carrier for Wallenius Wilhelmsen

IN mid-September, a naming ceremony for the newest addition to Wallenius Wilhelmsen's fleet was held at the Port of Baltimore, in Maryland, USA. The 20,228dwt *Toronto* was christened by Mrs Elisabeth Hartmann, the wife of Arild B Iversen, president of Wilhelmsen Lines, Wilhelmsen Lines Shipowning, and Wilhelmsen Offshore & Chartering.

The UK-registered *Toronto*, built by Mitsubishi Heavy Industries' Nagasaki yard with a focus on environmental protection, can carry upwards of 6500 cars, or a mix of cars and other vehicles. The vessel will be deployed in Wallenius Wilhelmsen's global trade routes.

Toronto is one of a series of ships boasting a highly optimised design that combines double-bottom fuel tanks and solid ballast with cargo space that maximises capacity and flexibility to carry cars and a wide variety of ro-ro cargoes, including construction and agricultural equipment.

In 2004, this new series won a ShipPax award for 'outstanding ro-ro cargo decks'. *Toronto's* sister ship, *Toledo*, was named at a ceremony in Sydney, Australia in April, 2005.

Wallenius Wilhelmsen, the company which created the futuristic zero-emissions-concept vehicle carrier *Orcelle* (*The Naval Architect* April 2005, pages 3 and 14), is jointly owned by Wallenius Lines, of Sweden, and Wilhelm Wilhelmsen, based in Norway.

Wallenius Wilhelmsen's newest car/vehicle carrier, the 6500-car capacity *Toronto*, built by Mitsubishi Heavy Industries, is seen here arriving at the port of Baltimore. She is the third of a new series of six ships able to carrying a wide range of ro-ro cargoes.

Toronto is the third of a series of six new ships ordered from Mitsubishi for Wilh Wilhelmsen and is one of 14 new ships that will be put into service by Wallenius Wilhelmsen over the next four years. An advanced hull and propeller design, together with yard-patented stator fins, are expected to deliver a 10% reduction in fuel consumption. This will help Wallenius Wilhelmsen meet its ambitious environmental targets for 2005 and beyond. These goals include reaching an average of 1.5% sulphur in fuel oil; minimising emissions; the use of tin-free antifouling paints; a ballast water exchange (BWE) system; CFC- and HCFC-free cooling agents in refrigeration plants; and biodegradable oil in the sterntube. In September 2004, this operator signed a three-year agreement with the World Wildlife Fund, the global conservation organisation, to preserve and promote the conservation of marine life on the high seas.

Bearing monitors chosen for new container ships

German owner Hapag-Lloyd AG has chosen to fit Amot XTS-W bearing condition monitoring systems on three new 8750TEU container ships under construction. The XTS-W has been specified in place of traditional temperature monitoring systems to ensure earlier warning of bearing wear before problems start, as discussed in *The Naval Architect* October 2005, page 12.

The new system will detect wear of main, big-end, and crosshead bearings before steel-on-steel contact occurs, unlike older techniques that allow shutdown before failure but not before problems have already developed. The XTS-W concept uses totally new technology based on linear bearing wear instrumentation, with highly accurate displacement sensors and progressive wear indication.

Hapag-Lloyd is expanding its present fleet of 57 ships by eight newbuildings, to be delivered until 2008. The new ships are being built by Hyundai Heavy Industries in South Korea. A fiurther benefit of installing the XTS-W system is that it should maximise the time for controlled engine shut-down and ship manoeuvres, while allowing for the most effective planned maintenance.

Sensors produce a signal with every engine revolution, processed to generate a continuous representation of the extent of bearing wear, and subsequently generating alarm/warning signals in association with the wear trend monitoring functionality. A RISC microprocessor-based signal processor will provide multi-channel operation, standard interfacing and automated calibration; it will handle up to 14 displacement sensors simultaneously.

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150tonnes on 100 wheels on the way to Korea

A shipyard heavy-lift transporter, produced at the Scheuerle plant in Pfedelbach, Germany, completed a journey to Heilbronn´s Neckar harbour entirely on its own axles. This giant transporter - 23m long and 8m wide - has a 150tonne tare weight accommodated on 100 wheels.

The new Scheuerle transporter will be used in an unspecified Korean shipyard for transporting large blocks or sections from fabrication halls to paint shops and onto to assembly docks. Actual maximum payload is 800tonnes. The transporter has an electronically-controlled multi-directional steering feature which provides numerous alternatives; these include standard, crab, transverse, and circular steering modes by which the vehicle can turn on its own axis. Delicate driving operations are provided by hydrostatic drives that allows completely smooth and extremely accurate load positioning.

Power for the complete hydraulic system is generated by two synchronised 388bhp diesel engines which, in each case, drive hydraulic pumps via a transfer gearbox. All functions such as traction drive, steering angle as well as lifting and setting down loads are carried out by means of an on-board computer and are electronically monitored with ultra-sensitive electronic equipment. This modern transportation technology is one basis for cost-effective shipbuilding using sectional construction methods.

Contact: Lothar Riesenegger, Scheuerle Fahrzeugfabrik GmbH, Öhringer Strasse 16, D-74629 Pfedelbach, Germany.
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Hose-handling cranes adapted for LNG vessels

MacGregor has recently adapted its standard hose-handling and provisions cranes for LNG carriers' specific requirements. One adaptation required is longer crane outreaches but without increasing lifting capacities - outreaches up to 25m are common. There are often requirements for remote controls, either by cabled or wireless handsets. Stainless steel wire ropes, couplings and fittings for hydraulic hoses are also common - at least at the enquiry stage. Another new improvement is the introduction of textile-sleeved hydraulic pipes on deck, to contain any local leaks, but MacGregor claims it can fulfil all special requirements needed for LNG carrier cranes, and its onboard cranes are now also being used to handle free-fall lifeboats.

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Adax Group acquires Norac AS

The Norwegian manufacturer of marine accommodation systems, Norac AS, has joined Adax Industrier, which is expected to boost its growth and development. Together with Norac, the Adax Group will have 700 employees, 500 of which are outside Norway. Annual Adax turnovers are now anticipated to reach NKr500 million in 2006.

The Adax Group is a Norwegian-owned industrial corporation with expected sales of NKr300 million in 2005 - 80% of which being sales outside Norway. The Group has manufacturing plants in Norway and Lithuania, and includes: Adax AS - a leading manufacturer of heating products under the brands Adax, Glamox Heating, and Norel. Other members include MRK Industrier AS - specialist in lamination of cabinets and cabinet fronts for galleys and bathrooms; and Bever Industrier AS (50% owned) - manufacturer of interior panelling.

Norac AS is a leading manufacturer of fireproof and sound-insulated accommodation units for cruise liners and commercial ships, as well as offshore and land-based accommodation installations, including prefabricated bathrooms. Norac AS has manufacturing plants in Arendal, Horten and Ringebu, Norway, also in China. The company's annual sales turnover has been some NKr200 million.

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HVAC business taken over

Unitor Ships Equipment (now part of Wilhelmsen Maritime Services) has reached an agreement to transfer its activities in the shipbuilding heating, ventilation, and air conditioning (HVAC) market to Teknotherm AS. The transfer includes HVAC products, a group of engineers in Poland, as well as Unitor's order backlog of HVAC systems.

Teknotherm will represent a continuation of Unitor's HVAC activities in the shipbuilding market with respect to provision of technical solutions and market contacts, as well as after-sales and service capabilities. Unitor will continue to strengthen its refrigeration spares and service, and Teknotherm will, through a separate agreement, appoint Unitor as HVAC service subcontractor at selected locations.

Contact: Roy Moberg, managing director, Teknotherm AS, Norway. www.teknotherm.com

Kocks acquired by TTS Marine

In a continued policy of acquisition of companies to complement its current portfolio, Norway's TTS Marine ASA, based in Bergen, has completed its purchase of the German company Kocks GmbH, Bremen, with effect from October 1, 2005. The company will be renamed TTS Kocks GmbH.

Kocks has a well-established range of deck machinery, deck machinery controls, and electric and hydraulic systems for use with deck machinery. With this acquisition, TTS hopes to be able to achieve more work in China.

Kocks GmbH currently has 34 employees, with expertise within engineering, service and sales. The product range is complementary to the current TTS portfolio, and the company has considerable experience in the German shipowning market, where the majority of newbuilding orders go to Korean and Chinese shipyards.

Kocks was established in 1952, then offering both engineering design and production of winches and other equipment at workshops in Bremen. Since 1998 the company has operated a 100%-owned subsidiary in the Czech Republic for production and assembly of deck machinery. Following bankruptcy in 2004, the assets of the company were sold and a new company, Kocks GmbH, was established.

During the past year the company has ended production and assembly in Bremen, and established a joint venture company in Korea as an alternative production and assembly base. Hence the company has established a structure focused on engineering, service and sales in Bremen, with low-cost production and assembly for European markets in the Czech Republic, and for Asian markets in Korea. Operations during the past 12 months showed a turnover of €25 million, but considerable costs related to structural changes created a loss. However, these losses are not expected to affect the future. A turnover of €29 million is expected for 2005, increasing to €34 million for 2006.

Contact: Johannes D Neteland, president and chief executive officer, TTS Marine ASA, Norway. Tel: +47 55 94 74 00.

D'Artagnan: a large cutter suction dredger from IHC Holland Merwede

WHAT is probably the largest-ever self-propelled cutter suction dredger has recently been completed by the leading dredger specialist IHC Holland Merwede at its Kinderdijk yard. *D'Artagnan*, ordered by Soc de Dragage International SA (SDI), a French subsidiary of the Belgian company Dredging, Environment & Maritime Engineering NV (DEME), has been carefully engineered to provide a versatile operating platform (104.40m length bp and 25.20m breadth), capable of dealing effectively with a range of seabed soils, even with a swell running.

The two spuds fitted at the stern enable straightforward spud guidance and direct propulsion, while the dredging ladder is at the bow, thus both dredging and sailing are in the same direction. This is a reversal of the arrangement on the 2004-built *JFJ de Nul*, also from IHC Holland but for the Jan de Nul group.

High levels of autonomy are included, with an ability to continue working in temperatures ranging from -10°C to +40°C and in water depths from 6m to 35m - the latter is achieved by fitting low and high trunnion points and by applying a large cutter ladder angle to obtain maximum depth. When operating in shallow water, trim is an important parameter for dredgers, and therefore the centre of gravity must be accurately determined at an early stage in the project. On large cutter designs, vessel weight can represent around 90% of the displacement at minimum dredging draught, therefore any inaccuracies can have considerable impact.

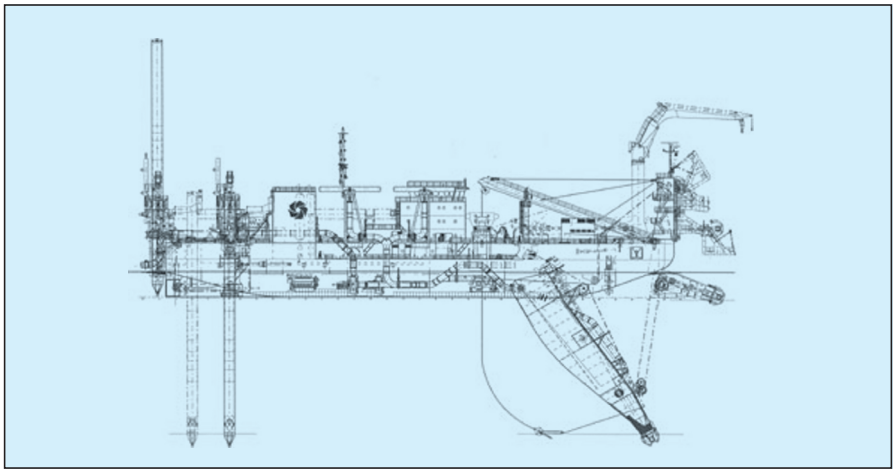
If required, spoil can be discharged by pipe at very large distances - up to 10,000m. To achieve this capacity, while at the same time providing an ability to deposit spoil into a barge alongside, three dredge pumps are fitted. The cutter system includes DEME's Dracula features for efficiency when dredging rock, and completely different cutter and suction mouths can be used; these can easily be exchanged using cutter crowns patented by DEME and SDI.

TECHNICAL PARTICULARS
D'ARTAGNAN

Length, oa	123.81m
Length, bp	104.40m
Breadth	25.20m
Depth	8.20m
Draught, design	5.50m
Draught, max	6.15m
Dredger pipe diameter	1000mm
Dredging depth	from 6m to 35m
Propulsion/alternator engines	2 x 6000kW
Dredge pumps (on board)	2 x 6000kW
Dredge pump (submersible)	1 x 3400kW
Installed power	28,200kW
Speed, transit	12.50knots
Accommodation	43 persons
Classification	Bureau Veritas

Picture: IHC Holland Merwede

The newly completed *D'Artagnan* is one of the largest self-propelled cutter suction dredgers; she is somewhat similar to the *JFJ de Nul*, completed last year by the same yard, IHC Holland Merwede, but has a completely different dredging/spud arrangement and features a new type of high-pressure seal on the ladder and jet-water systems.



Profile of the newly completed cutter suction dredger *D'Artagnan*, built by IHC Holland Merwede for SDI, the French subsidiary of the Belgian company Dredging, Environment, & Maritime Engineering (DEME).

For better performance in swell, the principal dimensions have been increased, and the spud has also been enlarged and strengthened significantly. A special feature is the spud carriage installation. In a swell, the pontoon hull can generate considerable forces on the spud via the carriage but these forces can be shrunk when the link between spud and pontoon has some flexibility. Thus, on *D'Artagnan* a totally-buffered spud carriage has been fitted; this is claimed to be a brand-new concept.

Additionally, the stiffness of the longitudinal buffering, achieved by wires and hydraulic cylinders, is variable; as a consequence, the dredger is able to tune the flexibility of her anchoring system according to sea conditions. The wires also transfer the spud reaction force between the carriage and hull.

Associated features that aid efficient operation include anchor booms to enable *D'Artagnan* to position her own anchors, a spud tilting installation, special deck areas for repairs and maintenance, and a deck crane - capable of traversing the length of the hull - to handle heavy items and particularly cutter heads, for which the crane was specially designed.

Dredge pump capacity has been increased by 35% compared with predecessors by installing 15.4MW of power. Because both dredging and sailing are in the same direction, a combined navigation/dredging console is fitted, with advanced dredging automation and state-of-the-art cutter control. Training for the dredge master was carried out ashore on a Constance Bonacieux simulator. A special alarm function enables the relevant page of a so-called SCADA system to be display on the screen at the touch of a button.

As far as environmental protection is concerned, *D'Artagnan* is notable as the first ship to feature a newly developed IHC Lagersmit high-pressure seal, the Jetwater Supreme, for the cutter ladder and jet-water systems (*The Naval Architect* May 2005, page 9). The concept uses 10 radial lip seals in series to achieve a 20bar pressure over a relatively large area and to overcome the normal 2bar pressure limitation of such seals. This solution will absorb large axial and radial movements, and cope with a wide range of pressures and speeds.

Vosta dredging package for *D'Artagnan*

A THIRD-GENERATION cutting system, designed to work in hard rock, has been supplied to the new cutter suction dredger *D'Artagnan* (featured on an adjacent page) by the dredge systems specialist Vosta LMG. This cutting system was first revealed at the Europort 2003 exhibition and has already been tested on another cutter suction dredger, Dredging International's *Amazone*.

D'Artagnan is equipped with 11 cutter heads of various types: Type T6 for sand and clay, and a further T6 model for multipurpose duties, also a T6 rock-cutting version, and a different type, T8, also for rock. T6 cutter heads have been designed for dredgers with a maximum cutter power of 6000hp, whereas the T8 system can handle powers up to 8000hp.

The T8 cutter heads delivered to the owner, SDI (DEME group), are six- and seven-bladed models, and are believed to be by far the strongest cutting system ever built for dredgers. The head is said to be almost twice as strong as the strongest designs of the early 1990s.

Despite the extreme strength of the cutting system, the weight of each tooth is not more then 20kg, making them still easy to handle. Due to a unique locking system, worn teeth can be replaced much faster. This means an increase in dredging efficiency, especially when teeth consumption is high, which is typical when working hard rock.

Vosta has supplied to the same ship 50 specially designed, high-pressure ball joints of the H15-1000 HP type for use in floating pipelines. As opposed to conventional high-pressure ball joints, these are said not to require the use of a plastic liner in the gland to cope with the extreme pressure. With a bore of 1050mm and an outer dimension of more than 2000mm, the joints can handle a test pressure of at least 40bar while the weight of each joint is kept below 7000kg. This combination of size, pressure, and weight is claimed as unique in the dredging industry and, combined with construction without gland liners, is said to represent a new standard in high-pressure ball joint design.

Some of the 11 Vosta cutter heads seen on a transporter prior to being delivered to IHC Holland Merwede for installation on *D'Artagnan*.

Spud carrier to cope with large swells

In addition, Vosta LMG engineered the dredger's flexible spud carrier, based on a Vosta special design. In this, a parallel rope guide, which is tensioned hydraulically, reduces load peaks. This ensures that the dredging process is largely independent of even heavy sea motions - a big improvement over earlier types. The spud carrier system is flexible in all directions, and on top of that it can also handle the full power on the two spuds in all directions.

Due to *D'Artagnan's* size and the fact that the ship is designed to work with hard rock, normal dredging anchors are not suitable. DEME therefore asked Vosta LMG to explore a workable solution. The engineering study focussed on modular anchor platforms, and these were subsequently chosen. Two anchor platforms of approximately 250tonnes each will enable the cutter ladder to perform its duty efficiently in hard rock.

***D'Artagnan* at the outfitting quay, showing two of the Vosta cutter heads stowed above the dredge ladder. A special crane that can travel the length of the hull is used to place the cutter heads in position.**

Dredger projects keep Bakker Sliedrecht busy

THE Dutch electrical specialist, Bakker Sliedrecht, has been working on several interesting dredger projects recently. These have included the complete electrical installation for two dismountable stationary cutter-suction dredgers built by IHC Beaver Dredgers for South Africa. Each ship has a 750kW submersible dredge pump drive consisting of a frequency converter, DC bus system for 45kW electric winches, and an 1800kVA high-voltage shore connection.

In China, Bakker designed and delivered a turnkey package for three twin 3700m³ split hopper barges, designed by DF-Marine and FKAB and ordered from the Xinhe Shipyard in Tianjin (one of these, *L'Aigle*, was illustrated in our September 2005 issue, page 30). Equipment included switchboards, distribution panels for a layout based on twin 625kVA diesel-alternators, also control consoles with navigational equipment and mimic diagrams. A further identical vessel but equipped for dredging, built at the same yard and for the same owner (Jan de Nul), featured two larger alternators (2 x 1000kVA), plus a dredge pump alternator of 1925kVA, and a 750kW jet pump drive with soft starter.

For two cutter dredgers associated with this project, Bakker Sliedrecht designed and engineered the complete electrical package, including supervision and commissioning. The plant comprised a 5000kVA alternator, 700kW transformer, 1500kW cutter drive, a 1250kW submerged pump drive, and three winches each of 250kW. All were driven and controlled by Bakker direct water-cooled frequency converters.

A further turnkey project involved the heavy cutter dredger *Fu Min 9 Hao*, also built in China but at the Wenchong Shipyard in Guangzhou for Long Won Dredging. The ship design was made by IHC Holland, and Bakker Sliedrecht supplied the complete electrical system on an assistance turnkey base, including engineering, alternator network, drives, switchboard, cable routing, crew instruction, and commissioning.

On this ship, electrical supplies come from a main diesel-alternator set of 2100kVA at 690V and a shaft driven alternator off the main engine (also 2100kVA), and two auxiliary alternator sets, one of 1000kVA and the other of 250kVA, both at 400V. An efficient dredging system is centred on custom-built submersible motors for the 1000kW cutter drive and a 1444kW dredge-pump drive. A direct-water-cooled frequency drive by Bakker is used for the cutter and a so-called electric shaft system for the dredge pump. Both torque and speed of the winches and gland pumps are controlled by an energy-saving DC-bus arrangement, also designed by Bakker Sliedrecht.

A further dredger project for this energetic Dutch company involved *JFJ de Nul* - one of the largest-ever self-propelled cutter suction designs - which was completed last year by IHC Holland Merwede. Here, Bakker executed the engineering, manufacturing, supply, and installation of all drives and controls (water-cooled frequency controlled type), as well as the high- and low-voltage switchboards, power mains, control consoles, transformers, cables, and wring. In all, this totalled 27,000kW, including 6000kW for diesel-electric propulsion and 15,800kW for dredging.

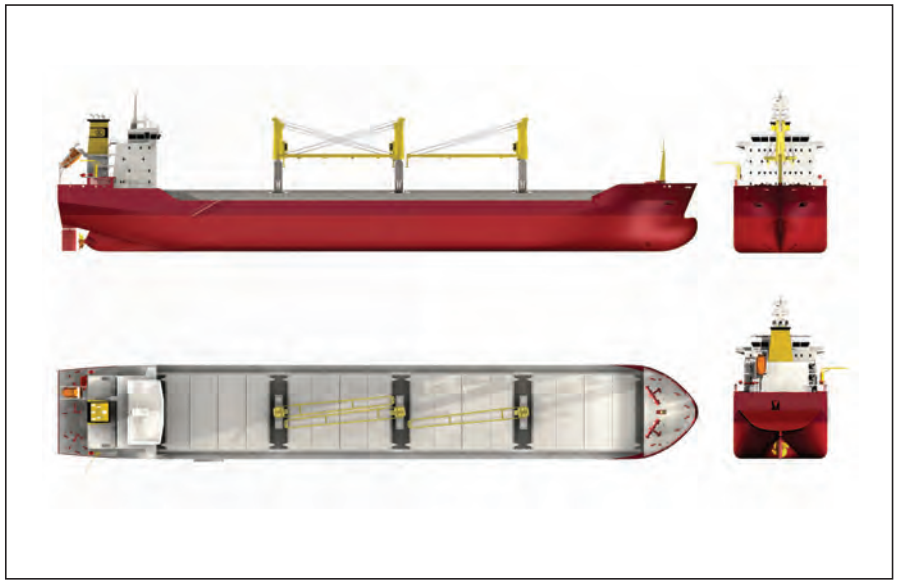
An artist's impression of the new Chinese heavy cutter dredger *Fu Min 9 Hao* at work. This is one of several dredgers for which Bakker Sliedrecht has supplied electric packages recently.

NG-Bulk20: a new Turkish double-skin bulker design

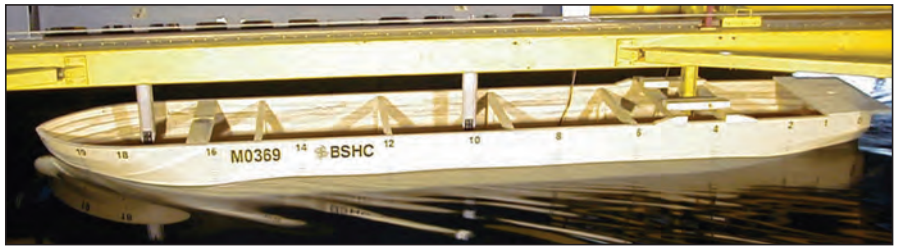
AN INTERESTING new bulk carrier, the NG-BULK20, has been conceived by the Turkish consultancy Delta Marine Co, from Istanbul. This thoughtful 21,000dwt design's superior features include flexible loading capability, low fuel consumption, relatively high speed, environmental features, and long-life easy maintenance, when compared with similar designs. In addition, the NG-BULK20 is designed to operate worldwide, including through the Panama and Suez Canals and the St Lawrence Seaway. The latest IACS Joint Bulker Project rules have been taken into consideration during engineering work.

NG-BULK20 has four equally dimensioned double-skin cargo holds and cargo hatches. Different from the classical bulk carrier's hatch coaming, dimensions are larger when hold dimensions are taken as reference. Cargo holds are of 28.20m x 21.00m, with coaming dimensions of 24.50m x 18.20m; thus there is close resemblance to box-shaped spaces.

These features are planned to allow easy loading and discharge for non-bulk cargoes. Despite large hatch coamings, the vessel keeps its grain-fitted characteristics. NG-BULK20 complies with Heavy Cargo notations, and the maximum tanktop load for each hold is 18tonne/m^2, while steel coils in two rows are possible. Moreover, Grab Loading notations are also applicable, thanks to extra thickening of the double bottom plate.



Impressions of the new NG-BULK20 design from Delta Marine.



A model of the new bulk carrier being tested at the Bulgarian Ship Hydrodynamics Centre.

Optimised hull

All necessary finite-element analyses have been carried out, and reinforcement included where high stress values were recorded. At the same time, the structure is optimised from the point of view of steel weight; this work was performed by Mesh Engineering using patent flow solver codes and the CFD viscous flow solver code Fluent. Powering and resistance tests were carried out at the Bulgarian Ship Hydrodynamics Centre, in Varna, and the resulting hull form is considered to be one of the best when compared with the centre's archives. The aft form is especially designed for uniform wake as far as possible so that only low harmonic propeller forces, far from risks of vibration, are generated.

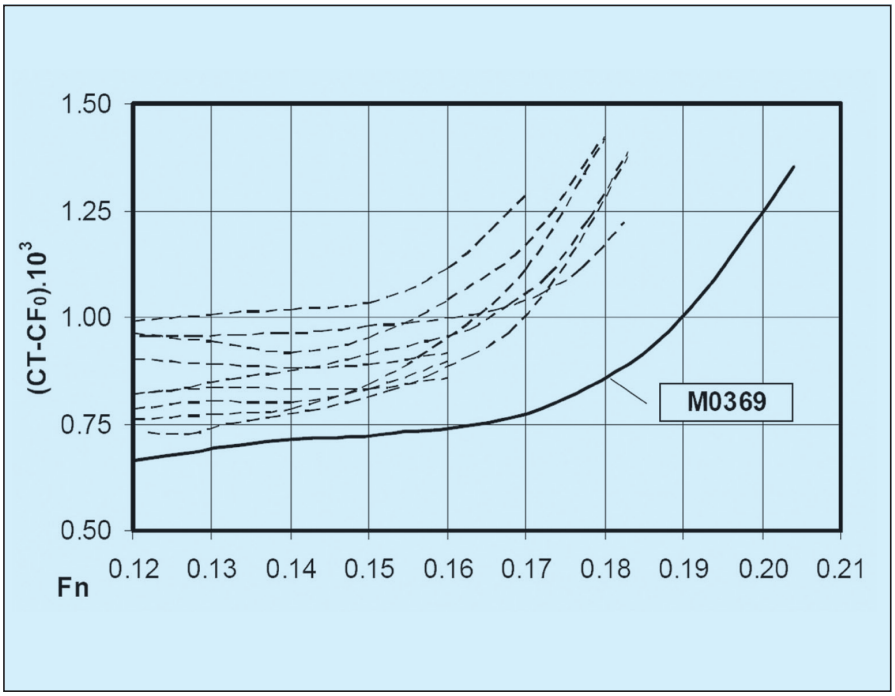
As a consequence of the double-skin design, no structural elements are present in the holds. By placing ballast tanks between two holds, not only can transverse bulkheads can be smooth but also access to the holds, according to the latest rules, is possible from this area. Cleaning time is dramatically reduced, thanks to the absence of structural elements in the holds. No structural elements will appear on the weather deck, with the exception of brackets and bulwark stiffeners, and all deck pipes and electric cables are enclosed in the side ballast tanks. No valves are fitted in ballast tanks, and all ballast and bilge pipes run through a tunnel located in the centre of the double bottom.

Cargo holds are fitted with folding-type hatch covers, each constituting four panels with closed undersides. Every hold is convenient to carry dangerous goods and each is mechanically ventilated. The vessel would normally be equipped with three electric cranes, located between holds 1 and 2, 2 and 3, and 3 and 4; each would be of 30tonne lifting capacity at 28m.

The hull girder is designed in such a way that the vessel can withstand 20% more moment than calm-water hogging, claims Delta Marine, and sagging values recommended by class societies take into consideration various loading

TECHNICAL PARTICULARS
NG-BULK 20 BULK CARRIER

Length, oa	157.90m
Length, bp	151.50m
Breadth, moulded	23.20m
Depth, moulded	12.50m
Draught, design	8.60m
Draught, scantling	9.00m
Deadweight, design	20,000dwt
Deadweight, scantling	21,000dwt
Gross	14,400gt
Net	7650tonnes
Cargo holds	26,500m^3
Water ballast	8500m^3
Heavy fuel	600m^3
Diesel oil	130m^3
Fresh water	150m^3
Main engine	MAN B&W 8S35MC
Output	5920kW at 173rev/min
Speed, service, design draught, 90%MCR, 10% sea margin	14.50knots



A graph illustrating the efficient hull form in terms of Froude numbers, achieved for the NG-BULK20 by the Bulgarian Ship Hydrodynamics Centre, compared with archive models.

Cross-section through a typical cargo hold.

combinations, including extreme loadings with alternate holds, keeping one hold fully empty or holds 1 and 4 empty while holds 2 and 3 are loaded.

The planned propulsion train is to be a 5920kW MAN B&W eight-cylinder S35MC two-stroke engine, running at 173rev/min and driving a direct-coupled 4.40m diameter FP propeller without any shaft alternator. Instead, three heavy-fuel-burning 550kW diesel-alternators are proposed; interestingly, these are expected to be from Hyundai's new HiMSEN range (*The Naval Architect* March 2005, page 25). A high-lift rudder and a 800kW bow thrusters would be included.

Environmental features

All the requirements of MARPOL are included, as well as future proposals and the Bureau Veritas Clean Sea and Clean Air notations. Engineroom bunker tanks are kept away from the shell, and high-capacity ballast tanks eliminate the need to fill cargo holds, and ballast exchange should become easier. Of course, a double-skin is a further useful aid.

SLF Sub-Committee meets in London

Development of explanatory notes for SOLAS was a major focus of a recent meeting of the Maritime Safety Committee's Sub-Committee on Stability and Load Lines and on Fishing Vessel Safety (SLF). The Intact Stability Code and a variety of guidelines were also considered at the meeting, which was held in London from September 12-16.

THE sub-committee worked to develop explanatory notes on probabilistic damage stability related to the harmonised SOLAS Chapter II-1. Of immediate interest to many were the complex discussions on intermediate stage flooding, equalisation time, progressive flooding, and escape routes. The sub-committee agreed that the following explanatory notes should be contained within a 'living document' with the possibility for regular revision until the entry into force of the new SOLAS Chapter II-1 in 2009.

Regulation 4 - general calculations

When defining flooding boundaries and non-watertight compartments, ie, compartments containing decks, inner bulkheads, structural elements, and doors able to seriously restrict the flow of water, these must be divided in terms of the corresponding non-watertight spaces. Such an analysis does not apply to B-class fire-rated bulkheads normally used in accommodation areas.

The sub-committee agreed that, in terms of sequential flooding computations, the damage extent and its location determine initial flooding. Calculations should therefore be performed in stages, with each stage comprising at least two filling phases (half-full and full) for each flooded space. Each subsequent stage assumes that all connected spaces have been flooded simultaneously until an impermeable boundary or final equilibrium is reached.

In terms of defining escape routes, the sub-committee stated that horizontal evacuation routes on the bulkhead deck only include those routes used for the evacuation of undamaged spaces. At the same time, horizontal evacuation routes do not include partially immersed escape routes.

Regulation 7-3 - Permeability

The sub-committee agreed that acceptable conditions for using non-standard permeabilities should be defined within the explanatory notes. Such permeabilities will reflect the general condition of the ship throughout its service life rather than specific conditions.

Regulation 19 - Damage control information

Guidelines for damage control plans and information to the master were also considered by the sub-committee. However, since there was no majority support for the proposed guidelines, the sub-committee invited members to submit amended proposals to the correspondence group. In addition, the issue of support in emergency situations will also be dealt with by other relevant IMO bodies.

Regulation 22 - Prevention and control of water ingress

In principle, the sub-committee supported the need for guidance on the survivability of open watertight doors. However, there was some concern that the proposed methodology was too strict and that the survivability criteria used were not linked to similar criteria in the regulations themselves.

Intact Stability (IS) Code

Due to recent changes in ship design, the sub-committee considered if the weather criterion should be moved from the mandatory Part A of the draft revised IS Code to the recommended Part B. However, the sub-committee agreed that the present weather criterion should remain as it is in the short term. In that regard, the latest amendments to SOLAS chapter II-1 will not enter into force before January 1 2009, which means that the IS Code, together with relevant amendments to SOLAS chapter II-1, would not be adopted prior to that date. Consequently, the sub-committee agreed that there is an urgent need to provide the industry with a guideline for alternative assessment of the weather criterion through an MSC circular.

On a related issue, some delegations noted their preference for separate guidance on parametric rolling in head seas, while other delegates favoured comprehensive revision of the present guidance. While the sub-committee endorsed the development of guidelines for the approval of stability instruments, it also endorsed the view that performance-based criteria should be developed over the long-term, taking into account the dynamic phenomena leading to large roll angles or accelerations.

The sub-committee agreed that Part B, Chapter 4 on stability calculations performed by stability instruments of the draft revised Code should be referred to the DE Sub-Committee and that Part B, Chapter 5 on operational provisions against capsizing of the draft revised Code should be referred to the STW Sub-Committee.

Passenger ship safety

At MSC 80, definitions of the terms 'casualty threshold' and 'time for orderly evacuation and abandonment' were agreed. The MSC has also decided that future passenger ships should be designed to meet the 'safe return to port' concept after a casualty and that relevant casualty thresholds should be developed. To begin development of the return to port casualty threshold, the sub-committee focused on the new SOLAS regulation II-1/8 and agreed to coordinate its work with an ongoing EU project - SAFEDOR - which is examining flooding prediction and survivability assessment techniques. The sub-committee also requested that the International Towing Tank Conference (ITTC) simulate time-to-flood and related ship motion behaviour of damaged ships.

The sub-committee agreed to develop mandatory requirements for water ingress detection and continuous flooding level monitoring systems with a view to providing the master with real-time information on flooding progression. In addition, the time-dependant survivability of passenger ships in damaged condition was added to the SLF work programme.

Other issues

The 1966 LL Convention

The sub-committee agreed that the 1966 Loadline Convention was not in need of further revision except to harmonise damage stability provisions within IMO instruments. However, at its next meeting the sub-committee expects to discus the problem of hatch cover loading.

Resolution A.266 (VIII)

Given the proposed provision concerning air pipes in compartments used for cross-flooding, the sub-committee had previously agreed to revise Resolution A.266 (VIII). The sub-committee agreed that two issues should be included in the revision, namely cross-flooding times through ducts, and the restrictive effect of counter-pressure in tanks. The issue will now be taken up by a correspondence group, with a target completion date of 2006.

Tonnage measurement: open-top container ships

Following an extensive discussion, the sub-committee agreed to amend the provisional formula of reduced gross tonnage (GT) for open-top container ships. The reduced tonnage should be placed in the 'Remarks' column of the International Tonnage Certificate. Broader issues relating to tonnage measurement were also discussed, including the possible revision of the 1969 Tonnage Convention. While a number of delegations supported the need to address long-term effect of tonnage measurement upon ship design and safety, the sub-committee agreed that these issues are beyond its current mandate.

Ballast water management

The sub-committee will inform the committee that it does not believe that transitory deviation from safety standards should be permitted during ballast water exchange.

The IMO Damage Card

As no documents had been submitted with regard to revision of the IMO Damage Card, the sub-committee invited member governments and international organisations to submit appropriate comments and proposals for consideration at its next meeting.

MSC Circular 650

Proposals to clarify the terms 'existing cargo ships' and 'repairs, alterations and modifications of a major character', as used in MSC Circular 650, were considered, and will be examined further by the Correspondence Group.

Next meeting

The next meeting of the sub-committee will take place from September 11-15 2006.

This report is compiled in association with BIMCO (The Baltic and International Maritime Council).

The Royal Institution of Naval Architects

Advanced Marine Materials & Coatings

22 - 23 February 2006, London, UK

Second Notice

Advances in the technology and application of materials in the marine environment continue. This conference will examine recent developments in the area with additional focus on the use of coatings.

Lightweight structures have always been at the forefront of research. There have been recent advances in the marine use of aluminium and titanium as well as continuing rapid progress in the available range of composites. Steel structures have also been addressed with continuing research into high strength varieties, not to mention steel composite and sandwich materials.

Coatings can be used in marine applications to change a wide variety of material properties. These can range from: paints, which can provide corrosion resistance and antifouling properties; to coatings that can provide increased wear resistance, better mechanical properties or fire protection.

This conference will provide a forum for materials engineers, naval architects and those involved in the manufacture and application of coatings to meet and share recent developments.

Papers are invited on all related topics including the following:

- Lightweight structures
- Impact of Environmental Legislation
- Proposed IMO directive on ballast tank coatings
- Composite overlays for steel structures
- Corrosion control

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Dangerous goods top DSC agenda

BIMCO took part in the tenth session of the Maritime Safety Committee's Sub-Committee on Dangerous Goods, Solid Cargoes and Containers (DSC), held in London from September 26-30 2005.

THE sub-committee considered the casualty report on a container ship, indicating that thiourea dioxide was packed in a container stowed under deck in a hold close to fuel tanks with a temperature of 30ºC. In addition, the hold was not ventilated and regulations did not require temperatures within the hold to be monitored.

The sub-committee therefore considered a proposal to amend the IMDG Code to require either containers carrying thiourea dioxide to be stowed away from radiant heat or that the cargo be carried in reefer containers. However, the sub-committee agreed that the SOLAS Convention and the IMDG Code require shippers to provide appropriate information on the cargo to enable its proper stowage and safe carriage, making such an amendment unnecessary.

The casualty report on another container ship indicated that the ship's dangerous goods list did not show that the ship was carrying 20tonnes of calcium hypochlorite, nor was the cargo declared as hazardous. Furthermore, the container carrying the cargo was not appropriately labelled, leading to the storage of the container on the bottom tier near the heavy fuel service tank and the engineroom.

With regard to this case, the sub-committee considered a recommendation that calcium hypochlorite be shipped using refrigerated containers. However, emphasising that SOLAS requires shippers to declare dangerous cargoes and that they must be carried in compliance with the IMDG Code, the sub-committee agreed that there was no need for a specific requirement for calcium hypochlorite at this time.

BLU Code

On the basis of a proposal from BIMCO and several other industry representatives, the Maritime Safety Committee previously agreed to amend the *Code of Practice for the Safe Unloading and Loading of Bulk Carriers* (BLU Code) by extending the code to ships carrying grain. This amendment will provide grain-carrying ships with protection against unsafe loading and discharging practices. The DSC was assigned the task of beginning the amendment process.

Noting that the *Code of Safe Practice for Solid Bulk Cargoes* (BC Code) has been adopted by the Committee, the sub-committee agreed to identify amendments to the BLU Code that are needed as a consequence of the 2004 BC Code. In particular, the latter made bulk carrier numbers, which had been assigned to certain solid bulk cargoes, obsolete. The sub-committee also recognised the need for amendments to the *Manual on Loading and Unloading of Solid Bulk Cargoes for Terminal Representatives* (BLU Manual) and SOLAS Chapter VI. To begin addressing these issues, the sub-committee established a correspondence group on an extension of the BLU Code to include grain, in which BIMCO was invited to participate.

IMDG Code amendments

The Maritime Safety Committee has agreed that all amendments to the IMDG Code should be adopted at two-year intervals. In that respect, the DSC Sub-Committee is to prepare and agree to proposed amendments. These proposed amendments will then be circulated to all IMO members and SOLAS contracting governments for consideration and adoption by the MSC at the following session.

Adopted amendments will enter into force 18 months later on January 1 of even years. In addition, governments will be invited to apply new amendments on a voluntary basis one year prior to the date of entry into force of new amendments. During that period, dangerous goods must be carried in compliance with either the IMDG Code in force or the Code incorporating the new amendments.

BC Code amendments

The preliminary report on the casualty of a bulk carrier was submitted to the sub-committee. The report indicated that the vessel was carrying a cargo of hot briquetted iron/direct-reduced iron (HBI/DRI) fines from Venezuela to China and experienced a series of explosions in the cargo holds. In that respect, the sub-committee noted that a safety procedure has been developed for the loading and unloading of HBI/DRI fines, which was put forth as an appropriate amendment to the BC Code.

In addition, the sub-committee previously considered the casualty of a general cargo ship where an explosion in a cargo hold blew off the hatch covers. At that time, the sub-committee agreed to a DSC Circular on explosions in cargo holds loaded with recycled aluminium.

On a related issue, the sub-committee considered the proposed schedule for direct-reduced iron fines, although it was unable to agree on limitations regarding the cargo condition at the time of shipment, ventilation or inerting of the cargo during transport. However, the sub-committee agreed to a circular, notifying administrations and others of the dangers of shipping and transporting DRI cargoes. IMO members are urged to submit relevant information regarding the safe handling and transportation of DRI fines to the sub-committee for its further consideration.

Mandatory application of the BC Code

The sub-committee began its task of identifying mandatory and recommendatory parts of the BC Code, and also addressed the need for amendments to SOLAS chapter VI and VII on making the BC Code mandatory. In this regard, the sub-committee established a correspondence group to handle these issues, in which BIMCO will be an active member.

Along with a number of other tasks, the correspondence group will clarify the classification of seed cake (an issue brought forward by BIMCO at DSC 9). It will advise the sub-committee accordingly, and will also consider the development of a schedule for direct-reduced iron fines to be included in the BC Code.

Other issues

The sub-committee discussed a number of other issues relevant to BIMCO members.

Container inspection programmes

A consolidated report on container inspection programmes covering 7301 cargo transport units was considered by the sub-committee. Of these, 1928 (26.4%) were found to have a total of 2975 deficiencies. The sub-committee urged member states that have not yet carried out container inspection programmes to do so and submit the relevant information to the sub-committee.

Guidelines for partially weathertight hatchway covers

SOLAS chapter II-2/19 is applicable to all ships with weathertight hatchway covers, although the Maritime Safety Committee has eased the application of those provisions to container ships with partially weathertight hatchway covers. Therefore, the sub-committee decided not to amend the circular at this time.

Securing containers

At its last meeting, the Maritime Safety Committee discussed incorporating guidance on safe working platforms for the securing of containers into the *Code of Safe Practice for Cargo Stowage and Securing*. The objective was to ensure that ship designers, builders and owners provide adequate arrangements for the safe lashing and securing of containers and the safety of employees concerned. This issue has now been moved to the DSC work programme. In that regard, the sub-committee established a correspondence group that will develop guidance for providing safe working conditions for securing containers.

Magnesium phosphide fumigant

At its 53rd meeting, the Marine Environment Protection Committee noted that discharge of the spent cargo fumigant magnesium phosphide is not prohibited by existing marine pollution prevention conventions. However, the discharge of active packages, which can produce phosphine gas, could pose a significant risk to the public. In that regard, the sub-committee agreed to a draft MSC/MEPC circular addressing the disposal of fumigants.

Next meeting

The next meeting of the DSC Sub-Committee is scheduled for September 25-29 2006.

This report is compiled in association with BIMCO (The Baltic and International Maritime Council).

The Royal Institution of Naval Architects

COASTAL SHIPS & INLAND WATERWAYS 2

15 - 16 March 2006, London, UK

Second Notice

Coastal and inland transport is an essential part of the transport infrastructure. The Rhine, the Kiel Canal, the Dutch waterway system, the Great Lakes of the USA/Canada, and the Chinese river systems are already used extensively for commercial transport.

Although coastal and inland transport is slower than and generally not as flexible as land transport, it does have the advantage of carrying greater payloads. If the advantages are maximised, and road transport becomes more congested in the future it could be considered as a more viable alternative to road transport in some instances. There is currently European research into the possible advantages.

The design of vessels is an important factor, with each area of service having its own specific problems. For example: size or draught constraints, speed restrictions, wash restrictions, and other regulatory requirements. A vast array of commercial vessel types operate around the world's coasts and on its inland waterways. Many of these craft are unique, and have evolved to fill specialised niches on a particular stretch of water. This conference will explore what changes have occurred since the first conference in 1999 and discuss how future demands and regulations could affect the use of coastal and inland marine transport.

Papers are invited on all relevant topics, including:

- Vessel Types: feeder ships: coastal and inland bulk carriers, tankers, container ships; passenger ferries, fast craft, 'split ship' concepts, barges, pusher tugs, refuse lighters, dredgers, waterway maintenance vessels, pollution control and other special service vessels.
- Design: low wash, low emissions, low noise, environmental constraints, cargo/passenger loading, height/width/draught restrictions.
- Operation: economics of cargo transport, problems of high speed.
- Regulation and Leglisation: wash and speed restrictions, pollution.
- Coastal and Inland Waterways: Future development/opportunities, infrastructure/intermodality.

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Siemens expands innovative powering solutions

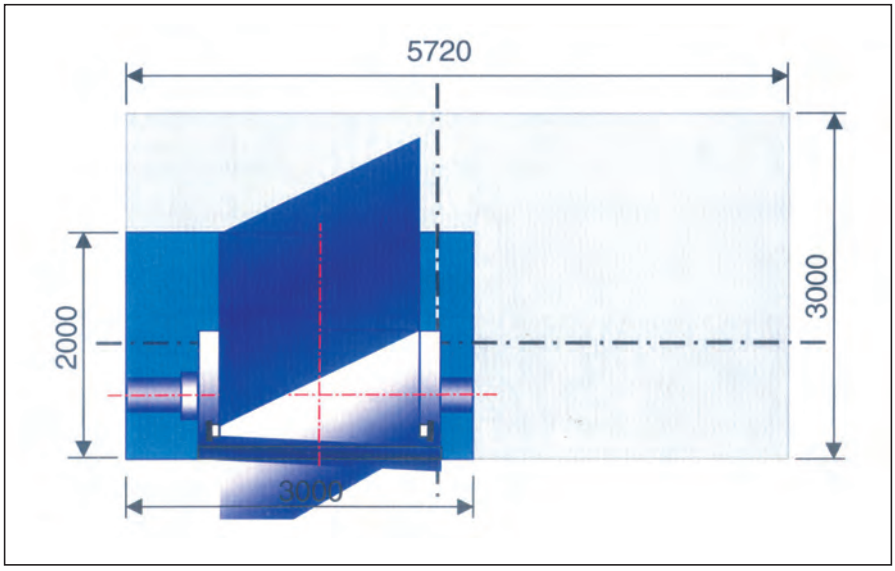
Acting on growing acceptance of electrical propulsion in the marine field, Siemens has developed an array of innovative new solutions aimed at yielding cost, operating and design benefits to users. David Tinsley reports.

A PLATFORM approach to the German company's new offerings is encapsulated in its recently extended series of Siship applications, encompassing all electrical and electronic equipment on board a vessel. At the same time, scope in providing complete powering arrangements has been widened by a new Siship COGES hybrid system for the powering and propulsion of LNG carriers. COGES is an acronym for combined gas and steam turbine integrated electrical drive.

Furthermore, Siemens' bid to strengthen its technological base and future capabilities in marine engineering is evident in the construction of a prototype generator incorporating high-temperature superconductors (HTS). This is currently being put through its paces at the group's Nuremberg test facility.

At a time of unprecedented investment in LNG carriers, and with the dominance of steam turbine propulsion finally broken, Siship COGES has been launched as a compact gas turbo-electric plant promising a very high degree of operational flexibility. The ability of the gas turbine prime movers to burn liquid and gaseous fuels simultaneously, including cargo boil-off, has special relevance to the gas tanker sector.

The high-temperature superconducting generator on which Siemens is conducting tests into this future power source, which could offer many benefits.



A diagram showing the huge reduction in size for a high-temperature superconducting generator, based on 16MW output at 3600rev/min.

Industrial gas turbines at the heart

Siship COGES can deliver around 50MW of electrical energy, supplying two electrical propulsion motors, the liquid gas compressors, cargo pumps and ship's services. Two gas turbines of the SGT-500 type are at the heart of the system, complemented by two heat recovery boilers, a steam turbine and an optional diesel generator. Besides the 17MW output from each of the gas turbines, another 10MW of power is obtained from the waste gases, by means of the heat recovery arrangements and single steam turbine. In addition, a diesel generator of some 5MW can be integrated, if required.

Electrical energy is distributed by either 11V or 6.6V medium-voltage switchgear, and a typical configuration could entail two 20MW propulsion motors. The redundant design of the layout ensures that propulsion power would remain available in the event of subsystem failure.

The SGT-500 is a lightweight, heavy-duty industrial gas turbine, derived from ABB Stal's Swedish-originated GT35. With a proven track record in some 160 industrial applications, the SGT-500 is claimed to be unique for its size in its capacity to operate on a heavy fuel mix with marine diesel oil, making for a substantially lower fuel cost than for other gas turbines, according to Siemens. Moreover, it can be run on a gaseous and liquid fuel mix, enabling cargo boil-off to be used.

The rationale for including a diesel genset as an optional element in the COGES machinery package is to confer additional flexibility or extra margin of power. One motivator for a shipowner to incorporate a diesel genset could be to provide back-up power when the vessel requires full power in a very hot climate, given the fact that the output of turbine machinery is somewhat lower at high ambient temperatures.

Furthermore, diesel genset capacity may also be used in support of a shipboard reliquefaction plant. Reliquefaction systems, such as those specified for the new generation of two-stroke diesel-engined LNG carriers ordered for Qatar export traffic, could be incorporated if gas prices rise to a level which makes it more attractive to run the gas turbines on a cheaper heavy fuel mix.

Siship COGES also embraces the automation and control for all the onboard systems, covering the power generation and distribution arrangements as well as the propulsion motors,

2005 RINA
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Nominations are invited for the 2005 RINA - Lloyds Register Ship Safety Awards.
Entries close 1st January 2006

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

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

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

There are separate categories for universities and industry. An Award of £1500 is made in each of the categories and will be presented at the 2006 RINA Annual Dinner.

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

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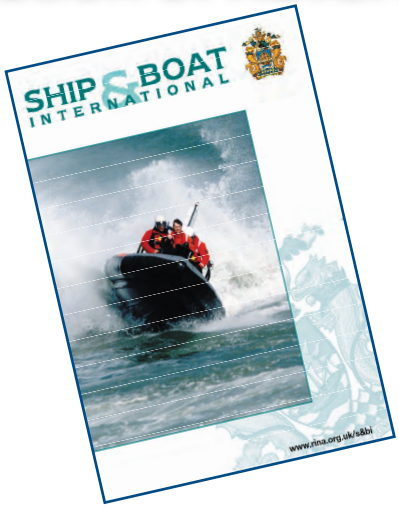

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cargo monitoring and safety systems. Automation and control is based on distributed S7 units, reducing the amount of cabling needed and increasing fail safety.

In addition to the gas turbines, Siemens can source both the steam turbine and the heat recovery steam generators from within its own organisation. The Siship COGES concept has been developed by the Industrial Solutions & Services arm, which acts as system integrator and service provider, drawing on the wider group's electrical and technical products.

Platform solutions

Competition is compelling the shipping industry to continually increase operational availability and safety, to optimise shipboard space for revenue-earning purposes, and to reduce operating costs at the same time. Siemens' strategy fostered over the past two years has been to link propulsion and electrical systems, automation and after-sales service in comprehensive solution platforms. These are said to facilitate planning and installation for shipyards, and yield advantages for shipowners in terms of vessel operation and management.

Standardisation of electrical equipment is a positive development, in the light of the increasing complexity and demands of ship design and operations, and the approach is claimed to offer lasting merits compared with conventional stand-alone solutions. A recent addition to Siemens' platform strategy has therefore been Siship PAX, covering all electrical and electronic equipment aboard cruise liners and ferries.

Siemens has also widened the market reach of its Norwegian-developed Siship Drive LV concept by formulating a diesel-electric, low-voltage propulsion solution for offshore vessels and special-purpose ships. This concept is based on pre-configured components tailored to shipbuilding requirements, and including generators, converters, switchgear, and propulsion motors.

The arrangements have been drawn up mindful of the conditions in which offshore vessels ply their trade, and which place particular demands on the operating safety of diesel-electric propulsion units. For instance, rapid load changes, abrupt stopping, and the lifting of the propeller above the water surface in rough seas present certain risks to a propulsion train. Control and safety elements encapsulated in Siship Drive LV are intended to ensure fail-safe operation under all operating conditions, and attendant high availability.

The switchgear equipment used within the framework of Siship Drive LV has been devised specifically for marine use, and employs the P^3 (power plant protection) safety solution and PMA 300 power management system. P^3 detects critical operating states of the generators and will disconnect a generator from the supply before any damage can be caused. Through recourse to the management system, electrical energy generation can be automatically restarted after a failure.

Initiatives in superconducting motors

Siemens' initiative in high-temperature superconductor (HTS) generator development could offer a new ship propulsion solution for the future. An HTS generator dimensioned to produce about 4000kVA at 3600rev/min is being run on one of the Nuremberg testbeds, to verify its suitability for shipboard duties and other applications. The savings potential offered by the 'low-loss' HTS technology is claimed to be considerable, especially in the context of all-electric ships. Germanischer Lloyd is following the progress of the project, which is sponsored by the Federal Ministry for Education and Research (BMBF).

HTS motors use superconducting windings instead of copper, generating a more powerful magnetic field, offering higher electrical efficiency and allowing the use of machines of very much reduced volume and weight for a given power (as also explained in *The Naval Architect* June 2005, page 47, with Japanese development work). A key target market for Siemens will be the large cruise-ship sector, in which the 'power station' concept is well established, whereby main generators driven by diesel engines or gas turbines provide the energy source for the considerable hotel load electrical requirement as well as electric propulsion motors.

The new synchronous generator is a joint development of Siemens Corporate Technology, Siemens Industrial Solutions & Services, and the group's Automation and Drives arm. The HTS wire has been designed and manufactured by another German firm, European Advanced Superconductors, of Hanau.

Experience gained from earlier long-term tests with a superconductive 400kW demonstrator motor, plus Siemens' know-how in the field of large drives, have all impinged on the design of the new 4000kVA synchronous machine.

Power generation contract for Aida cruise ships

In the meantime, Siemens has augmented its references in the cruise-ship market by landing a contract for the power generation and propulsion machinery, and automation systems to be fitted in Aida Cruises' two 68,500gt diesel-electric newbuildings at Jos L Meyer's Papenburg yard.

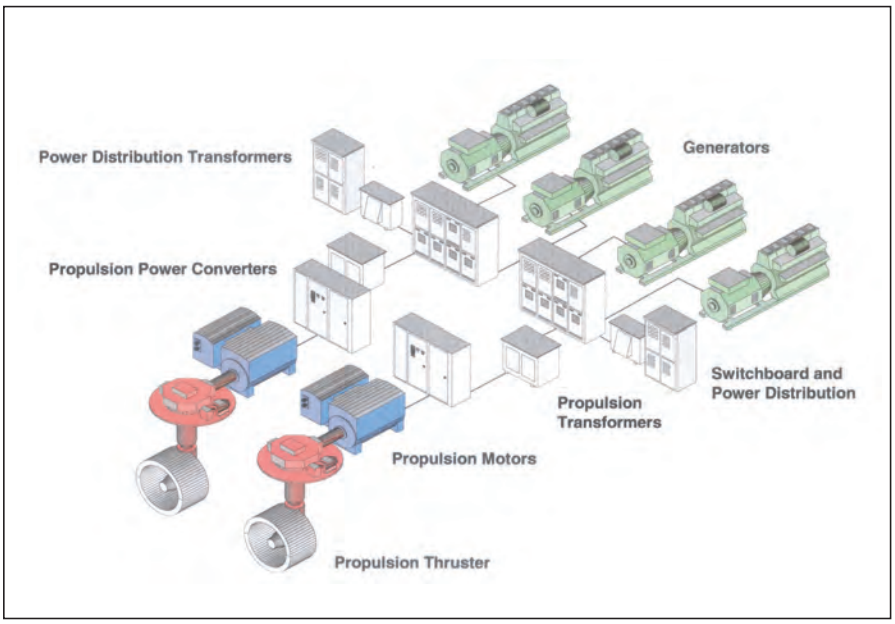
Four diesel-based gensets will produce approximately 36MW, and the two propulsion drives in each vessel will have a unitary output of 12.5MW, to ensure a speed of at least 21knots. Key features of the two propulsion motors will be an extremely low level of noise and vibration, and the adoption of two winding systems in each, individually fed from a separate converter. These arrangements promise improved propulsion system availability, since a malfunction in one of the phase windings should still enable the affected motor to produce 55% of its rated output.

Siemens is also supplying the four synchronous generators, to yield a total 48MVA, and covering the entire shipboard electrical power requirement. Power distribution throughout will be undertaken by a new, proprietary energy management system, employing medium-voltage switchgear. An open interface will be incorporated for the Siship IMAC marine automation system, handling all supervisory, alarm and control functions. Aida's 2030-passenger-capacity newbuilds are scheduled for handover in the spring of 2007 and spring of 2009.

An earlier contract award this year will see the company provide the power supply, propulsion and automation systems for two *Caribbean Princess*-class diesel-electric cruise liners to be delivered by Fincantieri to Carnival Corporation in 2007 and 2008.

Primary elements will be two propulsion motors in a system based on the Simar Drive Synchro concept, and six synchronous generators with a total output of 81.6MVA. Strengths of the diesel-electric mode in such applications include a high degree of operating flexibility, and improved environmental performance with regard to noise and vibration and exhaust emissions relative to diesel-mechanical drives.

An example of a typical low-voltage 'platform' power solution being offered by Siemens for a modern diesel-electric plant.



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In connection with this ambition, as of January 1, 2006, the Department of Marine and Transport Engineering, Faculty 3mE (Mechanical, Maritime and Materials Engineering) is offering:

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Education is focused on the two-year M.Sc level curricula of Marine Technology, Mechanical Engineering, Offshore Engineering and Transport/Infrastructure/Logistics while the chairs contribute to the three-year B.Sc curricula of Marine Technology, Mechanical Engineering and Civil Engineering.
The professors are expected to give leadership to their research group as well as to the coaching of graduate students and PhD's. They will initiate and maintain good relations with both national and international industries, universities and other relevant organizations, and initiate and implement research projects. The University offers these positions in an inspiring and challenging environment with laboratory facilities.
The Department has recently been reorganized and wants to be a visible and recognized scientific group at the global level.
We invite possible candidates to reflect on these vacancies and help us shape the Department into a world-leading position. Candidates should meet the following profile criteria:

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- Mechanical or Marine M.Sc degree engineers who have been working in the industry and/or research institutes for a number of years and who have a good network in the industry and relevant organizations.
  Alternatively, a Civil or Aerospace M.Sc degree engineer with sufficient background in Mechanical and Marine Technology.
- Experienced in carrying out research and publishing, especially at the interface of the various supporting disciplines. The University requires this to be proven through publications and/or preferably a PhD thesis.
- A highly motivated teacher, capable of working with and stimulating students at all levels to discover the art of Engineering.
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- Able to motivate and stimulate others within the University to carry out specific research and/or educational activities and to integrate their various results into improved designs.
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Further information

For further information about these vacancies contact: Prof. dr. ir. G. Lodewijks, Chairman of the Nomination Committee, Tel: +31 15 278 87 93. E-mail: G.Lodewijks@3mE.tudelft.nl

Application

Send your letter of application along with a complete resume before January 1, 2006 to: Mrs. drs. I.M.J.M. Emmerik, Department of Personnel and Organization, Faculty of 3mE, Mekelweg 2, 2628 CD Delft, The Netherlands. Tel: +31 15 278 58 94.
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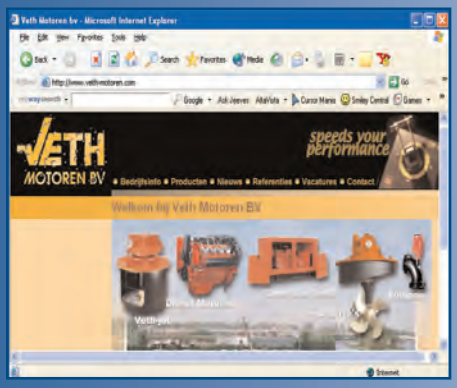

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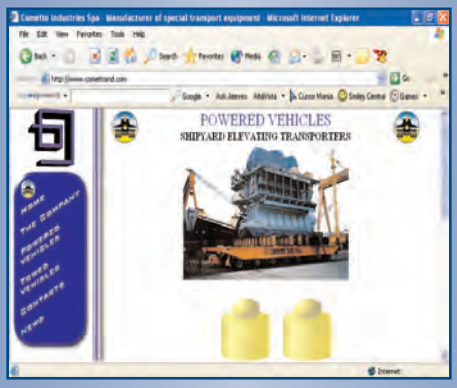

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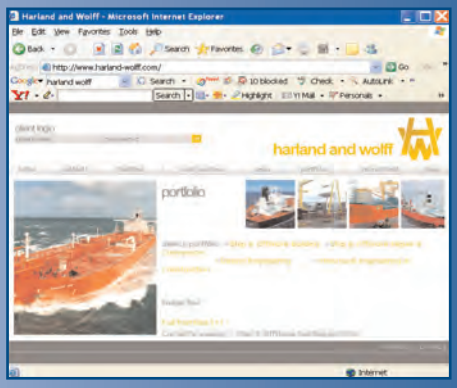

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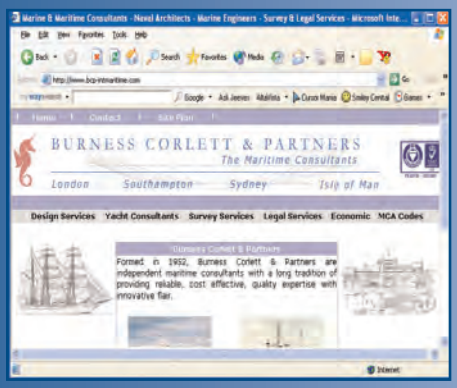

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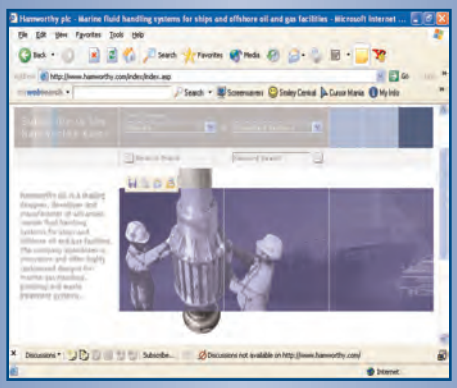

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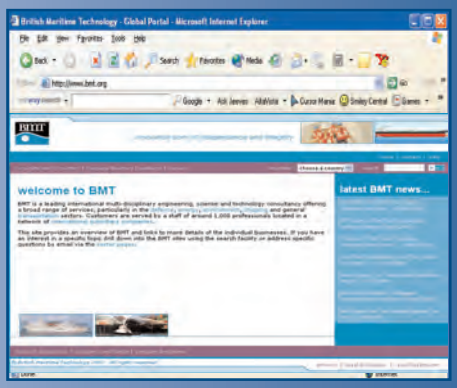

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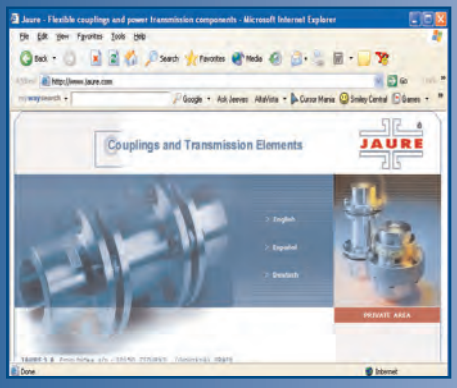

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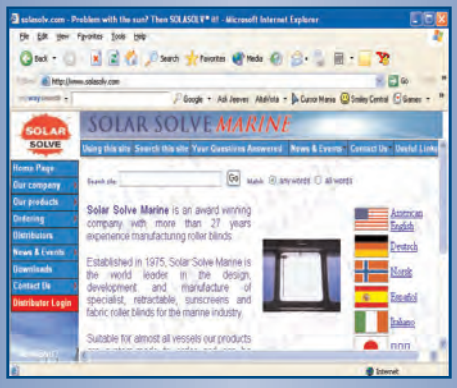

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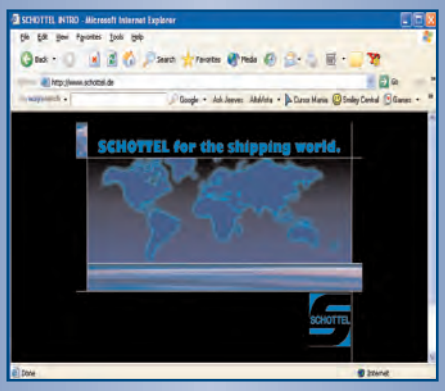

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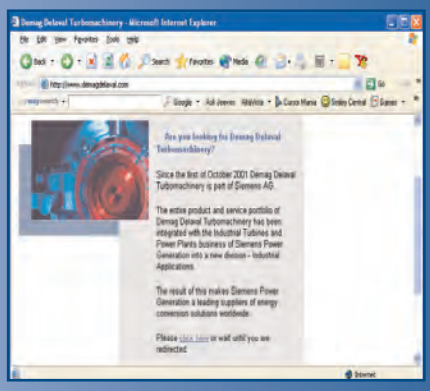

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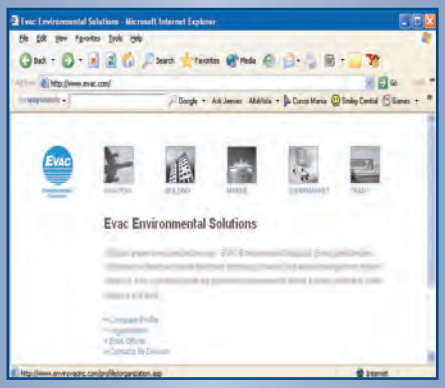

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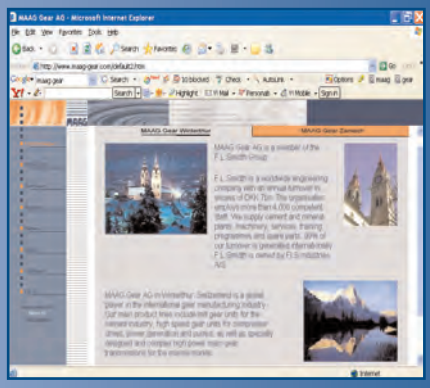

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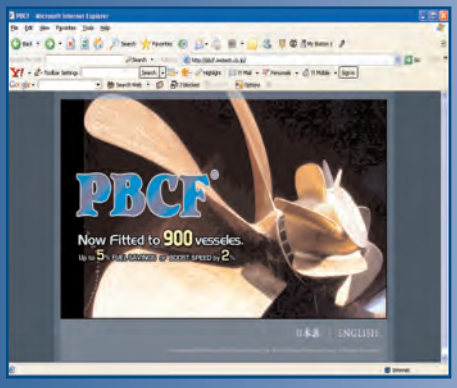

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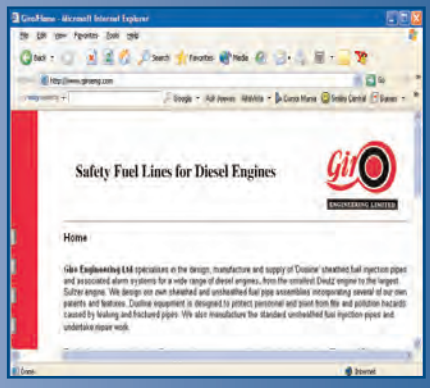

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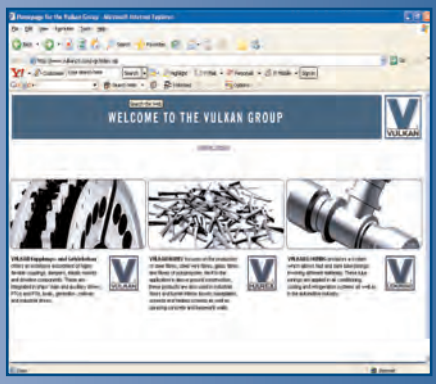

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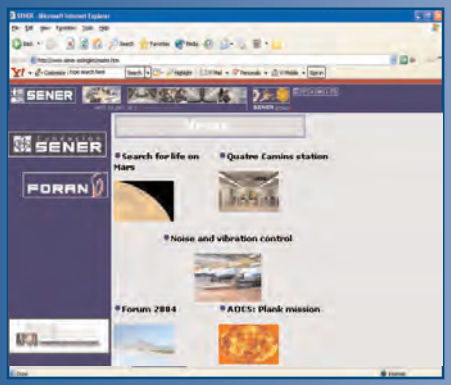

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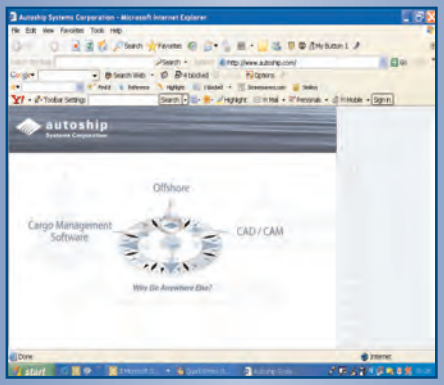

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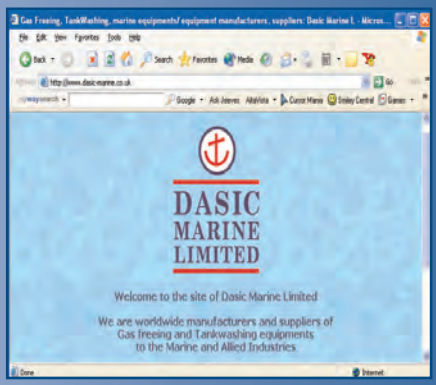

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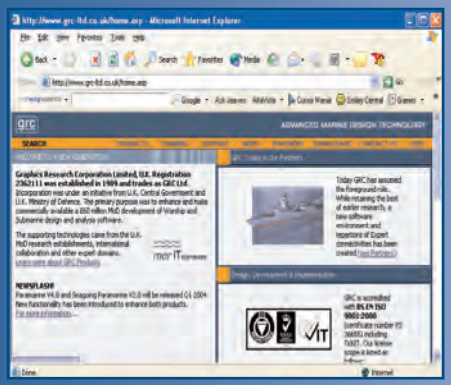

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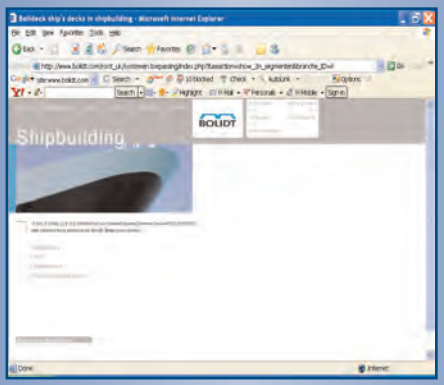

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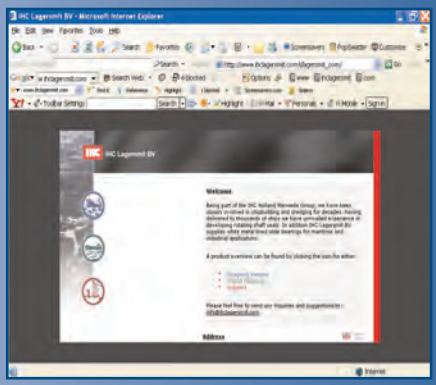

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