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Seen here on her recent sea trials is the 74,000m³ pioneering new-generation LNG tanker *Gaz de France Energy*. Built by Chantiers de l'Atlantique, she heralds a whole new era in LNG transport, since not only is she installed with the first example of the new GTT CS1 cargo containment system but she also features a dual-fuel-burning diesel-electric propulsion plant. The LNG market is currently most active, and some of the newest advances are discussed in our Editorial Comment on page 3.

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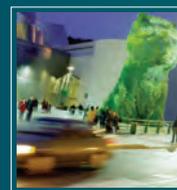
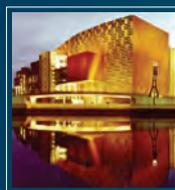
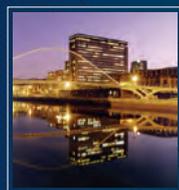
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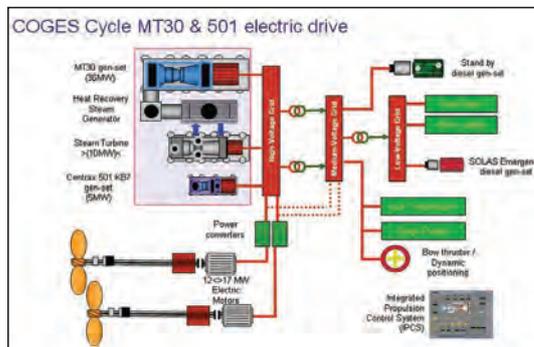
Rapid advances in LNG carrier orders and technology

SINCE we published our special supplement last September, *Design and Operation of Gas Carriers*, the bubbly world of LNG has moved further forward on several fronts. Bold pioneers are leading the industry into hitherto uncharted realms, where naval architectural and marine engineering skills will be taxed to the full. Probably the most significant of these vanguard advances involves the decision by a joint venture operation between US-based Overseas Shipbuilding Group (49.9%) and Qatar Gas Transport Co (50.1%) to order the first-ever really giant ships - of 216,000m³ capacity. Such designs have been discussed in this journal but this is the first time that they have become reality. It is not yet known which containment system has been chosen but it seems most likely that they will be of the membrane type.

These ships will also be notable in that they will be hauling gas under the QatarGas 2 project to a brand-new terminal to be built at Milford Haven in Wales (UK) over a period of 25 years. Total contract price is more than US\$900 million. Further similar-sized designs (210,000m³) have been ordered by the German company Pronav at Daewoo (DSME) but at the time of going to press, details were not known. More contracts for ships up to 250,000m³ are expected to follow soon.

Apart from their size, major departures for the OSG hulls, two of which will be built by Hyundai Heavy Industries and two at Samsung, will be a choice of twin propellers and a decision to power them using slow-speed diesel engines

Waiting in the wings: proposed components of an optimum propulsion plant for a 200,000m³ LNG carrier with twin propellers, based on a Rolls-Royce MT30 gas turbine operating on a combined gas/steam/electric (COGES) cycle.



solely burning heavy fuel, and with all cargo boil-off reliquefied. This is the first time ever that such technology has been specified, although details were fully discussed in our *Gas Carriers* supplement.

The engine design chosen for these titans will come from the MAN B&W stable and will be of the latest ME two-stroke type without camshafts and with electronic control of fuel injection. Each vessel will be installed with two 6S70ME-C models (2 x 18,660kW). MAN B&W's Holeby works will also supply four 7L32/40 auxiliary engines for alternator drive (4 x 3500kW) - an extra large electrical capacity will be needed for the reliquefaction compressors, which can absorb up to a huge 4MW (a possible detraction, according to some). This contract will certainly delight proponents of diesel technology for such ships, since it is more than 30 years since the dual-fuel *Venator* (with special Sulzer two-stroke machinery) went to sea. We shall have to wait for news of which propulsion machinery has been chosen for the Pronav series.

Reliquefaction plant will be supplied under a turnkey contract by Hamworthy Plc, which holds a worldwide licence for the Moss system (discussed in our *Gas Carriers*

supplement, page 20). Hamworthy has a confirmed order for the OSG vessels and holds a letter of intent for the Pronav designs; total value is £48 million. This leading British company, which has been working for several years with top Korean shipbuilders and with oil majors (notably ExxonMobil) on this cutting-edge technology, holds options with Korean yards for a further 11 sets!

According to Lloyd's Register, up to 48 carriers of 200,000m³ and above will be needed for the QatarGas and RasGas projects alone, with a further 100 vessels of lesser dimensions for other projects. One spin-off anticipated in the wake of very large LNG ships is a new generation of floating docks specially ordered for pre-delivery inspection. As reported in our Samsung special supplement in June 2003, that Korean builder is already assembling FPSOs in a floating dock, and when the yard's new floating crane is complete, sections up to 3000tonne will be able to be lifted into it.

Another most significant contract in recent weeks has been that for four more dual-fuel-burning diesel-electric ships (plus four options) of the 155,000m³ class (more or less the maximum standard size today). These have also been placed in Korea, but this time by BP. The order has been split between Hyundai's Ulsan site, and at its associate yard, Samho Heavy Industries (formerly Halla), at Mokpo, which is a newcomer to the LNG sector. All four ships will be classed with Lloyd's Register.

Unsurprisingly, the machinery chosen to generate primary power on these new designs comes from the Wärtsilä stable. Each ship is to be installed with medium-speed engines: two 12-cylinder and two nine-cylinder engines of the 50DF dual-fuel type in each ship, with a total output of 39.9MW.

At the same time as all these exciting developments, tenders are believed to be out for a third alternative propulsion option: gas turbine-based machinery. Certainly, manufacturers are poised to strike, as explained in a special article elsewhere in this issue, and a contract in the LNG sector would be hailed as a critical landmark.

Great interest is also currently centring on ice-classed LNG tankers, partly for Sakhalin fields in the Russian Far East. An important factor is that Russia holds 31% of all known natural gas reserves, according to Lloyd's Register, with the largest fields in the Arctic region, under the Barents and Kara Seas. Sakhalin needs hulls strengthened for first-year ice but Arctic LNG carriers will need to be much stronger to deal with multi-year ice. However, current plans envisage gas first being piped to Murmansk where it will be liquefied for onward sea transport. This market, only likely to open up after 2010, could possibly - according to some - even see LNG tankers being built in Russia itself - an exciting prospect!

Meanwhile, on the membrane cargo containment front, industry observers believe that despite the time taken to accumulate the advanced skills in assembling containment modules, it is possible that some yards using the GTT NO96 concept may switch since the insulation thickness needed in greater than the Mk 3. Apart from GTT's new CS1 concept, other candidates are a new system being created and proposed by Korean Gas, also Ocean LNG's cylindrical tank (see page 4 of this issue), and the hitherto unknown prism concept of ConocoPhillips.

Despite all this positive activity for our industry, it is sobering to be reminded by some analysts that at the current rate of natural gas consumption, including 32% burned in the USA, reserves will only last for another 68 years! 

Largest-ever LNG carriers ordered

IN recent weeks, the much-heralded arrival of more new-generation LNG carriers has finally become a reality, following the pioneering lead taken in 2002 by Gaz de France with two diesel-electric ships at Chantiers de l'Atlantique; all the newly-ordered hulls (believed to be membrane types) will be built in Korea. Perhaps the most notable contract is that placed by **Overseas Shipbuilding Group** for the largest-ever designs: four 216,000m³ ships to be powered by heavy-fuel-burning slow-speed diesel engines in association with cargo reliquefaction machinery; two will be constructed by **Hyundai Heavy Industries** and two by **Samsung**. These ships are planned to haul gas from Qatar to a new terminal to be built at Milford Haven in Wales. Further ships of 210,000m³ have been ordered from **Daewoo** by a Germany company, **Pronav**.

Just prior to this order, **BP Shipping** booked four 155,000m³ membrane-type vessels, plus four options, from **Hyundai Heavy Industries**; three of the total are planned to be built by Hyundai's associate yard, **Samho** (formerly Halla) Heavy Industries. All will feature diesel-electric propulsion with dual-fuel diesel engines. More details about these new contracts appear in our Editorial Comment.

NEW LNG TANK CONCEPT - The US classification society ABS has very recently given approval in principle to an interesting new cargo tank containment system. This is a cylindrical tank with spherical dished ends that has been developed by Houston-based Ocean LNG Inc. The company has also designed a 183,000m³ ship, into which could be fitted five of these tanks, each of 36m diameter and 40m high and with a cargo capacity of 36,000m³. The tanks are designed according to the IMO Type B independent code and based on leak-before-failure principles, also they are conceived to minimise filling restrictions due to sloshing effects - an important feature for vessels carrying part-cargoes. Ocean LNG additionally claims a 25% increase in cargo carrying capacity for a given hull form when compared with spherical tanks.

HOLIDAY SHIP FOR THE DISABLED - An interesting new contract signed by Merwede Shipyard, in The Netherlands, is for an inland cruising vessel specially adapted for sick and



This cylindrical LNG cargo tank, newly designed by Ocean LNG, of Houston, USA, is built to IMO Type B independent principles. It will be fabricated from a nickel-steel alloy (still being developed) and insulated by similar techniques used in competing systems. The concept claims several interesting benefits over existing spherical designs.

handicapped people. It has been ordered by the Dutch Zonnebloem national association to replace a 20-year-old vessel and will be considerably larger. Both single and double cabins will be installed, and all will have en-suite facilities. The new ship will additionally be faster and more manoeuvrable than her predecessor, and Zonnebloem expects that it will enable 2850 people to be given holidays annually - many more than the current 600.

TWO RO-PAX FERRIES FOR STENA - A pair of new 3100lane metre ro-pax ferries have been ordered by Stena Line to expand its North Sea driver-accompanied freight services from Hook of Holland to Killingholme, in the UK. The 7500dwt ships will be built in Norway by Fosen

Mek Verksted to a new design, the Stena Seabridger class, but hull fabrication has been subcontracted to Baltiysky Zavod in St Petersburg, Russia. Service speed will be 22.20knots.

INTERNATIONAL PAINT IN JAPAN - As planned, International Paint is now operating in Japan in its own right, alongside established Akzo Nobel companies there, following an agreement to end its long association (through International Coatings) with Nippon Paint, whereby marine coatings were licensed between the two organisations, which also cooperated in providing support and services. Now, each will pursue its own goals.

INNOVATIVE TECHNOLOGY AT HYUNDAI - The world's largest shipyard, Hyundai Heavy Industries, continues to impress: in recent months two significant technical advances have been made. Firstly, the employment of offshore construction technology in shipbuilding, by building a 105,000dwt tanker 'on the ground' and launching it by a jacking and floating barge process, already used at Ulsan for offshore vessels. Secondly, adoption of a so-called 'furan' method of propeller casting, which now enables the yard to cast two propellers weekly, compared with one using the previous cement method. It is expected that propellers weighing more than 100tonnes can be cast by this technique in the future.

GERMAN YARD AGREEMENT - In October last year, an agreement (forecast in our September German report, page 38) was signed to form a new shipyard alliance. Under this, ThyssenKrupp Werften and Howaldtswerke-Deutsche Werft (HDW) will merge to form a new group under Thyssen Krupp Marine Systems. This new union will include the HDW yard at Kiel; Nobiskrug, at Rendsburg; Blohm & Voss and Blohm & Voss Repair, in Hamburg; Emden-based Nordseewerke; Kockums AB, in Sweden; and Hellenic Shipyards, Greece.

ICE KNIFE ON RO-RO SHIPS - The profile of the new forest products ro-ro ships ordered from Stocznia Szczecinska by Spliethoff (discussed on page 21 of our November issue) will feature an unusual icknife above the bulbous bow, which was not included in the illustration. This is an owner's requirement, found from experience to be beneficial in trading regularly to Baltic ports during winter. It has been used on Spliethoff's earlier paper carriers, as on *Stadiongracht* presented in *Significant Ships of 2000*, also built at the Szczecin shipyard, and *Schippersgracht*, from Mitsubishi, featured in the same publication. Ⓜ

A computer-generated impression of the new ro-pax ferries to be built for Stena Line by Fosen Mek Verksted, using hulls to be fabricated by Baltiysky Zavod in St Petersburg.

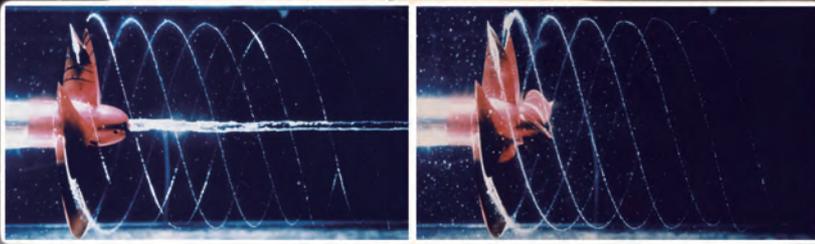


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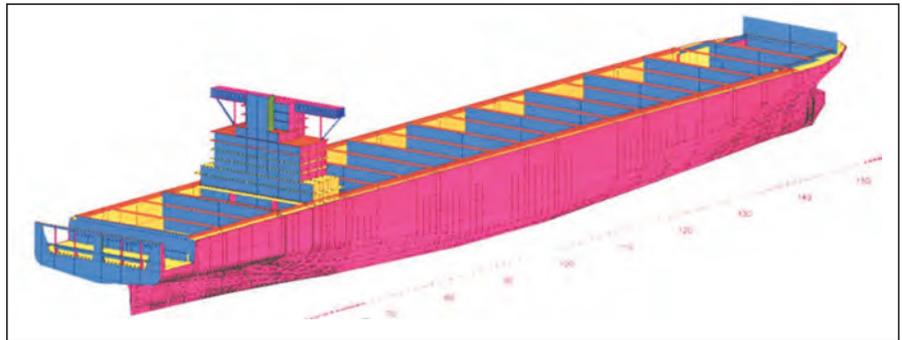
Container ships provide continuing prosperity - and challenges - for Germanischer Lloyd

IN an atmosphere of continuing financial health, Germanischer Lloyd has secured a contract to class and supervise construction of another series of very large container liners to boost its continuing strong lead in this sector. This will comprise four vessels of 8530TEU, plus one option, to be built at the Chinese yard, Hudong-Zhonghua, for the state-owned China Shipping Group; they will be the largest container vessels to be built in that country; up to now the biggest container ships at Hudong-Zhonghua have been 5618TEU designs.

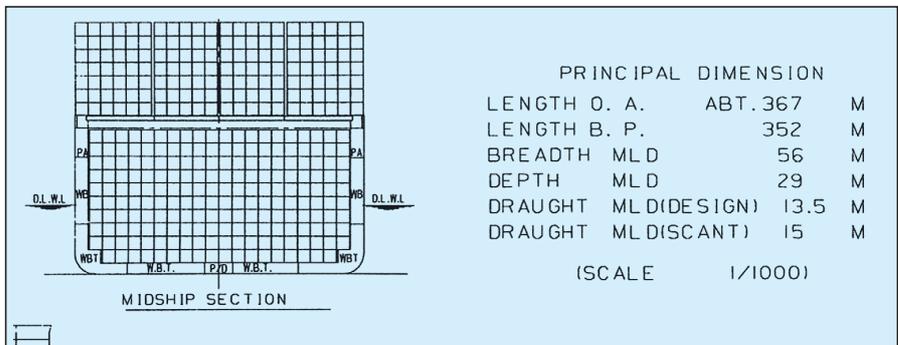
The ships' design will include technical features resulting from the cooperation between GL and Hudong-Zhonghua, which began in mid-2003. The new ships will actually have dual class, being also constructed to the standards of the China Classification Society. They will have a length bp of 320m, with a breadth of 42.80m, a moulded depth of 24.80m, and a draught of 14.65m - dimensions will make them largely similar to the 8100TEU GL-classed ships currently being built for CP Offen and Conti at the Samsung yard in Korea. Notations will be: +100 A5 Container Ship, Equipped for Carriage of Dangerous Cargoes, RSD and STAR, EP, ERS, and NAV OC. Delivery is expected in 2008.

More and more giant container liners are expected to be ordered, believes the society, as globalisation continues and as more than 70% of all cargoes are now carried in boxes. Already, 9200TEU designs have been ordered, including those by CP Offen (again at Samsung) and GL has invested a great deal in perfecting strong structures with no compromises in favour of container slots. Already the German society is claiming for other 9200TEU ships being classed by competitors that hull strength 'would not be acceptable (to GL)'.

At the same time, detailed studies are continuing into ships above 10,000TEU. Here, the deckhouse is likely to be separated from the machinery and positioned towards the bow, with the complete closing off of a hatchway in order to check global torsional deformations. To prevent hatch cover deformation and lashing problems, the open-hatch concept may once again find favour, with open holds positioned



Geometric model of a proposed 25knot 10,000TEU container liner, studied by Germanischer Lloyd using its Poseidon software. This ship would have a length bp of 335.00m, a breadth of 49.00m, depth of 27.60m, and a scantling draught of 15.00m. Deadweight is expected to be 115,000dwt, and the block coefficient would be 0.64.



Some owners are considering even larger vessels, such as this Germanischer Lloyd 12,000TEU proposal, with 22 rows across the deck.

behind the deckhouse; the closed-off forward hatch could be converted into fuel tanks protected by a double side-skin.

Four-stroke machinery and steam turbines for future container giants?

In interesting comments on technical challenges for really large container ships for the future, Dr-Ing Hermann Klein, a member of GL's executive board, notes that, according to an HSVA study, two seven-cylinder two-stroke engines with two propellers could well provide better propulsion efficiency than one 12- or 14-cylinder machine, although costs might rise by 5%-7%. At the same time, consideration is

being given by some owners to a switch to four-stroke diesel engines due to bulging order books for two-stroke machinery at major engine plants worldwide. Even more revolutionary is the consideration that, in a world of possibly declining oil reserves but still large coal deposits, our industry might see a resurrection of coal-burning, steam-turbine-driven machinery for future container liners!

Another new contract for the German society will be the classification of two 2487-passenger cruise liners recently ordered from the Meyer yard at Papenburg by German operator Aida Cruises. These 68,600gt designs will have a speed of 22knots. ⚓

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Norway's marine industry - facing up to globalisation

Richard White examines the challenges today being met quite successfully by companies operating in this high-cost country. A tough situation could hopefully be improved by new plans for more state investment in R&D, and by programmes to shorten the time between concept and commercialisation.

FOR a country with such a small population, Norway has an extremely large maritime industry, with world-leading companies involved in ship owning and operation, ship design and construction, and marine equipment production. To maintain and build this activity is a major challenge for a land with a high cost of living and labour rates many times greater than Asian or former Soviet-bloc countries. On the other hand, Norway is the world's third largest exporter of both oil and gas, and the offshore sector is a powerful generator of business for the marine industry.

Although labour cost is high, there is a smaller differential between the pay of fitters and welders, for example, and highly qualified engineers than in many competing countries. Thus, while vessel steelwork fabrication has to a large extent been subcontracted to Poland, Romania, or Asia, Norway can compete with knowledge-intensive activities such as ship design, and manufacture of equipment with a high technical content.

There is also a focus on creating and strengthening 'maritime clusters.' These aim to increase competitiveness by assembling a range of knowledge and skills. Operating knowledge comes partly from local shipowners placing orders with local yards, using local designs. Building the vessels provides direct employment, even where the hull and superstructure steelwork is shifted abroad, while much of the contract price represents equipment that is locally sourced.

Where local investors and banks with detailed knowledge of the industry are also involved, the result can be a cluster with strengths that individual companies could not offer. The weakness is that the concept is vulnerable to the boom and slump cycle typical of the marine industry, though this can be offset by other clusters - for example, fish farming or the furniture industry of the Sunnmøre region.

Norwegian shipyards have adopted different survival strategies. Efficient steelwork module production by the yards themselves, in parallel with pre-outfitting of modules, has had to give way to production in lower cost countries. Tactics include ownership or control of foreign yards, for example Aker Yards in Romania, or Ulstein Verft building hulls in Poland. Equipment suppliers have also had to face rapid globalisation and have come up with different strategies, some of which were reviewed at a recent conference (Verftskonferansen 2004, held at Ålesund, Norway. www.tbl.no).

Typical is Brunvoll, a family-owned internationally known name in thruster production based at Molde, which has found a satisfactory answer in highly automated production in Norway, even though 85% of the some 200 systems a year

are exported to 18 countries, including China and Korea. That company has a short management chain and places emphasis on advanced technical development and design for production. Whilst the equipment is made in Norway, Brunvoll also focusses on providing efficient worldwide service.

The furniture company Ekornes, whose Stressless range is sold worldwide, also concurred in backing design and automated production in Norway, while Rolls-Royce, as a global company with a very broad equipment portfolio and its own ship design business, takes a different approach. It has analysed the business process and all product components, and formulated a buy/make policy. Items are graded according to their level of criticality and how efficiently Rolls-Royce can make them itself. Based on this, the decision is made to buy in components, control their manufacture, protect the supply of critical items by, for example, forming partnerships, or manufacture in-house elements or products that are both critical and which Rolls-Royce can make competitively.

Ship and propulsion system design is an intellectually-intensive activity that provides substantial employment in Norway as well as a profitable export. Names such as Vik-Sandvik and Marin Teknisk are well known. UT-Design in Rolls-Royce has a strong position, providing both designs and integrated packages of equipment. The recent upsurge in the Brazilian shipbuilding industry has been largely based on offshore vessels of UT-Design, and apart from the home market, many UT-series vessels are built in the Far East.

This time last year Norway's shipbuilding activity was at a historic low, and several yards were building on speculation to keep a core workforce together or were almost operating on a care and maintenance basis. In recent months, however, business has picked up dramatically as confidence in the offshore sector returns, although in the high-quality passenger-vessel sector, where Norway retained an ability to build to a high standard, there has been a dearth of orders.

However, focus on EEZ management and pollution control has helped to reduce dependence on offshore, with Aker and Kleven Maritime currently building coastguard-type vessels for Norway and France respectively. New concessions have been awarded for the operation of double-ended ferries, which are a vital part of Norway's transport infrastructure. This will lead to the building of at least five gas-fuelled vessels, as well as the replacement of some aged tonnage by new designs and concepts, such as Fjellstrand's FerryCat.

Can Norwegian yards compete in building other types of vessel? Design capability is there, as are the facilities. One viewpoint is that the level of cost is such that only complex vessels are within reach; others believe that if politicians provide support for yards comparable with the EU, different ship types are viable. The future is likely to bring developments in coastal and shortsea shipping, where innovative concepts and improved cargo handling can make the politically desirable shift of freight from road to water more attractive. Fast vessels for transporting products from the fishfarming industry to external markets are one niche, while it is argued that Norway can successfully compete on product tankers, smaller gas carriers, and even simpler ship types - as long as they are built in series.

What is widely seen as a weakness is the low level of state investment in research, combined with a need to shorten the route and time needed to shift from an academic idea to commercialisation. Steps are being taken to improve this situation. One example is CeSOS, the Centre for Ships and Ocean Structures, supported by the Research Council of Norway, located at the university in Trondheim and sponsored by Det Norske Veritas, Hydro, Statoil, and the Norwegian Shipowners' Association. Its aim is to generate new, basic, knowledge about how ships and marine structures behave in a chaotic sea, paving the way for innovative designs and operational procedures. 

Cruise and specialist orders for lifeboats

LIFEBOAT and davit manufacturer Schat-Harding reported strong order books for lifeboats and davits in the third quarter of 2004. Orders totalling US\$16 million were booked, with demand strong from operators for units to be installed on passenger ships, offshore platforms, LNG carriers, ice-class tankers, and naval vessels.

Key passenger ship orders included six CTL38 cruise tenders and 14 MPC32 compact cruise lifeboats with PD davits for two MSC newbuildings at Chantiers de l'Atlantique, eight MPC32 boats and VIP davits for a series of ro-pax ferries building at Italy's Visentini yard, and two MPC32 boats with davits for the

lengthening of RCCL's *Enchantment of the Seas*. Offshore orders included two KISS800 systems for the Atwood Beacon platform, four KISS boats and davits for Pemex, and two MCB 600 boats for the Dolphin Energy project.

Specialist orders include four MCB28 boats and davits for a Russian icebreaker, and four KISS700 boats and davits for two icebreakers to be built at Norway's Havyard Leirvik, and two MCB24 boats for the LNG carrier building for Kristen Navigation at Korea's Daewoo yard. The Portuguese Navy has also ordered Schat-Harding davits for its 10-ship offshore patrol vessel series. 

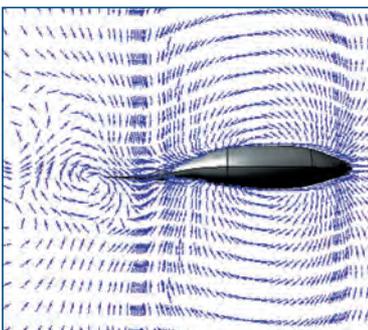
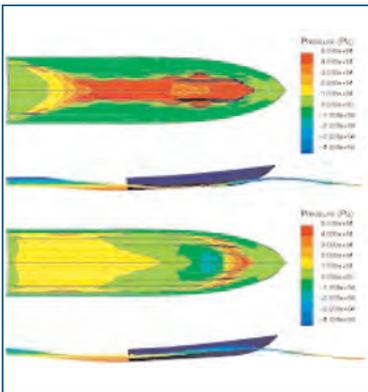
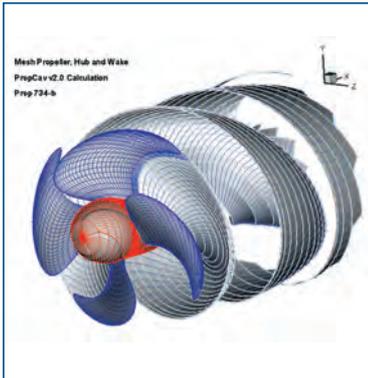
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Marine CFD 2005

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Second Notice



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The International Conference on Marine Computational Fluid Dynamics and associated workshops offer delegates the opportunity to meet and hear from the leading industry and research experts in this field from around the world.

Computational fluid dynamics is a powerful tool for solving complex hydrodynamic problems. CFD offers the designer cost and flexibility advantages compared with model testing. However, many still see their use as more of an 'art' than a science, and the province of specialists. A lot of work is going into making CFD a universal design tool.

Marine CFD 2005 will focus on the application of CFD techniques to hull hydrodynamics, marine propulsors (propellers, pods, waterjets, etc), hull/propulsor interaction, and ship aerodynamics for conventional and unconventional ship design. The programme includes software workshops which will give the delegates a chance to participate in and discuss demonstrations of the latest CFD software. The Institution invites papers on:

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Successful tests for largest davit ever built

ALL davits for BP's JIGSAW project are to be supplied by Bergen-based Vestdavit AS - in particular, the largest davit ever built. This project is a totally new concept for offshore rescue and recovery operations in the North Sea, and the first ships are currently under construction.

BP is building four regional support vessels, each carrying two autonomous rescue and recovery craft (ARRC) and two fast rescue craft (FRC). Vestdavit has been contracted to deliver eight large two-point davits for the ARRCs and eight single-point telescopic davits for the FRCs.

The ARRC davits are fitted with both shock absorbers and dual winch systems, including an individual tension system, and an automatic self-levelling system. The davit, it is claimed, is the first to use fibre rope, rather than conventional steel wire. Lifting capacity is 32tonnes and the vessel is 18.8m in length; power consumption of each davit is 226kW. These davits have been workshop tested, with successful results, and the first system has been sent to the yard to be installed upon the multi-role vessel, which is set to be delivered this year.

Vestdavit has been working on the project with BP for about two and a half years, as well as with the UK-based designer IMT. Before Vestdavit created the 32tonne offshore davit, the largest in existence was 12tonnes. The new davit is very complex, in fact it is really two davits in one: a dual winch system. A 3D CAD system was used to design it.

Further testing of this davit has been carried out on a quayside, and results were, according to Vestdavit, very promising. The company is extremely confident in this revolutionary unit since so much time and research was put into creating it. BP's own facilities model-tested this whole new concept, and in total the prototype davit took 20 weeks to build.

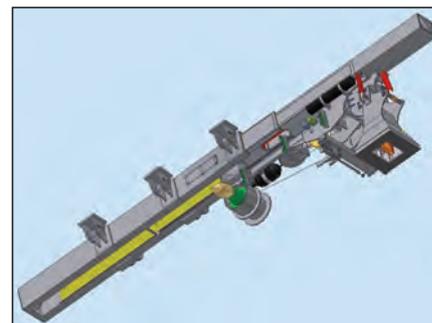
Another interesting aspect of a different MOB/FRC/workboat davit, also for the JIGSAW project, is that it is enclosed inside the hull, which protects it from external conditions and makes it ideal for vessels working in the Barents or North Seas. This compact system, which is a single-point telescopic davit and tri-



This 32tonne capacity davit - claimed by Vestdavit as the largest in the world - has been built for the BP JIGSAW offshore project.

axially compensated, has been patented in Europe and the USA, and Vestdavit has been using it since 1998.

In other news, at present, the company has around 50-70 orders for its standard/modified davits. A great many of these units are being delivered to Australia, for patrol and navy vessels which are building there. The *Armidale* Class of naval vessels, for example, of which 12 ships are building, will each have two 4.5tonne davits. These vessels are set for delivery in 2005 and 2006.



This telescopic MOB/FRC/workboat davit is tri-axially compensated and has a single handling point.

Another good market for Vestdavit is the USA, where the company has been firmly established for nearly 10 years. Several vessels in the US Navy, in fact, have davits from this company installed. Vestdavit believes it has this excellent hold in the US market due to its technically sophisticated work in North Sea areas.

Last year was a successful one for the company, and davits were supplied to ferries, as well as the traditional offshore market. In addition, half the supplies carried out were for retrofits. Vestdavit expects that 2005 will also be a successful period, as the offshore market is picking up, and the company has a backlog of orders to work on.

Current projects include davits for a new patrol craft in South Africa, the first time that Vestdavit has worked in that country. This vessel, which was christened in December last year, is the first of a series of three craft building for the South African government. In addition, six pieces of equipment, including an aluminium davit, are being supplied to Cheoy Lee Shipyard, in Hong Kong, which is also building a patrol craft.

New gauging systems for tankers

IN the last few years, the tanker industry has seen a surge in the construction of new, more complex vessels operated by smaller crews, creating a demand for efficient new technologies. As a provider of advanced marine equipment, Krohne Skarpenord has been designing solutions to the tanker market for 40 years and has developed tank level gauging systems that combine complementary and established concepts for added safety.

The company's precision level radar-type gauge (BM 70M) measures accurate ullage from the tanktop; other conventional radar-based systems, it is claimed, lack the ability to detect actual surface levels. By installing one pressure sensor close to the tank bottom, this precision

gauge will not only provide a precise weight reading through measured cargo density, it will also deliver full redundancy and fail-safe features.

Another product, the hybrid Cargomaster system, provides correct level indication while a tank is being emptied. Since the pressure sensor is installed in the aft end of the tank, it will tell the operator precisely how much cargo remains. This capability saves the crew time on stripping operations and provides surveyors with an accurate reading of 'remaining onboard' figures. As both the pressure sensor and the radar have individual approvals for closed gauging, downtime should, claims Krohne Skarpenord, be a thing of the past.

While each individual radar unit is a stand-alone type with local ullage display, Krohne Skarpenord offers systems to integrate these units via computer. Based on Windows XP software, a Cargomaster arrangement may be linked via satellite to shore-based offices, to assist with reducing costs related to surveyors and load planning.

This hybrid system can also help owners concerned with the lifetime costs of their tankers. A single day off-hire may compensate for the initial cost of the added functionality. If required, the system can have an ullage switch point between the two measurements, securing the radar measurement with a clean-tank picture.

Tests confirm efficiency of new propulsor

PROPELLERS, waterjets, and rudders form just part of the product range from Ulsteinvik-based Rolls-Royce. There are a number of drivers in the propulsion market at present, according to this company, namely, to decrease noise and increase comfort, and to improve safety, manoeuvring, and seakeeping. These can be achieved, the company believes, through hydrodynamic design.

Since 1942, Rolls-Royce has had its own hydrodynamic laboratory, and with this, can examine the efficiency of blade shapes, as well as other aspects such as noise. Currently, four new concepts are being worked on.

The mechanical Azipull thruster with pulling propeller, first introduced as a fixed-blade design, has the option to be CP. It can be used on high-speed ships and has a streamlined shape for optimal efficiency. This novel propulsor was installed (four units) on the world's fastest double-ended ferry in 2003, the FerryCat design from Fjellstrand. The prototype vessel, *Stavanger*, has now run in Norwegian coastal service for 10,000-12,000 hours, making 30 crossings a day, and reports confirm that it is in fine working order. Similar ferries have been ordered by a Turkish operator.

Recent tests, carried out at the end of last year on *Far Symphony*, showed a power saving of 20% when using the FP Azipull unit. There was a substantial noise problem in this offshore vessel on the bridge and aft deck, and new units showed a 10decibel-12decibel reduction in wheelhouse noise.

There are currently 40 Azipull units in service or on order, for offshore vessels and tankers. This includes a series of four 14,500dwt tankers building at Jinling Shipyard in China for a Swedish owner, Broström (*The Naval Architect* September 2004, page 96). ⚓

New range of lifeboats launched

SUPPLIER of offshore and ship equipment, Norwegian Maritime Equipment AS, has developed a new, complete programme of lifeboats and rescue boats named NorMar. The range includes enclosed, free-fall, and semi-enclosed lifeboats, and rescue boats.

Enclosed lifeboats are available in a variety of sizes, from 5.0m to 9.35m length, with capacities from 22 to 102 persons, and they come in cargo as well as tanker versions, normally with Bukh engines as standard.

Free-fall lifeboats in the range can also be delivered in many sizes, from 4.9m to 8.5m length and corresponding capacities are from 19 to 48 persons - a new 5.8m model was illustrated in our October 2004 edition, page 42. The drop height can be as much as 25m. These free-fall designs also come in both cargo and tanker versions.

Semi-enclosed lifeboats have a capacity from 45 to 150 persons, and corresponding lengths from 7.5m to 9.6m.

NorMar's scope of rescue boats consists of a number of versions with capacity from six to 15

persons and lengths from 4.25m to 7.5m. The rescue boats are equipped with either outboard motors or inboard engine with waterjet.

Regardless of type and size, all boats are delivered with BV-EC certificates but on request, all rescue equipment can be delivered with alternative certificates.

The company is currently working to extend the scope of NorMar products, and will continuously introduce new life-saving items to the market - as it recently did with the world's largest enclosed lifeboat and the smallest free-fall model. ⚓

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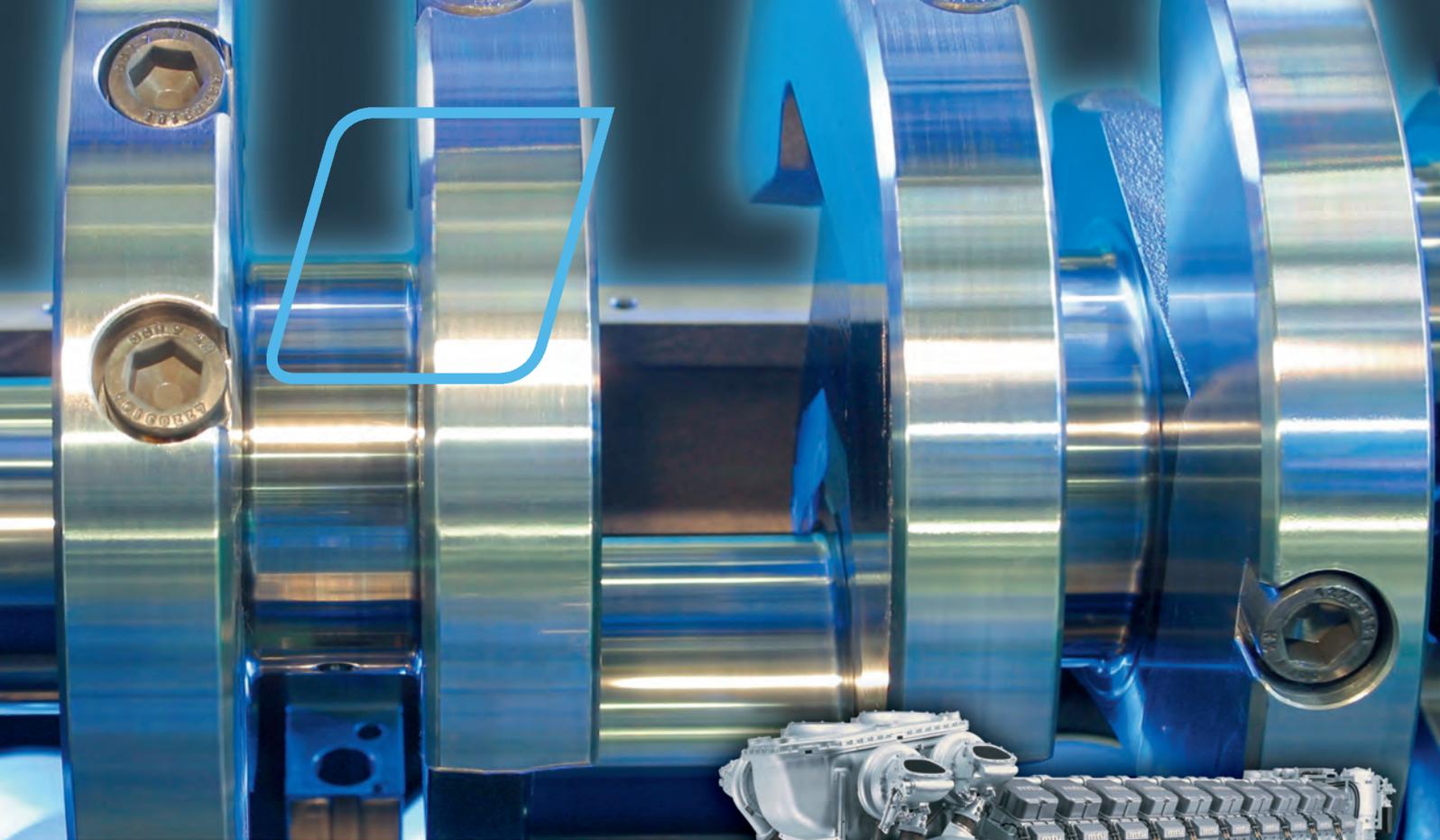
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Building of large offshore construction vessel begins

A LARGE construction vessel for ASolstad/SBM, a joint venture company owned by Solstad and Single Buoy Moorings, is currently being built by Ulstein Verft. This is one of the greatest single projects this yard has gained so far - in terms of both weight and size - and is worth an estimated Nkr650 million.

This Vik-Sandvik-designed vessel, to be delivered early in 2006, is 123.8m long, with a width of 28m, and fabrication involves 6000tonnes of steel. *Normand Installer*, as she is to be named, will be equipped with a moonpool, anchor-handling winches, and A-frame, also a heave-compensated 250tonne offshore crane. The vessel will be outfitted for 100 people and will have a power output of 24,000kW.

Steel cutting began in the middle of November last year, and superstructure building in December. Fore ship and aft ship hull sections have been subcontracted to Ulstein Verft's partner in Poland, Maritim Ltd. The fore-ship section will arrive at Ulsteinvik in May 2005, and the aft ship in July.

Ulstein Verft is currently working on another two vessels, both of which are smaller in size, and both of which are also destined for the offshore market. In addition to this, Ulstein Design, the yard's naval architectural division, has a P105-class vessel being built at Merwede Shipyard, in The Netherlands.

Brazil: an emerging market for Ulstein Elektro

An emerging market for Ulstein Elektro, the group's marine electronics and control systems company, is in Brazil, despite the fact that 50% of its work is still for Ulstein Verft. Ulstein COM is one of its most successful systems.

This integrated communications package (COM), appropriate for all types of vessels, combines public address, telephone exchange, external communication, TV/radio network, and data networks all into a single unit. Satellite TV/radio equipment, computer servers, and other types of communication equipment can also be installed. The equipment is fully integrated for easy installation and less cable work.

The concept is scaleable, and is tailored for future communication needs. Each unit is modular and can be installed into retrofits, where services can be adapted to existing equipment. Ulstein COM has been on the market for two years and is said to have been well received by shipyards, despite minimal marketing, and so far, more than 20 units have been sold.

With regard to Brazil, an agreement has been reached with EISA, a Rio de Janeiro-based shipyard. Ulstein Elektro has supplied a complete electronics package for an anchor-handling/tug/supply newbuilding for Norskan, which was delivered at the end of last year. In addition, navigation, communication, and intercom equipment will be supplied to four



Normand Installer is a 123.8m long construction vessel building at Ulstein Verft for Solstad and Single Buoy Moorings. She is set to be delivered in January 2006.

Vik-Sandvik-designed ships. Two contracts have additionally been signed with FELS Setal for UT-design vessels for Maersk.

Modular building concept to hone competitiveness

A research and development project, named ModNet, has been set up by the Ulstein group in association with partners in the Norwegian maritime industry, aiming to investigate how the group can improve its competitiveness. The final aim is to achieve a Norwegian-controlled, cost-effective process involving the construction and operation of a vessel internationally.

Part of the idea behind the project is to build vessels abroad, based on Ulstein's knowledge and experience, specifically through modular-based design using a global network of suppliers. This concept is about re-using knowledge and solutions, that is, producing and utilising good solutions as effectively as possible. This could involve modules or sections of a vessel, or a complete onboard system.

From modules, a yard can build both simple and complex vessels, also ship systems. Pre-conditions for doing so are well-designed interfaces between various components. Therefore, it should be possible for Ulstein to outsource all or parts of production, and use its knowledge and existing network to produce ships and systems cheaply.

This process would also involve other Norwegian companies, with whom Ulstein works. If Ulstein does build vessels overseas, it can build them according to this modular method, with the help of its current network of suppliers. This means it would be building at a low cost, but using the same quality techniques.

A close network of companies is being formed through this ModNet project, whose partners are working on new methods for business development, project execution, production, operation, and the sale of modular design ship solutions. Ulstein believes this is the first time that the maritime industry has made a collective attempt to familiarise itself with all the competitive-enhancing measures, whilst at the same time testing their effects.

ModNet should eventually lead to a pilot concept based on a multifunctional supply vessel for oil platforms, but the module can be developed for different ship types. Other participants in this project are Kongsberg Maritime, Siemens, Eksporthfinans, Norac, Brunvoll, Det Norske Veritas, and Kunnskapsparken a norwegian centre of excellence.

This innovative R&D programme also involves an assessment of those countries in which it might be most attractive to become established. The correct choice here is seen by Ulstein as one of the critical success factors for ModNet. 

New high-tech gangway control system for ISPS compliance

MOSS-based VingCard, manufacturer and supplier of locks and keys for marine and land-based industries, has for a number of years enjoyed a close relationship with cruise and ferry owners and shipyards, but also supplies to more mundane vessels as bulk carriers and container ships, for example. Today, IMO's new ISPS security code, which came into force in July last year, is demanding the introduction of new safety procedures onboard all vessels, and new products have been introduced by VingCard accordingly.

The company's Gangway Control System is claimed to allow users to know who is onboard a ship at all times. This innovative concept continuously updates the movements of passengers and crew embarking or disembarking, and security personnel have access to real-time reports and listings of passengers' locations, all in accordance with ISPS regulations.

Standard personalised ID cards are issued to all passengers and crew, and these cards have either a barcode or a magnetic strip on them. The cards can then be connected to another system, such as a fingerprint reader or a picture ID verification system, for increased security. As a passenger embarks, his or her card is scanned to register entry. This system can also be used for purchases made onboard, acting as a credit card, and it also opens the door to passenger cabins.

This real-time Gangway Control System also allows ship security personnel to gain access to passenger and crew data from any network PC. Reports can also be generated to show individuals' information and status.

The biometric fingerprint technology used in the VingCard system has only recently been launched, and over the next few months will be tested onboard a cruise ship. Two months ago, the fingerprint reader was also installed on a Norwegian Hurtigruten coastal ship owned by OVDS. VingCard believes that another possibility for the future within biometrics as a security measure is retinal scans.

If current VingCard magnetic key customers wanted to upgrade to the new Gangway Control System, all they would have to do is purchase a barcode reader and extend slightly their software and hardware; thus the upgrade is a very simple procedure. VingCard charges around €9000-€10,000 for the basic system, but this price very much depends on the size of the package required.

The company believes that the ISPS codes may well change again in the future, so the Gangway Control System has been constructed in a very fluid way. If regulation changes occur, then it will be easy to add to or adjust the existing system software.

Extension into other shipboard areas

The ISPS code has also allowed VingCard to reach into markets where it has previously not been involved, due to the safety aspect of the



The Gangway Control System which includes PC, camera, barcode reader, and fingerprint reader.

regulations. Tankers, for example, have amended regulations on engineroom and bridge doors.

VingCard believes it has the potential, in the future, to be able to supply a total passenger management system. However, after working on the Gangway Control System for the past 18 months, the company is just, at present, fitting the system onto ferries that require it.

In other news, VingCard has also been working with Hyundai Heavy Industries on a large series of LPG vessels for Qatar Oil, which are set to be built in 2006. An online central locking system, which has a different function for different levels of security, has been designed. This system has a switch for each security level - level one, for example, locks the engineroom door, where as level five would lock every door on the ship. Each level is controlled by a button or a switch. VingCard will supply the total system. It is believed that this concept is totally new.

This year, the company is also planning to expand its operations in China. Both this country, and Japan, have traditionally been successful areas for VingCard. Currently there is no factory in the Far East, and all components are still sent from Norway - where all of VingCard's units are manufactured.

If an owner requests, VingCard can make bespoke units and fittings. This is not a common procedure - due to issues with spare parts - but Disney requested specially-made handles for its cruise ships; however, using different finishes and colours is typical.

Naturally, the company is still active in its traditional core business, that is, keys and locks, padlocks, and cupboard locks. This range includes automatic and hydraulic door closers, electronic and safety boxes, the customised TrioVing master key system, and panic exit devices that comprise push-bar and touch-bar series.

Component contract for electric thruster motors

SCANDINAVIAN Electric Systems (SES) has entered into an agreement with Rolls-Royce Marine for the supply of low-voltage electric motors, motor starters, and frequency converters for the latter's new thruster systems. This contract also covers applications such as steering gears, for which SES recently commissioned its first delivery based on frequency-converter drives to Rolls-Royce Marine. The agreement is valid through 2006, with an option for extension. With its compact design, technical properties, and power range, this motor type is claimed to be well suited for azimuth and tunnel thrusters, as well as main propulsion duties for diesel-electric systems.

Expansion plans home and away for unique vacuum toilet system

ESTABLISHED in 1986, Jets Vacuum is a leading supplier of marine vacuum toilet systems. This company has been constantly developing its standard units, particularly its successful Vacuumator product, which has taken 11 years to perfect.

Four different sizes of Vacuumator are available for both newbuildings and retrofits. The latest (released at the start of 2004), and smallest, unit is the mini JETS 10NT. This has allowed Jets Vacuum to focus on a new market, that is, in pleasure craft, and smaller sized boats with up to five toilets. This system is not currently fully commercially available however yet, even though it has been launched.

The Vacuumator concept has an integrated macerator, and its in-line generator needs no priming, and avoids the need for traditional sealing and collecting tanks. There is no circulation of sewage to overheat the system and no foaming. By maintaining an optimal temperature, Jets' system claims to boost vacuum generating efficiency, and the correct temperature also creates the right conditions for desirable aerobic bacteria.

At present, Jets has a lot of orders for installations in the newbuild market, in fact, the company claims a 50% market share in this sector. By the end of October 2004, Jets had 480 orders in total for that year. In December 2003 the company sold its 3000th unit to Rodriguez Cantieri Navale for a passenger/vehicle ferry. Jets is growing rapidly,



The largest in Jets Vacuum's range is the 65MBA Vacuumator. These units are the heart of the company's state-of-the-art technology.

which can clearly be seen from the fact that turnover in 2003 was NKr95 million, and in 2004 it was NKr115 million.

Jets has supplied 140 Vacuumators to newbuildings in Korea in the past year, but has seen a slight downturn in its European market. However, notably 55 units were supplied to Italy, 25 to Germany, 35 to Norway, and 26 to Turkey, for all different types of vessels.

The retrofit market is also an important aspect of Jets' business. Recent deliveries include four 65MBA Vacuumators on *Disney Magic* and *Disney Wonder*. Indeed, cruise ships are a high

part of Jets' turnover, and 1800 units were also recently installed on *Jewel of the Seas* and her sister ships.

Last year Jets bought 30% of Mjoes, located in Bergen, a company that supplies pumps for the Vacuumator. Other future expansion plans include the building of a 1500m² assembly hall and stock room on the current site. This will approximately double Jets' available space. In addition to this, the company is establishing another assembly station (one already exists in Germany) in China, which will begin work early this year. 

New fast ro-ro concept

ANY type of vessel can be designed by ANVC-Design (formerly known as Nordvestconsult), an Ålesund-based company that is now part of Rolls-Royce Marine AS. Today, a number of interesting new concepts and improvements of old designs are in the pipeline.

Naturally, seakeeping is an important aspect of any marine design process, and NVC-design also investigates in detail structural problems caused by slamming, sloshing, and fatigue. Focus is additionally concentrated on the evaluation of hull line generation for the bow shape and structure to avoid damage to both the hull and deck equipment caused by green seas, also icing problems caused by green seas, and speed loss in head seas. Napa Steel 3D CAD system is used to help in these investigations. These studies ensure an increasing focus on functionality, simplicity, efficiency, redundancy, manoeuvring and directional capability, also 'life-cycle' cost analysis for different technical solutions.

An important new ro-ro concept design is based around the aim of solving the problem of pollution from road traffic in densely populated areas, reducing road traffic in central Europe, and avoiding expensive road taxes and restrictions on traffic such as 'slots' for different vehicles at



NVC's high-speed P2500 ro-ro freight ferry, which has yet to be built, is claimed to be both fast and economical. On an anticipated route between Southampton (UK) and Vigo in Spain, sailing time would be halved but trailer operators would have to pay a 30% premium.

certain times of the day. Funding assistance has been given by the EU to motivate the establishment of new routes and new transport corridors.

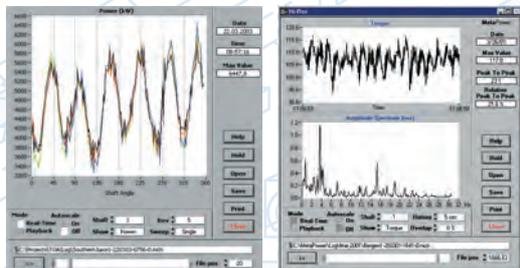
The hull design for this fast P2500 ro-ro, which could be sailing from Southampton to Vigo - a distance of 700nm - has a wave-piercing bow with demi-hull aft ship, and low resistance. This has been tested at Marintek's model tank, and more technical details of the concept appeared in *The Naval Architect* September 2004, page 80.

On the proposed route, a conventional ro-ro ferry takes 36 hours sailing at 20knots to complete this journey. The trailer cost is approximately €700. However, with the NVC high-speed concept, the crossing would take 18 hours (sailing at a speed of 40knots), and the cost for each road trailer would be approximately €1000. The price increase for trailers however, represents a 30% premium. An absolute condition for the success of this project is that correct logistics are in place in both transit and calling ports. 

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New markets emerging for thrusters

THURUSTER manufacturer Brunvoll has a range of units which it is constantly developing and improving. This company produces tunnel thrusters (with a range from 100kW to 2500kW), azimuth designs (from 500kW to 2200kW), as well as control, drive, and servo systems, and low-noise thrusters.

Since the company focuses exclusively on thrusters, it believes that it has several advantages over its competitors. For example, it has a dedicated after-sales service team of engineers that has expertise on every aspect and component of a thruster unit.

Brunvoll delivers around 200-220 thruster units annually, all of which are manufactured and engineered in Molde, and all of which are tailor-made to suit a customer's requirements. The fact that all units are built on site allows last-minute changes to be made very easily. There are no plans at the present time to move any of the production facilities, and Brunvoll claims to remain competitive in the market due to automation of a number of its production machines, for example, in welding.

In 1997 Brunvoll invented the 'silent' thruster, which has been a very big success in the cruise ship, megayacht, and offshore markets - in fact, the unit is ideal for any environment that needs

quiet areas. The thrusters have a range of sizes from 100kW-2350kW. This design has been verified by independent inspections, and according to Brunvoll, is the quietest in the market. An important recent installation has been on the *Millennium*-class cruise ships, built at Chantiers de l'Atlantique, where each ship has three 2300kW units fitted at the bow.

China is seen as a good potential market for the company, for ships that are being built for export, especially multi-purpose vessels and small tankers. Korea is another emerging market, and a number of deliveries have already been made there, to the Samsung and Hanjin shipyards, for example.

However, the most exciting new market today for the company is in Brazil, where the company has been promoting its units intensively for three years. It has received a number of orders from that country for offshore supply vessels, both newbuildings and retrofits. Last year in fact saw 10% of all its sales in Brazil. Another newly explored target area is Turkey, especially for the medium-sized tankers and bulk carriers that are being built there at present. In addition, early in 2004 some yards in Vietnam were also visited, and some good contacts were reportedly made.



Brunvoll's smallest low-noise tunnel thruster range measures from 85cm-100cm diameter and has ratings from 75kW - 250kW.

Brunvoll's biggest market last year was in Germany, due to the volume of container ships being built there, as well as cruise and passenger vessels emerging from Meyer Werft, as well as a number of megayachts. The company expects Germany to be its most significant market again in 2005. ⚓

Contract confirms role for gas-powered ferries

THE Bergen-based design and consultancy LMG Marin has several new and innovative concepts on its books at the moment. One of these is a gas-driven passenger ferry, which LMG Marin believes to be the only the second one of its kind.

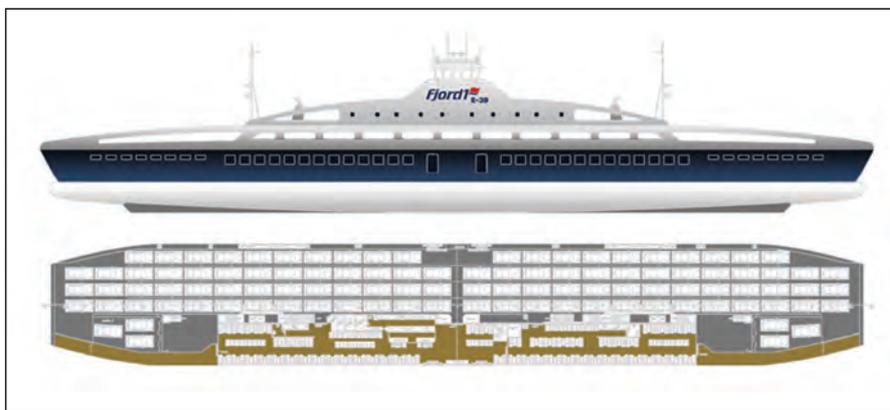
The contract for the design of two types of ferry was received in November last year from the company that runs a number of ferries in Norway, Fjord 1. Delivery is scheduled for the second half of 2006. The value of the contract to Aker Yards is approximately Nkr1.2 billion.

These new vessels will replace the current ships working the Halhjem-Sandvikvåg route and the Arsvågen-Mortavika route; both routes are on the main road (E39) between Bergen and Stavanger. The design of these vessels was conceived with Fjord 1, and LMG Marin has been working on it since the spring of 2004.

One of the ferries will have a 145-car capacity, and the other a 198-car capacity on two decks. They are naturally different sizes, and the larger ferry is also slightly faster, but they are sisters in all other ways. The new ferries will greatly enhance speed, capacity, and comfort on the crossings.

In total, two of the smaller ferries and three of the 198-car ferries will be built by Aker Brattvåg. The hulls will be built at Aker Tulcea in Romania, and will be outfitted at Aker Brattvåg's yard in Norway. The vessels will measure 129.5m in length and 19.2m in width.

The fact that the vessels will be gas driven was very much a political decision in that this fuel reduces harmful emissions by around 90%



A side profile and interior view of the 129.2m gas-powered ferry for 145 cars, designed by LMG Marin for Fjord 1. A further design for 198 cars will be of similar length but will have a second vehicle deck.

- NO_x, SO_x and CO₂ - and there is currently encouragement in Norway to use gas. There are also economic benefits in using this type of system, as well as the fact that noise levels are reduced.

Tests will be carried out sometime this month. Suppliers will also be decided up at the

time. LMG Marin hopes to be able to use Norwegian companies that are part of the maritime cluster, but naturally there is a cost issue involved. Rolls-Royce Bergen is likely to be a strong competitor for the gas-fuelled engines, as explained in our June 2004 Editorial Comment.

LMG Marin is confident that this concept can be used on other ship types. In fact, an offshore supply ship, *Viking Energy*, is already using a similar system. However, these are believed to be only the second passenger types, following the prototype *Glutra* built in 2000.

Involvement in European project

With regard to research and development LMG Marin is coordinating a log-based design approach philosophy programme. This project, which aims to improved competitiveness of European shortsea shipping and thus enables the transfer of cargo from road to sea by developing and implementing a new ship design approach, is a large European project with 12 partners, and a budget of €3.5 million. Aspects being investigated include methods and software and a background study has been carried out on existing vessels, and owners have been questioned about what they see as an efficient ship.

The aim of this project is to improve competitiveness in Europe, and improve designs by 30%, such as by decreasing weight and costs, and increasing efficiency, environmental performance, and safety, as well as for various logistics performance parameters within intermodal transport chains. This includes the design of better ships, through the integration of logistics/operational issues in the design process.

More specifically, efficient ro-ro vessels, which shall function as an integral part of dynamic intermodal transport chains, are being developed

based on the utilisation of the methodology. The resulting ship designs will be compared to state-of-the-art ship designs.

The methodology will also offer its users (ship operators, port operators, cargo owners, ship brokers, shipyards and consultants) a common platform to develop dynamic intermodal transport solutions, which provide the logistics/operational requirements for ships, port facilities, cargo handling equipment, and other aspects.

This project, which began in March 2004, will run for three years. The results will then be published and the aim is to implement some of the solutions that emerged from the study. LMG Marin's aim in establishing this project was to assist owners at the very beginning of the design stage.

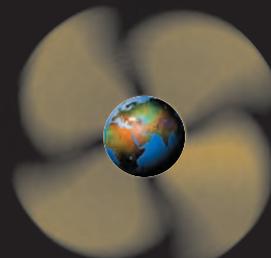
Meanwhile, a new series of eight to 10 product tankers is currently building in Russia to two different LMG Marin designs. Owners are Norwegian and Swedish. 

TECHNICAL PARTICULARS 145-CAR CAPACITY GAS-POWERED FERRY	
Length.....	129.2m
Breadth.....	19.1m
Depth.....	4.5m
Capacity.....	145 cars
Total passengers	545
Combination.....	12 lorries; 67 cars
Speed	17knots-22knots

TECHNICAL PARTICULARS 198-CAR CAPACITY GAS-POWERED FERRY	
Length	129.2m
Breadth.....	19.1m
Depth.....	4.5m
Capacity	198 cars
Total passengers.....	530
Combination	12 lorries; 150 cars
Speed	17knots-22knots

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Azipods for new Bohai Strait train ferries

China's growing fascination with train ferries is reflected in news of a fresh contract for two such vessels ordered by Sinorail Bohai Train Ferry for service on a long route across the Bohai Strait in north-eastern China.

The diesel-electric ferries, to be delivered by Tianjin Xingang shipyard in June and December 2006, will be equipped with ABB 4MW Compact Azipod drive units for greater manoeuvrability. ABB is also supplying a medium-voltage power plant with four generators for each ship. Unlike an earlier Chinese train ferry for the shorter route across the Hainan Strait in southern China (*Yue Hai Tie 1 Hao*, presented in *Significant Ships of 2003*) these are long-haul vessels set to cover a route of some 128km between Yantai and Dalian. This will cut short the long journey on the coastal highway between the two key centres. Up to four more ferries may finally be needed for this route. *The Naval Architect* hopes to present more details on these interesting ships in a future issue.

This order for the first two ferries is just one of a string of newbuild contracts for which ABB's Azipod propulsion, electrical power and automation systems are required. Another involves construction of an Arctic container vessel for Russia's MMC Norilsk Nickel, due to be delivered by Aker Kvaerner Masa-Yards in Helsinki, Finland in early 2006. The 14,500dwt ship, designed to Russian Maritime Register ice class LU7, will be equipped with one 13MW Azipod unit, as well as medium-voltage power generation and distribution systems from ABB. This vessel, which will be capable of breaking ice 1.5m thick, is destined to carry export and import cargoes on Russia's northern sea route to Murmansk and beyond.

Meanwhile, ABB is set to provide three 14MW Azipod units, one fixed and two manoeuvrable, for Royal Caribbean International's second Ultra Voyager cruise liner. This very large vessel is being constructed at Aker Kvaerner Masa-Yards for delivery in Spring 2007. The liner will also be equipped with a marine power plant with six main generators, a main switchboard, four bow thruster motors and 18 transformers.

ABB Oy, Marine & Turbocharging,
PO Box 185, 00381 Helsinki, Finland.
Tel: +358 1022 23738.
www.abb.com

Ro-ro access packages for Finnlines ferries

Marine engineering group MacGregor has won a contract to provide ro-ro access equipment and passenger lift packages for three 9300dwt ro-pax ferries to be built at Fincantieri in Italy. These Finnlines ships, believed to be the largest such vessels ever built and the fastest in their size-class, can carry 300 trucks and offer 4200lane metres for freight. When delivered between November 2005 and June 2006, they will sail between Scandinavia and Germany. Each vessel, also capable of carrying 500 passengers, will be

fitted with five lifts, two of them dedicated passenger units, two service lifts, and one for stores.

One passenger unit will be located midships with the other on the starboard side, while the service lifts are to port. The 1000kg capacity goods lift will carry stock between decks 10 and 11 and will also service the galley.

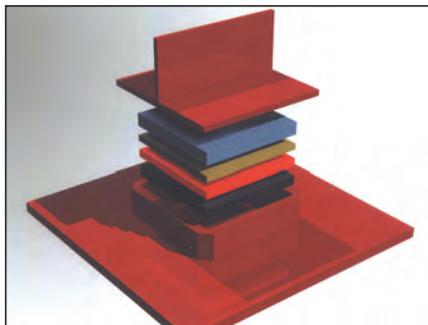
The group's ro-ro ship division will supply each ferry with a comprehensive access package including a series of external and internal ramps, ramp covers, bow doors, hoistable decks, and shell doors. All equipment is set to be supplied in the first half of this year. Finnlines is expected to take delivery of the first vessel in November 2005, the second one in May 2006 and the third a month later. In recent weeks, an option for two further ships has been taken up by the owner.

MacGregor Group AB, PO Box 4114,
SE-400 40 Gothenburg, Sweden.
Tel: +46 31-85 09 00.
www.macgregor-group.com

Tank support system for hot cargoes

A new cargo tank support system for large special tankers and/or heavy liquid cargoes has been introduced by Beele Engineering BV, of Aalten, The Netherlands. Beele's Ulepsi tank support system, designed for use aboard sea-going ships transporting high-temperature cargoes such as asphalt, coal tar, or creosote, comprises a set of independent supports attached to the hull, on which a cargo tank rests. The new 350mm x 350mm system is suitable for tanks with a cargo temperature that is kept at up to 250°C. The maximum load each tank support can bear is certified by Bureau Veritas as 98tonnes.

Such cargoes must be maintained at a high temperature because of their viscosity and so, the tank walls are subjected to heat of more than 200°C. These tanks cannot be secured



Components of the new Ulepsi tank-mounting system from Beele Engineering, for use where high-temperature cargoes are being loaded.

directly to a hull because of structural strains resulting from temperature differences between the cargo and seawater.

The Ulepsi tank supports each comprise a vertical and horizontal set of slabs, including a slab of EPDM rubber, one of silicone rubber, and one of Ultem - an injection-moulded glass-filled synthetic material, all encased in a steel housing. A typical system, made up of multiple supports, absorbs the tank walls' high

temperature, reducing it from around 200°C to close to 80°C. The company already offers a 200mm x 200mm support system.

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www.beele.com

Marine controls sold to L-3

Canadian technology group CAE has agreed to sell off its marine controls division to US group L-3 Communications Corp, of New York, USA, for around US\$248 million, to allow CAE to focus on its core civil and military simulation and training operations. The marine controls division, which provides automation and navigation systems to both naval and commercial marine markets, recorded annual revenue of Can\$158.6 million for the year ended March 31, 2004, representing some 15% of total CAE group sales.

The marine business employs 460 people worldwide, mainly in Canada, USA, UK, Norway, and India. L-3 Communications is a leading merchant supplier of intelligence, surveillance and reconnaissance (ISR) systems, avionics and ocean products, training devices and services, and navigation products. One group associate firm is L-3 MPRI Ship Analytics, based on the Isle of Wight, UK, a producer of PC-based training programmes for ship crews, in particular gas carriers (see our special September 2004 supplement *Design and Operation of Gas Carriers* - page 28). The deal is expected to be completed before March 31 2005.

Recent orders from CAE's marine division have included a string of new contracts for automation, control and navigation systems for tankers, ferries and cruise ships, together worth more than Can\$16 million. Foremost among these is one to supply CAE's Damatic automation systems and an integrated navigation system with voyage data recorders and bridge consoles for six new P-MAX tankers ordered by Stena Line from Croatia's Brodosplit shipyard (*The Naval Architect* October 2003, page 6). CAE is set to deliver the last set of equipment by summer 2007. The Damatic system enables a single crewman to control all shipboard machinery and equipment.

In Italy, Fincantieri has awarded CAE a contract to provide a machinery automation system for new ro-ro passenger ferries destined to sail in the Mediterranean. Installation of this equipment is due by April 2005. CAE has already supplied automation systems for 10 cruise liners constructed by the Italian shipbuilder.

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www.shipanalytics.com

Nikolayev yards struggling to adapt to modern conditions

A PRESIDENTIAL decree of October 20, 1998 approved the initiative of the Nikolayev Regional State Administration (NRSA) to create a special economic zone on the territory of the three large shipyards situated there - Chernomorsky, 61 Kommunars, and Okean - and ordered the cabinet of ministers to set it up. The harrowing difficulties of these shrinking yards - dominant employers in the area - depressed the whole region, and the decree was a sop to NRSA, aiming to give the impression that something was being done towards solving two huge problems: reducing shipbuilding costs and securing funding.

Envisaged were duty-free benefits for shipbuilding material and equipment imports, exemption from land and profit tax, writing-off yard debts, and lifting the restriction on banks to hold only 10% equity in companies. The anticipated aim of the latter was that this would induce them to invest in shipbuilding. NRSA was also after a co-ordinating role in terms of re-allocating spheres of new construction.

A Nikolayev special economic zone was subsequently established for 30 years on the trio's territory on July 17, 2000, setting a minimum investment at US\$3 million in shipbuilding, but the scheme provided no key changes, and certainly had no noticeable effect when Okean was acquired in 2001 by the leading Dutch shipbuilder Damen.

Meanwhile, state-owned 61 Kommunars Shipyard had seen little activity due to crippling cash shortages and delays to the completion of three refrigerated cargo ships for a Greek-Ukrainian joint venture Yugretransflot-Lavinia. Interim shipbuilding work took up only 35% of the yard's production in 2000, when 61 Kommunars failed to get listed for privatisation and opted for developing a holding structure. Eventually, in late spring 2001 the yard received a US\$5 million order from DOF Industries, of Norway, for completing under Det Norske Veritas rules the hulls of two 83.7m x 19.7m supply ships

Despite its importance to the Ukrainian economy, the once mighty shipbuilding industry in that country has been on an accelerating slide throughout the 1990s (following the collapse of the Soviet Union). Nevertheless, its potential as a foreign-currency earner is revealed by the US\$998 million won between 1992-1997 from exports and only US\$50 million from domestic contracts. Central government noted the high volume of yard credit debts and slow restructuring, and proposed measures to cut costs by up to 14%, also approving state guarantees for export credits. In 1999, the industry was profitable for the first time for many years, and was subsequently relieved of import duties for equipment for five years. New hope has come to one yard in the form of investment and orders from the Dutch Damen group, but the struggle to obtain orders remains. Ivan Berenyi reports.

for delivery by the end of that year, for outfitting in Norway. This was extended in mid-2001, under a US\$15 million deal, to hulls for four more supply ships within two years and six Arctic trawlers.

Two supply ship hulls were duly delivered, and in March, 2002 the first two Arctic trawler hulls of 74.5m x 16m, designed by the Norwegian

consultancy Skipsteknisk, were laid down. In April that year, the government expressed readiness to grant up to 50% fiscal support for completing the three 23,000dwt reefers, and industry equity in the yard was offered to Atanas Laskaridis.

In 2003, two of the reefer ships were completed and delivered, and last year the yard was awarded US\$3.7 million to complete a Ukrainian Navy cruiser and to hand it over without armament; it also secured a one-off payment of US\$2 million to complete the final unit in the reefer series. Furthermore, 61 Kommunars claimed to have received orders for two 4500dwt dry cargo ships from a Spanish company, the first for delivery in February, the second in June, of 2005.

Joint stock-holding society Chernomorsky Shipyard, with five subsidiaries on offer, was privatised but held by cashless local parties. Each of the five subsidiaries controlled its finance independently. Second largest of the five, Meridian Shipyard, is capable of building ships up to 6000dwt.

In mid-2000, William R Block & Associates, of Holland, was reported to have discussed the acquisition of a 75% stake in Chernomorsky and Meridian, before Kiev agreed to sell a majority interest. In 2002, interest was also shown by Greek and Russian parties, Avon in particular; however, in the end there was no bidders, although Japanese companies had also enquired about possibilities.

More recently, in 2003, inconclusive talks were conducted with Ukrmorport over building a tanker fleet, for which Chernomorsky's design bureau came up with a 105,000dwt project, and the building of a private port started on the yard's territory, projected to cost US\$15 million in phase 1. Last October, Chernomorsky started building the first of four 15,600dwt bulkers ordered by a Japanese customer, for delivery, fully outfitted, in December this year. The contract for all four is worth US\$62.5 million. ☺

Difficult times for design consultants

THE bedrock of the Ukrainian shipbuilding industry in Soviet times and august designers of ships and policy manipulators extraordinary, shipbuilding-oriented design bureaux and state institutes are a fading breed today, victims of changing winds. The most important, 1956-founded and Nikolayev-based Chernomorsudoprojekt, still retains limited visibility in the design stakes. Having provided blueprints for 40 vessel types in the past, resulting in construction of 500 vessels of 7 million dwt, today it boasts only three at Nikolayev yards - 45,999dwt tankers handling eight kinds of oil/products built for AVIN by Chernomorsky; 470,000ft³ reefers at 61 Kommunars; and 70,000dwt Panamax bulkers at Damen Okean. The bureau retains an up-to-date Tribon CAD/CAM system and possesses

Germanischer Lloyd ISO 9001 quality certification, but claims to suffer from plummeting CIS standards.

Technical director Anatoly Klimenko complains that decreasing product costs, shrinking staff, increasing quality and labour productivity, shortened periods of design development, and lowering of prices makes no difference in terms of attracting more custom for the design of either shipbuilding or associated marine products. In an interesting comment, he notes that, increasingly, today's more demanding customers insist on seeing an avalanche of options before making a choice; they also expect five selections and three serial manufacturing contracts out of 50 options.

Kiev-based Schuna Central Design Bureau OJSC, and Aquila, also Nikolaev-based

Shiprepair & Shipbuilding are primarily hull-brokers now, albeit Schuna still claims to be involved in producing designs for vessels up to 5000dwt, and Shiprepair & Shipbuilding in drafting detailed design documentation and providing GL quality certification for ISO 9002. However, the dominant trend is for local yards to build hulls for foreign parties, and, virtually without exception, they bring their own designs.

Very occasional government research and consultancy assignments in the shipbuilding sphere remain within the grasp of two JSC state institutes, the Ukrainian State R&D Institute of Standardisation & Certification in Shipbuilding (USR&DISCS) and the Research Institute of Automated Systems & Information Sciences in Shipbuilding. ☺

New owner for Kherson

SITED on the River Dnieper delta, the formerly and internationally most successful Soviet shipbuilder and concrete floating dock specialist Kherson Shipyard was put up for sale in July last year - the latest in many attempts - by its 100% owner, the Ukrainian State Property Fund (SPF). In September, Euroresource, of the Ukraine, was declared the winner of the tender for 83.61% equity 'for slightly more than the starting price' (the modest sum of US\$8.74

million). Losers were other local companies West-Invest LLC and Lenin Kuznitsa Trade House.

Rather belatedly, in 2003 this long-suffering yard, capable of building/repairing vessels up to 30,000dwt and constructing 7000tonne-30,000tonne lifting capacity ferro-concrete floating docks, was converted into a joint stock company (JSC). It had been idle from mid-1998, following the abrupt cancellation of a multi-tanker

Lukoil contract but in September 2002 the yard completed a 29,500dwt tanker hull (project 1433), abandoned in 1996 by a 'European customer', and sold it early in 2003 to the Turkish company Maks Denizliki Togaret Ve Sanayi.

Kherson's new owner is expected to whittle down the workforce to 5000 and to chop the shipyard into so-called independent subsidiaries within a holding framework, preparing the way for piecemeal sell-off. 

Damen brings new hope to Okean

TO date, the Nikolayev-based Okean Shipyard is the sole Ukrainian shipbuilder to find a foreign strategic investor, in the Damen Shipyard Group, from The Netherlands, and today the company is known as Damen Shipyard Okean (DSO). Although Okean had humble beginnings in 1951 as a small builder of non-propelled barges, it was successfully reconstructed and has graduated to the latest imported technologies of the time.

On the way, the yard has built, from the mid-1960s, large trawlers, refrigerated fish processing ships, self-propelled barges, and timber carriers, and, following another

upgrade round, it progressed to 70,000dwt Panamax bulkers, deep-sea super-trawlers of 8000tonnes displacement, dry cargo ships, and ore carriers. Despite all this, lean years followed the break-up of the Soviet Union.

Investment by the very active Damen group resulted in the delivery, in 2002, of two of the Dutch company's successful Combi Freighter cargo ships, *Rebecca* and *Sabrina*, to Geuze Shipping and an unidentified German owner respectively; both were of the 10500G type. A further ship of this class, *Frida*, was handed over in 2002.

In August 2004, a 1100TEU container feeder vessel was built for a German owner,

which was followed in September by *Nadja*, a Combi Freighter 10500G 1A type, also for Germany. A further ship of the same class, *Angelika*, was also delivered in November, again to a German owner, along with another 1100TEU container ship.

In November 2005, Damen Okean will complete a Combi Freighter 12000 cargo ship to a Dutch owner; she will be named *Morgenstond*. During the current year, the yard will also deliver to a Ukrainian owner, believed to be Ukrichflot, four 6000dwt sea-river cargo ships. Amongst its fellow Ukrainian yards, Damen Okean appears as one bright star. 

Zaliv: a much-modernised yard

ZALIV Shipyard, founded in 1938 and built on land reclaimed from the Kerch Strait in the Crimea, has turned a full circle during the past eight years. As a leading Ukrainian shipbuilder, it built 45 vessels between 1981 and 1996, and during the earlier 1970s a 150,000dwt tanker, which was way beyond the capabilities of other Soviet builders. Sadly, a three-year layoff ensued, with the yard staring final closure in the face, only to re-emerge again as the top Ukrainian yard. The January 1996 delivery of a third 68,232dwt tanker to Eletson was followed by an order drought, despite promising letters of intent.

Eventually, the Zaliv workforce shrunk five-fold to a skeleton maintenance staff of 900, and the end appeared nigh. At its nadir, there was even a short spell when the yard was renamed B Ye Butoma Kamysh-Burun Shipyard after Boris Ye Butoma, Soviet minister of shipbuilding for many years, but the move failed to warm Russian hearts or produce bail-out business. Finally, in 1999, however, a long-worked-at Benelux connection came into play, and three river semi-container ship hulls were completed for - and delivered to - Robo International, of Belgium. Production rose by 72.3%, and in 2000 a 5750dwt coaster hull - the first of six ordered - went to IHDA Shipping & Services, of The Netherlands, for completion.

That was the sole delivery of the year, with three following in 2001 while the fifth and sixth slipped into 2002. In that same year, pontoon hatch covers were exported to Germany, and

two Combi Freighter hulls of the 3800 type (of a total of four ordered by Damen Shipyards Bergum) went to The Netherlands for outfitting via a Zaliv subsidiary, Zatoka Shipyard, with financing from Diamantbank and ING Bank, of Kiev.

The remaining two Combi Freighter hulls were delivered in 2003, plus two of four 7600dwt container carrier hulls ordered by Dutch-based Maasroom CV through Zatoka, with IHDA supervision for one. Finance came from a consortium of Ukrainian commercial banks led by Diamantbank, of Kiev, and the latter's commitment was in due course extended to €10 million up to June 2004.

The ensuing two container carriers followed in 2004, along with the hull of a 35,000dwt chemical tanker going to Spain and construction of a 700TEU boxship hull being negotiated with a German party. The capacity of the shipyard, which can build vessels up to 150,000dwt, was however, only 30% utilised in 2003, a figure which rose slightly in 2004.

Zaliv, in which Brinkfords Co has a 82% share, is Ukrainian-registered and -owned (because Mr Zhvaniya, the owner of Zaliv, has Ukrainian nationality). During the last six years the yard has been modernised through Western assistance at a cost of US\$60 million. Investment has included an automated shotblasting and priming line, automatic plate and profile cutting equipment, TTS-designed block and panel lines (one of each) with ESAB welding equipment for blocks up to 300tonnes,

and a new paint shop complying with European standards. The panel line is in full production producing quality steelwork but the block line is only used occasionally.

Today, production facilities include a construction dock for vessels up to 340m x 54m, with lightweights up to 50,000tonnes; two 400m long transverse slipways for constructing hulls of 150m x 22m and up to 5500tonnes launching weight (using a trolley arrangement), and two deepwater outfitting quays of 278m and 240m long, plus a materials unloading quay 186m long.

One of the special features planned during the early 1990s for Zaliv were 10 dual walking beams, supplied by TTS, from Norway, and each capable of lifting 200tonnes. These were designed to haul blocks to a position adjacent to the construction dock. Although 10 were ordered, only six are currently in use for jacking and transporting blocks.

At the same time, TTS designed a very special vertical lift arrangement for the shipyard that could allow 2000tonne complete prefabricated hull sections to be lowered into the dock for assembly. Unfortunately, Zaliv never actually built the hardware, so today blocks up to 590tonnes maximum have to be lifted into the dock by two 320tonne gantry cranes. Today, TTS has a very active agent, broker, and consultant covering both the Ukraine and Russia; this is Black Sea Maritime AS, which additionally operates a coating company. 

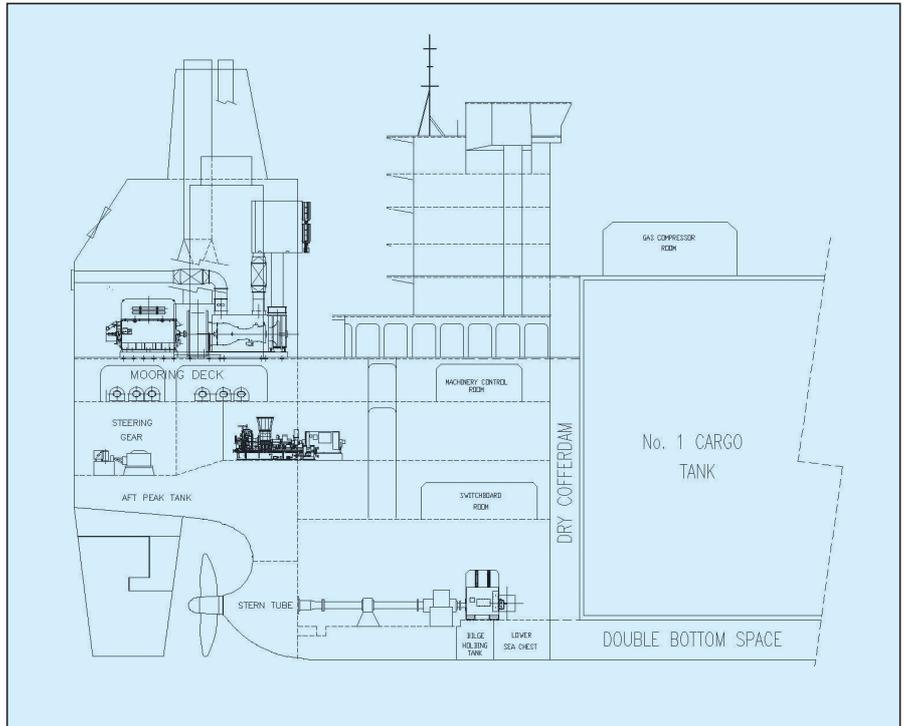
LNG carriers: gas turbines poised to strike

WITHIN in the next few weeks (if it has not already happened), it is very likely that Rolls-Royce - and probably GE - will be invited by a major shipping company to tender for a gas turbo-electric propulsion plant for a series of large new LNG carriers. This will be considered a critical foothold gain by these manufacturers, who have for some time been attempting to persuade operators and shipyards of the merits of such technology, which is, of course, already entrenched in the naval sector and more recently in cruise liners. Rolls-Royce might be considered to be in an advantageous position in that its group companies can offer many other components for such a package, including electrical installation, gearboxes, and propellers.

Certainly, the immediate attractions look good, with high-power-to-weight generating sets able to be positioned on the poop deck, and an ability to burn boil-off gas (ideally most of the time since turbine-friendly DMA distillate oil fuel is very expensive). Good possibilities exist for linking in a steam turbo-alternator using steam generated in the turbine exhaust gas (so-called combined cycle - combined gas, electric, steam - COGES). Such a package is currently being examined from a safety-case angle by the Korean yard Daewoo (DSME) in association with Lloyd's Register.

For its part, Rolls-Royce has been pushing its MT30 aero-derivative gas turbine, extensively using in commercial airliners. A typical combined-cycle plant could comprise a 36MW gas turbo-alternator set, a waste-heat powered 10MW steam turbo-alternator, and a 5.5MW set driven by a small Rolls-Royce 501 turbine. An emergency diesel-powered set, as required by SOLAS, would also be necessary.

An approximate 40% saving in installation manhours is projected by Rolls-Royce, compared with a steam turbine plant, alongside significant weight reduction - 1900tonnes for a combined-cycle plant on a 200,000m³ LNG carrier, compared with 2800tonnes for a steam plant, 3350tonnes for a medium-speed diesel-electric, or 2970tonnes for slow-speed diesel engines with reliquefaction plant. A further



A profile drawing showing how a Rolls-Royce MT30-based plant would fit into a LNG carrier, and revealing the very short engine room that would result. The 10MW steam turbine is positioned below the gas turbo-alternator, and the propulsion motors on the tanktop would be geared down to a suitable propeller speed.

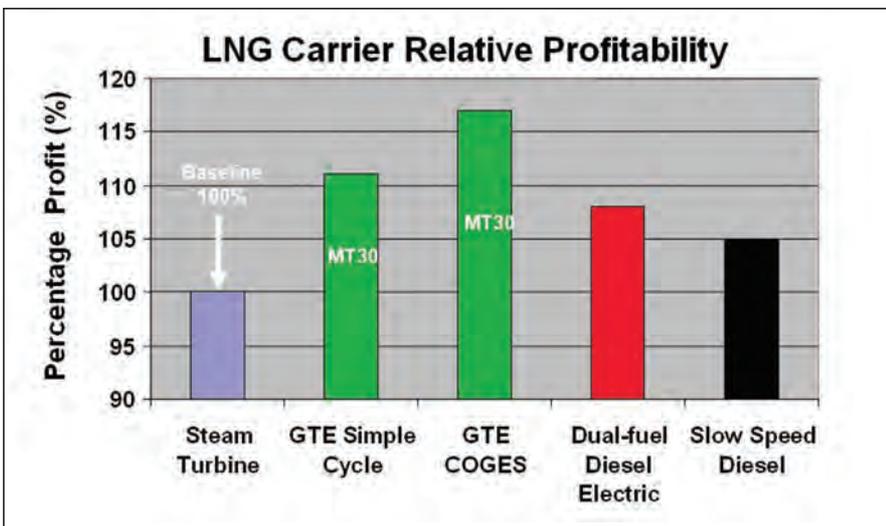
attraction is the extra cargo space available (approximately 10% is claimed) because of a shorter engine room.

A ship of this size would quite likely have twin propellers (FP or of the Rolls-Royce Kamewa ABP adjustable FP type) with single-reduction-gear electric propulsion motors, due to draught restrictions. More details of the attractions of gas turbines for LNG tankers can

be found in *The Naval Architect's* special supplement *Design and Operation of Gas Tankers*, published in September 2004.

Gas turbine-based plant is probably also suitable for standard size ships of around 145,000m³ but Rolls-Royce feels that the best point of entry is into the very large new generation of ships where many technical aspects are having to be re-thought. If the company is successful here, then it can start work on persuading shipyards in particular of the attractions for smaller vessels where established series-construction procedures and economies can be challenged.

Rolls-Royce notes that gas turbines are already employed at all points of land-based gas plants and pipelines, so adding them onto the marine transport link - where the company claims it can offer the lowest freight rate over competing systems - might seem a logical step, especially in a paradoxical situation where an exceptionally clean fuel is being carried in ships burning 'dirty' heavy oil fuel!



Rolls-Royce figures for relative profitability, showing the benefits of a gas turbine-based plant using a COGES cycle. Calculations are based on a very large 250,000m³ ship running between Qatar and the Gulf of Mexico.

Filter tests complete on new ballast water system

MITSUI OSK Lines (MOL) has ensured its compliance with new IMO ballast water discharge standards by fitting a filter which ensures removal of marine organisms and which features a cleaning system (said to be unique) that prevents clogging. MOL has been conducting R&D on a filter-based ballast water treatment system since 2003 as a result of IMO's then planned adoption of an international convention on the control and management of ships' ballast water (subsequently confirmed in February 2004).

The company's system ensures incoming ballast is filtered, removing most aquatic organisms before water enters the ballast tanks. MOL's proprietary new cleaning method uses both back-flushing and high-pressure jets to remove foreign matter from clogged filters, and the large filters are said to be adequate for various types of vessels, including large ships. Results from October 2004 showed that the

number of aquatic organisms over 50µm in minimum dimension was 0/m³, whereas in October 2003 the average number of aquatic organisms from 10µm to 50µm in minimum dimensions was 6/ml.

The MOL concept should ensure compliance with IMO standards for plankton. In the future, the company will look at ways to combine the system with another technique to ensure more effective removal of bacteria, which is difficult to filter because of its small size. MOL will also examine ways to expand the system's treatment capacity to at least 200m³/h to ensure approval under ballast water management treaty guidelines that are now on the table.

The treaty may be applicable to newly built vessels after 2009 if all goes smoothly. Shipping companies face an urgent need to develop a ballast water treatment device that conforms to these new standards. MOL continues to develop

the system for practical use in adherence with the objective of the treaty and believes it is an appropriate method for shipowners.

Results of two-years filter tests

Filter tests were carried out over two years at the company's Yokohama Honmoku Terminal D5 berth. Seawater surrounding the berth was pumped through the filter to measure size and numbers of plankton in the filtered water. The Marine Biological Research Institute of Japan conducted the measurements, and an exclusive filter made by Fuji Filter Manufacturing Co Ltd, with a mesh size of 5µm, was used.

During tests in October 2004, over 1m³ of natural seawater was sequentially pumped through the filter to meet IMO standards adopted in February 2004. The seawater contained around 470,000 organisms in minimum dimension (50µm or larger) for each cubic metre, but there were no species of that size in the water after treatment (the treatment ratio was 100%).

Table 1. Test results.

Date of test	Targets for purification	Number of plankton before purification	Number of plankton after purification
October 2003	Plankton in minimum dimensions from 10µm to 50µm	102 - 382 (average 254)/ml	4 - 7 (average 6)/ml
March 2004	Plankton in minimum dimensions from 10µm to 50µm	137 - 181/ml	2.6 - 9.9/ml
October 2004	Plankton in minimum dimensions over 50µm	470,000/m ³	0/m ³

Note: The test in March 2004 was the result of five samplings.
The test in October 2003 was the result of four samplings.

Table 2. Ballast water discharge standards.

	Aquatic species	Discharge standards
Plankton	1) Minimum dimension over 50µm (mainly zooplankton)	Less than 10/m ³
	2) Minimum dimension from 10µm to 50µm (mainly phytoplankton)	Less than 10/ml
Bacteria	Toxicogenic <i>Vibrio cholerae</i> (O1 and O139)	Less than 1cfu (=colony forming unit) per 100ml or less than 1cfu per 1g zooplankton samples
	<i>Escherichia coli</i>	Less than 250cfu/100ml
	Intestinal Enterococci	Less than 100cfu per/100ml

Guide to new pollution legislation launched

THE Indian Register of Shipping (IRS) has alerted the shipping industry to be prepared for yet another piece of maritime legislation, the Regulations for the Prevention of Air Pollution from Ships (MARPOL 73/78, Annex VI), due to enter into force on May 19 2005. Annex VI will apply to any ship of 400gt and above, and any ship fitted with diesel engine propulsion having a power output of more than 130kW.

Vessels of 400gt and above, and floating drill platforms built on or after May 19, flying the flag of a signatory party to Annex VI and intended for international voyages, will, on delivery, need to obtain an International Air Pollution Prevention Certificate. Similarly, existing ships will need to be certificated no later than the first scheduled drydocking after May 19, but in all cases by May 19, 2008.

To help the industry, specifically ship operators, understand and implement the new regulations, IRS has produced a booklet, *Guide to MARPOL 73/78, Annex VI - Regulations for the Prevention of Air Pollution from Ships*. The society believes the benefits of this booklet, which is said to be written in simple language, will include improved crew preparation; prevention of problems; and optimisation of costs and time in implementation.



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Bureau Veritas: recent initiatives for cleaner seas

THE critical issue of prevention of sea pollution by oil is regulated by MARPOL Annex I, which has fixed allowable discharge of oil residues at sea and has prohibited any oil discharges within more sensitive areas, the so-called 'special areas'. All oil-carrying ships not capable of meeting the criteria have thus to retain their oily residues onboard and subsequently pump them ashore to reception facilities.

This involves the fitting of appropriate equipment, including oil filters and alarms, sludge tanks, piping and pumping arrangements, and means for discharge ashore. Tanker operations require ballast-water handling facilities, washing equipment, oil discharge monitoring, control systems, and specific piping and pumping arrangements. In addition, requirements in terms of cargo tank capacity limitation, residual stability after damage, and recently, double-hull requirements are all aimed at reducing the effects of potential accidental pollution.

Bureau Veritas has integrated these requirements into its rules. The additional class notation CLEAN-SEA, for example, covers compliance with the relevant requirement of Annex I, in particular discharge criteria, oil filtering equipment, arrangement and capacity of sludge tanks, standard discharge connections, the oil record book, bilge water holding tanks, and pumps and piping.

Prevention of pollution by sewage and refuse

Discharge of sewage and rubbish are regulated by the MARPOL convention, Annexes IV and V. These are also integrated in the rules of Bureau Veritas and are included in the CLEAN-SEA notation, added in 2000, for certain ships.

Requirements for the assignment of this notation are given in Rule Note NR 474 DTM.

To secure it, ships have to submit MARPOL certificates (IOPP, with sewage system and oil filter Type Approval certificates), as well as operational procedures implemented onboard (SOPEP, bunkering procedure, oil record book, also refuse management, and sewage and grey water, and discharge control plans). A list of plans and document also has to be submitted which permits the society to check the conformity of a particular ship to the design requirements, together with details of periodical tests and measurements carried out by the owner.

Exhaust emissions

Reduction in exhaust emissions from ships is likely to prove one of the most challenging aspects for the shipping industry over the next decade; it is also expected to become an important competitive factor. Bureau Veritas has issued new class notations for ships which meet these new environmental requirements.

The society has recently established in its new classification rules an additional notation for ships fitted with equipment intended to minimise release of gaseous and solid effluents in the air. This CLEAN-AIR notation is assigned to vessels which are fitted with equipment enabling compliance with MARPOL Annex VI, ie, requirements related to ozone-depleting substances, NO_x, SO_x, shipboard incineration, and fuel quantity. For each of these substances, a complete documentation has to be submitted to BV which will check conformity with MARPOL requirements.

Ballast water

Class societies have been promoting notations to help owners in the new problems of ballast water exchange. The majority of operators have developed management plans on the basis of

sequential and/or flow-through exchange methods without independent vetting by a recognised organisation.

An investigation carried out by a class society has however revealed potential risks underestimated by the industry. Existing ships were not designed to undertake complete ballast water exchanges. If ballast exchange operations on these ships, especially those utilising the sequential and/or flow-through method, are carried out without understanding or controlling the risks, both ship and crew safety could be endangered.

Fears that safety issues were not being addressed have led certain class societies to establish procedure for the assessment of ballast water management plans with a particular attention to the proper training of the crew. For new vessels, design should take into account the ballast water exchange requirements. In that case, particular attention should be given to the system layout, capacity, tank configuration, and hull girder strength.

Health onboard

Bureau Veritas recently acquired Paris-based Aquarism, a specialist company dealing with the control of legionnaire and other viruses in water systems. Managing air and water contamination risks onboard passenger ships is becoming both more vital and more difficult as ships get larger and more complex. BV has unique experience with public buildings ashore, upon which ship operators can draw. The society has worked with Aquarism for some time and respects the expertise it has developed, both on cruise ships and ferries that BV has already certified and on the many major public buildings. Today, its team will form an integral part of Bureau Veritas, and will work with health teams who have extensive experience with complex marine air conditioning systems. 

Australian coatings secure environmental award

A NEW range of protective coatings and maintenance products from National Maintenance Products Pty Ltd (NMP) has been officially certified under the new Australian 'Good Environmental Choice' programme. NMP is believed to be the first Australian manufacturer of protective coatings and maintenance products to receive such certification.

The national product environmental declaration program, conducted under ISO 14020 series standards, examines all aspects of a company to assess its total environmental performance. Specifically, the standard combines the traditional environmental performance criteria, such as VOC levels and heavy-metal content, with additional criteria accounting for ozone-depleting material content, carcinogenic levels, packaging considerations, fitness for purpose, and general compliance to environmental regulations.

The environmental test regime for the Good Environmental Choice label included ensuring there were no VOCs, that titanium dioxide content did not exceed allowable limit (maximum 32g/m² of dry film), that there were no glycol ethers and heavy metals (such as lead and cadmium); and that all forms of product packaging could be recycled. There should also be no exposure to carcinogens during the use of relevant products - potential exposure may only be possible during product removal via airborne silica, but this can be avoided through the use of appropriate safety-ware and facemasks. In addition, products and their solvents and/or cleaning agents should not contain ozone-depleting substances.

Such a programme holds significance in the field of industrial-grade protective coatings, and it perhaps provides a glimpse into the future direction of protective coatings as a whole. In an industry that has arguably, some believe,

overlooked the health and safety of applicators and the environment alike - with the use of solvents, carcinogens, and corrosives still accepted - the new Australian label can provide proof that high-quality coatings and maintenance products, capable of withstanding the most brutal and demanding conditions, need not contain hazards. Technology has advanced considerably and safer raw materials are now at the disposal of formulators, making it possible, and perhaps in the mandatory in the future, to develop products that are free of potentially damaging components.

NMP's products are claimed to be 'field-friendly' in that they are surface-, ratio-, and moisture-tolerant (and can be used underwater), with a good shelf life. They are said to be safe to use and to be solventless, odourless, non-corrosive, non-flammable, and contain no carcinogens or teratogens. They are also easy to transport and store. 

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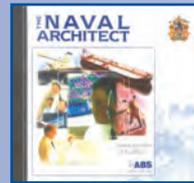
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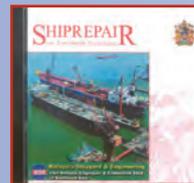
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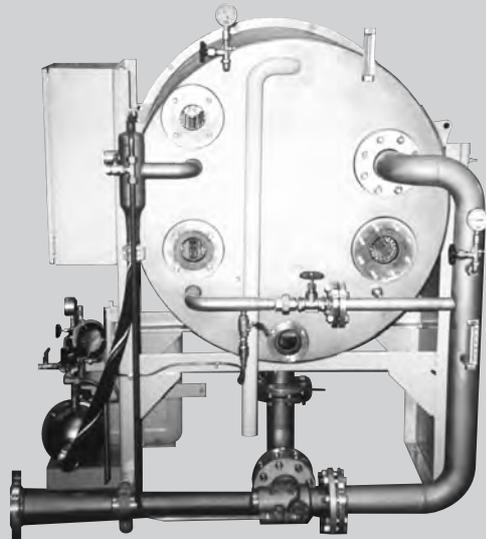


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Waste-water system for positive impact on environment

FLORIDA-based Marine Environmental Partners Inc (MEP) utilises a proprietary electro-chemical process in its ballast water and waste-water treatment system, MariSan, which has been designed for user efficiency and environmental safety. In August last year, MEP was awarded ISO 9001:2000 certification by Det Norske Veritas.

Fully automated, MariSan ballast and wastewater systems are also equipped with programmable logic control (PLC) systems that monitor, adjust, and record the level of treatment. These PLC units are available for both bridge and remote monitoring. MariSan systems are also designed within a small footprint to ease integration into existing layouts, and as modular components, which provide flexibility to increase capacity, for back-up, or for other needs. Installation, in most cases, can occur during normal commercial operation, and systems are said to be cost-efficient and to have low life-cycle expenses.

This ballast water system is a multi-step process that should eliminate invasive aquatic species, harmful bacteria, and viruses. It has been successfully operating under regulated conditions for nearly a year on Carnival Cruise Lines' ship *Elation*. The *Elation* system has been applied for acceptance into the US Coast Guard Shipboard Technical Evaluation Program (STEP), which will independently confirm the reliability of MEP's technology, while offering regulatory incentives to Carnival for early ballast compliance.

A MariSan ballast process begins as ballast water enters a vessel and passes through an automatic self-cleaning filtration module that removes organisms larger than 50microns. Larger ocean biota are immediately released back into

the environment, being native to that location. Before the ballast water held onboard is discharged, it is re-filtered, and then treated in stages to inactivate viable biota smaller than 50microns.

Utilising electrolysis in MEP's Bro-Gen module and ions from the IONZ generators, the water is treated using only the inherent properties of seawater and ambient air. A 'shear mix module' assures complete mixing of disinfecting agents with the ballast flow. This mixing action and residence time also stabilises the water chemistry in preparation for discharge.

A critical feature of MariSan is that the treated discharge is tested to prove that it has no negative impact upon an aquatic environment. The system's capabilities were initially validated in a facility built at and operated in the laboratory at Oceanographic Centre of Nova Southeastern University (NSU). Additional toxicology tests of discharged seawater taken from *Elation* were performed in independent laboratories, and these confirmed the earlier results.

MEP's work with the Nova's Oceanographic Centre also has led to a Sea Grant Award for the development of protocols - based on MEP's MariSan technology - for the testing of ballast water systems.

The ballast system can be adapted to many vessel types, and all components are sized according to the anticipated flow. MEP has several solids-removal technologies that can be deployed, based on the seawater content as determined by a ship's proposed routing.

The MariSan system incorporates the same electro-chemical process as the ballast system - plus additional components. However, it does not rely on membrane technology or bio-reactors at any stage. The equipment is capable of handling

all waste water produced onboard - from galley and laundry liquid to raw sewage. Built-in redundancy should ensure continuous operation and consistent effluent quality.

For the waste-water disinfection process, the effluent is pre-treated to remove debris, to adjust water chemistry, and to homogenise waste streams. Preliminary stream conditioning, advanced oxidation, and disinfection begin during the pre-treatment stage as well, where the first sanitising liquid is injected. The waste stream is virtually odourless after this initial cycle.

Electro-chemistry is utilised to prepare the water as it enters an advanced liquid/solid separation phase, where an additional disinfection and oxidation occur. A three-way safety valve is automatically activated if the PLC detects any non-compliant effluent, at which point it is returned to the waste stream in the supply tank for re-processing. Sludge is collected and removed for further treatment. All units are specially engineered for shipboard environments and to compensate for pitch and roll.

The MariSan system requires only 30minutes-60minutes start-up time, features on/off capability, and consumes small amounts of electrical power. Individual waste streams also can be pre-treated for re-use as technical water, reducing the need for make-up.

Recent contracts include a waste-water plant installed in spring 2004 on Silversea Cruises' *Silver Shadow* in preparation for its Alaska itinerary. In December 2004, MEP was awarded a contract with a US-based cruise line for a 1200tonnes/day package as well as a 250m³/h ballast system. This operator can exercise an option for both systems for a second vessel. 

Oily water separator employs natural bacteria

POLLUTION prevention solution introduced by US company EnSolve for bilge water, the PetroLinator, is a US Coast Guard- and International Maritime Organisation-approved oily water separator that can handle phase-separated oil, emulsified oil, and water. The system takes suction directly from a ship's bilge or oily water collection tank and reduces the total petroleum hydrocarbons to less than 15ppm. Emulsified oil is also managed by the system, whether caused by detergents and/or the ship's mechanical systems. There are three basic PetroLinator models: PL630, PL300, and PL100, to meet the different requirements for capacity and size constraints.

This automated bio-mechanical system is claimed to be safe and to require low maintenance. Unlike conventional oil water separators, the PetroLinator actually destroys oil and grease using naturally occurring bacteria. This technology has been successfully used in hundreds of land-based applications since the 1970s and has been improved and specially



The PetroLinator destroys oil and grease in bilge water using naturally occurring bacteria.

designed for shipboard applications. In 1998, EnSolve secured a patent for shipboard use of the PetroLinator.

The fully automated system is designed to work 24 hours a day, seven days a week but can accommodate other schedules or instances when

the bilge water has been entirely processed. Since its introduction to the marine industry, PetroLinator systems have been installed on a number of different ships with reportedly excellent results. Customers include UECC, Interlake Steamships, and BC Ferries. EnSolve has also received SBIR funding from the US Navy to develop the PetroLinator technology as a potential replacement for mechanical oily water separator systems on naval ships. 

Maritime Transportation - Safety Management and Risk Analysis

By Svein Kristiansen, Professor of Marine Systems Design, Norwegian University of Science & Technology. Elsevier Butterworth-Heinemann, Linacre House, Jordan Hill, Oxford OX2 8DP, UK. 496 pages, 200 illustrations. Hardback. £49.99, US\$74.95, €74.95. ISBN: 07506 59998

Seafaring has always been a dangerous occupation in which the certainty of discomfort inadequately compensates for the possibility of drowning. It is hardly surprising, therefore, that seamen are pre-occupied with safety while those who regulate their lives continue in their efforts to devise further and better rules.

In 1836, following three years in which 1702 British ships were lost, a select committee of Parliament reported on the several causes of shipwrecks (Ref 1), amongst which the inadequacies of ships, equipment and repair, and the incompetence of masters and officers featured prominently. Even allowing for today's more circumspect use of language, we should still acknowledge the currency of the complete list and include, in addition, items that have only emerged in our own times.

Despite public concern and that Committee's eloquence, it took a further six decades to enact effective legislation to regulate the British shipping industry and another century to bring about the present international maritime order. No doubt, there have been many significant achievements along the way, especially when one recalls the political accommodations built into the foundations of many of our International Conventions. Yet until recently, our approach to maritime safety has remained one of compliance within a regulatory framework shaped more by what can be agreed than by what is possible or needed.

In this timely new work, Professor Kristiansen quotes Kuo's (Ref 2) definition: 'Safety is a perceived concept which determines to what extent the management, engineering and operation of a system are free from danger to life, property and the environment', which, while widely accepted, nevertheless begs many questions - whose perception? how is something to be determined? - that highlight the difficulties standing in the way of those seeking to improve safety. As Kristiansen points out, the way is hard and progress is slow. There are many reasons for this. Complacency is more comfortable.

Catastrophes concentrate the mind and arouse enthusiasm for the response 'something that must be done'. But practical situations are often complex and the 'something that must be done' is too ambitious or too expensive to be acceptable to those charged with doing it. Today, formal safety assessment (FSA) promises some relief for the IMO committees and maritime administrations working to construct more rules, although its utility for the seaman on watch is more questionable.

Fundamental to progress in the field of safety and reliability engineering is the often misunderstood, or misrepresented concept of risk. It is this that is Professor Kristiansen's main concern. Whereas familiar, historical approaches to safety have been qualitative, the analysis of risk aims to be quantitative, relying on a variety

of statistical methods, even though it often has to deal with factors that are inherently difficult to quantify.

Risk analysis is not new. It combines several general techniques such as: preliminary hazard analysis, failure mode, effect and criticality analysis, fault tree analysis, and cost benefit analysis. These have been developed to address the circumstances of different major modern industries and which Professor Kristiansen here applies to circumstances arising within maritime systems. He is not the first to do this. But what he has done is to produce a comprehensive and lucid text book that is aimed at maritime practitioners and equips them with the tools to address a wide variety of familiar situations and problems.

Many commentators have observed that the majority of marine accidents occur as a result of human interventions, usually errors. But such observations tell us little. Whether in design, operation, or in other ways, people bear the ultimate responsibility for creating every conceivable artefact or system - including those that we call autonomous - from which it follows that better understanding of human decision-making and behaviour is central to the achievement of greater safety.

It is good to see that the classification societies and other influential maritime bodies have also arrived at this conclusion, widening still further the dream of the Reverend Joseph Woolley (Ref 3). His views were expressed in the very first paper to be read to The (Royal) Institution of Naval Architects, which looked forward to a more scientific approach to the art of naval architecture.

Professor Kristiansen has done this profession and the maritime community a great service by producing a book which so expertly addresses the issues of maritime safety and the tools now available to help us bring about further improvement. Everyone engaged in the design or operation of ships should be aware of, and even familiar with its contents.

John King
Professor, Cardiff University

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Car Ferries of the Irish Sea, 1954-2004

By Justin Merrigan. Published by Colourpoint Books, Colourpoint House, Jubilee Business Park, 21 Jubilee Road, Newtownards, Co Down, Northern Ireland BT23 4YH. Softback. 168 pages. £16.00. ISBN 1 904242 25 1.

Ferry buffs and everyone else, including naval architects, connected with the UK's rich history in both building and running ferries around the nation's extensive coastline, will delight in this new publication from a house well-known for its ferry and similar pictorially-based works. The Irish Sea has always been a particularly challenging environment for operators, not only

from the elements, as many of the action illustrations testify, but also commercially. One of the defining moments noted in the introduction was the loss of the *Princess Victoria* during a 1953 storm, when seas breached her half-height stern gates - an access arrangement unthinkable in today's safety climate.

Many operations were run by railway-orientated companies, notably British Railways and its successors, but enterprising newcomers were B+I Line, and more recently, Irish Ferries (including with *Ulysses*, one of the largest and most luxurious ferries ever on these routes) and the French company Brittany Ferries; some of these have ambitiously launched fast catamarans into these difficult waters, but the relatively long distances for some routes makes this type of ferry attractive for many. The book is right up to date, and includes illustrations of Brittany Ferries' *Pont-Aven*, delivered in 2004.

The comprehensive, detailed, and entertaining captions for the large number of illustrations are clearly written by someone with in-depth and enthusiastic knowledge of the industry; indeed, many readers will know that Justin Merrigan, who grew up in Ireland, today works with the leading Australian fast-ferry builder, Austral. The pictures do not appear to be arranged in any particular order, chronological or otherwise, but this does not detract from the value; however, in today's era of high-quality colour printing, it is a pity that not more of the photographs are in colour - but they were taken at a time when black and white photography was still the norm!

Tim Knaggs

Updated steering gear from Norway

A COMPACT four-vane Frydenbö RV steering gear from Rolls-Royce is entering service in a series of 4440TEU container ships building at the Gdynia Shipyard in Poland for German owners Döhle, Rickmers, and Hermann Wulff. The 8234-class ships are specified with RV6000-4 sets.

Significant advances in structural strength and performance are offered by the four-vane design, developed from well-proven Frydenbö RV series steering gear sets with two and three vanes. Exploiting a rotor housing and integrated stator vanes cast and machined from a single piece, the four-vane unit delivers a maximum mechanical rudder angle of 2 x 36.5deg and features two key improvements: an actuator hydraulically balanced when running in emergency mode, eliminating frictional losses in the bearings; and access to all internal parts without disconnecting the rudder stock.

Although the maximum working pressure is increased to 160bar - limiting the size and weight of the units, and yielding installation and service benefits for yards and owners - three spindle screw pumps are retained, fostering low wear and a long lifetime. A rudder carrier forms an integrated part of the bottom cover so that no separate carrier element is needed. 

Bright future for European shipbuilding and repair?

Ir Willem de Jong, chairman of CEMT, considers that the recent London conference on the future of European shipbuilding and repair was a most useful event and should provide a spur to future initiatives. He challenges the belief by some that Europe is in decline.

THIS conference on the subject of 'European Shipbuilding, Repair and Conversion - The Future'* proved to be an excellent combination of presentations on economic and technical subjects, with an emphasis on the role of research, development and innovation. Leading figures in European shipbuilding, shipping, university and research institutions, together with representatives of the European political scene, gave their opinions on the present state of our industry and how they see the future.

A relatively weak position in Europe against fast-growing shipbuilding industries of the Far East was highlighted, but it was also shown that, in absolute volume figures, European shipbuilding has, over the last 10 to 20 years, maintained a more or less constant turnover, with a strong position in niche markets and a particularly strong position in marine equipment.

Most innovations and new developments still come from Europe, a region where

shipbuilding, together with its associated industries, is still a very large business - it is absolutely unjustified to consider it a sunset industry.

The strategic interest of this sector for Europe was highlighted in connection with its large shipping fleet and growing shipping needs, whilst also the importance vis à vis naval shipbuilding was indicated. In this time and age, naval technology very often follows new developments that have taken place in the merchant shipbuilding - rather than in earlier days when it was the other way around. Maintaining a competitive and state-of-the-art naval shipbuilding industry requires the presence of a sufficiently strong merchant shipbuilding.

In connection with support programmes, the importance of initiatives such as Leadership 2015 was stressed and preferred above direct contract support. The necessity to create and maintain a level playing field within the European Union was stressed, and for the global situation the new OECD agreement on shipbuilding is awaited with impatience.

At the conference, some doubt was expressed regarding very large research projects, with too many participants, too high overhead costs, and too long cycles. Smaller projects, with faster lead times to results and with lower communication and coordination costs, are generally preferred. The

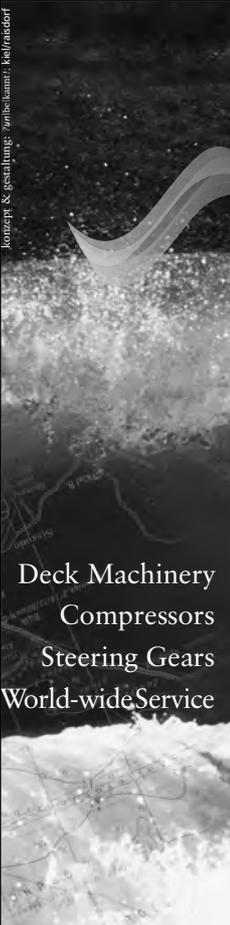
importance of innovative economic stimulation packages, such as loan guarantee systems and scrap-sell-build programmes, was also discussed.

Technical presentations covered a wide area of interest. These ranged from virtual manufacturing, integrated design systems, and shipyards layouts, to brand-new techniques such as the concept of composite sandwich-plate systems in both newbuilding and repair.

In many presentations, the need for improved education and training was emphasised, underlining the fact that today, shipbuilding is no longer just a craft but an industrial activity requiring a healthy mix of technological and organisational capabilities, together with well-developed craft skills.

This is not just a task for our educational institutes but also for the learned societies such as The Royal Institution of Naval Architects and others, working together in The Confederation of European Maritime Technology Societies (CEMT). This is why this conference was organised and why these societies will and have to continue to publish technical journals, organise lectures and seminars, and conferences. ☺

* European Shipbuilding, Repair and Conversion - the Future, held on November 2-3 2004 in London and organised by The Royal Institution of Naval Architects and The Institute of Marine Engineering, Science and Technology.



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Making software that naval architects love since 1972

Foran users' meeting: honing design and production

The 2004 users' meeting for Sener's well-established Foran integrated CAD/CAM software was held at the end of October in Granada, Spain. Eric Tupper attended this interesting event specially for *The Naval Architect* and reports on the proceedings, particularly on the important feedback from practical users.

SENER, Ingenieria y Sistemas SA, is a private engineering and consultancy set up in 1956. It employs some 1200 people and is a multi-branch engineering concern covering a broad range of technologies including aerospace, transportation, civil engineering, communications and marine engineering. Of the company's activities, probably the Foran system has had the greatest worldwide impact.

It began with the mathematical representation of a ship's hull which led to the Analytical FORms system which became Foran, and this was then extended as a tool to integrate all ship design and production activities.

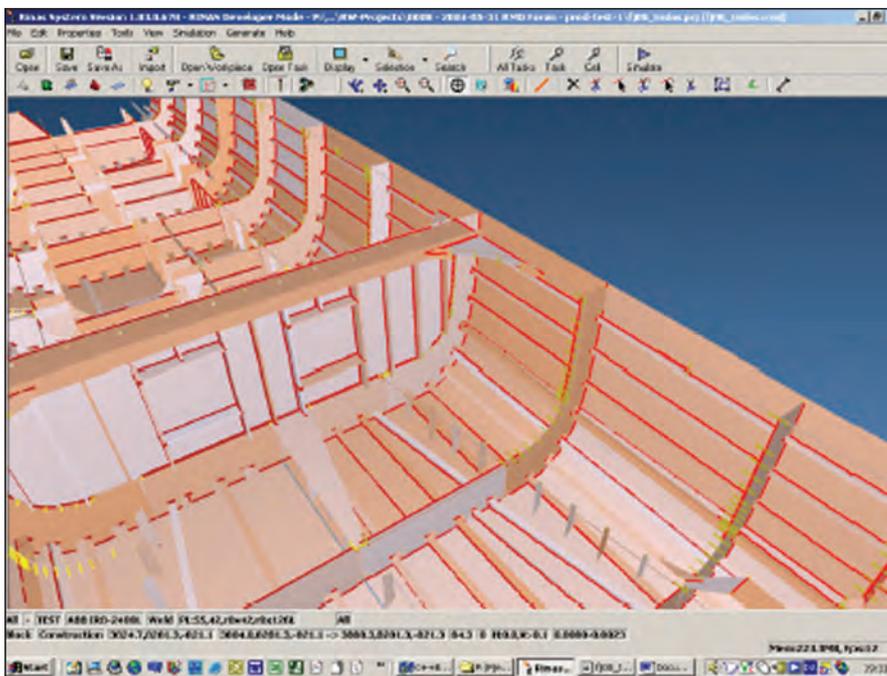
The first licence was granted to a shipbuilder in 1969, and today the software is used by 130 shipyards in 25 countries. In all benchmark tests carried out on such systems since 1991, Foran claims to have been the leader, except in one where it came second.

Sener recognises the importance of feedback from users to provide an understanding of the strengths and weaknesses of existing systems and the focus for future developments. The company's third FORUM (FORan Users Meeting) was held in Granada, Spain from October 27-29, where the new virtual reality system developed by the University of Catalunya and reported in the October 2004 issue of *The Naval Architect* (page 45) was demonstrated to participants. Delegates came from several major European marine countries, including Norway, Poland, Italy, Finland, and Russia.

Trends in marine technology in Europe

To head up the conference, an invited paper by V Parajon, of INNOVAMAR, outlined two projects under the European Union Framework VI Programme (FP6) (2003-2006) and explained the possibilities and problems of 21st century software tools and associated communication systems. INTERSHIP aims to improve methods and tools for the design and manufacture of complex one-of-a-kind vessels. It is consistent with, and is part of, Leadership 2015, aimed at making European shipyards more competitive. Expected savings when fully implemented are 10%-20% in the design phase, 6%-12% in construction labour costs, and 2%-7% in production material costs.

SAFEDOR is concerned with safety issues and involves 44 organisations from 12 European states. Part of FP7 will be MARTEC, whose objective for 2005-2007 is to achieve the understanding and tools for establishing a coherent R&D strategy in the European



An interesting presentation by Kjell Ove Tolo, from the Norwegian shipbuilder Fjellstrand, discussed the challenges and application of Foran to robotised welding of aluminium. Welding paths are generated automatically in the program RinasWeld.

maritime sector. Fundamental research is needed to support commercial developments even when the latter may be way off in the future. There is a need to co-ordinate the European Framework Programmes with national R&D programmes.

Communication networks, large data bases and software systems, and the Internet are examples of huge, inter-dependent open systems which behave in ways that are increasingly difficult to predict and control. Recent studies on the principles of functioning of complex systems - such as living organisms, ecosystems and societies - suggest that lessons on efficiency and reliability can be learnt from such systems. Besides mastering complexity, we must augment human capabilities by developing assistive, cognitive and interactive technologies. Projects aimed at empowering research include GEANT, the pan-European research communications backbone which already enables high-speed interconnection of more than 3900 research and education institutions in more than 30 countries.

The rest of the conference dealt with the development of Foran and the experience of a number of users.

Foran development strategy

It was explained that Foran is in constant development, with one or two new releases a year. The latest was Version 50, release 2.0, in February 2004, which included a new advanced

design and drafting module (FDESIGN), an integrated solution for collaborative engineering management (FTEAM), and a new development environment (FDE). Some details of these appeared in *The Naval Architect* July/August 2004, page 40.

The overall aims of development are to improve initial and basic design tools, reduce manhours, and improve design quality. It is recognised that early versions of Foran were strong in the later phases of design and production but weaker in initial design. The initial and basic design tools are therefore being improved by allowing fast definition of a 3D early model, covering hull form, decks, bulkheads, 3D spaces, hull structure, and outfitting general arrangements. Importance is attached to the ability to re-use initial and basic design data in detail design, while interchange of data between Foran and other CAD systems will be facilitated.

Several delegates spoke well of the training and support provided for Foran. More emphasis is now on 'e-learning' which is regarded as more efficient and economic for customers. Training sessions can be arranged locally at times and of duration to suit specific needs.

At the time of the meeting, the plan for future releases, with some of the main innovations, was:

- Version 50, release V50R3.0, December 2004 with improved internal structure

The Royal Institution of Naval Architects



HUMAN FACTORS IN SHIP DESIGN, SAFETY AND OPERATION



23-24 February 2005, RINA Headquarters, London, UK

Second Notice

Naval architects and marine engineers have a direct influence over designs and as such have an influence over how their designs are used by seafarers. In recent years, they have made increasing efforts to gain an awareness of human element issues and to improve their understanding of how and why their designs influence human behaviour.

The traditional view that human error is the major cause of all accidents is being challenged by some who consider human error to be a symptom of deeper problems with the system. Errors can be induced through bad design, poor training or poor/inadequate management systems. Indeed, some argue that modern technology has reached a point where improved safety can only be achieved through a better understanding of human element within the system.

This conference aims to bring together international specialists and professionals including designers, ship operators, mariners, equipment manufacturers and regulators to highlight how the sensible application of ergonomics and human factors can provide an opportunity to both reduce costs and improve safety. The Institution invites papers in such areas as:

- Integration of human factors into the design process
- Practical applications of human factors engineering
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- Design of navigation & control systems
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- Safety performance and management
- Maritime operating organisations and teamwork



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definition for basic design (FHULL); advanced tools for definition of outfitting structures and for defining supports (FPIPE); and improved drawing generation (FDESIGN).

- Version 60, release V60R1.0, mid-2005 with better definition of internal structure in FHULL; a new FHINFO module for hull manufacturing information, and outfitting improvements.
- Version 60, releases V60R2.0 and 3.0, will follow in 2006 and 2007.

In more detail, the following developments were reported:

New features in hull structure (FHULL). Leading into V60, the goal is to return to initial design to make the transition into basic design, and then detailed design, easier. A single model will be used for all design stages, facilitating information re-use, with increasing level of detail. The internal structure definition will use two environments (flat and curved surfaces) and two working modes (3D and 2D sketcher). A wide range of part types will be used.

FHINFO. Features include development of plates from any surface with automatic detection of planar, cylindrical and conical parts; generation of rolling line and bending lines for heat bending; automatic generation of template parts; information for marking flat or curved structures on the panel; plate nesting; interactive calculation of weights and centres of gravity and welding calculations.

FDESIGN. Including sections, labelling, dimensioning and configurable parts lists for drawings from the 3D model, section and surface drawings, and interim products drawings.

FDE - Foran Development Environment. This is based on the same standard as JavaScript and is aimed at system developers and designers.

Typical tasks that can be carried out are extracting data from a product model; tailor-made reports with graphics; implementation of customer specific commands; automation of repetitive tasks; and integration of Foran with other systems.

Auxiliary structures and supports (FPIPE). This features a hierarchical structure of elements with interactive tools for creation, editing and positioning; user structure libraries; tools, based on FDE, for customised reports and repetitive structures; information for fabrication and mounting.

User experiences

The delegate from the Spanish shipbuilding group IZAR reported that whilst the use of 3D models for steel and outfitting are commonly used in the later design stages and construction, they are today being used in early design with great promise. Interaction with the customer through digital mock-ups and virtual reality is improved; development of the design is smoother with the re-use of data in later design phases; and interchange of information with other disciplines is facilitated.

There is a need to improve CAD systems orientated to early design. The early design product model for merchant ships should embrace hull form and compartment definition; calculation of naval architectural attributes; application of classification society rules; finite-element analysis; weight and cost estimates; and reservation of space for systems. A warship model would also need to allow for simulation of operations; signatures; vulnerability and susceptibility.

IZAR's experience with Foran V50R2 is that it is orientated towards detail design. For early design, more flexibility in changing modes is needed, with better interactions with other

CAD systems. Interfaces with many naval architectural calculations is good but improved interfaces with more advanced analysis tools, such as finite-element analysis methods (FEM) and computational fluid dynamics (CFD), is required.

SteelCad Consultants, a Norwegian engineering company developing production documents for shipyards, reported that Foran V50 is the standard CAD/CAM system used in shipbuilding in Norway. Foran has been used since 1997 and after some teething problems, the company is very happy with the software. During 2004, Foran has been used for more than 100 hull form projects, 86 lofting and workshop information projects, and for 15 piping and outfitting projects.

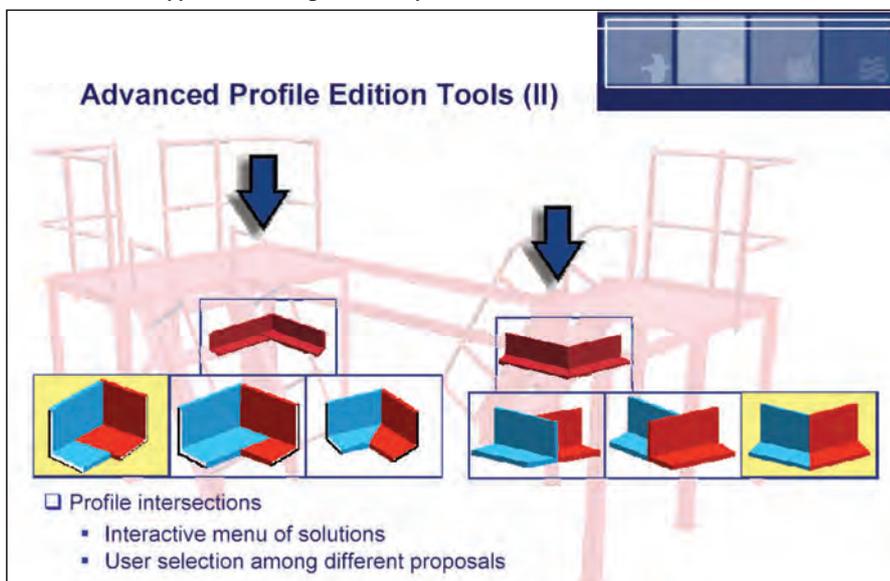
Rolls-Royce Marine, from Ålesund in Norway, described experiences over the last three to four years in introducing Foran and moving from 2D to 3D working. The Spanish package was chosen as a result of testing three different systems. The need was for one that would cover all phases of design and transfer into production. Training started on V40 early 2001 and on V50 in mid 2001, and the first Foran-based project started in early 2002. Rolls-Royce found the system user-friendly, easy to learn (e-training was appreciated), with good facilities for detailed design. The company, like others, saw a need to improve the early design phase.

SYX e-business Solutions AS is a system for global provision of online sourcing, procurement and collaboration solutions to engineering, procurement and construction projects. This concept operates on three web-based trading platforms, one related to shipbuilding. Typically, procurement costs are 60% to 80% of a newbuild project. In essence, a SYX system takes requirements from buyers and seeks products meeting these from industry. This involves interacting with many systems, with different ways of defining products. A lot of data is needed to define products, and many interactions between SYX, buyers, and suppliers are needed to ensure the product is the most cost-effective whilst being fit for purpose.

The Norwegian fast-ferry shipbuilder Fjellstrand, which builds mainly 30m to 60m passenger catamarans in aluminium but also the revolutionary FerryCat 120 double-ended ferry with Azipull propulsion, with a larger version FerryCat 240 proposed, described its use of Foran to assist software for welding robots. To date, investment in automating welding of aluminium structures has been only modest. Labour costs account for some 60%-65% of costs compared with 20%-25% in steel vessels. Robots will improve quality, flexibility, and efficiency whilst reducing costs.

The Italian Rodriquez Group, through recent acquisitions, has become a complex organisation spread over five divisions (as reported in the new supplement *Rodriquez: a Story of High-Speed Success*, published with the November 2004 issue of *The Naval Architect*). It produces an average of 80 ships at any one time. Use of Foran gives all sections access to a common data source, and helps develop and improve standards and

Sener's Rafael de Gongora discussed new solutions, using Foran, for designing shipboard auxiliary structures and supports, including advanced profile edition tools.





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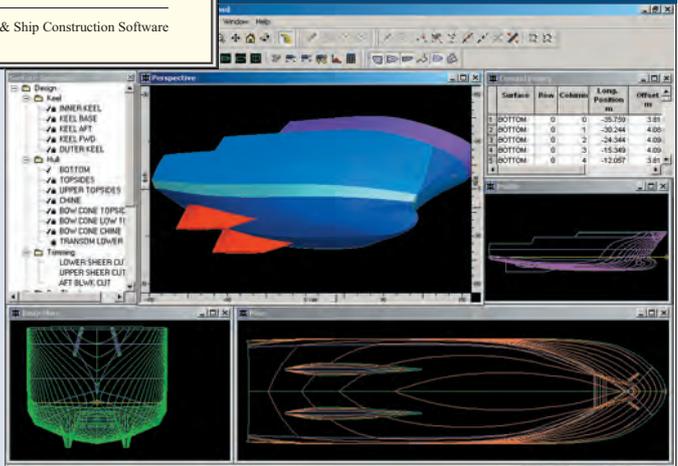
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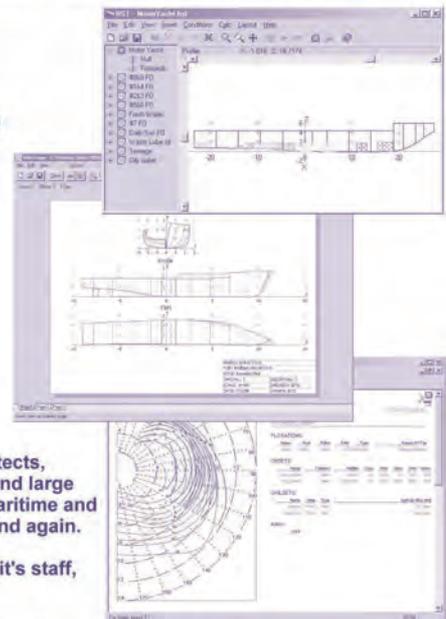
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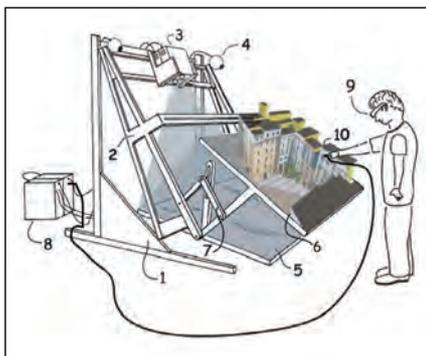
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common definitions of parts. 3D technology has reduced design errors, speeded up the process and reduced production problems, while management has the information to assess risk and control projects.

Several other companies spoke of the need to be able to operate on a global scale in order to be competitive. They have found Foran good for developing their own products and in interacting with other systems. Their experiences were in line with those outlined above and the improvements they would like are being addressed by Sener.

Low-cost 3D interaction

The new low-cost virtual reality system designed at the Polytechnic University of Catalunya was described and demonstrated. This system allows direct selection and manipulation of virtual 3D objects. The interaction is based on stereoscopic images projected over the user's working space and on devices tracking the user's natural movements. The system includes a screen, approximately the size of an office desk, which is adjustable in orientation and height. Sensors track the user's head and hand movements and a tactile device for the forefinger (the thimble) provides a sense of touch. A semi-immersive system with polarised glasses is used, based on back projection, instead of a totally immersive device such as a head-mounted display. The latter is not suited to use over a



A graphic representation of the proposed new affordable stereoscopic table for 3D interaction, that has been developed by the Polytechnic University of Catalunya, as explained by Carlos Andujar.

long period of time. The user's head and hand movements are tracked by a magnetic or optical system.

An improved version of the table is currently being commercialised by Sener for application in fields such as architecture, medicine and industrial design.

Conclusion

Sener has produced a very effective integrated suite. Users appear to be very satisfied with Foran, although implementation can take some time as old systems are replaced by the new. They report good experience with Sener's training and support services, and the use of e-training is appreciated. The effectiveness of Foran is apparently shown by its performance level in benchmark tests.

As with any successful system, customers are left wanting more and better facilities! These Sener aims to supply - the level of investment has doubled over the last five years, and effort is now concentrating on improving the initial and basic design features. This will include a single model covering all design phases, with information being used at each stage, together with a proactive development system and the increasing use of virtual reality techniques.

Sener has every reason to feel pleased with its achievements to date but is not resting on its laurels. Improvements to the concept are being made in response to the needs of customers. Ⓡ

New features on hull module

SINCE its release in July last year, ShipConstructor2005's Hull module from Albacore has seen many improvements, providing users with new easy-to-use functions for previously complex tasks. ShipConstructor2005 brought complex surfacing technology and lofting functions directly into AutoCAD for the first time. It also features functions for 3D modelling of structure, pipe, HVAC, and equipment. All functions are tightly integrated with an SQL server database, allowing the creation of production reports, production drawings, nesting and NC processing.

These additional features include NURBS-curve fairing (nudging); curvature colour display and isolines, and forward/backward surface mapping (Markline synchronising). Other new features include:

- shell expansion
- deck surface generation
- generation of developable and curved surfaces from NURBS-curves
- freeform rail extruded surface generation
- plate expansion strain as iso lines
- stringer creation using girthing function
- import/Export IDF, export GHS
- additional 2D forming template options
- bow fashion template by number of templates.

As a lead into a transfer of all fairing functions from ShipCAM to Hull, this new version offers the ability to fair curves inside of AutoCAD and

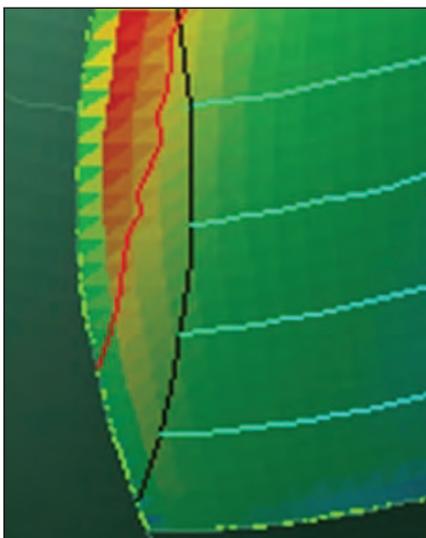


Fig 1. Curvature isoline ready for mapping to 2D.

generate developable and double-curved surfaces from the faired curves. Users can move control points individually or select any number and move them in unison.

A curvature display creates new opportunities to increase product quality, simplify construction and save man hours. The curvature display comes in two forms: colour coded display and curvature isolines - lines of constant curvature. This function can be used to detect and eliminate unfairness in any surface or mark problem areas for the forming of highly curved shell plate.

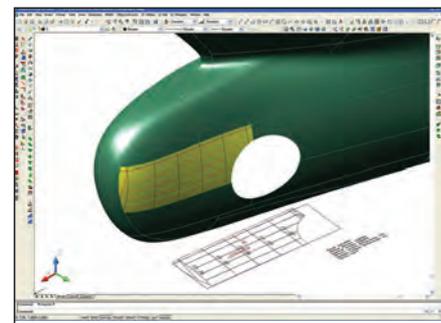


Fig 2. Expanded plate with forward/backward mapped markings.

Occasionally, plate expansion and plate forming involves difficult plates. ShipConstructor now adds tools that enable users to simplify these difficult cases. An example of this can be seen in Fig 1. The forward upper end of the plate contains curvature that is beyond the established threshold for easy plate forming. The shop has to be informed about this problem area. In this case the curvature isoline (red) is selected and mapped from the 3D plate to the 2D expanded plate. In the second figure (Fig 2) the green rectangle, defining the maximum plate size, has been overlaid onto the expanded 2D plate. The expanded plate is too large, so all a users had to do is choose 'Synchronise Plates' from the context menu to transfer the maximum 2D size back to the 3D hull surface for re-trimming. Ⓡ

FloWizard for CFD

A NEW software tool, FloWizard, has been launched by Fluent Europe Ltd to speed the use of computation fluid dynamics (CFD); it is claimed as the easiest-to-use CFD tool ever developed. For the first time, claims Fluent, engineers with no specialist CFD knowledge can achieve the benefits of applying CDF at the earliest stages of a design and development process to evaluate speedily, from CAD geometry, fluid forces, temperature fields, and other flow phenomenon.

The source of this power is a comprehensive wizard-driven interface, which can guide a user through the complete CFD process, from CAD import, through problem set-up and solution stages, to post-processing; in addition, the software generates an automatic results

report. FloWizard has been created from extensive usability tests in association with engineers from leading companies worldwide, and is claimed as the first CFD tool to include live collaboration as standard, enabling designers at any number of locations to work together.

The package is powered by Fluent V6, a commonly used and powerful CFD tool, to provide a very high level of accuracy and to allow simulations to be seamlessly passed on to Fluent V6 users for more complex simulations and analysis. Full customisation to individual company requirements can be provided. Overall, this new product should improve design quality and identify promising possibilities earlier in a design project. 

Daewoo CAD unification project complete

A COMPUTER unification project at the Korean shipyard Daewoo Shipbuilding & Marine Engineering (DSME), involving a full implementation of the entire Tribon M3 CAD/CAM software package, has been completed six months ahead of schedule. Today, all new commercial marine projects at the yard, also several offshore ones, are being designed completely in Tribon M3.

As a result of the success of the operation and for providing 'exceptional services over the last three years', a plaque of appreciation was presented by DSME to Aveva, the UK company that today owns Tribon. 

Common tanker rules now in RulesCalc

LLOYD's Register is believed to be the first classification society to have the completed RulesCalc Version 3.0 software in operation; this package from the UK company Code 27 Ltd, based in Sussex, is specially designed to support the Common Tanker Rules. Early in 2002, Lloyd's Register joined forces with ABS and Det Norske Veritas to develop new rules for oil tankers and to provide an enhanced level of structural durability. The first draft was produced in June last year and was given to Code 27 for integration into RulesCalc. 

Aveva software link with Hyundai

A new strategic partnership has been set up by the UK-based Aveva Group plc, which today includes the Tribon integrated CAD/CAM software package in its portfolio. This agreement has been made with the leading Korean shipbuilder Hyundai Heavy Industries and under it, Hyundai will commit US\$8 million and collaborate with Aveva in the development of the Vantage marine product programme, which is expected to be ready during the next financial year. A major theme of this programme is the Vantage Enterprise Net (VNET), claimed as a unique 'engineering collaboration and integration platform'; Hyundai's employment of this will be the first-ever in the marine sector. 

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New double-hulled bulkers from Daewoo

Sir - I read with some interest and satisfaction about the recent design of double-hulled Capesize bulk carriers from Daewoo (*The Naval Architect* October 2004, page 18); this yard must be congratulated for its promotion, over several years, of double skins for bulkers. Nevertheless, as a former chief marine superintendent for P&O Bulk Shipping and having been a member of the FSA team at IMO on the safety of bulk carriers, I am acutely aware of some of the claims made against such designs in the recent Marine Safety Committee debate on the subject.

The outcome of that debate was not to mandate such designs at international regulatory level and yet there appears still to be interest in them. Having worked with such vessels since the early 1980s, I could never agree with sentiments expressed by the opponents on issues of safety, even if I do sympathise with some of the claims that more regulation and experience is necessary before mandating.

This is now in hand with the new SOLAS Chapter XII regulations and indeed IACS is also doing its bit. My satisfaction is in the fact that Daewoo and others are successfully marketing such vessels, which can only lead to an accumulation of more expertise.

I was dismayed, however, to see some other comments in the article. The first concerned the location of some bunker tanks in double bottoms beneath cargo holds. Why are designers so pre-occupied with putting fuel in places where it is difficult to retrieve (ask any chief engineer), especially in cold weather? Why also do they ignore the nature of the trade of the vessels they are designing?

Do they not know that these vessels are discharged using grabs that each weigh 30tonnes, which frequently hit the tanktops rather more forcefully than they should? Do they not know that penetrations are therefore not uncommon? A full head of bunkers then has no problem in flowing into a cargo hold, from where, via the bilge system, it becomes an instant pollution hazard.

If the bunkers cannot be contained within the boundaries of the engineroom, it is only acceptable to place them in a pair of topside tanks, preferably aft, from where the contents are not only out of most harm's way but also easily retrievable, often by gravity alone (as in the New Green Cape design, *The Naval Architect* May 2004, page 56. *Ed*).

A second issue is with the statement in the article that forecastles are considered by some to be a most useful feature in preventing green seas breaking over No 1 and 2 hatch covers - an under-statement if there ever was one. I have yet to meet a master who does not believe that the most dangerous development in Capesize bulk carriers was the demise of the forecastle.

Contrary to popular belief, the earliest Capesize ships all had forecastles. The issue is not only that protection is afforded to the forward hatches, which to any seaman is obvious, but also that the anchors are up and clear of the water. Most flush-decked vessels

spend their lives dragging their anchors in the water, and the pounding impacts and removal of protective coatings on shell plating, which is on average 17mm thick, is a serious threat to the integrity of the forward spaces.

Those vessels, because of their length, are guaranteed not to rise to the oceanic waves which, unlike the growth in vessel size, are the same length as they always were. They therefore take on the sea-keeping characteristics of a submarine - without a pressure hull as security. These vessels frequently have forepeaks that hold 7000tonnes, which when flooded, are a serious threat to seaworthiness. We should have learned that from *Derbyshire*, also a flush-decked ship.

Finally, I was surprised to see that the vessel depicted was equipped with side-launched lifeboats. This conflicts with one of the principal outcomes of the FSA study; in conjunction with early warning of sinking provided by water ingress monitoring, it is the requirement for Panamax and Capesize bulk carriers to be equipped with free-fall lifeboats having a float-free capability.

I therefore appeal to naval architects to consider these matters and to consult the senior officers of the vessels, both on deck and in the engineroom, for the wealth of experience available there (this wise move has been advocated on several occasions in *The Naval Architect's* Editorial Comment column, most recently in November 2002. *Ed*).

Capt Dennis Barber, FNI, ARINA
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UK

Ships as safe havens

Sir - On page 43 of the October 2004 edition of *The Naval Architect*, we read (under the heading 'Ships to be their own lifeboats?') that 'A new project initiated in Sweden ... aims to develop a new passenger ship design concept incorporating safety levels in respects of such aspects as resistance to sinking, methods of evacuation, and fire safety'. Nobody likes to be reminded that their new epoch-making idea has, in fact, been thought of before, but I clearly recall a UK Board of Trade (a forerunner of today's Maritime & Coastguard Agency) surveyor stressing to us apprentices in the late 1940s that the ship itself - especially a passenger-carrying one - must always be regarded as her own Number One lifesaving appliance in the event of flooding or fire, only to be evacuated as a final resort. Administration surveyors have repeated this view over and over again during the last 60 years.

While welcoming the development of new and improved life-saving apparatus (LSA), my experience of designing passenger ships has always been focussed on ways and means of making them as safe as possible in the event of misfortune, with the principal objective of permitting all hands to remain on board a buoyant, stable, and upright vessel, albeit a badly damaged one, whether underway or not. With all respect to SSPA and its technical

collaborators in this 'new project', I sincerely trust that the question mark following the words 'Ships to be their own lifeboats?' can be permanently deleted.

The Board of Trade surveyor mentioned above had spent the then recent Second World War at sea and was torpedoed twice. This is usually a circumstance in which the ship tends to abandon her crew, rather than vice versa, leaving only time for those still alive to jump for it. When a seaman jumps into the sea, particularly from a deck high above the water, he may well die of a broken neck if his lifejacket is not properly secured.

The impact of water on the underside of a lifejacket drives it upwards with such force as to break a neck if it cannot pass over the head. A significant number of seamen from torpedoed ships during the Second World War lost their lives in this way, rather than by drowning or hypothermia, as survivor rescue-records starkly show.

Our Board of Trade surveyor strongly maintained that lifejackets should be fitted with a pair of webbing groin straps (similar to an airman's parachute harness, anchored to a single point on the waist strap at the back, passing between the legs to a pair of buckles (similar to an aircraft seatbelt) approximately 300mm apart at the front of the waist strap at the bottom of the lifejacket. The groin straps and waist straps are simultaneously tensioned by sharply pulling the loose ends of the groin straps - never mind tying bows in little pieces of tape with frozen hands.

Unhappily, this surveyor passed away before completing a prototype of what he called his 'second-generation' lifejacket. Nevertheless, he demonstrated (from his own experience) the global view which we, as naval architects, are pledged to take of the survivability of human life at sea.

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Fossil-free fuels, sails, and nuclear fusion

Sir - I refer to the interesting Editorial Comment in the November 2004 issue of *The Naval Architect* titled 'Time to seek fossil-free propulsion?' The suggestion is that the issue should be considered on the basis of emissions to the atmosphere which damage the environment, and availability of oil and gas supplies for ship propulsion. As is mentioned, it is fair to say that great efforts are being made to reduce the volume of pollutants released into the atmosphere by the combustion of fuel oil in marine diesel engines. Until recently, there was little information available on the significance of exhaust emissions from ships, and any data available were dated and unreliable. Lloyd's Register, in a major research programme completed in 1995, provided the shipping community with a reliable set of generalised exhaust emission factors into estimates of general levels of emissions and distribution of gases into the

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atmosphere by ships. The findings revealed that all heavy-oil-burning engines exhibited higher particulate emission rates of 4kg-12kg/tonne of fuel, compared with gas-oil engines, the rates of which were below 2kg/tonne.

Another study, conducted by Japan's Ship and Ocean Foundation and presented at IMO's 45th session, in October 2000, established that total emissions from ocean shipping were 400 million tonnes each year, based on CO₂ measurements. This was derived from world transport patterns, vessel type, and fuel consumed.

The aim was to develop and put into effect technological improvements to systems and equipment. One of the objectives of the programme was to contribute/influence future IMO environmental legislation. This created the realisation among diesel engine builders that it is more than likely, that in future 'dirty' engines will eventually become unsaleable as much stricter legislation takes effect. The code drawn-up by IMO's Marine Environment Protection Committee governs all diesel engines of more than 130kW output, except those installed solely for emergency use.

On the question of fossil fuel availability, crude oil and natural gas are the raw materials of the petroleum industry. To ensure future supplies to meet increasing demands, there is continuous exploration for new sources of oil and gas and this is a long-term operation. With each year that passes, we were told the situation is not as bad as previously thought because of new oil discoveries, and improved methods of oil and gas extraction from the ground. Based upon today's estimates of petroleum production and the elusive quantity of reserves, there seems to be sufficient petroleum to meet demands beyond the 21st century. It may therefore be said that there will be no energy crisis, nor a potential for running out of energy sources in the near or medium term. This is due to major oil companies pushing exploration and production methods to the limit.

Will the oil ever run out? The answer is, eventually, yes, because oil is a non-renewable resource, but by then it may no longer matter. It should be borne in mind that the Stone Age did not end because the world ran out of stones!

In your comments, it is mentioned that 'fuel accounts for approximately 50% of a merchant ship's running costs'. This should not be a surprise. In my book titled *Energy and Ships*, published in 1988 in the UK and subsequently translated into Japanese, the introduction states 'cost for fuel represents more than 50% of the operating costs of a ship'.

Sail system proposals re-activated

Your Editorial Comment also notes, because of high bunker oil costs, that interest is again being shown on wind-assisted propulsion for commercial ships, and that the energy problem has created a climate where there is incentive to give serious thought to wind-assisted propulsion.

There are five such systems:

- traditional soft sails
- rigid or semi-rigid aerofoils
- Magnus-Effect devices, such as the Autone Flettner rotor

- wind turbines
- airborne sails or kites.

The basic concept of all these is to develop aerodynamic forces by inducing a circulation of air around the rig, in exactly the same way as an up-ended aeroplane wing. It is the forward component of these forces which produces ahead motion of the ship. In assessing the performance of wind-assisted propulsion, it is essential to obtain prior knowledge of both the direction and strength of the wind. Today, such information may be obtained through efficient meteorology. The course of a vessel must therefore be constantly directed relative to the ever-changing weather systems in order to optimise the ship's speed towards its destination.

Basically, the problem is one of seeking strong and advantageous winds, and is exactly the reverse of what the already well-established method of weather routing for power-driven ships, seeks to do. A commercially viable, wind-assisted ship would need to make constant use of such weather information, and since power propulsion would also be available, the choice of the optimum route would pose a most interesting challenge to a ship's master.

During the late 1970s, the five basic systems mentioned above, were studied in the UK, Japan, West Germany, France, and the USA, and traditional soft sails were actively developed in Japan, where comprehensive research was started in 1977 to investigate various shapes of sail. A decision was made to build a two-masted coastal tanker using diesel propulsion as primary power, and the sails as secondary means of propulsion. During eight months' continuous operation, the installation on *Shin Aitoku Maru* achieved fuel savings of around 10%. Despite the relative optimism of those involved at the time, there was reluctance on the part of owners, including my own company, to show serious interest.

The reason for this is the fact that, in general terms, economy of operation lies in much larger ships than anything built during even the last days of sail. Basic laws of physics dictate that larger hulls need stronger winds to drive them at a speed appropriate to their size, and one aspect which does not change in this concept is the amount of wind available!

On the question of nuclear propulsion for commercial ships, my company's involvement in the use of nuclear energy for the propulsion of oil tankers stretches back to the time of the nuclear cargo liner *Savannah*, built in the 1960s in the USA as part of the Atoms for Peace programme, with the idea of demonstrating the technical feasibility of atomic energy to commercial ship application. During five years of experimental/commercial operations, *Savannah* travelled more than 45,000nm on seven voyages to the Mediterranean and one voyage to the Far East. By comparison, a conventionally powered ship travelling the same number of miles would require 28.8 million US gallons of fuel oil, and would have released several hundred tonnes of sulphur-bearing pollutants. Although fulfilling the mission for which this ship was designed and built, it was impossible to be an economic success. The ship was decommissioned in July 1970.

My company followed closely *Savannah's* performance, because its chief, Mr Onassis, was considering using nuclear propulsion for new VLCCs and for the then projected one million dwt tanker. Proponents of the Dutch NEREUS propulsion plant mentioned in the Editorial Comment may be disappointed when they face all the international safety restrictions. All the above is history (Nevertheless, see comments later in this letter. *Ed*).

Fuel cells: the next wonder?

With regard to the challenge stated in the Editorial Comment, namely 'It is a pity that more radical ideas for our industry's problems are not being promoted by industry', readers should look at the industry's efforts to develop and use fuel-cell technology and electro-magnetic propulsion. Both concepts require electrical energy, and the challenge is to produce that energy without fossil fuels, inexpensively.

A fuel cell is an electro-chemical device that combines hydrogen fuel and oxygen to produce electricity. Oxygen is taken from the ambient air, while hydrogen is extracted from liquid fuels such as methanol or gasoline using a reformer, or from water using electrolysis which separates hydrogen from the water - 70% of the earth's surface is covered with water.

The fuel cell operates without combustion so it is virtually pollution-free, and can operate at much higher efficiencies than an internal combustion engine. It produces electrical power from chemical reaction, and unlike batteries, as long as hydrogen is supplied, it will continue to produce electrical energy.

More than 160 years after its invention, the fuel cell is now a commercial reality. Its key feature as an energy converter is the significant reduction in the emission of greenhouse gas, and the high efficiency that delivers high fuel economy.

R&D work has been done in Japan since the early 1990s, where an LNG tanker, a ferry, and an observation ship were selected for the installation of a fuel-cell plant. Sea trials were carried out with satisfactory results, confirming prospects for commercial ship propulsion as being very promising. The fuel-cell concept is not laboratory-bench technology, it is well advanced for commercial ship application.

Another possibility is the electro-magnetic thruster (EMT), a type of linear motor based on Fleming's left-hand rule. A reaction between the magnetic field generated by fixed super-conducting magnets on board a ship and an electric current passing through the sea water, generate what is known as a Lorentz force in the longitudinal axis of the hull; a thrust is created as a reaction of the sea water jet moving astern, ie, jet propulsion. Electro-magnetic energy is converted directly into thrust without the use of intermediate moving parts, such as shafting and propellers.

This idea was first discussed in the USA in the early 1960s, when the world's first superconducting generator and motor operated in a boat at the David W Taylor Naval Ship Research and Development in Annapolis, Maryland. In the 1970s, model tests were carried out in Japan, and in 1985 a six-year development programme was initiated by the Ship and Ocean Foundation. In 1992,

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Fishing Vessels, Fishing Technology and Fisheries

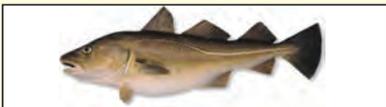


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Second Notice



The safety of fishermen, the sustainability of fish stocks, and the economic viability of fishing dependent communities are issues that have to be addressed simultaneously in order to ensure a sustainable future for fishing industries. Fishing is a difficult and hazardous occupation, presenting major challenges to all involved. The safety of the fishermen is heavily dependant on the quality of the design and construction of their vessels, while the success of their operations is dependant on the ingenuity of their equipment, fishing gear, and procedures. In recent years the sustainability of many fisheries has become an area of concern, and is the subject of international debate. As a result successful fishing in future will operate in a framework of controls on the amount of fishing effort and in the face of restrictions on the nature of the fishing gear aimed at promoting 'environmentally friendly' fishing techniques.



Participants in the many disciplines that have a mutual interest in these important overlapping areas are invited by RINA to submit abstracts for papers to be presented at the International Conference on Fishing Vessels, Fishing Technology and Fisheries. Papers can address any of the topics listed below, or related areas of interest:



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- Electronics: fish finding, alarms, integrated bridge systems
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successful sea trials were carried out in Japan with a 30m long craft, *Yamato 1*, using a super-conducting electro-magnetic hydrodynamic propulsion system (EMHD), featured in *The Naval Architect* November 1991, page E509. During trials, a speed of 8knots was attained, using two thrusters and an electric power through the sea water of 3600kW.

The standard theory of super-conductivity was created 37 years ago and, like fuel-cell technology, it is today no longer still in the laboratory. The shipping industry is interested in this type of propulsion for commercial ships, especially for high-speed passenger and cargo designs where modern propellers cannot deal with cavitation problems, which limit their application to the 40knot speed range. With the EMHD system, it should be possible to break through this barrier.

Possibilities for nuclear technology

Both above-mentioned concepts require electrical energy. The challenge is to produce that inexpensively, without the use of fossil fuels. The answer is nuclear technology, plus hydrogen. Only recently have experts started to be convinced of hydrogen's unique properties and potential advantages, and because it can be manufactured directly from water, this makes it free of the political dangers of cartels. Once nuclear power is tied economically to hydrogen production, hydrogen is destined to be the ultimate chemical carrier and the real non-polluting fuel of the future.

The incentives to develop and implement civil nuclear power for electricity generation are: economics, a need to conserve non-replaceable hydrogen resources, and environmental benefits. The question is: is today's nuclear technology so advanced as to make it absolutely dependable and safe? One can say with some comfort that so far as the Western World is concerned, in competent hands, present technology works well.

In the UK, authorities 50 years ago were concerned over the future of uranium supplies, and decided that the development of a fast breeder reactor, with the potential of releasing some 100 times more energy from the available uranium than a conventional reactor, should be pursued with vigour. In 1989, a formal agreement was signed, bringing together and rationalising the separate European programmes, which became known as the European Fast Reactor Utilities Group.

The cost to develop the fast reactor proved much greater than had been envisaged. Also, shortages of uranium, envisaged in the 1950s and 1960s, did not develop, so a need was not seen to introduce fast reactors on a commercial scale in the near term. There was also a genuine concern that the plutonium bred in such reactors, unlike the mixture of plutonium isotopes bred within the fuel of most nuclear power reactors, can be very suitable for weapons production. As a consequence, France's Super-Phoenix and the UK's Dounreay fast reactor were switched off.

Another contributing factor to the decision was the fact that, estimates of world terrestrial uranium reserves vary from 6 million to 30 million tonnes, depending upon the maximum extraction price. Thirty million tonnes of uranium could provide electrical energy, at the present level of consumption of electrical energy, for 10 thousand years. Added to this, if extracting 100 times more power using the fast breeder reactor system, the period of generating electricity using nuclear fuel will be many more thousands of years. What is also important is the effect on the atmosphere. Extensive use of nuclear energy would save burning coal equivalent to 20 trillion tonnes.

Nuclear fusion

In the meantime - actually for decades - scientists have been aiming to create a limitless supply of energy, with machines that mimic the nuclear fusion process that

drives the furnace at the heart of the sun and the stars. The idea of fusion has its origins 70 years ago, when the physicist Hans Bethe, of Cornell University in the USA, solved a centuries-old question for astronomers: from where do the sun and the other stars obtain their energy? Bethe suggested that the energy came from the fusion of the lightest of all elements, hydrogen atoms. They are transformed into helium, but 1% of the mass of the hydrogen is converted into energy. The practical test that showed Bethe was right came with the hydrogen bomb, which was detonated on November 1 1952, at Eniwetok. Today, the aim is to achieve control of the atomic reaction, thus creating a small sun-on-earth, with an almost limitless source of energy to generate electrical power in conventional steam-turbine-driven alternators, using the abundance of hydrogen as fuel.

In December 2003, officials involved in the International Thermo-Nuclear Experimental Reactor (ITER), met in Washington DC, USA, to choose a host for the project. The countries involved are the USA, China, Russia, South Korea, Japan, and the European Union. Meanwhile, it is comforting to know that there is sufficient uranium ore in politically stable countries such as the USA, Canada, and Australia, to provide fuel for civil nuclear reactors for several decades.

I feel that the 21st century will see the dawn of fusion energy. Nuclear fusion has been termed the clean process in which hydrogen is caused to react at extremely high temperature and pressure, forming helium and releasing energy, plus some radiation.

Andrew G Spyrou, FRINA

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France

(Dr Spyrou is a Fellow and Founding

Member of

The UK Institution of Nuclear Engineers)

Self-contained anchoring and mooring winches from Norway

ADVANCES at Rolls-Royce Rauma Brattvåg in the design of hydraulic winches for anchoring and mooring duties on merchant ships have created new options in self-contained and direct-driven designs, and both types have now been commissioned in newbuilding projects. Self-contained winches are not a new concept but mark a departure for this company in the merchant shipping sector. New 'plug-and-play' packages embrace the electro-hydraulic winch and its associated low-pressure hydraulic power system, supplied ready for a yard to mount on to the deck or on to a foundation, with only cables and piping to be connected. A reduced amount of piping also benefits owners.

Among the first ships to be installed with these self-contained winches will be seven 150,000m³ LNG carriers at Hyundai Heavy Industries, which have been ordered by Greek owners Dynacom Tankers (three ships) and Tsakos

Shipping (one ship), also NYK Line, of Japan, (three ships). Each shipset will be based on 30tonne-pull mooring winches and 102mm K3 chain-equipped windlasses.

Direct-drive winches have been delivered by Rauma Brattvåg for many years but designs have now been modularised and arranged to fully exploit the company's new 64bar low-pressure hydraulic power system. Today, mooring winches can be supplied with ratings up to 20tonnes but capacities up to 30tonnes will be offered in the future. The elimination of a gearbox eases installation, and operators further benefit from reduced maintenance and very high anchoring speed through built-in dynamic braking.

Direct-driven mooring and anchoring winches of this new modular-configured design have been specified for five 53,000dwt Diamond 53 double-skin bulk carriers ordered by Graig from Chengxi

Shipyards, China. The vessels will feature 15tonne capacity mooring winches and 78mm-diameter K3 chain-equipped windlasses.

New towing and anchor-handling winch

On the offshore front, Rauma Brattvåg has recently launched a new 350tonne towing and anchor-handling winch, which is claimed to combine reduced installation costs and higher power/weight ratios for improved speed and torque performance. Winch drive systems operating at 64bar hydraulic pressure retain the traditional merits of low-pressure systems but benefit from a considerably increased power output from a given size of motor, fostering a reduced installation cost and weight for each installed kilowatt, together with speed and torque performance that is claimed to be excellent.

Until recently, the largest motor output was around 1000kW. With the higher working

New double-hulled bulkers from Daewoo

Sir - I read with some interest and satisfaction about the recent design of double-hulled Capesize bulk carriers from Daewoo (*The Naval Architect* October 2004, page 18); this yard must be congratulated for its promotion, over several years, of double skins for bulkers. Nevertheless, as a former chief marine superintendent for P&O Bulk Shipping and having been a member of the FSA team at IMO on the safety of bulk carriers, I am acutely aware of some of the claims made against such designs in the recent Marine Safety Committee debate on the subject.

The outcome of that debate was not to mandate such designs at international regulatory level and yet there appears still to be interest in them. Having worked with such vessels since the early 1980s, I could never agree with sentiments expressed by the opponents on issues of safety, even if I do sympathise with some of the claims that more regulation and experience is necessary before mandating.

This is now in hand with the new SOLAS Chapter XII regulations and indeed IACS is also doing its bit. My satisfaction is in the fact that Daewoo and others are successfully marketing such vessels, which can only lead to an accumulation of more expertise.

I was dismayed, however, to see some other comments in the article. The first concerned the location of some bunker tanks in double bottoms beneath cargo holds. Why are designers so pre-occupied with putting fuel in places where it is difficult to retrieve (ask any chief engineer), especially in cold weather? Why also do they ignore the nature of the trade of the vessels they are designing?

Do they not know that these vessels are discharged using grabs that each weigh 30tonnes, which frequently hit the tanktops rather more forcefully than they should? Do they not know that penetrations are therefore not uncommon? A full head of bunkers then has no problem in flowing into a cargo hold, from where, via the bilge system, it becomes an instant pollution hazard.

If the bunkers cannot be contained within the boundaries of the engineroom, it is only acceptable to place them in a pair of topside tanks, preferably aft, from where the contents are not only out of most harm's way but also easily retrievable, often by gravity alone (as in the New Green Cape design, *The Naval Architect* May 2004, page 56. *Ed*).

A second issue is with the statement in the article that forecastles are considered by some to be a most useful feature in preventing green seas breaking over No 1 and 2 hatch covers - an under-statement if there ever was one. I have yet to meet a master who does not believe that the most dangerous development in Capesize bulk carriers was the demise of the forecastle.

Contrary to popular belief, the earliest Capesize ships all had forecastles. The issue is not only that protection is afforded to the forward hatches, which to any seaman is obvious, but also that the anchors are up and clear of the water. Most flush-decked vessels

spend their lives dragging their anchors in the water, and the pounding impacts and removal of protective coatings on shell plating, which is on average 17mm thick, is a serious threat to the integrity of the forward spaces.

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Finally, I was surprised to see that the vessel depicted was equipped with side-launched lifeboats. This conflicts with one of the principal outcomes of the FSA study; in conjunction with early warning of sinking provided by water ingress monitoring, it is the requirement for Panamax and Capesize bulk carriers to be equipped with free-fall lifeboats having a float-free capability.

I therefore appeal to naval architects to consider these matters and to consult the senior officers of the vessels, both on deck and in the engineroom, for the wealth of experience available there (this wise move has been advocated on several occasions in *The Naval Architect's* Editorial Comment column, most recently in November 2002. *Ed*).

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Sir - On page 43 of the October 2004 edition of *The Naval Architect*, we read (under the heading 'Ships to be their own lifeboats?') that 'A new project initiated in Sweden ... aims to develop a new passenger ship design concept incorporating safety levels in respects of such aspects as resistance to sinking, methods of evacuation, and fire safety'. Nobody likes to be reminded that their new epoch-making idea has, in fact, been thought of before, but I clearly recall a UK Board of Trade (a forerunner of today's Maritime & Coastguard Agency) surveyor stressing to us apprentices in the late 1940s that the ship itself - especially a passenger-carrying one - must always be regarded as her own Number One lifesaving appliance in the event of flooding or fire, only to be evacuated as a final resort. Administration surveyors have repeated this view over and over again during the last 60 years.

While welcoming the development of new and improved life-saving apparatus (LSA), my experience of designing passenger ships has always been focussed on ways and means of making them as safe as possible in the event of misfortune, with the principal objective of permitting all hands to remain on board a buoyant, stable, and upright vessel, albeit a badly damaged one, whether underway or not. With all respect to SSPA and its technical

collaborators in this 'new project', I sincerely trust that the question mark following the words 'Ships to be their own lifeboats?' can be permanently deleted.

The Board of Trade surveyor mentioned above had spent the then recent Second World War at sea and was torpedoed twice. This is usually a circumstance in which the ship tends to abandon her crew, rather than vice versa, leaving only time for those still alive to jump for it. When a seaman jumps into the sea, particularly from a deck high above the water, he may well die of a broken neck if his lifejacket is not properly secured.

The impact of water on the underside of a lifejacket drives it upwards with such force as to break a neck if it cannot pass over the head. A significant number of seamen from torpedoed ships during the Second World War lost their lives in this way, rather than by drowning or hypothermia, as survivor rescue-records starkly show.

Our Board of Trade surveyor strongly maintained that lifejackets should be fitted with a pair of webbing groin straps (similar to an airman's parachute harness, anchored to a single point on the waist strap at the back, passing between the legs to a pair of buckles (similar to an aircraft seatbelt) approximately 300mm apart at the front of the waist strap at the bottom of the lifejacket. The groin straps and waist straps are simultaneously tensioned by sharply pulling the loose ends of the groin straps - never mind tying bows in little pieces of tape with frozen hands.

Unhappily, this surveyor passed away before completing a prototype of what he called his 'second-generation' lifejacket. Nevertheless, he demonstrated (from his own experience) the global view which we, as naval architects, are pledged to take of the survivability of human life at sea.

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Ireland

Fossil-free fuels, sails, and nuclear fusion

Sir - I refer to the interesting Editorial Comment in the November 2004 issue of *The Naval Architect* titled 'Time to seek fossil-free propulsion?' The suggestion is that the issue should be considered on the basis of emissions to the atmosphere which damage the environment, and availability of oil and gas supplies for ship propulsion. As is mentioned, it is fair to say that great efforts are being made to reduce the volume of pollutants released into the atmosphere by the combustion of fuel oil in marine diesel engines. Until recently, there was little information available on the significance of exhaust emissions from ships, and any data available were dated and unreliable. Lloyd's Register, in a major research programme completed in 1995, provided the shipping community with a reliable set of generalised exhaust emission factors into estimates of general levels of emissions and distribution of gases into the

atmosphere by ships. The findings revealed that all heavy-oil-burning engines exhibited higher particulate emission rates of 4kg-12kg/tonne of fuel, compared with gas-oil engines, the rates of which were below 2kg/tonne.

Another study, conducted by Japan's Ship and Ocean Foundation and presented at IMO's 45th session, in October 2000, established that total emissions from ocean shipping were 400 million tonnes each year, based on CO₂ measurements. This was derived from world transport patterns, vessel type, and fuel consumed.

The aim was to develop and put into effect technological improvements to systems and equipment. One of the objectives of the programme was to contribute/influence future IMO environmental legislation. This created the realisation among diesel engine builders that it is more than likely, that in future 'dirty' engines will eventually become unsaleable as much stricter legislation takes effect. The code drawn-up by IMO's Marine Environment Protection Committee governs all diesel engines of more than 130kW output, except those installed solely for emergency use.

On the question of fossil fuel availability, crude oil and natural gas are the raw materials of the petroleum industry. To ensure future supplies to meet increasing demands, there is continuous exploration for new sources of oil and gas and this is a long-term operation. With each year that passes, we were told the situation is not as bad as previously thought because of new oil discoveries, and improved methods of oil and gas extraction from the ground. Based upon today's estimates of petroleum production and the elusive quantity of reserves, there seems to be sufficient petroleum to meet demands beyond the 21st century. It may therefore be said that there will be no energy crisis, nor a potential for running out of energy sources in the near or medium term. This is due to major oil companies pushing exploration and production methods to the limit.

Will the oil ever run out? The answer is, eventually, yes, because oil is a non-renewable resource, but by then it may no longer matter. It should be borne in mind that the Stone Age did not end because the world ran out of stones!

In your comments, it is mentioned that 'fuel accounts for approximately 50% of a merchant ship's running costs'. This should not be a surprise. In my book titled *Energy and Ships*, published in 1988 in the UK and subsequently translated into Japanese, the introduction states 'cost for fuel represents more than 50% of the operating costs of a ship'.

Sail system proposals re-activated

Your Editorial Comment also notes, because of high bunker oil costs, that interest is again being shown on wind-assisted propulsion for commercial ships, and that the energy problem has created a climate where there is incentive to give serious thought to wind-assisted propulsion.

There are five such systems:

- traditional soft sails
- rigid or semi-rigid aerofoils
- Magnus-Effect devices, such as the Autone Flettner rotor

- wind turbines
- airborne sails or kites.

The basic concept of all these is to develop aerodynamic forces by inducing a circulation of air around the rig, in exactly the same way as an up-ended aeroplane wing. It is the forward component of these forces which produces ahead motion of the ship. In assessing the performance of wind-assisted propulsion, it is essential to obtain prior knowledge of both the direction and strength of the wind. Today, such information may be obtained through efficient meteorology. The course of a vessel must therefore be constantly directed relative to the ever-changing weather systems in order to optimise the ship's speed towards its destination.

Basically, the problem is one of seeking strong and advantageous winds, and is exactly the reverse of what the already well-established method of weather routing for power-driven ships, seeks to do. A commercially viable, wind-assisted ship would need to make constant use of such weather information, and since power propulsion would also be available, the choice of the optimum route would pose a most interesting challenge to a ship's master.

During the late 1970s, the five basic systems mentioned above, were studied in the UK, Japan, West Germany, France, and the USA, and traditional soft sails were actively developed in Japan, where comprehensive research was started in 1977 to investigate various shapes of sail. A decision was made to build a two-masted coastal tanker using diesel propulsion as primary power, and the sails as secondary means of propulsion. During eight months' continuous operation, the installation on *Shin Aitoku Maru* achieved fuel savings of around 10%. Despite the relative optimism of those involved at the time, there was reluctance on the part of owners, including my own company, to show serious interest.

The reason for this is the fact that, in general terms, economy of operation lies in much larger ships than anything built during even the last days of sail. Basic laws of physics dictate that larger hulls need stronger winds to drive them at a speed appropriate to their size, and one aspect which does not change in this concept is the amount of wind available!

On the question of nuclear propulsion for commercial ships, my company's involvement in the use of nuclear energy for the propulsion of oil tankers stretches back to the time of the nuclear cargo liner *Savannah*, built in the 1960s in the USA as part of the Atoms for Peace programme, with the idea of demonstrating the technical feasibility of atomic energy to commercial ship application. During five years of experimental/commercial operations, *Savannah* travelled more than 45,000nm on seven voyages to the Mediterranean and one voyage to the Far East. By comparison, a conventionally powered ship travelling the same number of miles would require 28.8 million US gallons of fuel oil, and would have released several hundred tonnes of sulphur-bearing pollutants. Although fulfilling the mission for which this ship was designed and built, it was impossible to be an economic success. The ship was decommissioned in July 1970.

My company followed closely *Savannah's* performance, because its chief, Mr Onassis, was considering using nuclear propulsion for new VLCCs and for the then projected one million dwt tanker. Proponents of the Dutch NEREUS propulsion plant mentioned in the Editorial Comment may be disappointed when they face all the international safety restrictions. All the above is history (Nevertheless, see comments later in this letter. *Ed*).

Fuel cells: the next wonder?

With regard to the challenge stated in the Editorial Comment, namely 'It is a pity that more radical ideas for our industry's problems are not being promoted by industry', readers should look at the industry's efforts to develop and use fuel-cell technology and electro-magnetic propulsion. Both concepts require electrical energy, and the challenge is to produce that energy without fossil fuels, inexpensively.

A fuel cell is an electro-chemical device that combines hydrogen fuel and oxygen to produce electricity. Oxygen is taken from the ambient air, while hydrogen is extracted from liquid fuels such as methanol or gasoline using a reformer, or from water using electrolysis which separates hydrogen from the water - 70% of the earth's surface is covered with water.

The fuel cell operates without combustion so it is virtually pollution-free, and can operate at much higher efficiencies than an internal combustion engine. It produces electrical power from chemical reaction, and unlike batteries, as long as hydrogen is supplied, it will continue to produce electrical energy.

More than 160 years after its invention, the fuel cell is now a commercial reality. Its key feature as an energy converter is the significant reduction in the emission of greenhouse gas, and the high efficiency that delivers high fuel economy.

R&D work has been done in Japan since the early 1990s, where an LNG tanker, a ferry, and an observation ship were selected for the installation of a fuel-cell plant. Sea trials were carried out with satisfactory results, confirming prospects for commercial ship propulsion as being very promising. The fuel-cell concept is not laboratory-bench technology, it is well advanced for commercial ship application.

Another possibility is the electro-magnetic thruster (EMT), a type of linear motor based on Fleming's left-hand rule. A reaction between the magnetic field generated by fixed super-conducting magnets on board a ship and an electric current passing through the sea water, generate what is known as a Lorentz force in the longitudinal axis of the hull; a thrust is created as a reaction of the sea water jet moving astern, ie, jet propulsion. Electro-magnetic energy is converted directly into thrust without the use of intermediate moving parts, such as shafting and propellers.

This idea was first discussed in the USA in the early 1960s, when the world's first superconducting generator and motor operated in a boat at the David W Taylor Naval Ship Research and Development in Annapolis, Maryland. In the 1970s, model tests were carried out in Japan, and in 1985 a six-year development programme was initiated by the Ship and Ocean Foundation. In 1992,

successful sea trials were carried out in Japan with a 30m long craft, *Yamato 1*, using a super-conducting electro-magnetic hydrodynamic propulsion system (EMHD), featured in *The Naval Architect* November 1991, page E509. During trials, a speed of 8knots was attained, using two thrusters and an electric power through the sea water of 3600kW.

The standard theory of super-conductivity was created 37 years ago and, like fuel-cell technology, it is today no longer still in the laboratory. The shipping industry is interested in this type of propulsion for commercial ships, especially for high-speed passenger and cargo designs where modern propellers cannot deal with cavitation problems, which limit their application to the 40knot speed range. With the EMHD system, it should be possible to break through this barrier.

Possibilities for nuclear technology

Both above-mentioned concepts require electrical energy. The challenge is to produce that inexpensively, without the use of fossil fuels. The answer is nuclear technology, plus hydrogen. Only recently have experts started to be convinced of hydrogen's unique properties and potential advantages, and because it can be manufactured directly from water, this makes it free of the political dangers of cartels. Once nuclear power is tied economically to hydrogen production, hydrogen is destined to be the ultimate chemical carrier and the real non-polluting fuel of the future.

The incentives to develop and implement civil nuclear power for electricity generation are: economics, a need to conserve non-replaceable hydrogen resources, and environmental benefits. The question is: is today's nuclear technology so advanced as to make it absolutely dependable and safe? One can say with some comfort that so far as the Western World is concerned, in competent hands, present technology works well.

In the UK, authorities 50 years ago were concerned over the future of uranium supplies, and decided that the development of a fast breeder reactor, with the potential of releasing some 100 times more energy from the available uranium than a conventional reactor, should be pursued with vigour. In 1989, a formal agreement was signed, bringing together and rationalising the separate European programmes, which became known as the European Fast Reactor Utilities Group.

The cost to develop the fast reactor proved much greater than had been envisaged. Also, shortages of uranium, envisaged in the 1950s and 1960s, did not develop, so a need was not seen to introduce fast reactors on a commercial scale in the near term. There was also a genuine concern that the plutonium bred in such reactors, unlike the mixture of plutonium isotopes bred within the fuel of most nuclear power reactors, can be very suitable for weapons production. As a consequence, France's Super-Phoenix and the UK's Dounreay fast reactor were switched off.

Another contributing factor to the decision was the fact that, estimates of world terrestrial uranium reserves vary from 6 million to 30 million tonnes, depending upon the maximum extraction price. Thirty million tonnes of uranium could provide electrical energy, at the present level of consumption of electrical energy, for 10 thousand years. Added to this, if extracting 100 times more power using the fast breeder reactor system, the period of generating electricity using nuclear fuel will be many more thousands of years. What is also important is the effect on the atmosphere. Extensive use of nuclear energy would save burning coal equivalent to 20 trillion tonnes.

Nuclear fusion

In the meantime - actually for decades - scientists have been aiming to create a limitless supply of energy, with machines that mimic the nuclear fusion process that

drives the furnace at the heart of the sun and the stars. The idea of fusion has its origins 70 years ago, when the physicist Hans Bethe, of Cornell University in the USA, solved a centuries-old question for astronomers: from where do the sun and the other stars obtain their energy? Bethe suggested that the energy came from the fusion of the lightest of all elements, hydrogen atoms. They are transformed into helium, but 1% of the mass of the hydrogen is converted into energy. The practical test that showed Bethe was right came with the hydrogen bomb, which was detonated on November 1 1952, at Eniwetok. Today, the aim is to achieve control of the atomic reaction, thus creating a small sun-on-earth, with an almost limitless source of energy to generate electrical power in conventional steam-turbine-driven alternators, using the abundance of hydrogen as fuel.

In December 2003, officials involved in the International Thermo-Nuclear Experimental Reactor (ITER), met in Washington DC, USA, to choose a host for the project. The countries involved are the USA, China, Russia, South Korea, Japan, and the European Union. Meanwhile, it is comforting to know that there is sufficient uranium ore in politically stable countries such as the USA, Canada, and Australia, to provide fuel for civil nuclear reactors for several decades.

I feel that the 21st century will see the dawn of fusion energy. Nuclear fusion has been termed the clean process in which hydrogen is caused to react at extremely high temperature and pressure, forming helium and releasing energy, plus some radiation.

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Self-contained anchoring and mooring winches from Norway

ADVANCES at Rolls-Royce Rauma Brattvåg in the design of hydraulic winches for anchoring and mooring duties on merchant ships have created new options in self-contained and direct-driven designs, and both types have now been commissioned in newbuilding projects. Self-contained winches are not a new concept but mark a departure for this company in the merchant shipping sector. New 'plug-and-play' packages embrace the electro-hydraulic winch and its associated low-pressure hydraulic power system, supplied ready for a yard to mount on to the deck or on to a foundation, with only cables and piping to be connected. A reduced amount of piping also benefits owners.

Among the first ships to be installed with these self-contained winches will be seven 150,000m³ LNG carriers at Hyundai Heavy Industries, which have been ordered by Greek owners Dynacom Tankers (three ships) and Tsakos

Shipping (one ship), also NYK Line, of Japan, (three ships). Each shipset will be based on 30tonne-pull mooring winches and 102mm K3 chain-equipped windlasses.

Direct-drive winches have been delivered by Rauma Brattvåg for many years but designs have now been modularised and arranged to fully exploit the company's new 64bar low-pressure hydraulic power system. Today, mooring winches can be supplied with ratings up to 20tonnes but capacities up to 30tonnes will be offered in the future. The elimination of a gearbox eases installation, and operators further benefit from reduced maintenance and very high anchoring speed through built-in dynamic braking.

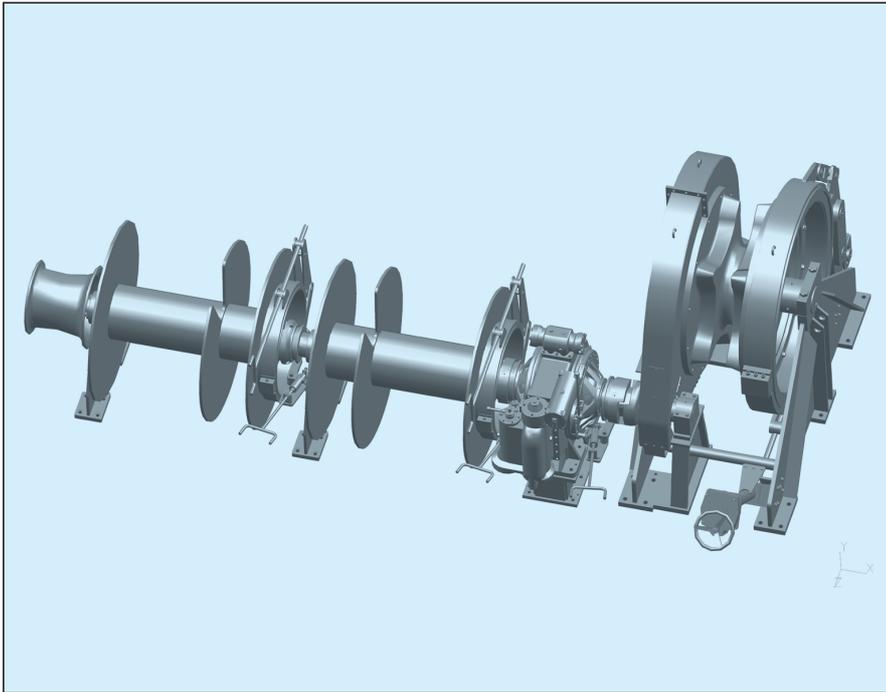
Direct-driven mooring and anchoring winches of this new modular-configured design have been specified for five 53,000dwt Diamond 53 double-skin bulk carriers ordered by Graig from Chengxi

Shipyards, China. The vessels will feature 15tonne capacity mooring winches and 78mm-diameter K3 chain-equipped windlasses.

New towing and anchor-handling winch

On the offshore front, Rauma Brattvåg has recently launched a new 350tonne towing and anchor-handling winch, which is claimed to combine reduced installation costs and higher power/weight ratios for improved speed and torque performance. Winch drive systems operating at 64bar hydraulic pressure retain the traditional merits of low-pressure systems but benefit from a considerably increased power output from a given size of motor, fostering a reduced installation cost and weight for each installed kilowatt, together with speed and torque performance that is claimed to be excellent.

Until recently, the largest motor output was around 1000kW. With the higher working



Rolls-Royce mooring winches with hydraulic direct drives (the unit seen here is combined with a windlass) are currently supplied with ratings up to 20tonnes but capacities up to 30tonnes will be offered in the future.

by 65% and cable lifter efficiency by 112%. Compared with the marginally more powerful older 380tonne three-drum unit, functionality is greater while the price is substantially lower.

A 64bar hydraulic motor is mounted at each side of the winch. Rauma Brattvåg motors are of a three-chamber rotary-vane design, with one, two, or all three chambers used to generate power as required, giving the winch great flexibility. For handling rig chain, cable lifters are driven from either side of the aft drum. The lifters can be sized to suit the various chains in use, and the spooling gear used on the 350tonne winch is also flexible in its design.

Spooling of wire evenly on to drums is controlled by fairleads which are carried on upper and lower chains, the fairleads moving from side to side to give correct spooling for the wire in question. Key advantages are that the winch can be specified in different drum lengths, and the spooling gear requires only a different length of chain to function for any width of winch.

As a further advance for this large winch, Rolls-Royce is now looking at even greater sizes since it believes anchor-handling vessels will become ever larger. More winch concepts are thus being prepared which look at how to reduce costs and increase winch functionality. 

pressure and design refinements, however, the single motor rating now extends to 1700kW, this power increase being secured while maintaining the dynamic capabilities of the BRH64 drive system.

The new winch solution is available with two or three drums and good layout flexibility in

terms of length and diameter of wire, compartmented drums, and other aspects, to suit different operating areas. Compared with the company's older 300tonne winch solutions, the new unit is marginally more expensive (representing a vessel price increase of approximately 2.5%) but raising drum efficiency

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Friction reduction in flow over 3D dimples

A NOTE has been received from G I Kiknadze and I A Gachechiladze, of Inventors Network GmbH, Germany, describing research [Ref 1] during which they discovered secondary tornado-like jets self-organising in water flowing past 3D dimples on the surface of plates. Later, they obtained proof of this phenomenon in air flow [Ref 2]. In Ref 3, for the first time, results of aerohydrodynamic and thermo-physical experiments were published, indicating significant reduction of hydraulic losses and intensification of heat and mass transfer, with the lower growth of hydraulic resistance accompanying self-organisation of the tornado-like jets.

The tornado-like jet self-organisation process and mechanisms of this phenomenon are described in Refs 4 and 5. The shapes of the dimples and other characteristics of the textured surfaces which were named TLJT (Tornado-Like Jet Technology) surfaces, are described in various patents including Refs 6 and 7.

Later, the mechanisms of the phenomenon and the effects accompanying the self-organisation of the secondary twisted jets on the TLJT-textured surfaces were the subject of theoretical and experimental research and development carried out by the authors and their colleagues, with active assistance and support provided by BASERT (Russia) and Inventors Network GmbH (Germany). Experiments carried out late in 2003 on fluid (water) flowing past flat metal plates installed in the working section of a circulation channel are described below.

The working section was formed by a square pipe with the cross-section dimensions of 300mm x 400mm and it was equipped with a three-component balance measuring the forces acting upon the plates (Fig 1 and Table 1). The design provides independent measurement of the three force components F_x (along the flow direction), transverse F_z and vertical F_y . The main features of the balance system are the elastic spokes connecting the test plate and gauges to provide force measurement independent from the torques. Measurement of F_x is by means of only one gauge and so is independent from torques and force applied in y and z directions.

The experiment for measuring the frictional resistance on the surfaces of the test plates was comparative, that is, comparison was made of the forces acting from the water-flow side on the textured plates with the magnitudes of similar forces acting on a smooth plate. The pattern on the textured plate was a regular triangular grid of 3D dimples, each with a

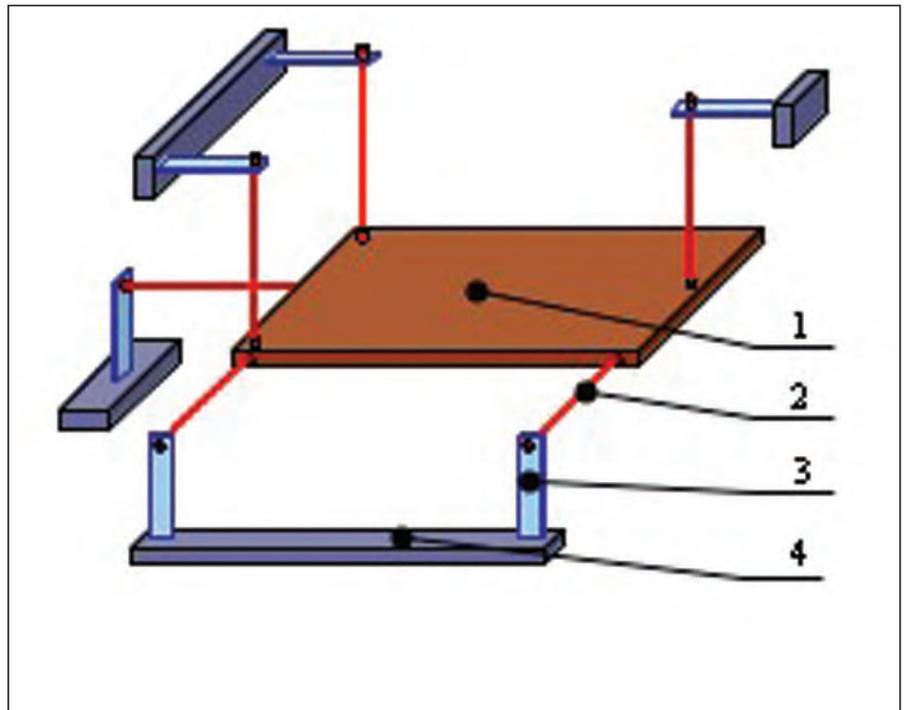


Fig 1. Scheme of the balance system: 1 - test plate, 2 - connecting spokes, 3 - gauges, 4 - channel walls.

diameter of 40mm and with a spherical surface in the centre. This spherical part of the dimple had the diameter of $d=36\text{mm}$. The dimple depth is $h=0.06d$.

The grid had pitches of 73.6mm x 63.7mm; the number of rows along the plate was 10; the plate size was $0.368\text{m}^2 \times 0.679\text{m}^2$. The plate frictional resistance coefficient was determined from the equation:

$$F_f = C_f \times S \times \rho V_\infty^2 / 2,$$

where $F_f = F_x$ - longitudinal force component defining the magnitude of the surface friction, C_f - constant of friction $C_f = 2F_f / S \rho V_\infty^2$, S - area of the plate streamlined surfaces $S = 0.378 \times 0.679\text{m}^2$, ρ - fluid density, [kg/m³] (for water $\rho = 1000 \text{ kg/m}^3$ at $t = 20^\circ\text{C}$), V_∞ - velocity of the oncoming flow above the boundary layer formed over the test plate.

Thus determined C_f for a smooth plate was compared with the well known function of this coefficient from Reynolds number:

$C_f = 0.0267 \cdot \text{Re}^{-0.139}$ (see, for example, the law of longitudinally streamlined smooth flat plate resistance described in G Shlikhting's monograph [Ref 8]).

Experiments were conducted over the velocity range $1\text{m/sec} \leq V_\infty \leq 7\text{m/sec}$ at a water flow temperature $t = (18-20)^\circ\text{C}$, which defined the range of Reynolds numbers along the plate length:

$$1.0 \times 10^6 \leq \text{Re} \leq 7.5 \times 10^6$$

The working section and plate were located in the vicinity of the turn from the channel vertical section to its horizontal section, where there is a high level of turbulence. Judging by variations of the velocity profile above the plate and measured fluctuations of these velocities at the points of the profile measurement along its surface, the boundary layer on the plate was turbulent.

Fig 2 shows the relationship between F_x and the flow velocity, and illustrates the difference in friction between the textured and smooth plates. It follows from these functions that C_f for a smooth plate is linked with Reynolds by the relationship:

$$C_{f\text{sm}} = 0.0360 \cdot \text{Re}^{-0.135},$$

while C_f for a textured plate is given by the relationship:

$$C_{f\text{TLJT}} = 0.0385 \cdot \text{Re}^{-0.150}.$$

Table1. Main parameters of the balance system.

Force component	F_x	F_y	F_z
Number of gauges	1	3	2
Range of measurement, N	± 50	± 500	± 50
Accuracy, %	<1.0		

The average reduction in friction coefficient on the textured plate compared to the smooth plate is 17%.

Together with the results related to friction reduction on textured surfaces published in the references, these results make it possible to use the textured surfaces on various bodies moving in water, air, or overland, as well as in pipelines transporting gases or liquids. Ⓣ

The authors express their thanks for the assistance of Mr J Friesch, from HSVA, The Hamburg Ship Model Basin, Germany, and Mr H Lienhardt, from LSTM Erlangen, Institute of Fluid Mechanics, Erlangen-Nuremberg University, Germany. Ⓣ

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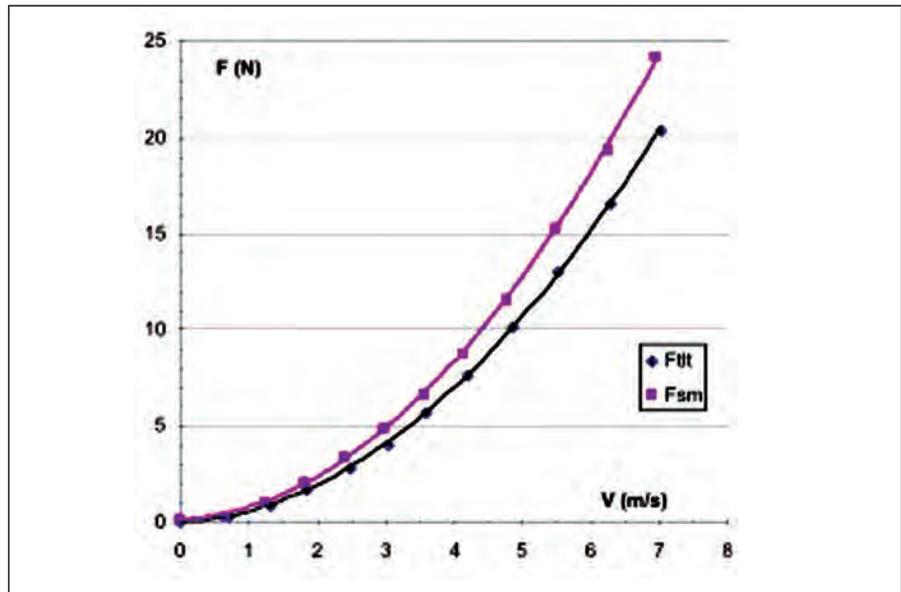


Fig 2. The friction force (F) plotted against the flow velocity (v) for smooth and textured plates.

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Seen here at the New Zealand factory of Mooring Systems Ltd is a complete MM800 (Quay Sailor 80) vacuum mooring unit, ready for shipment to the port of Dover in the UK. We reported on this order in our July/August 2004 edition, page 36. This single unit is intended for evaluation at the new Nos 8 and 9 ferry piers; on completion of trials carried out over several months, five more units will be built (not three in total, as we were originally informed).

This interesting automatic concept was first launched in 1988 as a shipborne alternative to conventional mooring winches, with four units fitted on the then new TranzRail ferry *Aratere*. Since then, emphasis has shifted towards quay-based installations, although Mooring Systems still has ship-borne designs ready. Apart from the installation in New Zealand, systems are working in Australia at Melbourne and Devonport for Patrick Shipping's Bass Strait ferry services. Ⓣ

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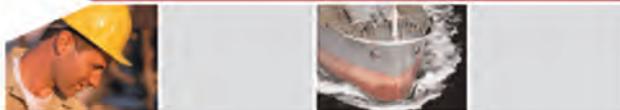
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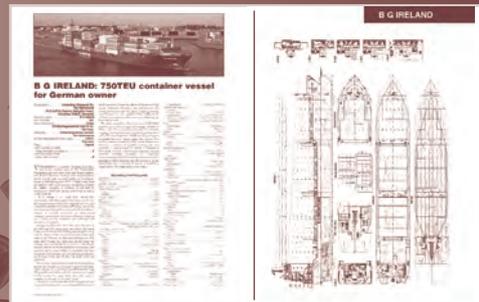
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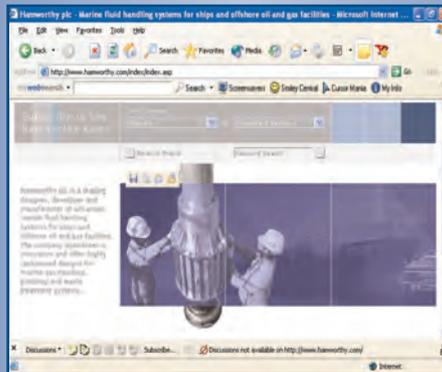
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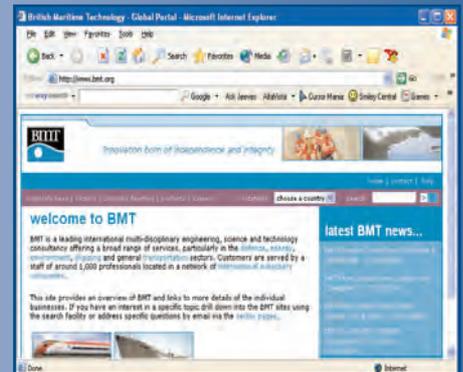
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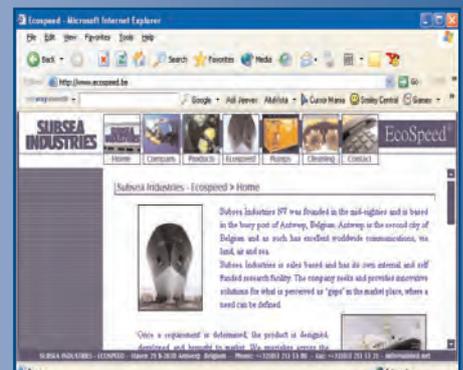
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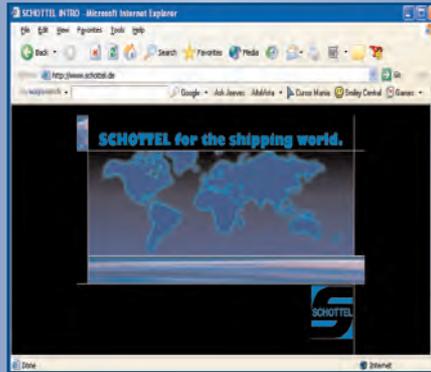
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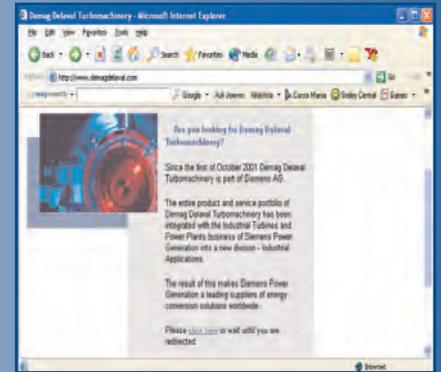
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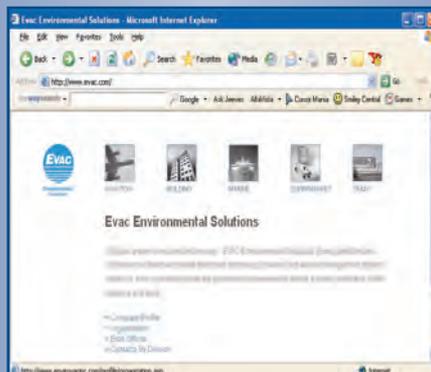
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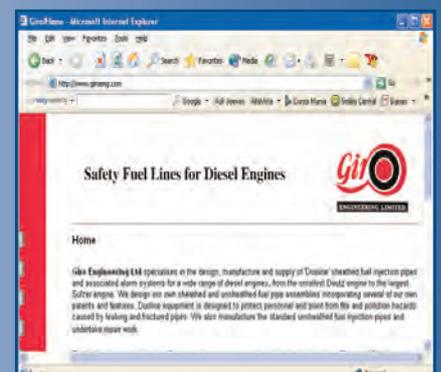
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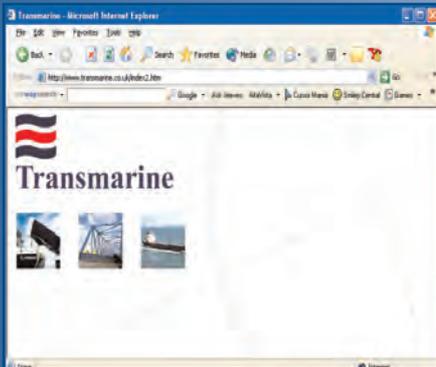
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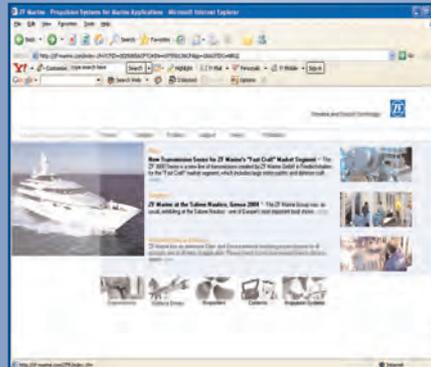
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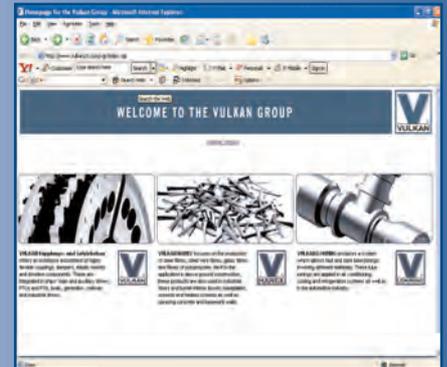
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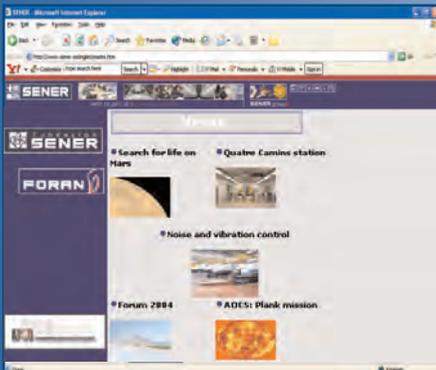
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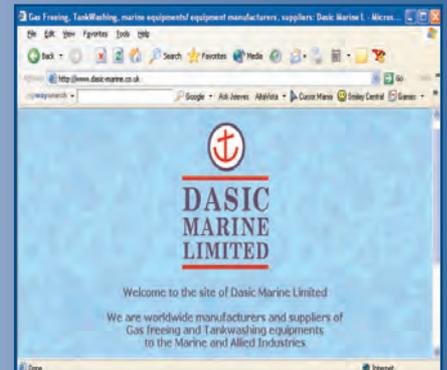
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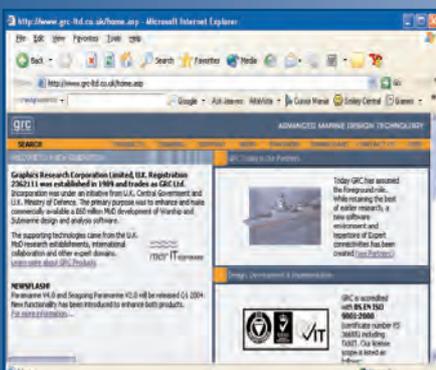
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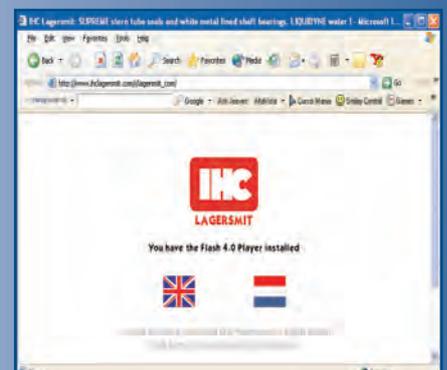
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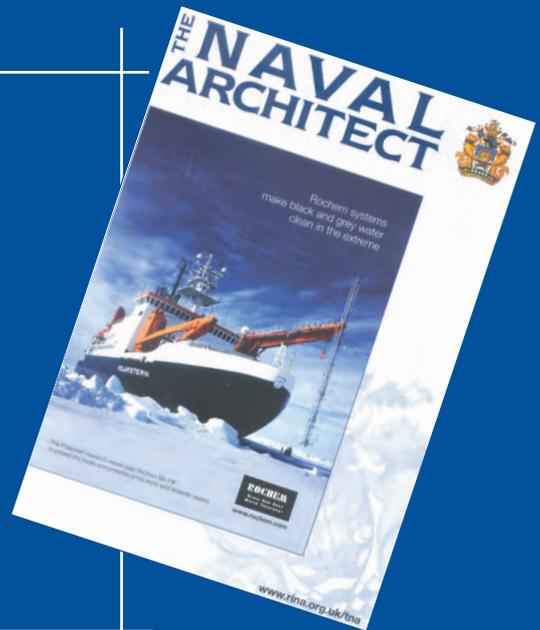
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