THE NAVAL ARCHITECT

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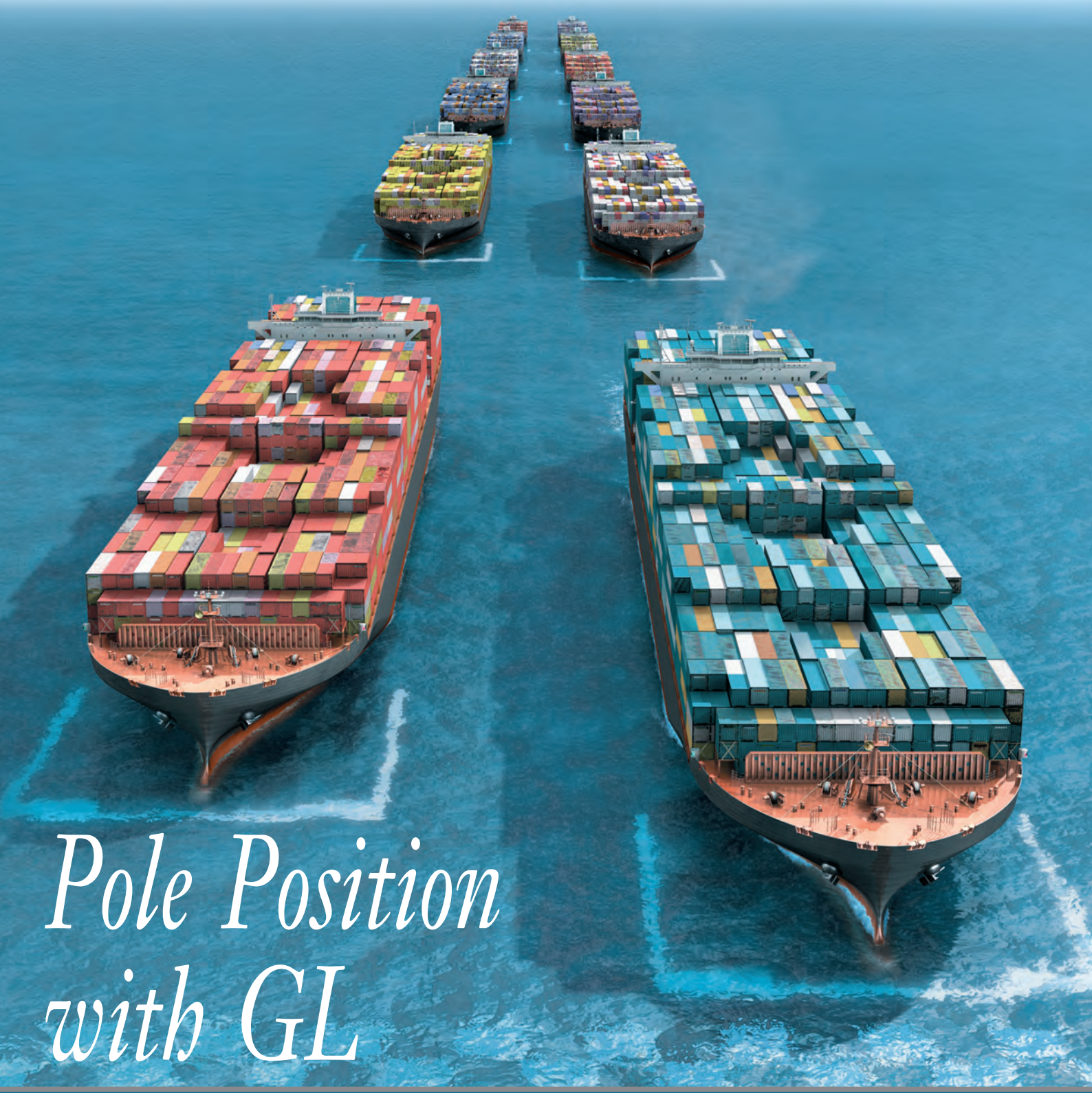

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THE NAVAL ARCHITECT

Work continues at SES Europe, in Norway, on the evolution of next-generation large and small fast air-supported commercial vessels based on concepts from Effect Ships International. Seen here on test is a model of a proposed 125m-long ro-pax ferry/express cargo design; this particular test is being run at 55knots in extreme overload conditions on a full-scale displacement of 6300m^3 (design displacement 4000m^3). More details can be found in our Norway feature, page 14.

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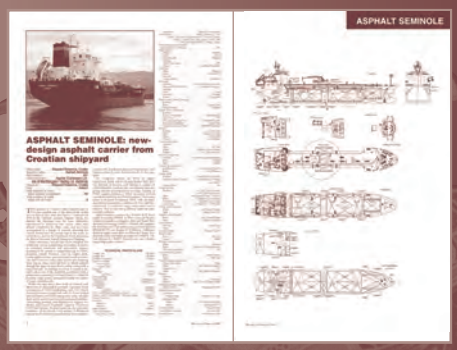

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What future for controls and automation?

ACCORDING to a recent article in The Nautical Institute's highly interesting newsletter *Alert* - a publication referred to previously in this column, a small cargo ship ran aground because the chief officer was asleep - a result of both fatigue and alcohol. He was alone on the bridge because the ship's normal practice was not to employ a lookout during darkness, and significantly, the bridge watch alarm was not in use since neither the chief officer nor the master knew how to operate it.

This is not the first time that a ship has run aground due to lack of attention by watchkeepers, and although the issues are mainly those of operation rather than design, such events raise other questions over technical controls on merchant vessels. In theory, of course, it is quite feasible for ships to sail in the open sea without any personnel onboard at all, although whether this is really practical is questionable.

Modern control systems are ever more complex, and many are becoming increasingly integrated, funnelling various aspects into one console to provide totally seamless operation - as *The Naval Architect* was able to discover during a December visit to one of the leading exponents of this art, Kongsberg Maritime, in Norway. Conversely, it is interesting to note that some operators in the offshore support field, where precision working alongside platforms is a major part of day-to-day life, have decided to split aft-facing consoles into two - one for positioning and the other for communication - in an attempt to limit the number of accidents. This feature will actually become, we are informed, part of Det Norske Veritas regulations in July this year.

Modern automation at work: engineers work at Kongsberg Maritime DataChief C20 screens and keyboards onboard a shuttle tanker.

In today's cost-conscious world, a major theme of Kongsberg has to be to ensure that every product is cost-effective, and to this end, less essential components are purchased while the key processing and interface items and their design remain inside the company. Not only must systems be cost-effective, they must also include redundancy features, be functional - and be understandable. A modern bridge or machinery control room is a mass of instruments, dials, and panels - not surprising when a large cruise or container liner's automation system may have to process 10,000 signals. To try and refine this conglomeration, Kongsberg hopes that in the future it will be able, with the help of a common technology base, to further improve the merger of machinery, cargo control, and navigation, to provide watchkeepers with less data but more information. The new Kongsberg System Technology, or K-Line, is an important step in this direction.

Readers of this journal will be pleased to learn that a valuable part of this process is to try and work more closely with naval architects and engineers right at the very start of a project, to ensure that as far as possible a ship is optimised for its crew. This is a most laudable aim and should be every subcontractor's number one priority, but for various reasons does not always seem to happen. Such action should ensure a better integrated product and, most importantly, shrink the time taken to design and install any system, and help to complete the ship on schedule.

One factor that may ease this process is an apparent trend of some shipbuilders - including the Aker Group and DSME (Daewoo) in Korea - to take more charge of the complete design process by creating their own ship designs and systems from scratch, rather than relying on work by outside consultancies; bad news for some naval architects but maybe a better, more economic end-product delivered on time.

Once a ship is at sea, interesting new automation openings are believed to be opening for remote diagnostic tools. This is partly a result of the unfortunate trend today to employ more economic crews from countries with little maritime tradition - a move that has very recently been thrown into the open by Irish Ferries' plan to shift away from its traditional Irish crews, with a subsequent bitter dispute. The downside is that systems and equipment may not always be tended correctly, or in the case of the grounded cargo ship referred to earlier, simply switched off.

Special tools can enable a technical office ashore to examine, via satellite link, many shipboard systems and take any appropriate action. Closed-circuit TV pictures may help to specify the appropriate action and possibly, in a real Big Brother scenario, check if anyone is actually awake in the wheelhouse!

Sixteen years ago, Doug Clarke, FRINA, in a paper read at the London branch of RINA (extracts from which were reported in *The Naval Architect* April 1990, page E182), predicted complete ship control by one man, with the aid of aircraft-type technology. Mr Clarke was well qualified to comment; apart from being a Fellow of this Institution, he was also a marine engineer and a Companion of the Nautical Institute.

His predictions have largely come to pass, thanks to the introduction of data buses, local area networks (LANs), and fibre-optic cables. In addition, his proposed 'computer-based design simulator rig with the generic ship system', aimed at providing a 'prototyping technique able to identify unacceptable consequences of projected ship designs and modifications before metal is cut' has arrived with the highly advanced CAD/CAM software and product models now offered by many companies worldwide.

Whether the end hardware is produced any more effectively is possibly more questionable. Whether the ever-increasing use of associated automation onboard a ship - despite its undoubted excellence and ability - is acceptable to crews sailing on long deepsea voyages raises many social questions. They might even end up becoming automatons themselves from the resulting boredom. Perhaps we should also remember that a ship may be controlled by one man, but is that man in control?

Sparkle again in the ferry market

AFTER several months of a lull in the ferry sector, the market appears to have perked up, and several most interesting contracts (or letters of intent) have been signed. Big news in recent months from Italian shipbuilder **Fincantieri** is the securing of orders for passenger ships with a difference. The first is a vessel placed by Norwegian owner **Ofotens & Vesteraalen D/S (OVDS)**, one of two operators of the world-famous Hurtigruten coastal express service; however, this will be different from the more usual passenger/cargo/vehicle ferry designs that serve this multi-port route, in that special features will be included to enable the ship to operate summer cruises to Greenland. There is an option for a second ship.

The new ice-strengthened vessel will be of 12,000gt, with a length of 110m and a breadth of 20m. A total of 200 passenger cabins will be installed for 500 passengers, with a further 60 cabins for crew members. Like other ships in the fleet, four refrigerated cargo holds will be included with space for 200 pallets, together with a small garage for 25 vehicles - probably featuring side-shell access as is normal on the Hurtigruten, so that vehicles can be loaded and discharged against a conventional quay. The last ships ordered for this route were OVDS' *Finnmarken* (2002) from Kleven (presented in *Significant Ships of 2002*) and the Fosen-built *Midnatsol* (2003) for Troms Fylkes D/S, the other operator of ships on this service.

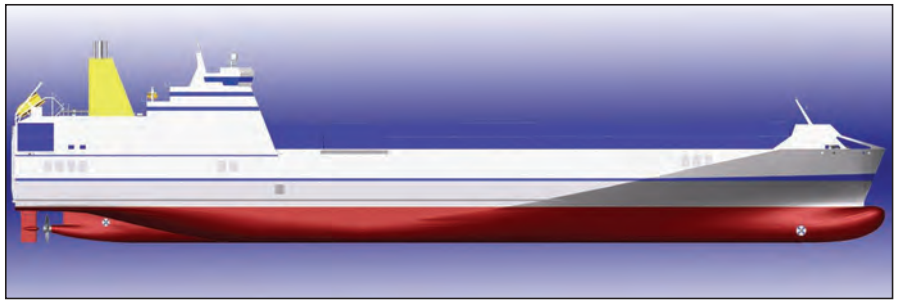
Fincantieri's second interesting contract, placed in October, comes from Estonia and is for a pair of new-generation ice-class ferries for the **Tallink Group**, which continues to expand its young fleet. The new Italian-built designs, planned to serve routes to Finland and Sweden, will be both large and fast, with a gross of 36,000gt, a deadweight of 5000dwt, and a service speed of 29knots. Other ships for this owner are already on order in Finland at **Aker Finnyards**, a builder more associated with Tallink; these comprise two more cruise-ferries - the second was confirmed at the end of December, also a new type of fast passenger/vehicle ferry, for which there is also an option (reported in our September 2005 issue, page 4).

Length of the new designs to be built in Italy will be 175m, with a breadth 28m, and a draught 7m. Amenities, including 240 cabins, will be provided for 2200 passengers, plus 2000 lane metres for lorries or 660 cars. A suitably large propulsion plant totalling 50,400kW will be installed.

Scandinavian operators continue to command headlines, and another new potential order comes in the form of a letter of intent from **Color Line** to build two day ferries at **Aker Finnyards** (Rauma site). Although full details have not been released, the project title is Color Superspeed, and the length and breadth will be 211m and 26m respectively; the speed has not been given. Space will be provided for 1800 passengers, with 2000lane metres for vehicles. The contract price is €232 million, and delivery is planned for 2007 and 2008.

An impression of the two new 29knot passenger/vehicle ferries to be built by Fincantieri for the Estonian operator Tallink. Up to 2200 passengers will be accommodated, and ro-ro space will total 2000lane metres.

An impression of the new fast day ferries to be built for Color Line by Aker Finnyards.



An impression of Flensburger's new ConRo 200 freight design, four examples plus six options of which have been ordered by an unspecified European owner.

Meanwhile, production has recently started of Color Line's second cruise-ferry, to be named *Color Magic* - sister to *Color Fantasy*, which is already in service. *Color Magic* will be built partly at Rauma and partly at Turku, and delivery is expected during the fourth quarter of 2007.

FAST FERRIES FOR HAWAII - On the fast-ferry front, Austal Ship's US yard, at Mobile, Alabama, has confirmed an order for two large Auto Express 107m-long catamaran passenger/vehicle ferries for Hawaii Superferry. They will, it is believed, be the largest aluminium-hulled commercial ships ever built in the USA; construction of the first ferry has actually been under way since June 2004, in order to help prepare the yard for building of the US Navy's littoral combat ships. The project has been instigated to reduce reliance on air transport among the islands in the wake of the events of September 11 2001.

Each ferry will be able to carry 866 passengers and 282 vehicles between Honolulu and Maui, Kauai, and Big Island. Four MTU 20V 8000 M70 diesel engines will drive four Kamewa 125S11 waterjets for a service speed of 37.00knots. Classification will be undertaken by Germanischer Lloyd.

MORE RO-RO SHIPS FOR FSG - More ro-ro ships have been added to the order book of German yard Flensburger Schiffbau-Gesellschaft, with a contract from an unspecified European owner for four examples (plus six options) of the yard's new ConRo 200 freight design. This 13,080dwt class will have 2604 lane metres of ro-ro space and a complement,

PEOPLE

We very much regret to record the death of **DAVID GOODRICH**, former chairman of BMT Ltd (British Maritime Technology), and a past-president of The Royal Institution of Naval Architects (1999-2002).

LONE FØNSS SCHRØDER has been appointed chairman of the board of Wallenius Wilhelmsen Logistics, the ocean transport and service company, and instigator of the Orcelle 'green' concept ship.

The Royal Institution of Naval Architects

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

14 - 15 September 2006, Busan, Korea

Second Notice

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

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

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

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

- Design of larger capacity vessels
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including drivers and lashing crew, of 31. Service speed will be 19.00knots, and the last ship of the four firm orders is anticipated to be delivered in the third quarter of 2009. FSG already holds orders for a larger ConRo design from Belgian operator Cobelfret. These have 3900 lane metres of ro-ro space and are notable for their five cargo decks (*The Naval Architect* July/August 2004, page 4).

MOORING TRIALS FOR ICEBREAKER - Completion of the large nuclear icebreaker *50 Let Pobedy*, which has been lying at the quay at Baltiyskiy Zavod for several years awaiting final completion, now appears to be close. Machinery assembly has been completed, outfitting of the accommodation and public spaces is being finished, and nuclear fuel is expected to be loaded this month (January). After reactor start-up, complex mooring trials under control of a new automation system, SEVER-M1, and under supervision of the Russian Maritime Register of Shipping (RS), will take place.

Technical monitoring of work is being handled by personnel from the RS branch for nuclear ships. This society claims to be the only one in the world to have merchant-type ships with nuclear power plant in its class; RS has developed special rules for the classification and construction of nuclear ships and floating structures, also rules for the classification and construction of nuclear support vessels.

Some trials for *50 Let Pobedy's* equipment have already taken place, and the volume of work is gradually increasing. Sea trials are scheduled to be held in the Baltic Sea, after which the icebreaker will sail to her home port of Murmansk.

In other news, RS has recently signed a new bilateral agreement with US class society ABS to extend a long-standing agreement on cooperation. This principally covers the provision of field surveys for ships and floating structures in service and under construction, as well as design approval, technical documentation, and certification of materials and products.

An impression of Viking Line's new 25knot passenger/vehicle ferry to be built by Aker Yards.

An impression of Stena's new deepwater drill ship, recently ordered from Samsung. Note the two drilling derricks. The vessel will be fully equipped for work in inhospitable areas, such as the Norwegian Sea and the Barents Sea.

LPG CARRIER BOOM AHEAD? - Qatar's highly ambitious and expansive plans to become a huge maritime transport hub, especially centred on this Middle Eastern country's massive natural gas reserves, could have some very interesting spin-offs for naval architects and shipyards. Apart from the well-publicised Q-Flex and Q-Max giant LNG carriers that are in the process of being firmed up or ordered, there could be some other useful work up for tender soon.

According to Christian E Steimler, marketing manager for Qatar gas Transport Co, who was speaking during November in London at Det Norske Veritas' LNG maritime forum, up to 30 very large LPG carriers could be needed to export petroleum gas generated as a by-product of LNG processing. These ships could be designed for trading to both the Far East and to Europe.

A further market could arise for up to 15 Handymax bulk carriers, as gas processing is expected to generate up to 10,000tonnes of dry sulphur daily. Sulphur is a useful product for, amongst others, mining companies, who use it to aid mineral extraction. The bulk carriers could additionally load export cargoes of Qatari-produced fertilizer.

NEW FERRY FOR VIKING - Aker Yards and Mariehamn-based Viking Line have confirmed a letter of intent for the construction of a new passenger/vehicle ferry, with options for two further hulls. Delivery would be in January 2008, and the price is expected to be around €120-€130 million. The ships would be built at Helsinki and are planned for operation between Helsinki and Tallinn. Service speed will be 25.00knots from a 40MW machinery plant, with up to 2500 passengers onboard. The hull will be 185m long and 27.70m wide. Viking has not ordered any new ships since the late 1980s.

GIANT NEW STENA DRILL SHIP - More heartening news for the shipbuilding industry comes in market beliefs that offshore drilling is once more in the ascent. This is confirmed not only by several semisubmersibles on order but also by a contract placed by Stena Drilling for a large monohull drill ship at Samsung, in Korea, with a displacement of 97,000tonnes. The dynamically positioned hull will feature two drilling derricks instead of the usual one, and will be capable of working in water depths down to 3000m but drilling to depths of 11,000m.

Primary power will come from a bank of six Wärtsilä 16V32 diesel engines driving alternators of an unspecified make. Each will have an output of 7290kW at 720rev/min. Factors in the award of the engine contract are said to have included the lowest specific fuel consumption of various competitors, and Samsung's experience of working with Wärtsilä machinery on earlier drill ships, the *Deepwater Pathfinder* type, featured in *Significant Ships of 1998*.

A second new Wärtsilä contract is for complete packages for a new pair of 350TEU container feeder designs order at the Bijlsma Shipyard in The Netherlands. Bijlsma had been in financial trouble but is now a member of the Dutch VeKa group, which has actually ordered the ships. For each vessel, Wärtsilä will deliver a 832LN propulsion engine (3280kW at 750rev/min), a reduction gearbox, a 3.20m diameter Lips CP propeller, and a transverse tunnel thruster.

Hatsu Shine: first of 10 new S-class container liners for Evergreen group

Major efforts have been made on this new 7024TEU series from Mitsubishi's Kobe yard to ensure 'green' environment-friendly credentials, including plugging into shore electrical supplies when in sensitive ports.

The 7024TEU *Hatsu Shine* is the first of 10 new S-class container liners for the Taiwan-based Evergreen Group. Special emphasis is placed on the high number of 'green' features onboard. The first four will be operated by UK subsidiary Hatsu Marine.

ONE of the top-ranking global container-liner operators must certainly be the successful Taiwan-based Evergreen Group, founded in 1968 by Dr Y F Chang and initially employing secondhand vessels. Since the mid-1970s, with a four of an earlier S-class 646TEU ships, all Evergreen ships have been ordered in series and are distinguished by a letter of the alphabet. Gradually, larger ships were built, including geared, multipurpose, and even bulk designs. Evergreen is also notable for operating a shipyard, not in Taiwan, as might be expected, but at Nagasaki in Japan (the former Hayashikane yard), where several smaller container designs have been built.

In recent year, ambitions have become bolder; in the mid-1990s, 10 R-type liners of 4229TEU capacity were ordered, to be followed by a further 10 of 4211TEU (the D-class). All these Panamax types were virtually identical and planned to operate Evergreen's round-the-world service. Later, Evergreen shifted to the post-Panamax scene: five 5364TEU and 13 upgraded 5652TEU U-class, followed by five 6332TEU E-class hulls, and now the newest 7024TEU liners, headed by *Hatsu Shine*; she was inspected by *The Naval Architect* on arrival at Thamesport (Isle of Grain) during her maiden voyage to Europe. Although these are the largest owned vessels, the first of a further eight 8073TEU ships, *Hatsu Courage* (all long-term-chartered from a German owner), was scheduled to enter service in December last year.

Those ships with Hatsu prefixes are operated by Hatsu Marine Ltd, a UK-flag company set up in 2002 and a wholly owned member of the Evergreen group (another member is Uniglory). *Hatsu Shine* was delivered in September 2005 from Mitsubishi's Kobe yard in Japan. She and her sisters are similar in appearance but slightly larger than Evergreen's E- and U-class vessels but, most importantly, they include much new technical thinking by both Evergreen and Mitsubishi - particularly on the environment front. They are claimed by Maurice Storey, Hatsu's chairman, to be '10 years ahead of their time'. It is also pleasing to note, from a British perspective, that *Hatsu Shine* and her successors will sail with UK cadets onboard.

Most fuel is carried in transverse tanks between cargo holds and above the tanktop. Some tanks are also arranged below holds (but still above the tanktop) in narrow parts of the hull.

TECHNICAL PARTICULARS
HATSU SHINE

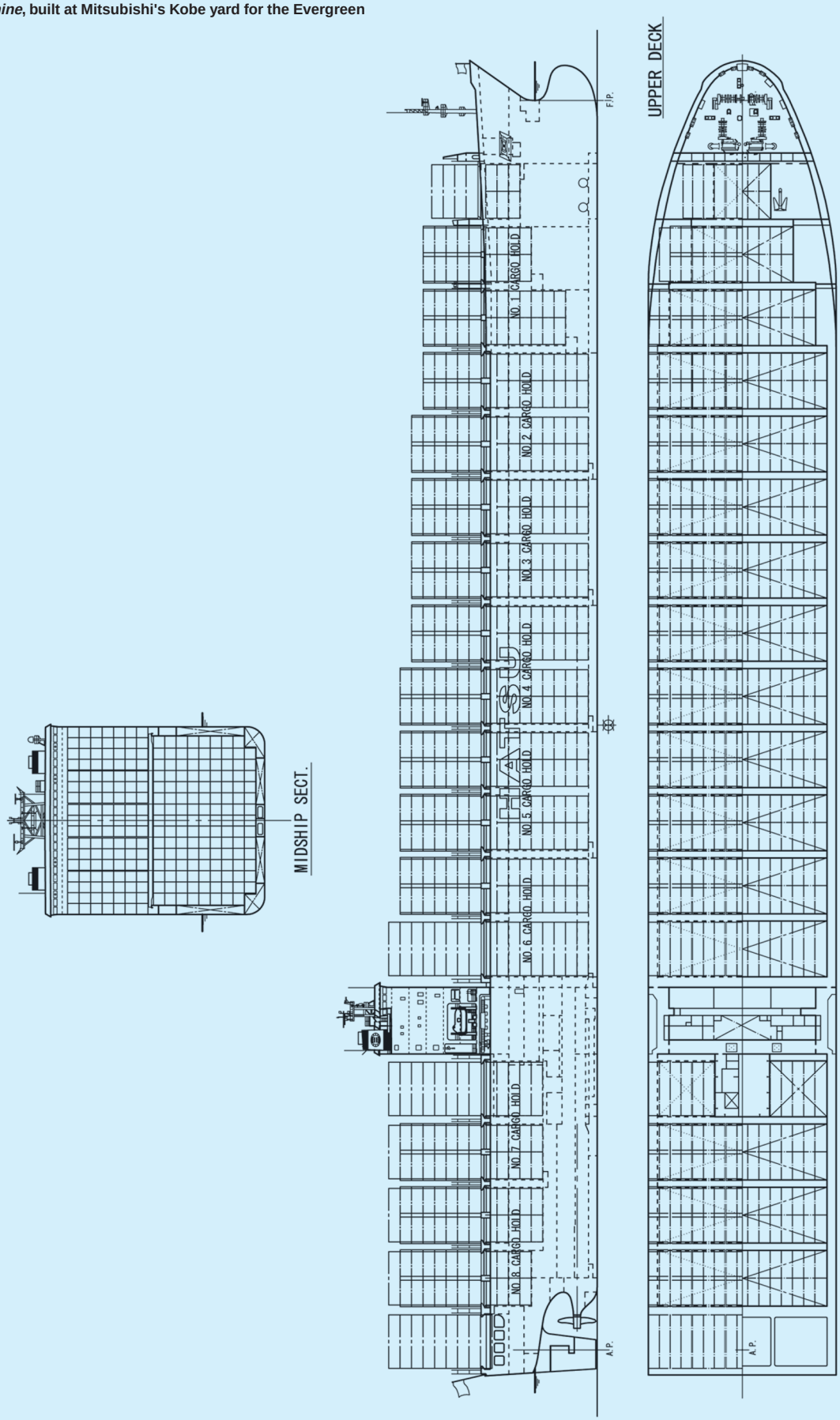
Length, oa	300.00m
Length, bp	285.00m
Breadth, moulded	42.80m
Depth, moulded to upper deck	24.20m
Draught, design/scantling	14.20m
Deadweight, design/scantling	78,693dwt
Container capacity	7024TEU
	15 rows (holds), 17 rows (deck)
Refrigerated plugs	839
Main engine	Mitsubishi-Sulzer 10RTA96C
Output	54,900kW
Speed, service	25.30knots
Crew	18
Classification	Lloyd's Register +100 A1 Container Ship, ShipRight (SDA, FDA, CM), *IWS, LI, EP, + LMC, UMS

Evergreen has taken a lead in introducing 'green' features in advance of legislation - even though container designs are not bound by all IMO regulations; notable among these is a double skin throughout rather than just in way of the cargo holds. In addition, fuel tanks are positioned transversely between the container holds (and under them in the case of some forward and aft spaces in the narrower parts of the hull) and above the double bottom to minimise spills in the event of a grounding accident.

At the same time, much larger holding tanks than usual are provided for oily bilge water, grey water, and hold bilge water to avoid discharge in sensitive areas. Working in conjunction with these is a B+V Industrietechnik oily water separator - with a higher capacity than normal - to ensure that MARPOL's 15ppm overboard limit is maintained. In the same sector, a special 'air-space' sterntube seal system is fitted to avoid oil leaks from the propeller shaft. Special rooms are also provided for holding galley and other waste prior to incineration. All these features ensures that the new liners can comply with Lloyd's Register's EP notation.

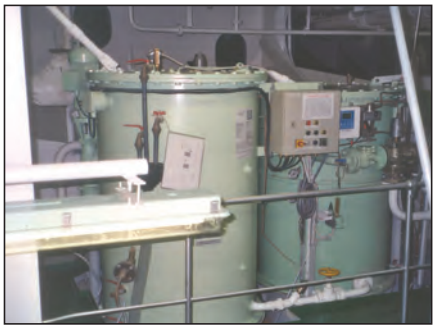
Both the Mitsubishi-Sulzer 10RTA96C main engine and the large MAN B&W auxiliary engines (the latter 2900kW sets are positioned two to port and two to starboard) are refined for

General arrangement plans of the 7024TEU container liner *Hatsu Shine*, built at Mitsubishi's Kobe yard for the Evergreen Group.



A fine view over the main Sulzer diesel engine is offered to engineers in the adjacent control room by these large windows.

Ballast, bilge, and fuel tanks can be monitored and controlled from these screens in the deck office.



This high-capacity B+V Industrietechnik oily water separator works in conjunction with extra large holding tanks for oily water and hold bilge water to ensure that the MARPOL 15ppm overboard limit is maintained.

low-NOx emissions, and equipment is provided for switching to low-sulphur fuel where necessary, and a dedicated tank is provided for this purpose. As a reflection of the rising concern over exhaust emissions, *Hatsu Shine* and her sisters are following some Baltic ferries in being provided with a so-called cold-ironing arrangement - a large cable reel and onboard transformer are fitted so that in ports such as Los Angeles on the US west coast (and probably others in future) the diesel-alternators can be shut down and 6.6kV electrical power imported from shore and converted to 440V. The Los Angeles initiative is known as the alternative marine power (AMP) programme.

On the naval architectural front, special attention has been paid by Mitsubishi to aft-end hull refinement to minimise drag and improve efficiency, while the design fatigue life is expected to be 30 years - hull strength has been analysed by Lloyd's Register's ShipRight software (SDA, FDA, and CM modules). Hull refinement has meant that a 10-cylinder main engine could be installed instead of the more normal 12 cylinders for a ship of this size.

So-called cold-ironing: a special feature onboard the new class is the inclusion of one of these cable reels (stowed under the green cover) so that shore electrical power can be imported in sensitive ports (such as Los Angeles). The S-class's large diesel-alternator capacity (4 x 2900kW) - necessary to cope with up to 839 refrigerated containers - can then be shut down. Evergreen believes that such a feature will become increasingly common.

These benefits will be assisted by application of the latest tin-free antifouling paint. The last six ships in the series will actually be operated by Evergreen itself; these liners will be classed with ABS, including the ES (environment safety) notation.

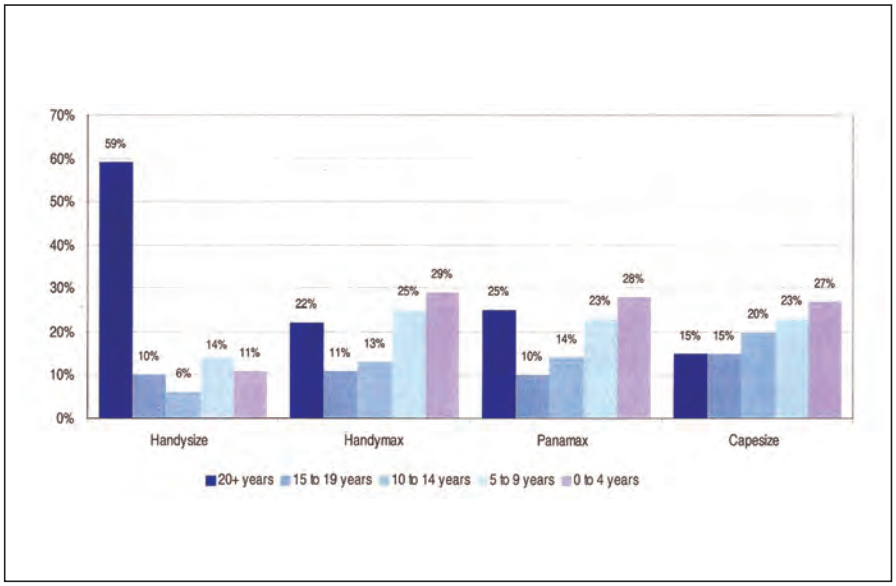
From the large cargo/deck office in the accommodation block, control of the ballast, bilge, and bunker systems can be handled from screen-based displays showing valves and lines on one screen, and tank ullages on another. Nearby is a further small screen by York Refrigeration for monitoring the large number of reefer containers on board - up to 839.

Handysize re-vamp: the next move in bulk carriers?

A SIGNIFICANT re-shaping of the bulk carrier fleet in the Handysize sector (25,000dwt-30,000dwt plus) seems potentially imminent, believes class society Germanischer Lloyd. This forecast stems from the fact that over half (59%) of all ships in this size range are more than 20 years old; if freight rates and high newbuilding prices begin to fall from their current high levels, owners of older tonnage will, the society believes, start to carefully consider their options as regards replacements.

One promising solution could be a shift towards multipurpose designs to offer increased cargo versatility in the niche markets where many companies operate. Other factors that may influence their decision include new terminals and their infrastructures, which often impact on ship dimensions.

Handysize ships have shown a continuous increase in numbers since 2000 and currently represent the largest sector of the four principal bulk sectors (Handysize, Handymax, Panamax, and Capesize), although in terms of numbers of vessels on order, the Handymax market has seen the greatest growth. Whatever the exact specification of next-generation Handysize vessels, it seems highly likely that they will feature box-shaped holds (as used on many modern Handymax ships) without cell guides, wide open-type hatches with some holds longer than 12m to accommodate steel pipes and other special cargoes. Deadweight is expected to be around 30,000dwt. At the present time, few owners seem prepared to commit themselves to any more details.



A graph showing the high proportion of Handysize bulk carriers that are aged 20 years or more, a fact that could herald the arrival of a new generation of different ships. Source: Clarkson Research.

Impact of new legislation

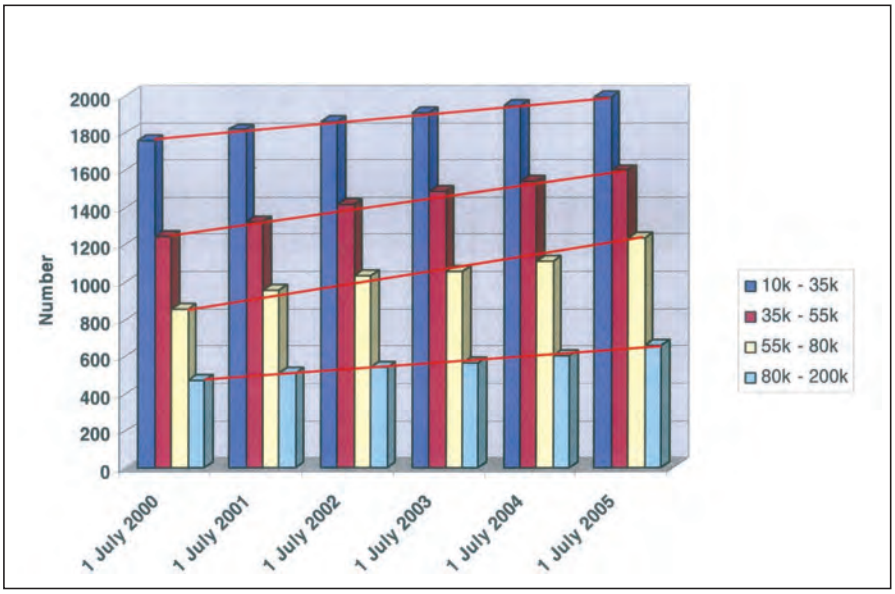
With a high profile history of losses and accidents in recent years, all bulk carriers have become the subject of intense scrutiny and particularly of new legislation. For their new ships, owners will primarily have to take account of the IACS common structural rules for both bulkers and tankers, which were adopted in December 2005 by the International Association of Classification Societies and which are due to come into force on April 1 this year; these are likely to mean an average steelweight increase of around 3% (or 8% if taking 1998 weights).

A further important factor will be the revised SOLAS Chapter X11 (July 1, 2006), while coming up on the close horizon are new fuel tank protection rules (2007, 2009, and 2010), which will be especially significant for bulkers, also implications of the Ballast Water Convention (2009), and further away, IMO's proposals for goal-based standards.

Owners are already seeking from GL potential solutions for next-generation bulk designs prior to approaching a shipyard, and one matter that the society is currently studying is the effects of torsion on bulk carriers in oblique seas - torsion can affect the specification of hatchway dimensions. With steel prices today at more than US$1000/tonne, any practical solutions for effective steelwork will also be much appreciated.

Overall, the ramifications of new regulations are expected to mean that new bulk carrier prices will probably increase by 1%. Nevertheless, owners are unlikely to make any firm decisions about new tonnage before the middle of this year.

A graph showing the large number of bulk carriers in service (October 2005) in the range 10,000dwt to 35,000dwt, which includes the Handysize sector. Source: Fairplay.



LETTER TO THE EDITOR

Deadweight or displacement?

Sir - In the September 2005 issue of *The Naval Architect* (pages 146 and 148), an article appeared by Dr C B Barrass on the subject of interaction. On page 148 (in the centre), the author refers to the deadweight tonnage of each of two passing vessels. In considering the physics of ship interaction, I would suggest that the appropriate parameter is the displacement tonnage, and that use of deadweight tonnage is incorrect.

I am concerned that, in particular, young naval architects may well be misled by the author's use of deadweight tonnage.

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Norwegian exporters look to emerging markets

David Foxwell reports on efforts by Norway's marine equipment sector to win orders in new parts of the world.

NORWEGIAN yards are currently full, mainly with orders for offshore support vessels stretching into 2007; nevertheless, the country's naval architects have a long and successful history of exporting designs for a wide range of vessels, and are particularly noted for their expertise in tankers and passenger ferries. Norway's marine equipment companies cannot rely on the domestic market alone, and through organisations such as the Norwegian Maritime Exporters (NME), have targeted, and continue to target, new markets in order to secure business.

Focus on India

In recent years, the NME has organized several 'inward missions' to countries such as China and more recently, into Vietnam, which have become, or are in the process of becoming, centres of world shipbuilding. More recently, the NME's attention has turned to the Indian shipbuilding market as the Indian-owned fleet grows significantly and Indian yards gear up to invest in new facilities to meet welcome orders for export ships.

As a recent presentation given by representatives of Innovasjon Norge to the NME highlighted, the age profile of much of the Indian fleet makes replacement essential, and many major players in that market, such as Shipping Corp of India (SCI) and Essar Shipping, are planning large-scale investment in newbuildings. SCI alone is planning a US$1 billion expansion, modernisation, and diversification programme, noted the Innovasjon Norge report, whilst companies such as Great Eastern Shipping, Mercator, and Varun are planning to replace older tonnage.

Of even greater potential importance to export-orientated Norwegian manufacturers are plans being developed for major shipyards in India, such as government-owned Cochin Shipyard, Hindustan Shipyard, and privately owned ABG Shipyard, in Surat, also Bharati Shipyard Ltd. Turnover from shipbuilding in India is rising steadily in both the state-owned and private sector, noted the NME, and for the first time, in 2006 the Indian order book includes more ships for export than it does for domestic owners.

As the Innovasjon Norge report also highlighted, vessels due to be delivered are of a much larger average deadweight than in former years, all of which strongly suggests that opportunities for export-minded Norwegian equipment companies will grow, with Cochin planning to invest R1.6 billion to increase capacity by between 2% and 30%. At the same time, ABG plans to invest R3.75 billion to set up a new yard at Dahej, in Gujarat, and Bharati is investing significantly in the expansion and modernisation of its Ratnagiri shipyard.

Shift to overseas manufacturing

Norwegian companies understand that their emphasis on technical innovation makes them leading players in the international marine equipment market place. However, they also recognize that manufacturing costs in northern Europe are a barrier to securing market share, and a number have, therefore, moved much of their manufacturing activity offshore, to countries such as China, in order to establish themselves in shipbuilders' 'backyards.'

Moving manufacturing capability offshore to countries such as China and the Baltic states, and sub-contracting hulls to countries such as Romania, has not been universally popular at times. Nevertheless, major manufacturing groups such as TTS Marine say that doing so has enabled them to flourish in a highly competitive market. TTS, for example, recently entered into an agreement with Dalian New Shipbuilding Heavy Industry Co (DNS), part of China State Industrial Corp (CSIC), regarding the establishment of a joint venture company in Dalian for the production and sale of cranes for ships built at Chinese shipyards,

At the time that the agreement with Dalian was announced, TTS Marine said it recognised that in order to succeed in the modern market, companies need to be close to their customers, and by the end of 2005 it planned to have approximately 100 employees in China in companies owned wholly or partly by the TTS Group, along with a sales offices with six employees in Pusan in South Korea.

Earlier this year, TTS Marine reported its best ever quarterly result, and said turnover in its ships equipment area - which includes marine cranes and cargo handling equipment - was up significantly. Other companies such as crane manufacturer Hydramarine have reported a record order intake in the current financial year.

Adax Group acquires Norac

At the end of last September, one of the leading manufacturers of marine accommodation systems in Norway, Norac AS, was acquired by Adax Industrier, a development which both companies claim will provide them with important geographical and manufacturing synergies. Adax Group is a Norwegian-owned corporation with 80% of its sales coming from outside Norway. Norac is a well-known manufacturer of fireproof and sound-insulated accommodation for cruise ships and commercial vessels, as well as offshore and land-based installations.

Enhancing performance in a seaway

RESEARCH and development is a key feature of the Norwegian maritime cluster, a notable example of which is Performance in a Seaway, a collaborative research project between Rolls-Royce Marine, Marintek, the National Technical University of Norway (NTNU), and a newly formed University Technology Centre (UTC). Over the last decade, Rolls-Royce has developed a model for cooperation with universities and research institutes, the aim of which is to promote research with commercial potential. Some 25 universities and research institutes all over the world have this relationship with Rolls-Royce. UTC partners are chosen among the top players in relevant fields, and the UTCs are long-term relationships, typically for 10 years.

The thinking behind the Performance in a Seaway project is that, traditionally, ships and propulsion machinery have been optimised for operation in calm water, and operation in heavy seas has only been taken into account in terms of crude safety factors. 'As we all know, ships only occasionally operate in calm water', explains Marintek's Professor Sverre Steen, who now head the UTC. He notes that the use of crude safety factors to accommodate the effects of waves and ship motions usually results in designs that are too heavy, costly, and inefficient. Moreover, in some cases this strategy produces vessels or propulsion units that are insufficiently strong or powerful, leading to costly and sometimes dangerous failures.

'With the establishment of the Performance in a Seaway UTC, Rolls-Royce, Marintek, and the NTNU intend to take design tools for ships and propulsion units to a level at which the effects of waves and ship motions can be taken into account in a sound and scientific manner', Professor Sverre explains.

Although the subject of the UTC will be ship performance in a seaway, most emphasis will be put on propellers and their dynamics in a seaway, with the following topics being covered:

- dynamic forces on propellers in a seaway due to effects of ventilation, cavitation, and ship motions
- interaction effects between hull and propulsors
- added resistance and speed loss in waves for modern hullforms
- use of intelligent control methods to enhance performance; such as roll damping by use of tunnel and azimuth thrusters, and use of active control to reduce dynamic forces on propellers and azimuth thrusters
- optimum design of azimuth thrusters
- development of an advanced ship simulator

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MANAGING RISK

for simulation of ships in a seaway. This will be utilised as a platform for implementation of the results of basic studies in other parts of the UTC.

During the project, the NTNU is responsible for the most basic research, while Marintek performs more applied projects, and implements techniques in the simulator and other computer-based tools, such as the ShipX Hydrodynamic Workbench. Professor Sverre said that, currently, work in the UTC is focusing on two main areas:

- development of ship simulation software that includes accurate simulation of the motions of a ship in a seaway, and realistic mathematical models for propulsion performance. The ship simulator acts as a platform for the implementation of the methods and tools developed in other UTC tasks and projects
- research on propeller dynamics, with a focus on dynamic loads on propellers subject to intermittent ventilation and strong vertical motions, as experienced by propellers and thrusters when operating in extreme seas in a dynamic positioning mode. This work is headed by Dr Kourosh Koushan, who has been conducting scale model experiments on propellers in waves, measuring forces on a single propeller blade and making recordings using high speed video.

Another ongoing R&D project is also looking at propulsion. The so-called Propeller Forum or 'Propellkameratene' is a group of 10 Norwegian propeller manufacturers plus classification society DNV, the NTNU, and Marintek, which is running a three-year joint industry R&D programme. Members also include manufacturers such as Helseth, Brunvoll, Servogear, Scana Volda, Rolls-Royce Marine, Heimdal Propulsion Norway, Finnøy Gear & Propeller, West Mekan Produksjon, Nogva Motorfabrikk, and Wärtsilä Propulsion Norway.

Norwegian companies are using projects such as the Propeller Forum to ensure that they maintain their expertise in propulsors.

Evolving new design and analysis tools

The aim of the forum is to develop new and more efficient design and analysis tools, and to secure Norway's long-term competence in key areas of the discipline. Funds are being provided by the Research Council of Norway and Innovasjon Norge to support the programme. Norwegian manufacturers of propellers, thrusters, and rudders are a mixture of small and medium-sized enterprises plus large international companies like Wärtsilä Propulsion Norway and Rolls-Royce Marine, but all are recognized in Norway as keystones of industry in their respective regions.

The companies supply their products to the marine and offshore industries, each being a sector where there are stringent requirements regarding efficiency, emissions, and safety. They also supply builders of fishing and passenger vessels, including high-speed craft, as well as more conventional vessels.

It is recognised therefore that this is a part of the marine industry with a great deal of experience, but one that demands an ongoing commitment to R&D and innovation, into such factors such as reducing fuel costs and emissions; enhancing and making manoeuvring more efficient and safer; reducing noise levels; and enhancing the documentation of product performance.

Participants in the three-year programme hope to develop long-term competence and to improve the efficiency and implementation of design and production processes in the companies involved. Utilisation of the results of the programme will take the form of delivering improved installations with lower fuel consumption and fewer emissions. Improved tools for the optimisation of ships' operating profiles and more efficient propulsion and manoeuvring systems will, it is hoped, deliver improvements in emissions and fuel consumption of up to 10%-15%.

Main activities of the Propeller Forum are:

- developing and verifying new design and analytical methods, including different propulsion and manoeuvring configurations, for which industry currently lacks numerical analysis tools
- developing methods for the analysis of propulsion and manoeuvring systems operating under various loads and for given working profiles
- improving design and production processes
- developing expertise and human resources at university and college level, in order to raise the level of cooperation within the sector
- develop and implementing methods for the design and analysis of propulsion and thruster systems in order to maintain competitiveness.

ASV designs combine speed and load-carrying capacity

ON-GOING development of the concept of air-supported vessels (ASVs) by SES Europe (*The Naval Architect* July/August 2003, page 52) has seen, during the last 12 months, development of a number of new, larger designs and a number of patented ASV concepts - owned by Effect Ships International AS (ESI) - evolved, which, the company believes, are be suitable for a wide range of applications.

Four different ASV main configurations have been investigated, including ASV monohull and multi-hulls designs, the latter created with a considerable amount of tank testing at SSPA, in Sweden, to back up the theoretical work. Two 9m manned models were built by Katamaran Konstruktion GmbH, of Austria, and tested by the National Technical University of Athens, with assistance from SSPA Sweden and SES Europe.

The models represent a 40m fast ASV catamaran with a design speed of 70knots, and a 125m ro-pax/express cargo craft with a design speed of between 50knots and 60knots. Both designs are 'skirtless', and the ASVs are designed for waterjet propulsion; however, other propulsion systems may also be used.

The 125m ASV design differs somewhat from the ASV 40m designs, but shares several of the advantageous features of the smaller version.

A manned 9m model of a proposed 125m-long ro-pax catamaran ferry developed by Effect Ships International is seen here travelling at 60knots on a displacement of 5300m³.

This design combines air cushions and displacement bodies. As the company highlights, operating any 125m x 45m vessel at 60knots demands an innovative approach, and the 9m-long ASV 125 model was successfully tested at full size speed of 60knots with an operational displacement of more than 5500m³.

Tests at 50knots were performed with a full-size displacement corresponding to 6000m³-plus, thus allowing for a significantly increased payload. Tank testing indicated a soft and comfortable ride.

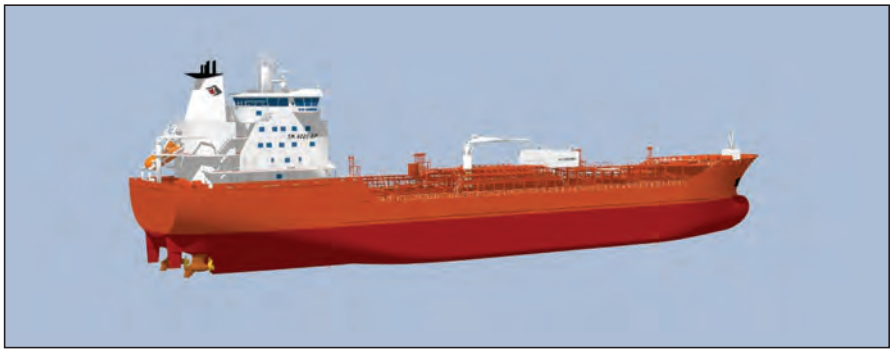
Compared with conventional super-slender catamarans or trimarans, the ASV 125 design has a significantly larger 'footprint,' and the added draught at high loads is markedly reduced. Based upon investigations with a manned model, the company sees additional potential applications for the ASV 125m type design in a range of sizes and speeds.

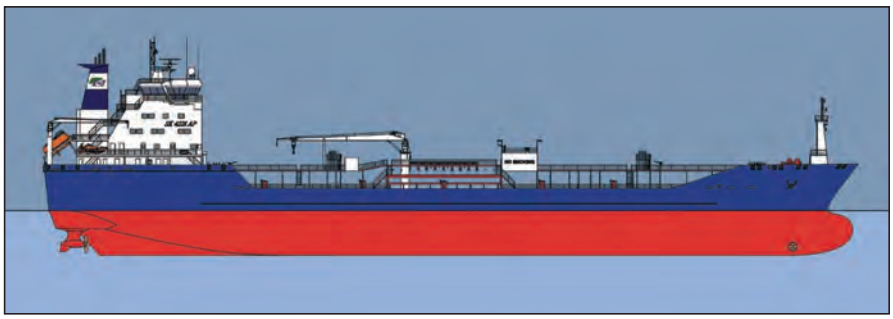
Innovative tankers from Skipskonsulent

SKIPSKONSULENT, the Norwegian firm of naval architects that is now part of the Vik-Sandvik group, is particularly associated with the design of ro-ro and ro-pax ships, passenger vessels, container ships and reefers; it has additionally conceived numerous tanker designs for owners in many countries, including, most recently, innovative, environment-friendly and commercially-efficient designs for owners in the UK and Sweden. Several designs from Skipskonsulent have been reported in past issues of this journal. Most of these have an emphasis on redundant machinery and thus on enhanced safety and environmental protection, and in at least two of the designs, on reducing the ship's external noise signature.

TECHNICAL PARTICULARS
SK 4228AP TANKERS

Length, oa	146.60m
Length, bp	134.40m
Breadth, moulded	22.00m
Depth moulded	11.80m
Draught, design/scantling	8.00m
Draught, ballast	5.10m
Deadweight	14,500tonnes
Cargo capacity, 100% including slops	19,000m³
Water ballast	7550m³
Bow to centre manifold	75m
Keel to mast top	39m
Ice class	Finnish-Swedish 1C
Number of segregations	9
Pumping capacity	3360m³/h
Loading capacity	600m³/h
Main engines	2 x MAN B&W 7L27/38
Output	2 x 2380kW
Speed, loaded	13.00knots
Accommodation	16
Classification	Det Norske Veritas + 1A1 Tanker for Oil products, ESP, Tanker for Chemicals, Ice 1C, NAUT-AW, EO, Clean Design, RP, NAUTICUS (Newbuilding), VCS-2, ICS, TMON





Skipskonsulent's SK 4228AP product/chemical tankers for Broström (above and top) are believed to be the first tankers to feature the DNV Clean Design notation. They are also notable for their Azipull main propulsion thrusters. The first ship is expected to be delivered very soon.

Among them is the new D-class oil/products tanker for Broström Tankers AB, four of which are being built at Jinling Shipyard, in China. The 14,500dwt SK 4228AP design is purpose-designed for North West European trades, and is noteworthy for its fully redundant propulsion, restricted draught, and a Clean Design notation. These are believed to be the first tankers with this environmental notation from DNV - and an emphasis on

intensive trading, with loading/discharging operations that are limited only by shore installations.

An important feature of the specification is a pair of Rolls-Royce Azipull mechanical propulsion thrusters (as reported in our September 2004 edition, page 96), which are driven by MAN B&W Alpha 7L27/38 engines - a plant that reflects the owner's need for high reliability, such that an additional DNV notation - RP - can be secured. Additional manoeuvrability for quick turnrounds will be ensured by an over-sized 1000kW bow thruster.

The design also emphasises low noise levels on board, which Broström considers appropriate for operation in an 'urban' environment when in port. Munters SCR (selective catalytic reduction) units will be fitted to both main engine exhausts, also to the four licence-built MAN B&W 6L16/24 auxiliary engines; these should cut NOx emissions by 98%.

The SK 4228AP is of single-deck design with double sides and double bottom in the cargo area. The tanks are of phenolic-epoxy coated steel, and all onboard cargo handling and tank cleaning systems are of the closed-loop type to reduce the risk of spill or contact with products or residuals. To reduce the risk of injury to the ship's crew, mooring drums are housed in a purpose-built arrangement that also reduces the risk of damage to the equipment while enhancing efficiency and reducing time in port.

A high cargo capacity for a vessel of this size means that the SK 4228AP design will be particularly well suited to transporting light products, with 14 tanks of different sizes in an optimised configuration that allows for up to nine segregations. An excellent ratio between draught and capacity (the operational draught being just 8m) will enable the ships to gain access to ports with restricted water depths.

The first example of this environment-friendly product/chemical class was launched last June, and is due to be delivered in January or February this year. Entry into service in north west Europe is anticipated sometime in the second quarter of 2006.

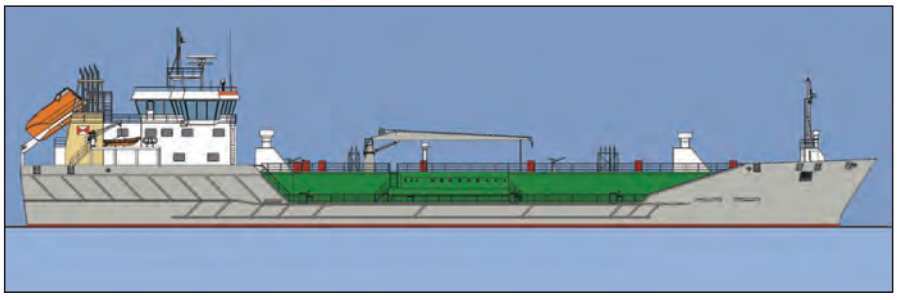
Diesel-electric tankers for F T Everard

PERHAPS the most interesting current design from the Skipskonsulent portfolio is that being provided for UK-based F T Everard's quartet of SK 4210-class oil products tankers. These coastal vessels are under construction at Qingshan shipyard in China, with the first, *Speciality*, expected to be fully operational very soon.

The tankers are noteworthy for their twin-screw propulsion with diesel-electric machinery, but have a host of other interesting features, including a fully segregated ballast arrangement, remote controlled cargo monitoring, variable-speed electric cargo pumps, and an emphasis on environment-friendly and cost-effective operation.

As is the case with the Skipskonsulent design for Bröstrom, these new ships also reflect Everard's need for the external noise signature to be reduced to a minimum, given that they will work into and out of smaller ports and harbours with significant residential populations nearby. Like their larger Swedish-owned counterparts discussed above, these ships have electrical, rather than hydraulically driven, cargo pumps and deck machinery, while the bow thruster and diesel-alternators, also the exhaust systems, valves, and ventilation fans have also been selected with low noise levels in mind.

An impression of the SK 4210 design for F T Everard, which combines diesel-electric propulsion with a low external noise signature.



Profile of Everard's SK 4210 oil products tanker.

TECHNICAL PARTICULARS
SK 4210 PRODUCTS TANKER

Length, oa	95.14m
Length, bp	87.00m
Breadth, moulded	17.00m
Depth, to main deck	7.70m
Draught, design	5.20m
Draught, scantling	5.90m
Deadweight, design	3480dwt
Cargo tank capacity	4600m³
Propulsion motors	2 x 900kW
Classification	Det Norske Veritas + 1A1 Tanker for Oil Products ESP, RPS, E0, ICS, CCO, TMON, VCS-2, NAUTICUS, LCS (DIS)

Offering a cost-effective combination of phenolic-epoxy coatings, the six cargo tanks offer six segregations and two fixed washing machines in each cargo/slop tank. The SK 4210 design has a discharge rate of 1125m³/h with three pumps running simultaneously, there being a total of six 375m³/h units fitted.

Two 900kW propulsion motors are supplied with electrical power from an unusual number of six 515kW diesel-alternators, to provide the ships with a trial speed of 13.5knots. The electrical package has been engineered and supplied by the Dutch company Imtech.

Rim-drive thruster technology launched by Rolls-Royce

RIM-DRIVE technology is making further strides into the marine world with the introduction by the Rolls-Royce group of a thruster based on this technique. We first reported on rim drives in our July/August 2003 issue, page 21, with the introduction by General Dynamics' Electric Boat division of a podded propulsor, which had been model-tested by HSVA in Hamburg, Germany.

Now Rolls-Royce, in Norway, has launched a design, the prototype of which has ordered by Olympic Shipping for fitting on a new offshore support vessel under construction at the Aker Søviknes yard. This RT1600 model, rated at 800kW, will be installed in the aft skeg acting as a stern side thruster; other conventional thrusters will be installed to aid dynamic positioning (to be performed with the aid of a new system also from Rolls-Royce). The rim drive is an integrated system combining electrical, mechanical, and hydrodynamic elements. The electric motor takes the form of a thin ring; its stator is incorporated in the tunnel, and its rotor carries propeller blades that 'point' inwards.

In due course, Rolls-Royce anticipates that the power range of rim tunnel thrusters will be broadened, and the technology will be used in other types of propulsor. The electro-mechanical part of the technology will also be applicable to winches, steering systems, and other products.

This particular technology has been developed in Norway over a period of several years by Rolls-Royce, in Ulsteinvik, and Smartmotor, in Trondheim, working in close collaboration. A prototype unit has been subjected to function trials and long periods of endurance testing in Norway, and to detailed evaluation in the cavitation tank at the Rolls-Royce hydrodynamic research centre in Kristinehamn, Sweden.

An impression of the new Rolls-Royce rim-drive thruster. As can be seen, the blades in this highly efficient concept are attached to the rim, and there is no central hub or strut. In the future, the electro-mechanical part of this interesting system could also perhaps be applied to winches and steering gear.

Several features combine to provide advantages for an owner. These include the fact that water flow through the unit is unobstructed, since there is no gearbox in the tunnel, nor are struts needed to support a hub. Propeller blades are attached to the rim, eliminating uncontrolled flow between blades and tunnel. The permanent-magnet motor design is claimed to be very efficient.

Together, these factors give a high total efficiency and reduced noise and vibration. Because more thrust is produced for a given power input, fuel consumption is reduced, and this saving can be substantial in applications such as offshore support vessels operating in dynamic positioning (DP) mode, where thrusters may run for hundreds or thousands of hours a year. Fuel saving is not only a matter of money; the impact of the vessel on the environment is also reduced.

The Rolls-Royce rim thruster is designed to be mountable and dismountable under water, so that it can be removed for servicing if required without drydocking. Water-lubricated bearings are employed to eliminate propeller shaft seals and oil-filled gear housings.

The motor is an integral part of the unit in the tunnel, so a ship designer no longer has to find space for an electric motor in a thruster room. The only parts of the thruster inside the hull are the cables connecting it to the frequency-control supply cabinet. The cabinet is similar to that used with any frequency-controlled electric thruster, and its location is flexible.

Large diesel-electric plant for new seismic ship

AN order to supply a powerful diesel-electric plant, totalling 16,800kVA, for a new seismic ship has been secured by Bergen-based Scandinavian Electric Systems (SES). The ship will be built at the BMV site of Bergen Yards for a domestic owner, E Forland, to a design, known as ST-327, from Skipsteknisk. Bergen Yards is a relatively new Norwegian shipyard group with four members; BMV is based at the former Bergens Mek Verksteder.

SES involvement will cover design, engineering, production, testing, delivery, and commissioning of four generators of 16,800kVA in total, plus main and emergency switchboards, AFE-type frequency drives, two main electric propulsion motors, each of 4200kW, and two thrusters of 1500kW and 1200kW. The main and emergency switchboards are to be supplied by the company's subsidiary, SES Austevoll AS, and included in the total package is a ship automation system from Kongsberg Maritime.

SES believes that this may be one of the largest low-voltage diesel-electric systems ever built. In addition, the contract represents confirmation that the Aktiv Front End (AFE) frequency-drive solution is finally accepted in the market. This solution has been used on ships since 1998, and today second-generation systems are being built; SES holds an orderbook to equip 12 ships, with a further nine options.

Last year, the Scandinavian Electric Group (SE Group) secured orders for at least NKr260 million, and many domestic and international projects are currently being negotiated for similar deliveries.

An impression of E Forland's new seismic ship, which will be powered by a SES 16,800kVA diesel-electric plant featuring Aktiv Front End frequency drives.

The Royal Institution of Naval Architects

Warship 2006: Future Surface Warships

June 2006, London, UK

Second Notice

This symposium, the 26th in RINA's successful Warship series, will look at the next generation of surface warships.

All capabilities of these new ships must be carefully balanced to complement the existing naval inventories, meeting new Operational Requirements in the post cold war world of the expeditionary force and the police action, whilst bringing cost effective improvement wherever possible. This is especially important where new designs have been conceived to replace more than one class of ship, a trend that seems to be emerging and which points towards the 'multi-purpose' warship. Joint nation collaboration in the development and procurement of common ships is still an important element in many projects where nations have similar requirements.

This conference will discuss the whole subject but will focus particularly on how the issue of survivability affects the design of warships.

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Cutting-edge controls for next-generation ships

New models of automation and control that ally the best technology from the offshore and merchant-ship worlds are being evolved by Kongsberg Maritime to meet the challenges of 21st century shipbuilding and the need for fully integrated, seamless operation in a fully cost-effective manner.

Kongsberg Maritime dynamic positioning systems are playing a vital role on shuttle tankers when they are hooking up to offshore buoys. In future, LNG tankers making similar loading operations, including under Arctic conditions, will also welcome such equipment.

SIMPLE marine controls for merchant ships - perhaps epitomised by the spartan bridge of the SD14 and similar standard cargo ships of the 1970s - are a thing of the past, as naval architects, shipbuilders, and owners struggle to cope with the realities of the modern marine world. At the same time, major efforts are being made by leading exponents in this field, such as the Norwegian group Kongsberg Maritime, to perfect fully integrated, seamless layouts, grouping controls from the many individual systems onboard today's vessels. These span everything from navigation, dynamic positioning, and cargo handling, to ship safety, boiler and engine controls, power management, emergency shutdown, and bunker and ballast systems. The aim is to supply 'the full picture', as the company states in its publicity material.

During the last 15 years, the Kongsberg group has evolved to reach its premier position (it has 14,000 ships in operation with equipment onboard) through an emphasis on cutting-edge technology allied to judicious acquisition of other leading international names from Norway, most notably Norcontrol, Autronica, and Simrad. However, only a few weeks ago, Simrad's leisure marine business was sold off as the group made a decision to concentrate on the commercial marine and oil/gas sectors. A second major arm is defence and aerospace - the company's original market.

Tremendous efforts are made at the company's headquarters and assembly plant in Kongsberg town - to which *The Naval Architect* made a recent special visit - to ensure efficient - and most importantly, cost-effective - designs that can be tailored with core established technologies right at the start of a project. A large engineering division carrying out such tasks is said to be much appreciated by both owners and shipyards, and some NKr250 million is invested annually in R&D to ensure that the company remains in the vanguard.

Redundancy is always in-built and whenever possible less essential components are purchased off the shelf, leaving the key processing and interface modules to be of Kongsberg's own design - essential on a large cruise liner or container vessel, where up to 10,000 signals may have to be processed reliably. Standard systems for merchant marine vessels are manufactured in the company's second plant not far away at Horten, but other components are sourced from elsewhere in Norway and Europe. Special efforts are also made to try and ensure that equipment is 'backwards-compatible', ie, it will fit into older systems when an upgrade is ordered.

Coping with the shift to Asia

The marine industry's recent inexorable shift to a new axis in Asia has called for parallel moves by Kongsberg Maritime to augment its existing subsidiaries around the world. In Shanghai, China, the company's console manufacturing plant has doubled in size within the last two years, while work is also expanding in Singapore where yards are witnessing a mini-boom in the number of semisubmersible platforms under construction. Other new activity centres are in two emerging shipbuilding nations: Vietnam and India.

The company feels most strongly that it is essential to have local bases in these new countries so that it can listen closely to what owners, builders, and designers there are saying about control systems and what they require. Happily, remote dictation from Norway as to what they should be ordering is not considered an option by Kongsberg! In this respect, Chinese yards are particularly open to discussion and ideas as they build up their expertise.

Involvement in new-design LNG carrier technology

One of the prime focus points in Asia at the present time is the LNG sector - a very special market where, as most people know, long-term charters are generally the order of the day, although today this scenario is changing with the arrival of a small spot-trading market. At the turn of the century, some 80% of LNG carriers were being ordered in Japanese yards. Since then, there has been a major shift to Korea, which is now the leading expert in the construction of such ships, although China is beginning to emerge as a challenger and has already secured orders for five membrane-type ships, at Hudong-Zhonghua Shipbuilding, in Shanghai.

Today, the LNG industry is changing rapidly as very large ship sizes up to more than 210,000m^3 are being ordered, and new propulsion technology - such as dual-fuel diesel engines and heavy-fuel engines allied to cargo reliquefaction, and re-gasification - takes over the role of the traditional steam turbine. For the near-future, several interesting new cargo containment proposals are also being launched, including alternatives to the GTT Mk 3 and NO 96 patent membrane systems and the concept of compressed or pressurised natural gas.

Such new systems require new control/monitoring technologies, and Kongsberg Maritime, which for many years, has designed cargo gas management systems, has had to work rapidly with owners, sub-suppliers, project leaders (such as Qatar Gas) to evolve suitable systems, balancing innovation with reliability. At the same time, the company must ensure that the fullest possible engineering support is given to Asian shipyards constructing these complex vessels.

In July last year, approximately 67 third- and fourth-generation LNG carriers (145,000m^3 and 200,000m^3-plus respectively) on order have Kongsberg controls of some form or other specified. However, the

company notes that, with the rise in the number of ships being ordered in line with the LNG boom, equipment packages are becoming increasingly more standard, with a speedier supply chain.

This is a result of the fall in prices as yards become more competent in the complex systems onboard, and as LNG becomes more of a standard commodity rather than a special cargo. In parallel, Kongsberg has had to focus on simpler, more integrated packages, which ally the various complexities of an LNG carrier - cargo control, custody transfer system, boiler, diesel engine, or (for the future) gas turbine control, HFO engine and dual-fuel systems - with the last-mentioned requiring especially precise gas management control.

With the introduction of cargo re-liquefaction or re-gasification, gas operations are becoming more akin to a process plant, in which, of course, Kongsberg Maritime has much experience, and the company is working here with various manufacturers. At the same time, the company must keep an eye on embryo niche gas technologies, such as compressed natural gas (CNG), where smaller and fewer ships are likely to be needed but where interesting openings may arise. Nevertheless, it is to the volume LNG market that Kongsberg Maritime looks mostly; it is here that most cost-effective technology can be employed - and cost-effectiveness must remain a watchword so that the company can compete successfully when the market shows signs of a downward slide.

Russia: an emerging new market

Another most interesting market, with great future potential, is Russia, where Kongsberg Maritime has been involved (often through Finnish shipyards) since the 1970s. A special focus in this country at the present time is new-generation ships and offshore or land-based loading systems to export reserves of oil, gas, and minerals, and specially designed for cold-climate operation in the Baltic, western Arctic, Sakhalin (Russian Far East), and the Caspian Sea, all of which in their special ways pose technical challenges.

Some of the difficulties of setting up new systems to operate in high latitudes and similar difficult conditions are already being realised in advance. With reference to the huge Arctic reserves of Russian natural gas, Kongsberg Maritime believes that it quite likely that the Moss spherical tank system (already specified for the first Norwegian Snøhvit tankers) could prove a success, owing to its accurately definable sloshing features.

Notwithstanding, Kongsberg is already well experienced in systems for cold-climate operation, and which in any case, are probably more connected with a ship's structure rather than electronic control systems (eg, ice crushing a tanker loading at an offshore buoy and the extra stability problems associated with large volumes of ice build-up on deck). However, the company is involved in new studies, aiming to provide suitable packages, noting that aspects that need special consideration are rapid and squally wind changes in the Barents Sea area, difficult currents, shallow water, less available meteorological information, heavy snow showers, and fog. 'What-if' scenarios are suddenly becoming more relevant.

It should be helpful that some Russian yards are already trained to install Kongsberg equipment, and Kongsberg is additionally cooperating with several companies there. These include the Far Eastern Shipping Co (FESCO); a Kongsberg dynamic positioning system is fitted to the new icebreaker/support vessel *Fesco Sakhalin* (*The Naval Architect* July/August 2005, page 41). Automation and propulsion control packages are also being supplied to a pair of product tankers and a series of container ships being built under a joint Iranian/Russian project at the ISOICO yard, at Bandar Abbas, in Iran. Of course, several leading Russian owners have today become international players, ordering ice-class ships not in their home country but particularly at yards in Korea (such as the bow-loading Aframax series from Hyundai for Primorsk Shipping, featured elsewhere in this issue), and Kongsberg Maritime is currently working with projects at yards involved in tanker projects

Closer involvement at project start time

Like others, Kongsberg Maritime is aiming to work more closely with naval architects and engineers at the very start of projects, to try and ensure that an optimal design is achieved, and to avoid problematic alterations at a later stage. This is becoming a more important aspect of the company's activities. At the same time, it has been noted that many more shipyards, including giants such as the Aker group, in Europe, and DSME, in Korea, are creating more of their own ship designs and systems from scratch, rather than relying on outside consultancies, as has been quite normal for several years.

It is believed that shipbuilders are trying to both optimise designs, to take better control of a complete project, and to shrink the total time - and hence cost - taken to complete a project. Since Kongsberg's aim is to supply a seamless integrated control/automation system, this move could have positive benefits for all. But who will actual be the defining party if this trend grows - ship equipment supplier, shipyard, or owner - is still not fully known.

Cruise liner and ferry safety

Another interesting sector where Kongsberg Maritime is aiming to play an important role is in cruise liners and ferries. A brand-new project which is just now entering service is that involving Norfolk Line's (AP Møller group) new trio of 34,500gt ro-pax ferries, built at Samsung, in Korea. This are planned to operate on the Dover-to-Dunkerque route across the English Channel, and the first, *Maersk Dunkerque*, is already in service.

On this ferry, a Kongsberg Maritime DataChief C20 integrated automation system is installed with more than 2000 input/output signals, while a tailored fire/safety package and an emergency shutdown system are also in operation. Eleven workstations are fitted - in the wheelhouse, engine control room, ship's office, and chief engineer's dayroom. The highly distributed system comprises advanced power management and control for three 2280kW diesel-alternators, two 3800kW shaft alternators, and total process monitoring and control for the main engines, tanks, fans, compressors, valves, and pumps.

Typical of new technology from Kongsberg is the AutoChief C20. The first of these main engine remote systems went to sea last year, controlling the prototype MAN B&W ME-type (camshaftless, with electronic controls) low-speed engine built by Hyundai Heavy Industries. This was installed on *SCF Aldan*, lead ship of a series of six Suezmax tankers ordered by Russian owner Sovcomflot. The AutoChief 20 will, by use of common architecture and a CAN-bus, link with this ship's DataChief C20 alarm and monitoring equipment - a cost-effective solution that is easier to install.

The fire, safety, and shutdown equipment, based on a new functional concept, will monitor and control fans and dampers, emergency shut-off valves, fire alarm system, fixed water extinguishing system, drencher equipment, and a fixed gas firefighting layout.

Current and future generations of mega cruise liner, carrying up to 3600 passengers plus a 1000 or more crew (such as RCCL's new Freedom series), have huge implications for safety in an emergency. Kongsberg feels that the most appropriate solution is for the company to provide systems that will inform the master as to the technical situation on his ship, rather than advising passengers - the most difficult of cargoes - where they should move or what they should do. Crew members can then shepherd passengers appropriately by direct means.

Kongsberg Maritime firmly believes that vessel status information for the crew is the most valuable of all, although, for the future, the company is studying, in association with various institutes, the possible introduction of information systems that might provide details for passengers to help them make their own decisions.

New technology concepts

On the technology front, Kongsberg Maritime is aiming to integrate its three core control systems - cargo, machinery automation, and offshore - into one common package, to try and mitigate some of the expense of developing special concepts. This policy is based on absorbing the best of standard systems from the Horten factory into the

flexible design work carried out at Kongsberg town, so that either a standard system or a tailored solution can be offered, as appropriate. The brand-new Kongsberg System Technology (K-Line) is part of this.

However, Kongsberg notes that today, yards are pushing more and more for a standard package and are trying to minimise the number of 'specials'. Additionally, concepts used successfully in the offshore field are also now being transferred to merchant ships. The first products of all these changes are being delivered today, one example being a fully integrated solution for a luxury megayacht at Viareggio Superyachts, in Italy, covering the whole product spectrum of navigation, dynamic positioning, machinery automation, power management, and propulsion control.

At the same time, investment is being made in new supporting tools for configuration design (for example, integrating five former computer cards into one STRYK DENNE), seamless integration, new man-machine interfaces, improved customer support, databases, and test duties. Increased functionality is a further target, while another important aspect likely to play an increasing role is maintenance tools for remote real-time diagnosis - a technique already extensively employed in the oil and gas industry.

The latter concept is not yet being fully utilised in the marine industry because of limited access to cost-efficient communication solutions worldwide. Nevertheless, remote maintenance and artificial information tools may form an increasingly essential part of every shipowner's armoury. Kongsberg's electronic log books (*The Naval Architect* March 2004, page 36) are already paving the way here. The goal is to provide more information but less data, and hopefully on fewer consoles! Today, a typical offshore support ship may have up to 30 monitor displays in its wheelhouse; Kongsberg believes this can be reduced to four or five.

Typical of Kongsberg Maritime new-generation integrated control systems for modern LNG carriers is this SVC-400 plant ordered for three ships at DSME. The first set was delivered to Korea at the end of 2005. Further orders have since been secured to supply equipment for other ships, including eight LNG carriers at Samsung and Hyundai; these will be of the latest type, with diesel-mechanical propulsion plus cargo reliquefaction (four ships) and dual-fuel diesel-electric systems (a further four).

Exciting times ahead

Clearly, these are exciting times for Kongsberg, with further growth expected in the LNG field (250,000m^3 vessels expected to be ordered imminently), and offshore drilling entering a new phase of expansion - Stena's giant drill ship newly ordered from Samsung is just one example. At the same time, new opportunities are opening up in cold-climate regions, and new mega container liners of up to 13,000TEU capacities are ready for ordering.

In the cruise liner sector, where Kongsberg Maritime is also involved, new generations of ship, with innovative control and monitoring concepts on board, are anticipated, while a positive scenario in the luxury yacht market - where complete packages are often specified - is yet another factor to put into this positive equation.

A TOTAL of 10 folding cranes are being supplied by Norwegian Maritime Equipment to five new coastguard vessels for service around Norway's coasts. The contract was actually placed by Szczecin Ship Repair Yard Gryfia, in Poland, which is building the ships for Remoy Management and Remoy Shipping.

All the cranes are similar but five can be adapted for grab operations, and they are described as combined knuckle and telescopic-boom designs. Lifting capacities are: 1.3tonnes at 10m, or 2.8tonnes at 5m. The cranes will be delivered with winches, also with continuous rotation and slew bearings; the latter is believed to be unusual (but also better, according to NME), since such bearings are normally only fitted to larger designs. Stainless-steel pipes and fittings will be included, and operation will normally be by radio remote control.

Silicone antifouling solution from Jotun

For the first time, Jotun is now marketing a silicone-based foul-release coating. Clive Woodbridge reports.

NORWEGIAN marine coatings specialist, Jotun, has released a new silicone-based elastomeric foul-release coating, which it is marketing under the SeaLion brand. Designed particularly for use on relatively fast, high-activity vessels, SeaLion joins Jotun's existing range of TBT-free antifouling marine coatings, which include SeaQuantum, SeaOmega, and SeaForce.

SeaLion, which can be used both on new and existing ships during drydockings, is considered particularly well suited for container ships, LNG carriers, cruise liners, ferries, reefer vessels, and car carriers. On these categories, SeaLion can be used to coat the hull, propeller (a relatively new idea), and rudder, and is capable of keeping these areas smooth and free from fouling for at least 60 months, claims the company. Jotun also suggests that SeaLion could be successfully employed as a coating for the propeller on many VLCCs and bulk carriers.

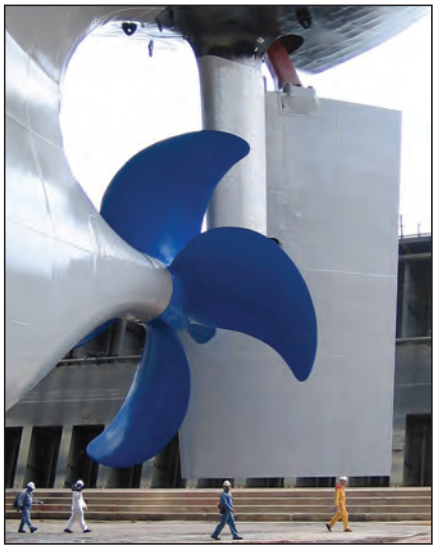
According to Bjorn Wallentin, group manager, antifoulings, 'SeaLion should be used if the activity of the vessel is predictable. If the vessel is likely to remain idle for relatively long periods then SeaLion should not be used because, as it does not release biocides, the ship will foul'.

The properties of the SeaLion coating ensure that any fouling that may be attracted to a vessel while it is stationary or slow moving is rapidly removed once the ship is in motion. Consequently, those areas of the hull that have been coated with SeaLion will always present a smooth, clean surface, avoiding any reduction in speed, or increased power requirement, as a result of the drag caused by fouling.

Mr Wallentin says 'Our experience tells us that in most cases, after application of SeaLion, a vessel's speed will initially increase and/or fuel consumption will be reduced'. Jotun claims that fuel savings will be around 1.5%, compared with most TBT-free antifoulings over a 10-year perspective. Based on a container vessel operating at a speed of 24knots, with a 90% activity rate, engaged in world-wide trade, and bunkers at US$250/tonne, Jotun calculates that the savings compared with a medium-quality TBT-free antifouling could be around US$2.475 million over 10 years. The speed gain from opting for the silicone product is estimated to be typically between 1knot and 2knots.

Mr Wallentin says, 'The aim of SeaLion is to create a clean and smooth hull, to achieve faster speeds and lower fuel consumption levels. With today's high fuel prices, this becomes even more important'. He adds, 'SeaLion has an impressive self-levelling effect when applied, creating a very smooth surface that reduces friction. The average roughness is around 0.8µm, compared with 9.5µm with SeaQuantum classic'.

When coating with SeaLion, three separate products are applied. These include an epoxy vinyl-based anti-corrosive bridge coat, Safeguard Universal ES, which is followed by a tie-coat, designed to provide a high level of adhesion between the undercoat and topcoat, and a smooth topcoat.



Jotun's new foul-release silicone coating SeaLion can be applied to both propellers and rudders as well as the underwater hull to offer extra benefits.

The SeaLion tie coat acts like an epoxy-type seal on the inside and a silicone-like seal with the SeaLion topcoat, and is the most vital element. Mr Wallentin observes, 'However effective the bridge coat and efficient the surface of the top coat, the ability of the tie coat to form perfect adhesion between the two is critical'.

As well as offering speed and fuel consumption benefits for owners, Jotun suggests there are other advantages from specifying SeaLion. For example, vessels coated with this product will require less paint than alternative solutions. The company also contends that while with some other silicone foul-release coatings, up to 40% of the product can be lost into the atmosphere on application, significantly less volume is lost with SeaLion, as it has very little dry spray. As a result, while this new product is relatively expensive for each litre, the overall cost of coating a vessel with an antifouling can be reduced. Furthermore, since there is less paint to apply, the time required by yards to complete this operation is also likely to be much less.

By their very nature, silicone-based elastomeric coatings have low surface tension and are as a result less hard than traditional TBT-free antifoulings, and require care when being handled by shipyards. However, Jotun argues that SeaLion is considerably tougher than other products on the market, and although scraping or scratching will damage the surface, bumps can be absorbed by the cushioning effect of the coating system. Furthermore, SeaLion, it is claimed, dries faster than other similar coatings on the market, reducing the risk of damage taking place within the yard.

Jotun recognises that, in general, the application of silicone systems is different from ordinary antifoulings. As a result, whenever SeaLion is applied, the company promises to ensure that a team of highly skilled coatings advisers is present.

While SeaLion is designed for use over a vessel's entire underwater hull area, Jotun believes there are particular benefits from using this product for propellers and rudders, maintaining efficiency and reducing maintenance costs. According to Mr Wallentin, 'The high forces experienced by propellers and rudders are the very conditions that benefit from SeaLion's foul- release properties. Macro-fouling is swept away in those areas where it would normally be expected to develop, leaving the propeller and rudder smooth and clean'.

As a result, any potential loss of power and reduction in speed is avoided, and the expense of carrying out underwater cleaning during service is reduced. Furthermore, Jotun suggests that cavitation of rudders and propellers in service can be reduced, as the comparatively soft and long-lasting SeaLion system provides a 'virtual cushion' against the effects of air bubbles imploding directly onto the rudder and propeller.

There are also environmental benefits from using the SeaLion foul-release coating. There is no release of biocides, the product is free from metals, has a low VOC content, and has a positive impact on fuel consumption overall.

To date the SeaLion has been applied in test patches on a number of LNG carriers and car carrier hulls, as well as on the propeller and rudder of a container ship. Experience so far is said to be very positive.

Although Jotun stresses that there is no reason why SeaLion should not be used for newbuildings, it accepts that this product may meet with resistance within some yards, concerned about the risk of cross-contamination with other projects in progress. Another issue which may limit SeaLion's application in newbuilding yards is the fact that it must be applied in a minimum temperature of 15°C, and 30% humidity, as it is cured partly by humidity. There would therefore be difficulties in applying SeaLion in winter in many South Korean or Chinese yards, for instance, although Jotun believes such obstacles could be overcome.

New ice-classed tankers for Primorsk handed over

IN October last year the 100,800dwt Aframax tanker *Pavel Chernysh*, built by Hyundai Heavy Industries Ltd as part of the 1599-1603 project, was handed over to the Primorsk Shipping Corp (PRISCO). She is the first of five sisters and has been classed to ice class 1A according to Det Norske Veritas, fully complying with the requirements of Exxon Neftegaz Ltd, a subsidiary of ExxonMobil. These tankers are designed for oil transport within the Sakhalin-1 project, in the Russian Far East. The second and third ships have now also been handed to PRISCO (the third, *Viktor Titov*, will be presented in *Significant Ships of 2005*).

The Transas Group is equipping these tankers with its new integrated navigation concept, the Hyundai-Transas Intelligent Bridge System (HTiBS). The basic configuration of this comprises five multi-functional stations. Each can be used as radar, ECDIS, or conning display, depending on the navigator's requirements, thus improving working conditions on the bridge. The vessels of the 1599-1603 project are fitted with eight work stations. This joint development by Hyundai and Transas is set to become the first navigation system certified by DNV to meet NAUT-AW class C standards.

Pavel Chernysh **and her first sister** ***Captain Kostchev*****, seen at Hyundai Heavy Industries' outfitting quay, were recently handed over to the Primorsk Shipping Corp. They will be used for oil transportation within the Sakhalin-1 project, hence the bow-loading gear.**

Ballast water management system for sediment removal

THE issue of aquatic invasive species, including the transfer of harmful organisms in ships' ballast water and sediments, is seen as one of the four greatest threats to global marine bio-diversity and ecosystems, and as a significant threat to coastal economies and even public health, according to IMO. To counter this, Dutch company Greenship has introduced a new shipboard ballast water management system.

This is claimed to be ideal for ships with ballast flow rates from 50m³/h up to 5000m³/h, and has been designed to achieve virtually every standard proposed by IMO's MEPC 53; it has been land-based tested and witnessed by Lloyd's Register EMEA.

The equipment consists of a sediment removal system, Sedimentor, for removing sediment and biota (80% >10micron, △P=2) during intake, as well as an electrolyse system for extermination of bacteria and organisms (with a claimed kill rate of 100%).

The Sedimentor should prevent sediment build-up in ballast tanks; not only does the system fight the pollution in ballast water, it also prevents the cause of the consolidating mud-problem, whereby tonnes of sediment in ballast tanks can affect fuel consumption. Recent calculations appear to indicate that there is an economic benefit on fuel consumption of up to 3% and even more by separating sediment from ballast water (source: Chemgas, The Netherlands) which can help to provide an attractive return on investment.

The Sedimentor removes 100% >20micron and 80%>10micron sediment particles, with remaining sediment particles remaining in suspension; they will leave the ballast tanks during de-ballasting.

Installation

A Sedimentor is engineered from modular parts, which enables the construction of any capacity required, providing maximum flexibility in construction and space. Two volumes are offered: 50m³/h and 100m³/h. As an example, a 250m³/h sediment removal system is made of two 100m³/h and one 50m³/h volume.

The Sedimentor can be easily integrated into existing ballast systems, and modules are measured for easy access into an engineroom. Personnel do not need any specialist training for operation and maintenance.

Cyclones in the modules have an operational life time of approximately 4000 hours-6000 hours and are easily replaceable. They are made of Lloyd's Register-accepted marine plastic, resulting in a lightweight construction and helping to avoid any occurrence of corrosion within the system.

The sediment removal system, Sedimentor.

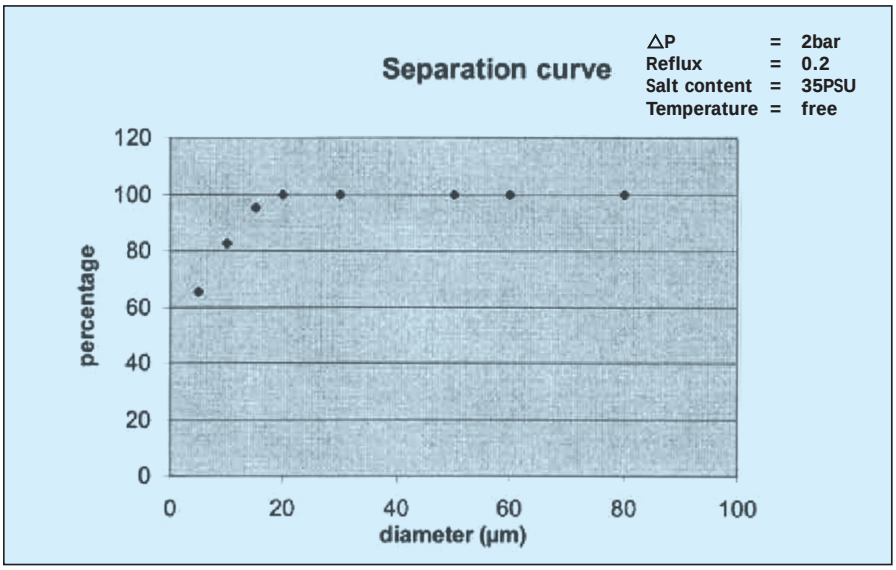
Electrolyse concept

Greenship's other product is an electrolyse system, which can be used for disinfection of water without using any chemical treatment. The company's inline disinfecting technique can be successfully implemented in a wide range of applications. Using the ions and salts present in water, the electrolytic cell produces sodium hypochlorite.

After dosing the sodium hypochlorite in the water, it returns to its original structure. In this way, there should no negative effects for the environment. The electrolyse system should be easily integrated into existing systems, being compact and easy to install.

Sodium hypochlorite, which kills and de-activates, is widely applied for the disinfection of water. The major advantage of this type of electrolytic cell is the long-lasting coating that occurs as a result of the process. The electrolytic cells can disinfect with a minimum of maintenance for the duration of approximately three to five years.

With no moving parts, the system operates when the ship is in upright position and when inclined at any angle of list up to and including 15deg either way under static conditions and 22.5deg under dynamic conditions (rolling) either way, also simultaneously inclined dynamically (pitching) 7.5deg by bow or stern.



This graphic shows that 20micron particles (sediment + biota) are 100% removed, while 80% of the particles (sediment + biota) larger than 10micron are separated.

Royal Navy follows the environment-responsible waste management path

THE UK Ministry of Defence (MoD) and The Royal Navy are fast becoming leaders, alongside commercial operators, in the field of environment-responsible waste management, partly due to leading-edge technologies being developed by QinetiQ in conjunction with the Defence Logistics Organisation (DLO). Advanced waste treatment concepts from QinetiQ are currently being trialled onboard the frigate HMS *Grafton* and aircraft carrier HMS *Illustrious*. The equipment (first discussed in *The Naval Architect* January 2003, page 18) forms part of a fully integrated waste management system (IWMS), which is claimed as the first of its kind to combine innovative waste disposal technologies, to provide a complete solution.

The Navy's Versatile Maritime Force (VFM) of the future will require a flexible global reach unrestricted by environmental legislation. In a maritime context, the dominant regulations are implemented through MARPOL 73/78. However, these regulations are the least stringent and only apply in international waters (under 12nm offshore).

Regulations in territorial waters, the littoral, are often far tighter and more vigorously enforced. The UK government has decreed that it will comply with host nation legislation where reasonably practicable and therefore this national and local legislation will impact on sustained military operations in the littoral. Concurrently, lean-manned ships, the drive to reduce through-life costs, drudgery issues and minimal reliance on port waste reception facilities, all support the requirement for an advanced waste management system onboard ship.

Global environmental legislation, including IMO's MARPOL rules, mean that, in future, ships' wastes will have to be offloaded at port for land disposal, or be treated onboard to achieve strict new environmental targets. QinetiQ's IWMS claims to allow ships to operate for up to six weeks without having to discharge waste materials, helping to dramatically cut back on port and harbour offload costs. The IWMS has also been designed to minimise manual intervention in waste handling, helping to improving health and safety standards.

This chute is part of the IWMS. The unit has been designed to minimise manual intervention in waste handling, helping to improving health and safety standards.

The integrated waste management system bioreactor, created by QinetiQ.

The technology works by using a membrane bio-reactor to treat and recycle all sewage, shower, and laundry waste. This produces clear and safe water which can be discharged into the sea or re-used for washing and other functions. State-of-the-art incinerator technology is also used to ensure, it is claimed, that waste emissions are less toxic than other existing waste management systems.

Another technology is based on pyrolysis, a thermal destruction technique that is far more advanced than incineration. QinetiQ, with Bristol-based company Compact Power, has developed an onboard pyrolysis system, which will comply with emerging MARPOL legislation, and NATO future emission targets. It will reduce reliance on shore facilities and time spent in port to offload stored waste.

The equipment will also require less manpower resources and free up valuable onboard storage space. If sea trials planned for 2007 are successful, the system is likely to become the standard solid-waste disposal technique for all RN surface ships. Additionally, research into microwave technology has the potential to resolve the issue of food waste at sea, which will have considerable benefit to operations in coastal waters.

Benefits of the key technologies in IWMS include:

- pyrolysis - trials reveal that the process can treat all solid waste, including food, and reduce processing time to less than five hours on an aircraft carrier. This would normally take around 22 hours using compactors and storage equipment, and nine hours for the AIS
- membrane bio-reactors - effluent can be discharged anywhere under MARPOL rules, with currently no restrictions under local legislation. The potential exists to recycle effluent for technical water. This could be used for high-usage areas such as in the laundry, also on aircraft and deck washdown, which will increase endurance time in coastal waters
- microwave - there is often a requirement to offload decomposing food waste into a barge or other craft alongside. Additionally, it is becoming ever more difficult to land food waste ashore, especially foreign food waste in the UK. QinetiQ's technology has the potential to resolve these issues.

Grey-water treatment

QinetiQ is also currently working alongside PDL Solutions to adapt and scale hydro-cyclone and so-called TORE technology to build a prototype grey-water treatment system. The system operates with a cyclone action to remove solids from the grey water. The TORE is a hydraulic conveyor of solids that contains no moving parts.

The prototype unit has been designed for use on vessels with grey-water storage tanks and is sized to treat 11,250litres daily. Trials took place early in November last year to determine whether the unit can be re-used to produce technical water for showers, laundries, and wash down, thus reducing the load on fresh water production.

QinetiQ believes, that due to the effective and efficient nature of IWMS, there is likely to be a good market for these systems, particularly with cruise liner operators. This, coupled with ever more stringent legislation over the next three to five years, will help to drive owners to fit such technology.

New oily water separators meet strict requirements

UK-based Victor Marine has launched a new range of oily water separators which fully comply with the IMO MEPC 107/49 regulations that came into effect on January 1 2005. The latest marine bilge water separator to be developed by the company is the MiniSep CS series, which has been designed to complement the VM Series launched by Victor Marine in 2005.

The CS Series can handle heavy fuels, diesel oils, and emulsified oils, and has been fully type-approved by Lloyd's Register, while it was, at the time of writing, still awaiting approval from US Coast Guard. In tests, the design achieved separation results of less than 5ppm, well below the IMO required standard of 15ppm.

The design is based on a flow-through, two-stage processing system, which does not need backwash cleaning cycles. Moreover, no membranes, carbon filters or chemical treatments are used, the company stresses. Victor Marine has incorporated its Hi-VOR technology for heavy fuel treatment and the AGM filtration system to ensure a high degree of reliability and cost-effectiveness in the treatment of bilge water.

A 'plug and play' philosophy has been adopted to aid stress-free installation, while the simple design requires minimal training for staff to operate. The high media capacity allows for a long running time between services, to help generate cost savings. In addition, Victor Marine claims that 80% oil recovery rates can be achieved with the CS series. This generates further cost-saving benefits, as product recovered can be re-used as high-grade fuel onboard.

The CS Series is constructed in painted mild steel, and incorporates two chambers, with a single positive-displacement feed pump, and a new coalescer. The new separator range has a compact footprint, which makes it suitable for all types of vessel, and also for retrofitting in situations where older-generation separators are being replaced.

The CS Series is available in seven models, ranging from the CS250, which has a 6m³/day capacity, up to the CS5000, a 120m³/day capacity separator, that could, for instance, be installed on vessels up to VLCC size.

Victor Marine's CS series is available in seven models, ranging from 6m³/day up to 120m³/day.

Victor Marine's VM series, which was introduced onto the market in January last year, is a slightly more higher-performance separator. Comprising four stainless steel chambers, with a dual positive-displacement pump system, and a 558mm coalescer, the system was designed to provide very low life-cycle costs. The VM Series has been shown to have IMO test results of less than 1ppm. Like the CS series, it comes with a certified 15ppm oil content monitor with a data storage capacity of 18 months.

The VM Series is available in five different models. The smallest is the VM500, rated at 12m³/day, while at the other end of the size range is the VM5000, which can treat up to 100m³/day.

The VM series has been shown to have IMO test results of less than 1ppm.

New sensor range allows waste-water testing

A NEW range of IP67 stick water test meters from Eutech, have recently been introduced by Kittiwake. These microprocessor-based testers feature user-replaceable sensors for the economical extension of instrument life. Their design also enables them to float when dropped into water, making them easily retrievable. These latest units have large dual-display LCD screens for enhanced readability and comprehensive meter information.

The meters can be used for accurate testing of process water and wastewater, and are additionally ideal for accurate checks in cruise liner pools and spas, or at any other location where frequent pH testing or conductivity testing is required.

The equipment is said to have easy and quick push-button calibration, together with automatic temperature compensation and a hold function, with auto-power off and self-diagnostic features. An extended battery life of 500 hours is offered for the pH Tester 10 model, which is accurate to +/-0.1pH unit.

The EC (electric conductivity) Tester 10+ model is a dual-range conductivity unit that now measures temperature as well. Resolution from 0.01mS/cm (10uS/cm) to 10.00mS/cm (10,000uS/cm) is possible, and the unit retains accuracy at low conductivity; new cup-type sensors allows for small-volume measurements.

A further model is the TDS Tester 10+ is a dual-range TDS (total dissolved solids) unit that also now measures temperature, while offering a resolution from 0.01ppt (10ppm) to 10.00ppt (10,000ppm). This unit is claimed to retain accuracy at low TDS and, again, the new cup-type sensors allow for small sample measurements.

Working towards rope-free mooring

IN September last year, Mooring Systems Ltd, the New Zealand specialist whose automated vacuum-based mooring equipment has been featured in several issues of this journal (most recently July/August 2004, page 37), completed a third order for the same customer in New Zealand with the installation of two additional MoorMaster 400 units in the port of Picton. Most of this company's current output is geared towards shore-based designs, and this is the case with these systems.

As the need for higher capacity arose on the ferry route between North and South Island, the existing piers proved too short for a new larger ro-pax ferry *Challenger*, introduced on this route by Toll Shipping. Instead of spending time on obtaining approval for a jetty extension of some 50m and incurring significant costs for capital works, the harbour authority installed two mooring units with 40tonne holding capacity each at the head of the pier. These units can be attached to the parallel body of the ferry's superstructure, aft of the bow by approximately one third of the new hull's length.

MoorMaster units can be fitted to landing stages or T-jetties, and can be used for diverse purposes such as cruise ship berths, tanker piers, or bulk loading facilities. They are said to be able to accommodate ships of any length, without the need for mooring points at the extreme ends of a vessel, and can overcome necessary investment costs in new mooring piles and similar engineering.

Another example involves high-sided ferries, cruise liners, or car carriers moored against low-lying piers, where there might be insufficient room to deploy breast ropes to prevent a ship drifting off the pier in offshore winds. This is a common scenario in many ports of the world, and the only option sometimes available is to call up a tug.

Long swells and waves can create similar problems and cause hulls to surge along a pier. While not able to completely arrest a large ship's movement, a recent trial in Salalah, Oman, did prove the effectiveness of the vacuum design, when tests were carried out with a Maersk container liner. By fitting gauges to the equipment, useful figures were gathered for future pad designs. Measurements showed that amplitudes of the motion parallel to the pier and athwartships were reduced by 75%.

One of the systems recently installed at Picton for securing Toll Shipping's new ferry *Challenger*.

The new equipment at the Omani port of Salalah being tested on a Maersk container liner. Large ships moored at this port are particularly prone to movement along a quay as a result of long swells and wind.

Electric deck machinery for China's first LNG carrier

CHINA'S first own-built LNG carrier, under construction at Hudong-Zhonghua in Shanghai, is being equipped with deck machinery by Hatlapa Uetersener Maschinenfabrik GmbH & Co KG, a leading manufacturer of such equipment for more than 85 years. All the gear will be electrically driven with frequency inverter controls and six-pole motors (without auto-tension device).

On the forecastle, the combined anchor windlass and double-drum mooring winches have a maximum chain pull of approximately 1600kN, capable of lifting 14 lengths of anchor chain in water depths down to around 385m. This is far more than the normal classification requirement of 82m water depth.

These winches are equipped with automatic remote-controlled anchor let-go systems, allowing full control of the anchor speed and displaying both paid-out chain length and speed of drop. In case of power failure, manual operation of the windlasses will be possible.

One of the new electric combined windlass/winch units from Hatlapa being painted, prior to installation of China's first LNG carrier; this is being built at the Hudong-Zhonghua shipyard. It is believed that these are first-ever electric units to be fitted to such vessels.

It is believed that this is the first time that LNG carriers have been specified with deck machinery having electric drives. Previously, difficulties in obtaining explosion-proof motors had been the major reason not to install such winches onboard such tankers. However, through continuous research efforts and close cooperation with subsuppliers, Hatlapa has succeeded in developing this innovative machinery especially for LNG tankers. The whole package is subject to classification approval by ABS.

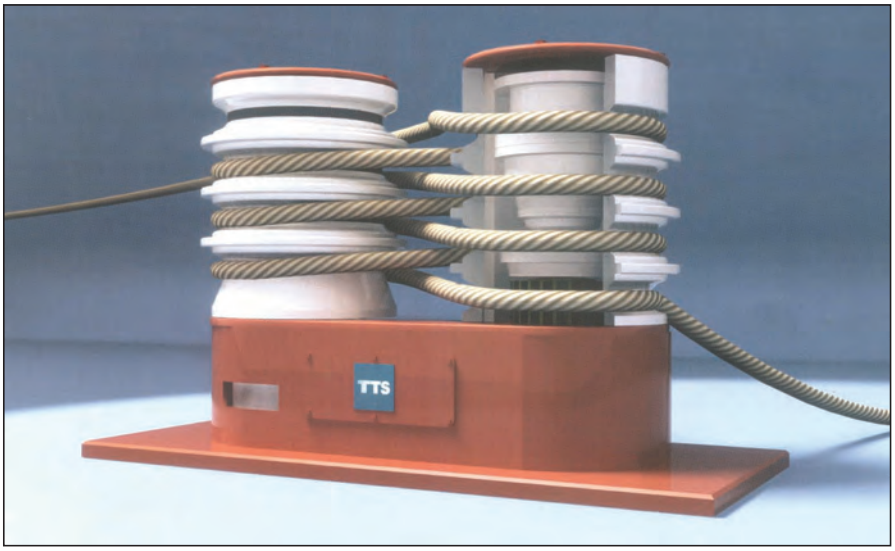
The first vessel is scheduled for delivery by November 2007, when it will be used to transport liquefied natural gas from Australia to South China's Guangdong Province, where a Yuan7 billion (US$846 million) LNG terminal is under construction. Apart from this first LNG vessel, Hudong-Zhonghua now has three other similar orders in hand, all of which will also have Hatlapa deck machinery.

First orders for TTS winch bollard

A SERIES of 49,000dwt product tankers under construction at DSME in Korea for Vela International Marine will be the first ships to be equipped with TTS' new winch bollard, featured in our November 2004 issue, page 36. This interesting equipment, which combines a mooring winch, fixed bollard, and warping drum or capstan, is claimed to provide easier operation, more flexibility, and improved safety.

A winch bollard can hold mooring rope just like a normal bollard but can also tighten and release lines in a controlled and safe manner. Normally, two crew members are needed to handle a mooring operation when fixing a rope onto a bollard, but with the new TTS design, only one man should be needed.

The reason for this is that the compact winch bollard system reduces line speed when the line becomes tensioned, and operators do not need to stand in line with the rope - a dangerous position. A winch bollard layout can replace different bollards and is supplied in hydro-electric or all-electric versions. For the electric version, frequency converter controls are fitted, and for the hydraulic version, the system is prepared to coupling to an existing ring main; alternatively, TTS will supply a power pack.



First orders have been secured for the winch bollard, an innovative mooring system from the Norwegian company TTS, which can be operated by one crew member instead of the normal two.

Optimal control during mooring operations should be possible, since the person handling the winch bollard can move and operate the foot pedal from the best possible position. A winch bollard has stepless speed control with high light-line speed, plus automatic reduction of line speed when the load increases. An integrated emergency stop is included together with an easy-to-control failsafe brake, while the drums are equipped with vulcanised rubber to prevent a line slipping. All bearings are self-lubricated.

International Forum

The Education, Training and Continuing Professional Development of Engineers in the Maritime Industry

Organised by the Royal Institution of Naval Architects
and the Institute of Marine Engineering, Science & Technology

IMAREST

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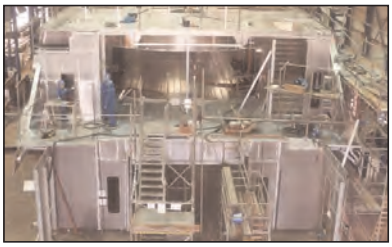

In a world of rapid changing technology, the education, training and professional development of a modern engineer will start at further or higher educational establishments but must continue throughout the engineer's professional career.

This conference will provide an opportunity through presentations and panel discussions to identify the maritime industry's needs, today and in the future, and to discuss how these might best be met by education and training providers

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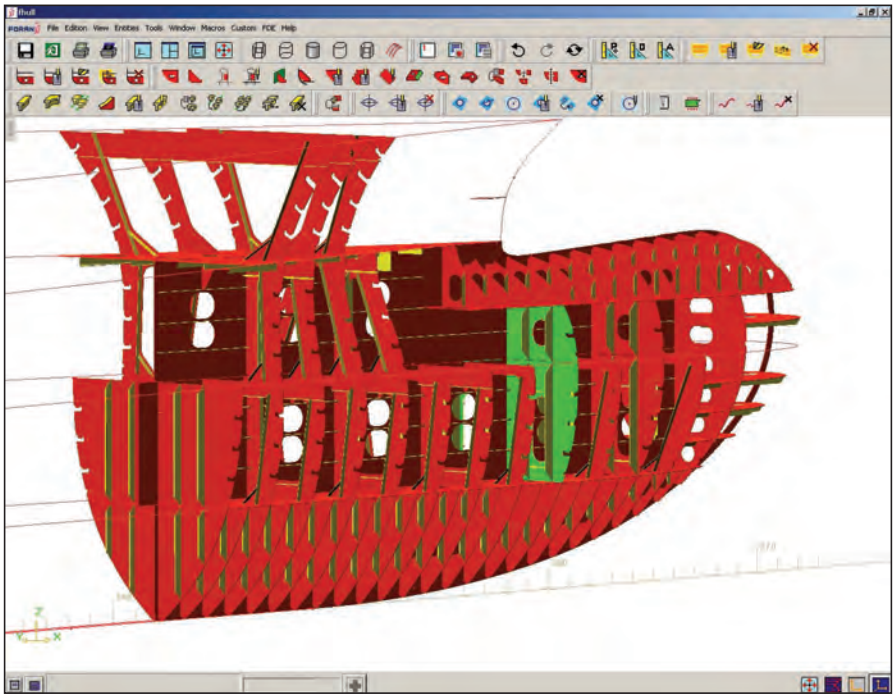
Latest advances in Foran

AFTER years of developing a new kernel and assimilation of the latest software, an up-to-date version of Sener's Foran, V60, has been released (as concisely reported in our July/August 2005 issue, page 52, and anticipated in January 2005, page 31). Module additions to this programme include damage probabilistic calculations, electrical design, drafting and mechanical, hull structure, structure production information, and machinery and outfitting.



The FHULL module allows users to work efficiently in 2D or 3D mode, and simultaneously in several sections if necessary.

FSUBD - damage probability calculation

The FSUBD - damage probabilistic calculation - module complies with current, and future, probabilistic regulations, that is, not only IMO MSC (58) for cargo ships, and resolution A265 for passenger ships, but also with the newest IMO MSC (80) regulation, that will be compulsory from January 2009.

The subdivision of a ship can be performed at any phase of the design by means of existing decks and bulkheads, or by user-defined additional limits and planes. When the position or characteristics of the decks and bulkheads are modified, their topological definition allows automatic update of the subdivision.

Once the subdivision is performed, calculations to check compliance with regulations are made, while the definition of simple and multiple penetrations is allowed.

Calculation results can be extracted as detailed or summary listings. Drawings are automatically obtained for the subdivision also the stability curve for each damage situation. Advanced visualisation options available in FSUBD include: dynamic zoom, panning, rotation of the scene, shading or wire frame view modes and multiple windows representations.

FCABLE - electrical design

FCABLE is Foran's V60 electrical design module, covering the most relevant aspects in design and production of systems onboard a ship. It includes functions to create several types of electrical diagrams, making 2D and 3D arrangements of electrical equipment, model cableways, route cables automatically or manually, manage cable terminations, handle the list of instrumentation and control signals, and administrate the electrical materials database.

The module benefits from the single Foran 3D model and its relational database. It provides a way to define all the data of an electrical project, avoiding redundancies and repetitive data input, and represents an efficient connection between the electrical department and other offices in a shipyard. Consequently, a reduction of design and production errors, also working man-hours can, says Sener, be achieved.

It includes a 2D application for schematics and 2D arrangements (EPOWER module), a 3D editor for equipment arrangements, cableway modelling and cable routing (FCABLE), and a report generator.

EPOWER constitutes the natural environment for defining electrical equipment and cables, which are automatically registered in the database as they are placed in the diagram. It also features some calculation functions (for example, cable section sizing according to different methods), automatic cable and equipment naming, graphic material lists, functions to import DXF and DWG formats, and other common 2D editing tools.

FCABLE also includes specific tasks for 3D equipment arrangement, definition of 3D cable paths, interactive 3D cable routing, and cableway modelling. Cable routing is controlled by user-defined 'cable population rules' applied both to routing paths and to penetrations. FCABLE maintains topology between cables, terminal equipment, and cableway 3D models.

Many other features are available in the 2D and 3D environments, such as different functions for database query, definition of attributes for cables and electrical equipment, definition and tracing of I/O signals, cable termination, cable life cycle, and cable orders (including nesting of cables in cable drums).

The report generator provides user-configurable lists of cables (for materials, ordering, cable laying, and cable connections), electrical equipment, I/O signals, automatic loop diagrams, and terminal connection diagrams. Electrical data can also be extracted from the Foran database by third-party applications.

FDESIGN - drafting and mechanical CAD

FDESIGN is now the module in Foran where all drawings - hull structure, machinery, outfitting, electrical, and accommodation - are obtained from the 3D model.

A wide variety of hull structure drawings can easily be obtained just by selecting the area of the ship or the build strategy node to be represented. Typical examples are shell expansion, class design drawings with symbolic representation, automatic labelled interim products drawings with attached material take-off, and traditional unit drawings.

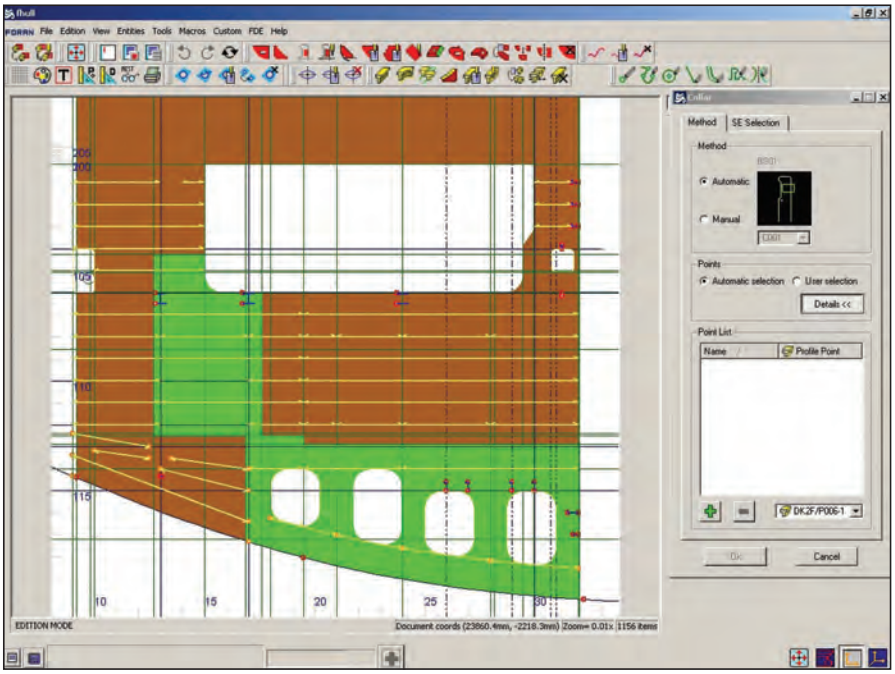
As to the machinery, outfitting, electrical and accommodation drawings, it is possible to select the type of representation (font of line, thickness, and colour) of each particular type of element, to automatically create sectioned pipe symbols, to include customised bills of materials, to show the insulation of lines, and to generate sections and details.

Once generated, all drawings maintain a seamless link with the 3D model, so any modification in the model produces updating of

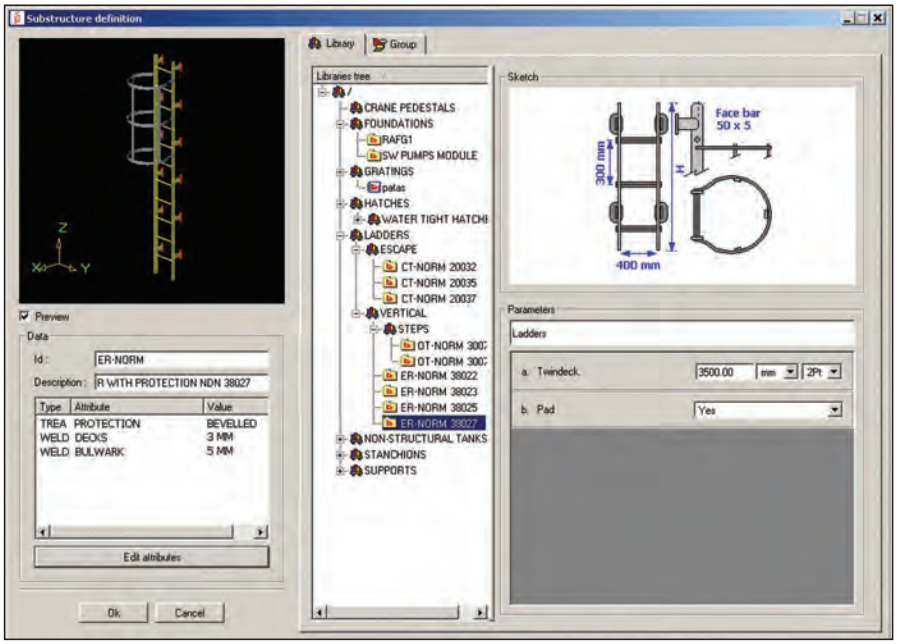
the drawings. This includes dimensions, labels, references to the ship and lists of materials that had already been added.

Drawings and documents generated by means of Foran Development Environment commands in other modules can be read by FDESIGN, thus allowing the possibility of further editing and modification. Insertion of predefined standards with automatic scaling is made by means of drag-and-drop techniques from the corresponding libraries.

FDESIGN includes advanced 2D drafting commands that also allow the use of this module as a stand-alone 2D drafting tool, comparable to other state-of-the-art CAD programs, and fully compatible with them. With the inclusion of advanced 3D modelling capabilities, FDESIGN also becomes the ideal tool for the design of cast parts and elements requiring a mechanical modeller approach.



2D sketch editor notch.



An auxiliary structures input data window screenshot.

FHULL - hull structure

Possibly one of the most interesting features of Foran V60 comes with the new approach to define the internal hull structure, now included in module FHULL, which completely replaces the old IPANEL module. The main concept is the application of the topdown paradigm: starting with the initial and basic design that is refined throughout the design spiral to achieve the detail design in a seamless process.

The application of this concept allows a more efficient approach to 3D modelling, as the whole process is carried out in a single module, and with important improvements in the topological relationship between structural elements and their constituent parts. A new user interface includes functionalities to facilitate work, such as massive copies of elements, global modifications, automatic handling of part thickness and much more. Additionally, a designer has the possibility of working simultaneously in several sections, either in a 2D or 3D environment.

Another feature is based on advanced Oracle queries that can provide valuable on-line information of any area of a ship, whether the information is displayed on the screen or not. The availability of this information should help to avoid frequent design errors caused in a multi-access environment, while it will greatly facilitate collaborative engineering in the same geographical area of the ship.

Other improvements worth mentioning are those focused on the implementation of some procedures that are frequently applied in the design of structures, such as automatic splitting of parts based on the crossing/non-crossing attribute of structural elements, the possibility of joining two adjacent parts with a simple operation, the automatic insertion of collars depending on the watertight/non-watertight attribute, thus contributing to relieve the designer of repetitive tasks and to improve efficiency.

FHINFO - structure production information

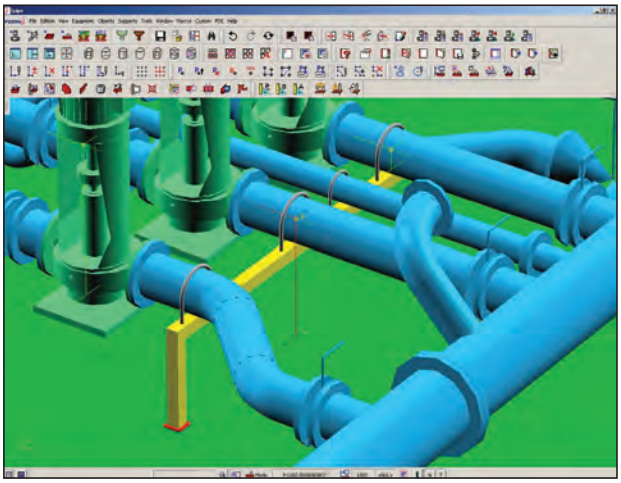
FHINFO deals with the development and bending of curved plates, assembly of curved panels, and fabrication of profiles. The user interface provides a combination of graphic areas, where the user can navigate through the 3D model of a ship and tree explorers that show the project breakdown in interim products and parts.

Plate development and bending functions cover the actual workshop practices of virtually any shipyard. The process applies to plates from any surface. Symmetric parts are independently evaluated so each one has its actual holes and markings. The process results are presented to the user in an interactive 2D window for visual checking, and then stored both as drawing files in FDESIGN format and text files in FDS format.

In addition, developed plates and templates are stored in the database and are available for nesting. The configuration options used in each plate are also stored for further reprocessing.

Curved panels are assembled on fabrication jigs. FHINFO provides functions to create both pin and plate-supported jigs. The panel can be selected as an interim product or as a combination of plate parts from any surface of the ship.

This task includes functions to calculate automatically the base plane of the jig according to different methods (eg, average



A screenshot of the FPIPE module, which allows the modelling of machinery and outfitting.

The working environment for the definition of supports on pipes, HVAC ducts and cable trays includes a new modification control tool that detects any change in the routing of the lines. The designer is then informed about the actions he should take to re-establish the situation, and some automatic decisions are provided by the program for designer verification. Customised fabrication sketches of supports, with attached bills of materials can be obtained, and their position included in spool and isometric drawings.

A complete set of advanced visualisation tools, such as clipping planes, customised auxiliary grid, use of transparencies, on-line navigation mode, dynamic zoom and panning are available. These, together with the on-line clash detection, allow the user, believes, Sener, to work in a very efficient and friendly 3D environment, facilitating the design and making it faster and more accurate.

tangent plane at a distance, frame parts always vertical), an interactive 2D editor to perform a fine adjustment of the panel on the pins grid and settings to configure some parameters such as pins spacing, floor-panel distance, and marking strategy.

Plate-supported jigs are controlled with specific options such as part thickness and material, part naming policy and part crossing style (passing, crossing, or egg-box).

The profile fabrication task provides information for profile cutting and bending. Profile sketches are automatically generated and contain part dimensions, end-cut details, bending and cutting margins, drain holes and notches positions, numeric or graphic bending information, also number and identification of equal or symmetric parts.

In addition to the three main tasks, FHINFO also provides functions for database query, customisable bills of parts, weights and centre of gravity of parts or assemblies (including outfitting), and default settings for the fabrication processes.

All drawing outputs can be configured by means of FDESIGN drawing templates.

FPIPE - machinery and outfitting

In V60, FPIPE is the single module for carrying out the modelling of all outfitting elements. It includes seven working environments that allow the designer to lay out equipment, route pipes, route HVAC ducts, define auxiliary structures, position supports, and define fabrication spools without closing the module.

The tools for pipe routing, fitting positioning and P&ID-3D model link have been further enhanced. Currently available, among others, are the possibilities to check on-line the compatibility of pipes with bending facilities, to automatically insert instruments in elbows and reducers, and to have a report of inconsistencies between the P&ID and the 3D mode.

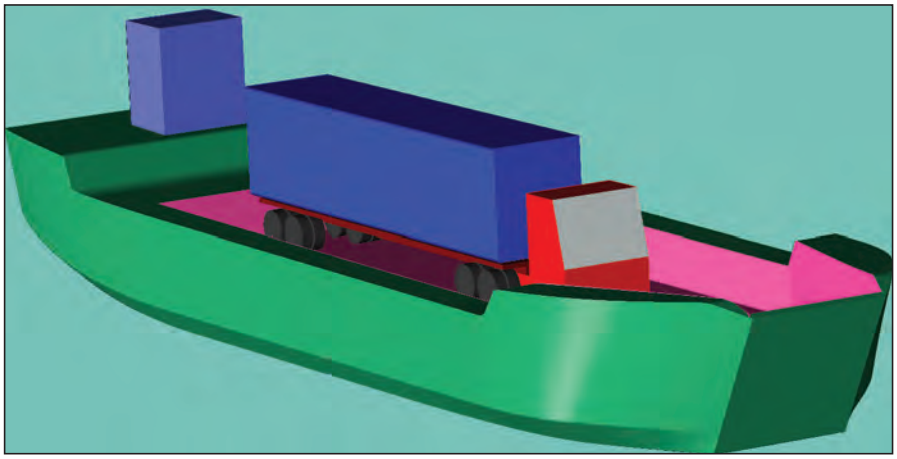
With the spool definition integrated in FPIPE, designers can, in an easy and fast way, take decisions affecting fabrication and assembly of pipes, closing even more the gap between design and production.

The generalisation of user-defined attributes to all outfitting entities provides the possibility to define any technological, design, fabrication, operation, assembly or environmental property, and to assign them to each particular element.

Visual basic automation: enhancing tools through COM integration with Microsoft Office

IN *The Naval Architect's* October 2005 CAD/CAM feature, we discussed some of the developments that have been made to Formation Design Systems' Maxsurf suite, which allow CAD/CAM software to integrate with other applications using Microsoft's COM (component object model) technology. This opens the door for users to write their own visual basic programs and macros to manipulate CAD models and analyses.

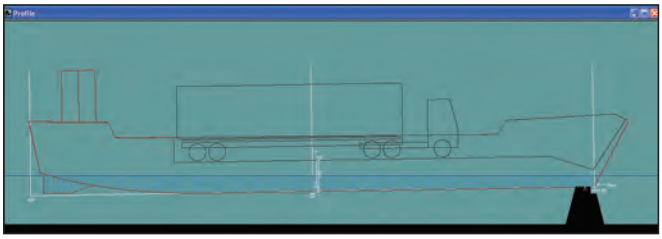
Here, specific applications of this technology will be examined: analysis of a lorry driving off a landing barge aground on a beach or slipway. Microsoft Excel spreadsheets have been used to drive Hydromax and collate the hydrostatic data. The technique can also be applied to other analyses and is particularly useful when trying to answer 'what if?' questions.

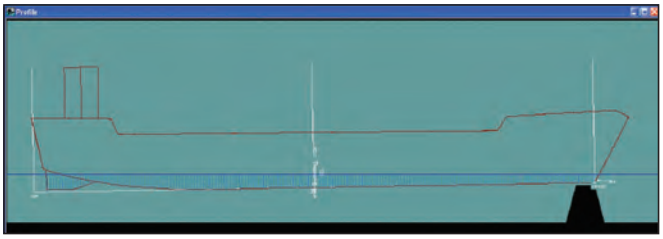


Maxsurf model of landing craft and lorry (lorry is for visualisation purposes only).

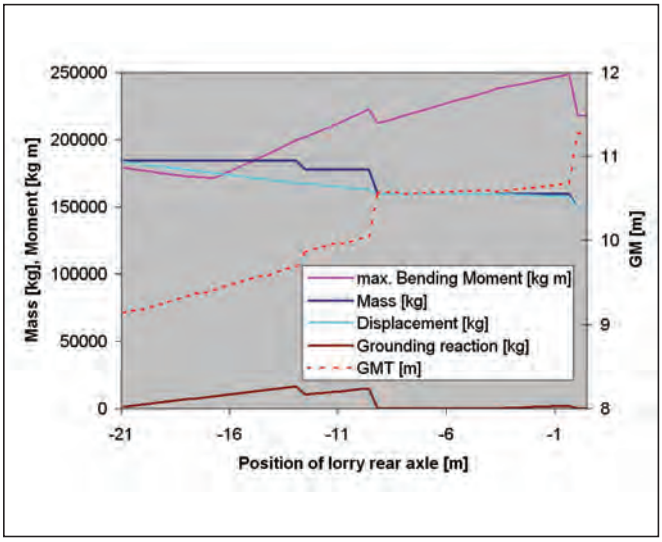
This landing craft loading/unloading example examines the behaviour of shifting weights on a relatively light displacement vessel, in this case, a lorry driving off a landing craft. The landing craft is loaded with one articulated lorry that is driven off the vessel. The effects on longitudinal strength, reaction load at the grounding point, and transverse stability can all be studied. A Microsoft Excel spreadsheet and visual basic macro are used to manipulate the Hydromax loadcase, perform a longitudinal strength analysis, and then extract and store the results for graphing. In addition, it is also possible to save screen-shots and join these together to provide an animation of the vessel.

Profile view of the landing craft before and after the lorry has driven off. In this case, the craft was not sufficiently beached as the bow lifts off the beach when the lorry has been driven off.

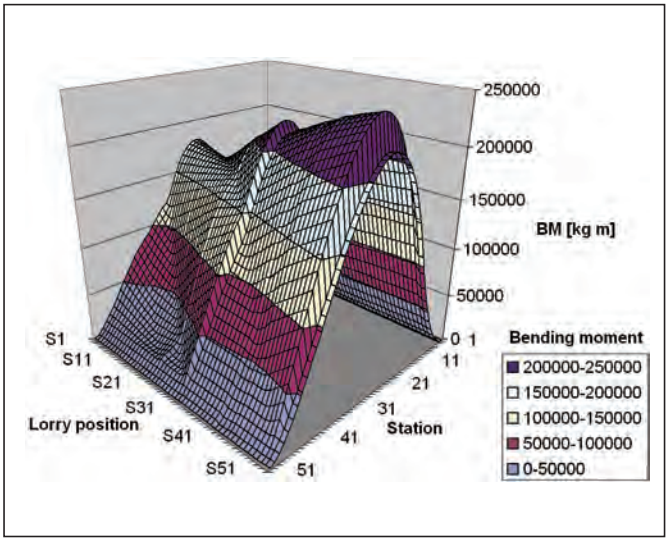




Plot of mass, displacement, grounding reaction and maximum bending moment as the lorry is driven off the landing craft. It can be seen that the grounding reaction becomes zero and that the landing craft floats off the beach. Clearly this is not ideal, and the landing craft should either be grounded further up the beach or be ballasted down by the bow.



Evolution of bending moment distribution as the lorry is driven off the landing craft. S1 to S53 represent the different positions of the lorry as it moves off the landing craft; S1 has the lorry furthest aft and by S51 the lorry is off the landing craft. Station 1 is at the stern and 51 at the bow. The steps occur as each of the three groups of wheels move off the landing craft.



ShipConstructor to support STEP

CREATOR of the 3D product modelling software ShipConstructor, Albacore Research Ltd (ARL) and Industrial Planning Technology Inc (IPT), are cooperating on the development of a translator that will enable ShipConstructor to import and export STEP files containing pipe, HVAC, and equipment data.

This technology will enhance ShipConstructor's interoperability in large shipyard environments, allow organisations to more easily access legacy data, and simplify the long-term storage and retrieval of archival product model data throughout an entire product lifecycle. IPT is developing the translators, using the all-new ShipConstructor Application Programming Interface (API), to create intelligent distributed system objects directly for the ShipConstructor product model database.

STEP, part of the International Organisation for Standardisation (ISO), is an international, non-proprietary standard for the exchange of product model data. Its intent is to help reduce the costs and improve the quality of data translation throughout a product's lifecycle, between different organisations involved, and between physically dispersed sites within an organisation. STEP was first introduced in 1994 and is now widely used by many of the world's largest manufacturers.

Recognising the importance of STEP to the shipbuilding industry, the US Office of Naval Research (ONR) and the National Shipbuilding Research Program (NSRP) awarded a small business innovation research grant to IPT in May last year. The goal is to develop a set of software tools that use STEP to help reduce the costs of pipe production for ships. Foremost among these tools is the development of STEP import/export capabilities for ShipConstructor, the design software-of-choice for the NSRP's second-tier shipyard design enhancement programme (reported in *The Naval Architect* April 2004, page 42).

Subcontracting between shipyards can reduce total construction costs by levelling workloads and maximising the use of automated equipment. However, current methods of subcontracting piping involve the use of paper drawings, resulting in substantial delays, costs, and errors. For naval vessels, piping represents more than 25% of ship construction costs, so increasing the efficiency of pipe subcontracting can result in significant savings.

Initially, IPT will develop a translator that enables ShipConstructor to import and export STEP files containing pipe, HVAC, and equipment data. IPT will also develop complementary tools that allow pipe shops to use STEP data most effectively. Subsequent development of the translator will focus on additional data types, such as ship hull moulded forms and ship structures.

Unlike other file formats and data transfer mechanisms, the STEP format can support an unlimited range of data, including geometry, topology, tolerances, relationships, attributes, assemblies, configuration, and more. By overcoming the limitations of proprietary CAD formats, STEP can provide a seamless exchange of product model data between design, analysis, and manufacturing systems. STEP can also help an organisation unlock its wealth of legacy data, by acting as a reliable data transfer mechanism between older, proprietary CAD systems and modern, product modelling systems like ShipConstructor.

The STEP translator will be released as an integrated component of ShipConstructor in spring 2006.

New presentations and enhanced core functionality in PIAS and LOCOPIAS

THE software suite PIAS, from SARC, based in The Netherlands, is known for its extended calculation and analysis capabilities. A recent enhancement is a new module for visualisation of the design solution, and generation of basic general arrangement plans.

For this purpose the required design information, such as the location of container slots and the shape of hull and compartments, is extracted from the PIAS database, so that generating a basic general arrangement does not require separate input. Thus, consistency between drawings and calculations is assured, at any design stage. Note that the same techniques can be used to generate 3D graphics of container loading, a vessel under heel and trim as calculated in either intact, damage stability modules, or other tasks.

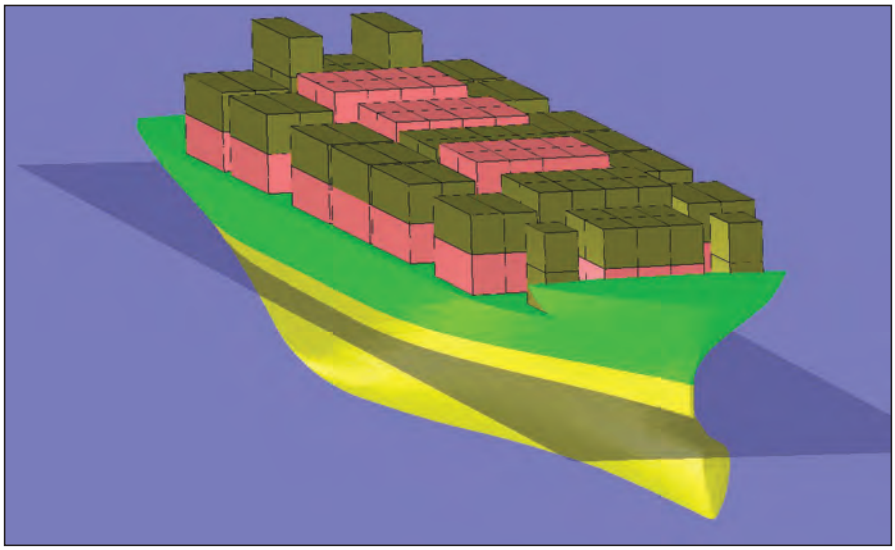
Another field of activity for SARC has been the development of a completely new module for probabilistic damage stability. PIAS has been equipped with modules for probabilistic damage stability, both for passenger vessels and dry cargo vessels, since 1989. The rules for hopper dredgers with reduced freeboard, also known as dr-67, were included at a later stage.

IMO's Marine Safety Committee adopted revised probabilistic damage stability regulations in May 2005, applicable to both passenger and cargo vessels, and these will enter into force on January 1 2009. Although the structure of the new regulations is identical to that of the old ones, significant details differ. For example, the number of calculation draughts has changed (from two to three), and the permeability of compartments is not constant anymore, but dependant of a vessel's draught.

In order to accommodate the changes, a new integrated module has been developed, covering all present and new (2009) regulations. This module is equipped with a significant number of user-switchable calculation preferences, and can base its calculations upon four strategies, listed from coarse to fine:

- based on zones. This in the conventional approach, where subdivision of the vessel is only approximated
- based on compartments, this matches the actual subdivision of a vessel
- based on constituents of compartments, so called sub-compartment. This method is suitable for highly irregular compartment configurations
- based on numerical integration (described in detail in *International Shipbuilding Progress*, Vol 52, No 2 (2005) pp 129-148), a first-principles approach.

Conceptual general arrangement plan, generated from PIAS information.



LOCOPIAS representation of an inclined vessel, loaded with containers.

Finally, SARC's LOCOPIAS loading software, which is now installed on more than 250 vessels, has been updated. Based on interviews with owners and masters, a number of presentation and user-interface enhancements arose. These have been implemented, both in LOCOPIAS' core part, and in specific functionality such as for ro-ro cargo and container loading. Additionally, the container module is extended with the capability to import and export EDI files in BAPLIE format.

New Career Opportunities for 2006

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A challenging position exists, with our internationally recognised client, that will involve plan review of structural and statutory items for all types of vessels for compliance with international regulations and standards, e.g. SOLAS, MARPOL. Additional knowledge/experience in finite element analysis would be beneficial. Successful applicants will be expected be Degree qualified and have marine industry / consulting office experience of at least 2 years in ship structures and/or marine statutory requirements.

Senior Naval Architect *South Coast* **to £35k**
Our client, a major UK shipbuilder, requires a Senior Naval Architect who is competent in ship design, equipment selection and specification writing. The candidate will act as a technical advisor during sea trials and represent the company during sales presentations. A flexible attitude to travel both within the UK and overseas is essential.

Principal Naval Architect *South Coast* **to £42k**
A major UK defence company is looking for a Principal Naval Architect to join the team in a role that will involve a variety of responsibilities from hands on ship design to team management. The ability to lead a multi disciplined design team and contribute to the management of the Naval Architecture design group is essential.

Principal Structural Engineer *South Coast* **to £38k**
A large UK Shipbuilder seek a candidate who has worked in a high level position previously, to offer the necessary experience and skills to undertake structural analysis of marine structures and interface with customers at all levels. There will be a strong element of project management in this postion, controlling both labour and material budgets.

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Major independent subsea contractor requires an individual who can offer specialist analytical expertise to the engineering department in areas such as pipe stress analysis, dynamic umbilical analysis, vessel analysis and Naval architecture. Candidates will need at least 5 years offshore industry experience and a willingness to work throughout a wide scope of company business.

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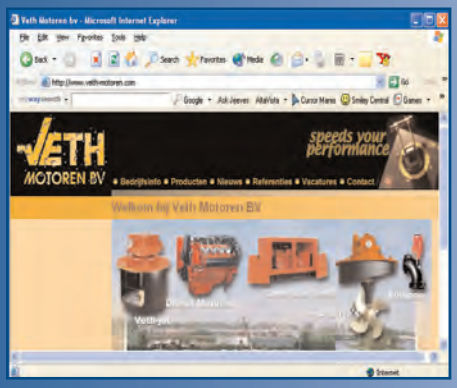

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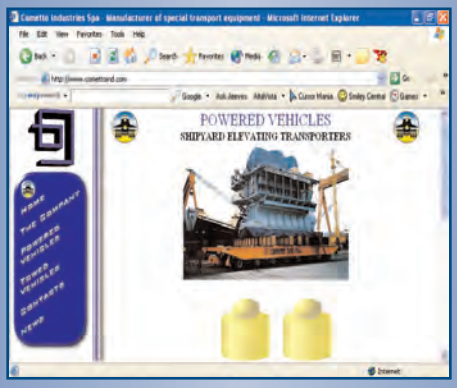

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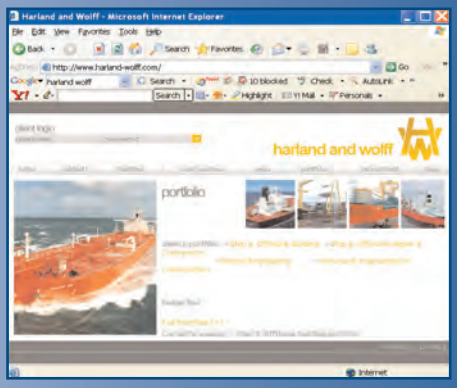

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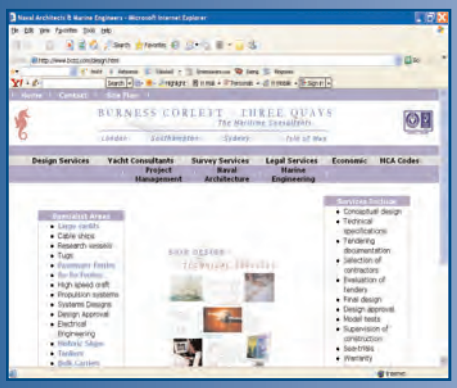

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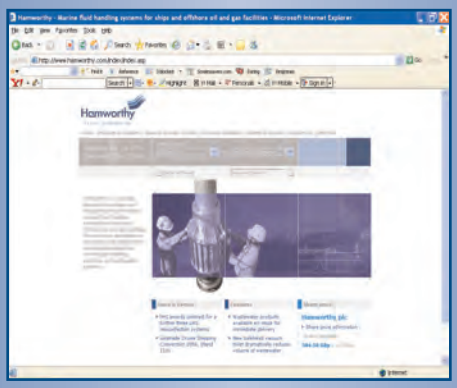

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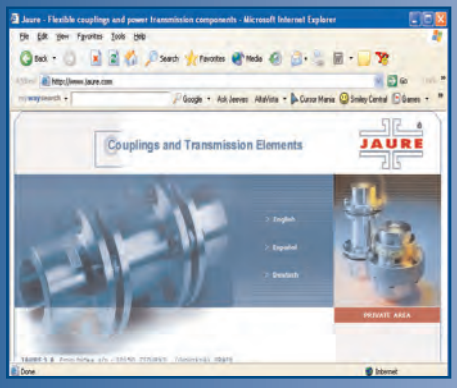

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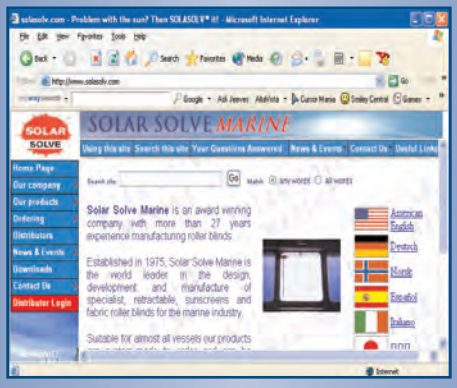

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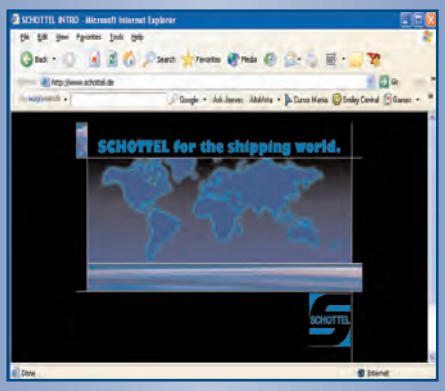

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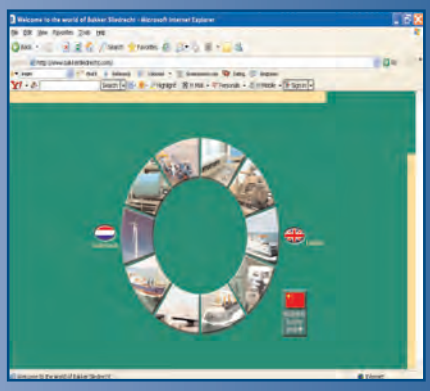

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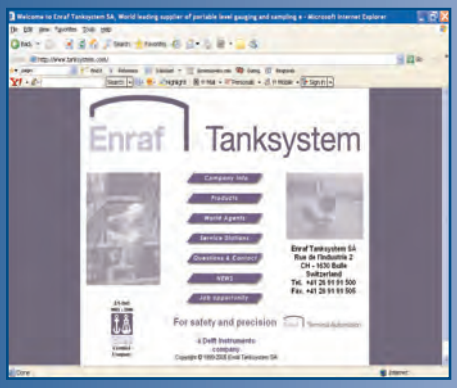

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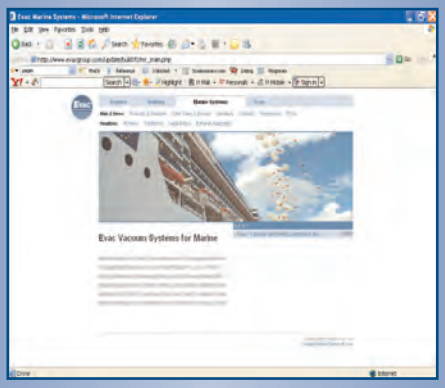

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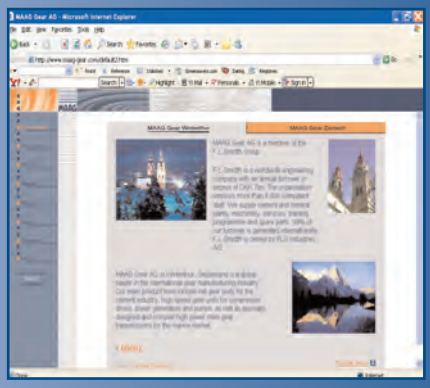

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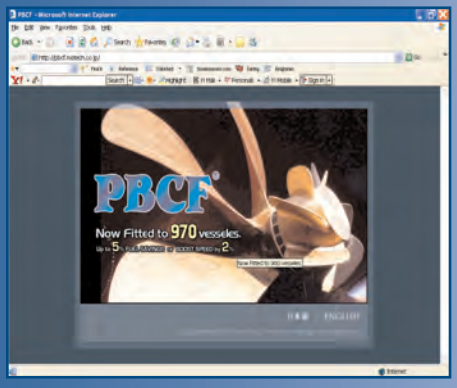

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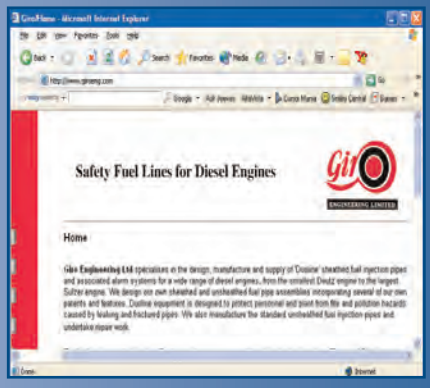

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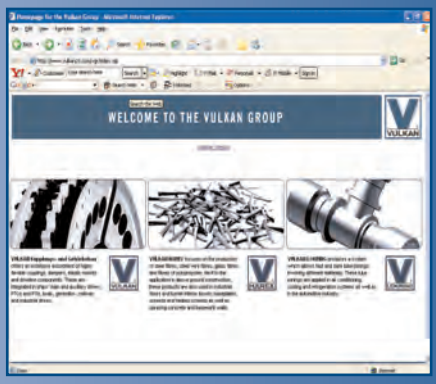

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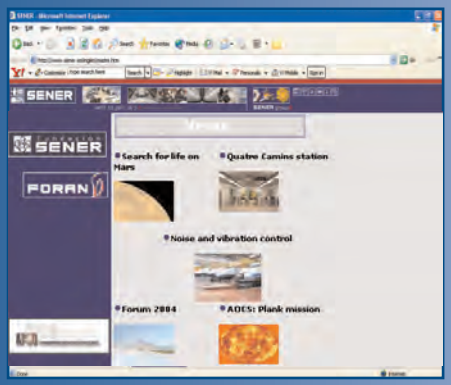

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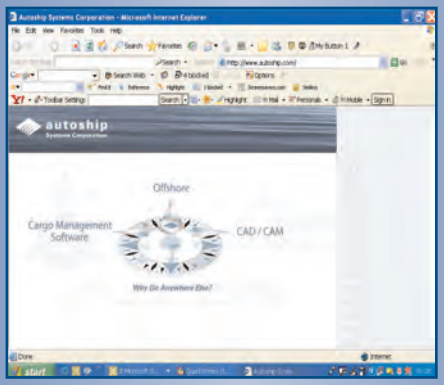

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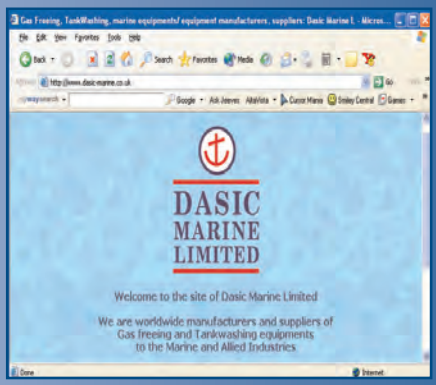

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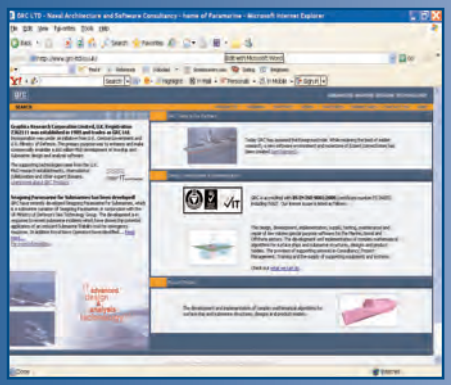

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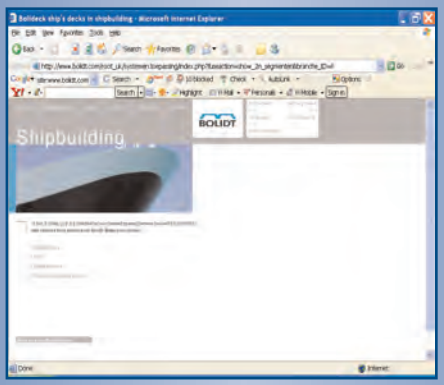

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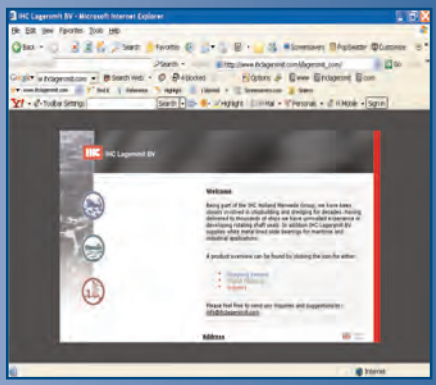

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