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A special feature of the lifeboats ordered from Umoe Schat-Harding for fitting on the new pair of 3887-passenger MSC liners booked at Alstom Marine will be a innovative semi-gravity davit design with reduced weight, fewer components, and claimed easier installation. The davits can be fitted slightly above the promenade deck, thus allowing the shipyard to include an extra cabin deck with outside balconies. More details appear in our Cruise Liner Technology feature, which begins on page 46.

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Aker + Alstom: a new force in European shipbuilding

SEISMIC metamorphoses in the international commercial shipbuilding world are relatively far and few between; possibly the last one of major significance was Japan's recent re-shuffling of its leading shipbuilders into fewer but stronger groups. The astounding news of early January that two European giants from totally different cultures, Aker Yards (mainly Scandinavia) and Alstom Marine (France), are to join hands - in effect, the acquisition of most of Alstom Marine by Aker - must be seen as a bold and positive shift towards a more optimistic future for Europe's generally beleaguered marine industries, at a time when much construction and equipment manufacture is now taking place in the Far East. It is hoped to conclude a deal by the end of March this year. No direct impact on employment is envisaged. Maybe other yards might consider similar moves?

The proposed deal only affects high-value ships, particularly cruise liners, but the three LNG carriers on order at Alstom Marine are not included in the sale; they will be completed by the new company as a subcontractor. No specific mention is made of future LNG ships, nor of Aker's expertise in ice-going ships; these are both exceedingly interesting - and high-value - markets at present where new opportunities are currently opening up, eg, with the imminent completion at the Helsinki yard of

Good news for the new Scandinavian/French group: an impression of the new mega-cruise liners for 3887 passengers to be built at Saint-Nazaire for Mediterranean Shipping Co (MSC).



Norilskiy Nickel. Last year, Aker announced that its Helsinki site, with its enclosed construction dock, would concentrate on ferries.

Under the Scandinavian/French link, it is proposed to establish a new company centred on the two Alstom yards - Saint-Nazaire (large) and Lorient (small). The type of ship in which these two groups are most successful and on which they are primarily pinning their hopes - cruise liners and luxury ferries - are not sectors in which Chinese, Korean, and Japanese shipbuilders yet have great impact on the global scene. Even so, this may well change as China builds up its experience; for example, Jiangnan Shipyard recently completed two new ro-pax ferries for China Shipping Passenger Lines; one of these, *Pu Tuo Dao*, is featured in RINA's newly published *Significant Ships of 2005*.

In Korea, Samsung has had, for several years, determined ambitions in high-grade ferries and cruise liners. Some success has been achieved in exporting quality ferries to Europe, such as the 30knot displacement ferries for Minoan Lines and now the newly delivered *Maersk Dunkerque*. The latter is the first of a trio of English Channel ferries for Norfolk Line, a group member of that most discerning of European owners, Maersk (AP Möller group).

Aker Yards (the dominant company in the new partnership, owning 75% of the newly created company) and Alstom Marine (which will retain the remaining 25% until 2010, when, depending on financial performance, this

share would be sold to Aker Yards) actually state that they will focus 'on high-value-added tonnage, including cruise liners'. Alstom's Marine 2010 programme, which follows the successful three-year CAP21 project, would continue, and the new company would, it is planned, benefit from 'a broadened product range and strong industrial synergies'.

Three LNG tankers currently completing or building at St Nazaire - including the CSI containment-system guinea pig *Gaz de France Energy*, which is still being repaired and remodelled as a result of most unfortunate containment membrane problems - are specifically excluded from the deal. At the end of 2003, Alstom Marine's chairman, Patrick Boissier, said he believed that LNG construction prices generally are no longer competitive in Europe.

However, it is well to remember that Aker Finnyards is still believed to retain an interest in gas tankers; today, this work is centred on the two Aker Ostsee yards in Germany. A large purpose-built factory at Turku, in Finland, was capable of manufacturing and assembling Moss-type spherical LNG tanks. Only four ships were actually built using tanks from this plant (the *Murabaz* class, featured in *Significant Ships of 1996*), following which the trend seemed to be towards the GTT membrane concepts.

Nevertheless, as we noted in our May 2005 Editorial Comment, Moss Maritime continues with investigations into refined spherical-tank systems; recent events at Samsung, in Korea, with secondary barrier leakages on a BG membrane-type LNG carrier, plus those problems at Saint-Nazaire, and the belief by some that spherical tanks may prove superior in the new gas latitudes off northern Norway and the Russian Arctic coasts, might turn the tide once again in favour of the sphere, with its easily calculable sloshing motions.

Scandinavia and France are totally different spiritual cultures but today each has a first-rate reputation for quality cruise liners and ferries, including *Queen Mary 2* and the soon-to-be-delivered *Freedom of the Seas*, to mention only two. Perhaps the proposed union might result in some revolutionary and real new concepts for shipbuilding from the pooling of two mindsets - and cause concern at competitors Fincantieri, in Italy, and Meyer Werft, in Germany.

What the reaction in Korea to the new link will be is difficult to gauge at the present time. Construction of a large cruise liner (or cruise-style ferry) remains an expensive business, because of large number of man-hours required for quality outfitting. Far East yards may justifiably consider that there are still possibilities of shrinking some of these costs and thus win a portion of any future new orders.

Since the completion of Royal Caribbean Cruise Line's *Song of Norway* in 1970 - generally considered the mother of all modern cruise liners - that market has gathered pace and grown relentlessly, until two or three years ago that is, and particularly following the events of September 11, 2001. Mediterranean Shipping's brand-new contracts for a pair of 3887-passenger liners at Alstom Marine - probably the highest passenger number ever - may well represent the tip of a new pinnacle to be attained and, combined with Carnival's new orders at Fincantieri, a new market mini-boom. They also show that size really does matter today. Such large designs may not be particularly people-friendly but they certainly benefit from economies of scale. Ⓜ

On-ground assembly shortens construction time

THE assembly of a crude oil carrier by Hyundai Heavy Industries (HHI) has been completed at the company's Ulsan yard in only 55 working days, by using the company's adventurous on-the-ground technique, without involving a drydock. Ships are jacked onto a submersible barge for floating. In just two years since its first on-ground shipbuilding project, this leading shipbuilder has succeeded in shortening the construction period by 35%, to 55 working days from 85 days, from keel-laying to load-out. HHI can now actually construct a vessel on-ground in approximately the same time that it can build a ship in drydock, through technical improvements such as the installation of larger blocks.

In addition, HHI has cut down building costs by minimising the transportation of hull blocks and improving work safety through the arrangement of four ships in rows, by the quayside. The world's largest 1500tonne gantry crane also makes it possible to handle mega ship blocks.

Earlier last month, HHI held a naming ceremony for two 105,000dwt crude oil carriers, built for Novoship of Russia, at the offshore yard. Six of these vessels have already been constructed on the ground, and the yard is scheduled to build 10 more crude oil carriers and seven LPG carriers by this method.

CHANGE OF NAME FOR SOFTWARE COMPANY - At the end of last year Albacore Research Ltd (ARL), creator of the 3D product modelling and production planning software ShipConstructor, changed its name to ShipConstructor Software Inc. The company believes it has outgrown its original name.

FIRST FOR INDIAN SHIPYARD - Dredging engineering and contracting company, Vosta LMG, recently secured a contract from the Indian shipyard Mazagon Dock Ltd for the supply of an engineering and components package for a 1500kW cutter suction dredger. It is believed to be the first time ever that such a large dredger will be built at an Indian shipyard. The order was placed by the Dredging Corp of India, which will take delivery of the vessel in 2007.

This dredger has been especially designed for dredging rock with an unconfined compressive strength of 40MPa. It will also have a spud system, which has been designed by Vosta for hydraulic advance and positioning of the vessel, enabling it to operate even in a swell. A parallel rope guide, which is tensioned hydraulically, reduces load peaks; this ensures that the dredging process is largely independent of any swell.

The vessel has a length overall of 87.50m, a length over pontoons of 76.20m, a breadth moulded of 16.00m, a hull depth of 4.25m, and its maximum dredging depth is 25m. Total installed power on the vessel will be 10,662kW.

Vosta LMG will take care of basic engineering, on-site project management, dredging trials, and dredge-master training. In addition, the company will supply all dredging-related equipment. The



Today, Hyundai Heavy Industries is able to complete the assembly of a large tanker in 55 days using its pioneering on-ground construction technique and with the assistance of a 1500tonne capacity gantry crane - said to be the world's largest.

ship will be equipped with a Vosta cutting system and two different kinds of cutter heads. One is suitable for cutting sand clay and soft rock, equipped with SC40 cutting teeth, and the other one, D40 type, for cutting rock.

NEW HEAD TO FIGHT SUB-STANDARD SHIPPING - Newly appointed DNV chief executive officer-elect, Henrik Madsen, has, as his prime aim, the strengthening of classification's global credibility, and of DNV in particular. Madsen is currently acting as deputy chief executive officer and will formally take over the top position in May this year.

'Above all', he stresses, 'as a classification society we must be determined in our efforts to fight sub-standard operators and vessels. We are currently engaged in a number of projects aimed at harmonising class rules, including the recent adoption by IACS of the common rules for tankers and bulkers; these and other measures will improve safety at sea'.

NORWEGIAN SHIP SAFETY ACT - The new Norwegian Ship Safety act is due to be passed in 2006, reports Norwegian law firm Wikborg Rein. Replacing the existing Norwegian Seaworthiness Act, which dates back to 1903, the new legislation is designed to bring Norway in line with international and EU regulations regarding vessel safety management.

The purpose of the new act is to safeguard life, health, property and the environment by promoting a high level of ship safety, ensuring a safe working environment, preventing pollution, and incorporating requirements and responsibilities for a vessel's safety management system. In addition, the new law makes provision for establishing and developing appropriate supervision and control, also arrangements for the development of regulations in compliance with international law, in particular IMO, ILO, and EU rules.

Norwegian and foreign vessels, except non-commercial vessels less than 24m in length, will be required to comply with the act, as will Norwegian-flagged vessels throughout the world. Foreign vessels will only be subject to the new act while in Norwegian waters.

FERRY SAFETY AGREEMENT SIGNED - IMO and the non-governmental industry group Interferry have signed a memorandum of understanding formalising the two organisations' intent to work together towards enhancing the safety of non-Convention ferries by collaborating, through IMO's Integrated Technical Co-operation Programme, on related capacity-building activities within developing countries.

Under the agreement, the two groups will work closely with interested parties such as Bangladesh, which has been selected as a pilot country for the partnership's work, with the aim of identifying potential solutions to raising ferry safety. IMO and Interferry have agreed to share certain costs, and IMO will seek financial support from governments and multilateral funding organisations. Interferry will reach out to private sector ferry operators and its own

PEOPLE

Dr NEIL CROSS has been appointed chairman of BMT Ltd from January 1 2006.

Since the beginning of 2006, **Dr-Ing CHRISTIAN SCHLIEPHACK** has been the new managing director of Reintjes alongside Dr-Ing. Frank Schubert. With effect from March 1 2006, Dr-Ing Schliephack will take office as sole managing director. Ⓢ

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members, as well as other international private sector groups, to inform them of the initiative and seek their support, as well as seeking the assistance of private sector ferry operators in the pilot country itself.

HEAVY-LIFT VESSEL ORDERED - Damen Shipyards, Gorinchem, has been awarded a contract by the Dutch shipowner, Jumbo Navigation, for the construction and delivery of a new heavy-lift vessel. Two vessels of similar design, *Jumbo Javelin* and *Fairpartner*, were completed by Damen to Jumbo in 2004. The new ship will be built and delivered by Damen Shipyards Galati, Romania, and delivery is scheduled for February 2008.

The vessel was ordered as a result of growing demand in the evolving oil and gas industry onshore and offshore, and the new ship will be built especially to load and discharge heavy objects using two cranes of 800tonnes each. Furthermore, it will be capable transporting cargoes with unrestricted length and width on the main deck hatches and will be additionally certified for sailing with open hatches.

The vessel will have a length of 144.57m, a beam of 26.50m, and a depth of 14.10m. The design draught will be 6.50m, with a maximum draught of 8.10m and corresponding deadweights of approximately 8200tonnes and 13,000tonnes. Propulsion will be by two 4500kW diesel engines driving two 4350mm CP propellers, giving the ship a speed of approximately 17.50knots. The installation will be suitable for running on heavy fuel.

Two tunnel thrusters of 1450kW each and one retractable thruster (1700kW) will provide the necessary side thrust for manoeuvring, station keeping, and DP operations. Electrical power will be generated by two shaft generators (of 3000kW each) and three dedicated diesel generator sets of 2 x 2281kVA and 1x 550kVA. Classification includes a DP-2 notation from Lloyd's Register.

The cargo cranes will have a maximum reach of 28m over the starboard side and 32m to port. A ballast system will be specially designed to counteract crane operations by means of three 700m³/h pumps. Additionally, stability pontoons will be provided so that the ship can lift 1600tonnes on a reach of 14m.

'UNIQUE' HULL SOFTWARE LAUNCHED - Det Norske Veritas has launched the Nauticus Hull software package for the design and strength assessment of ship structures. This particularly provides support for the new IACS common structural rules for double-hull tankers, which come into force in April.

Nauticus Hull provides an efficient environment for ship design, with capabilities ranging from simplified rule-check and scantling calculations to advanced tools for extended calculation procedures, including wave load and finite-element structural analysis. The software, developed in close cooperation with major shipyards in Korea and Japan, has been instrumental in the testing, development, and calibration of the new rules.

DNV also recently held an extensive training course on the new common structural rules at its academy in Shanghai. This attracted a wide



Stena Paris is a new first-of-series tanker which extends the range of Stena's innovative MAX-series vessels. Designated a P-MAX, this 65,200dwt product design can be identified by its extremely wide beam and twin screws. It is also claimed to be one of the safest vessels in its range ever built. A total of six ships are being constructed. Designed by Stena and her Croatian builder Brodosplit, *Stena Paris* is presented in more detail in the newly published *Significant Ships of 2005*.

range of participants from more than 14 Chinese shipyards. The training was carried out using the Nauticus Hull software suite, facilitating hands-on testing of the new rules. DNV is continuing to develop the software to ensure that support for the new bulk carrier rules also becomes a permanent part of Nauticus Hull.

NEW YARD SET FOR SUMMER OPENING - Dubai Drydocks, the leading Middle East shiprepair complex, will launch its US\$60 million newbuilding panel line and steel structure assembly facility in July this year, it has been reported. The yard, whose current facility has a monthly turnover of 2800tonnes of steel, plans turning over similar volumes of steel every month for new ships.

The yard is already building the steel for a large gravity-base structure with extensive piping, as well as four 6200dwt bunkering tankers, the first of which is due to be delivered in March. Dubai Drydocks, which also wants to be involved in mainstream tanker, bulk carrier, and containership sectors, is planning to build four products tankers in a series that could extend to 20 vessels. The yard is also believed to have signed letters of intent covering the construction of the pontoons of two semi-submersibles and two accommodation barges for Caspian Sea duties.

The first phase of work, involving the landward panel line, is expected to finish by April, while the load-out facility will be ready by August. In addition to shipbuilding, the new plant will add 10% to the yard's existing shiprepair capacity. Overall, the plant once ready, is anticipated to account for 25% of Dubai Drydocks' total turnover.

TWO NEW VESSELS FOR LIVESTOCK TRANSPORT - Italian shipowner, Siba Ships, has declared an option on a second livestock carrier, currently under construction at Labroy Shipyard, in Singapore. This second vessel will be a sister to hull T155, both of which are due for delivery from the yard in 2007. Siba reportedly owns the youngest fleet in the world for the transportation of live animals.

The new vessels will be capable of carrying approximately 30,000 sheep or 6500 cattle on seven decks (four enclosed and three open). They will have a deadweight of 7850dwt and a speed of 18knots, making them particularly competitive on developing routes such as South America to Asia and the Middle East.

Both vessels have been designed for the maximum comfort of the animals onboard. Fodder, stored onboard in a purpose-built silo, is distributed to the animals using a fully automated system. The fresh water plant, capable of producing 350tonnes daily, is also automated to ensure that every pen has fresh water available around the clock.

The new designs will also be the first to comply with the new Australian Maritime Safety Agency rules on air velocity in pens, with a ventilation system that ensures no less than 80 air changes/hour in the enclosed decks and 40 air changes/hour in the open decks.

For the first time ever in the livestock industry, the vessels will also be equipped with two separate and independent engine rooms, to comply with an IPS (Independent Propulsion System) notation - and to ensure that full services for the animals are always maintained. The vessels will have a crew of 32, 15 of whom will be dedicated to the care and welfare of the livestock onboard. Ⓢ

Wave drag reduced with SWEEP hullform

Don Burg, the inventor of a new patent-pending ship hull concept, the 'Ship with Wave Energy Engulfing Propulsors' or SWEEP, has combined the advantages of a bulbous bow with those of an air-lubricated ship (ALS) to reduce significantly the wave drag of displacement hullforms; recently, he has proposed a ferry version of the concept. Here, David Foxwell explains the new concept further.

Don Burg is known in the USA and internationally for the work that he has done on the air-lubricated ship (ALS), perhaps the most high profile of which is the SeaCoaster, a concept based on the use of twin air cushions and intended to offer fast speeds at high efficiency, good load-bearing capacity, a smooth ride and high level of stability. Mr Burg has more than 30 years of experience as a naval architect working on advanced marine vehicles, and 12 years experience in aerospace engineering prior to that. His naval architecture experience includes design and development of the SeaCoaster SECAT (Surface Effect CATamaran) and advanced technology waterjet and ventilated enclosed-rotor propulsors.

Several versions of the SeaCoaster have been proposed, including high-speed ferries, crew boats, and patrol vessels, but the concept has been furthest developed in the AMH SeaCoaster technology demonstrator built for the Office of Naval Research (ONR) in the USA. Built by Austal USA, this 31.2m surface-effect catamaran is being used to demonstrate advanced hullform technology on behalf of the ONR, and is operated by American Marine Holdings.

The patented SeaCoaster catamaran design has air cavities in the bottom of each hull into which air is blown, providing lift to the vessel, reducing resistance, and thus allowing higher speeds to be obtained. The AMH SeaCoaster was designed to achieve speeds of up to 56knots and, following its evaluation by the ONR, American Marine Holdings expects various departments of the US military to consider using it for a wide range of applications.

The patent for the SeaCoaster hullform is held by Air Ride Inc, Miami, and was previously applied to a 19.8m SeaCoaster catamaran ferry that remains in operation with Island Express Boat Lines, which has been operating the 149-passenger SeaCoaster ferry on Lake Erie since 1999. Originally developed with assistance from US Department of Energy's Inventions and Innovation Programme, the air-assisted catamaran has 'wave-slicing' fine-entry sidehulls. The air cushions formed between the catamaran's side hulls and the water surface support approximately 80% of the vessel's displacement. Another advantage of the hullform concept is its reduced draught. The reduced-wetted-area resistance of the SeaCoaster is claimed to shrink powering



An impression of a typical SWEEP high-speed ferry, showing the unique bow contours.

requirements by approximately 50% compared with conventional catamarans and monohulls at cruise speeds.

Large power reductions claimed

Taking into account the power required by the blowers, the SeaCoaster only requires around 60% of the power of a standard catamaran, and the design has no flexible seals and no air cushions between the sidehulls, as is the case with surface-effect ships (SES). Air Ride says the SeaCoaster also has excellent platform stability without any of the 'cobblestone effect' experienced with some other hullforms.

The vessel is also able to navigate in very shallow water, and in commercial applications, believes Mr Burg, the concept would enable more cargo to be carried at faster speeds with less horsepower than other high-speed catamarans or monohulls.

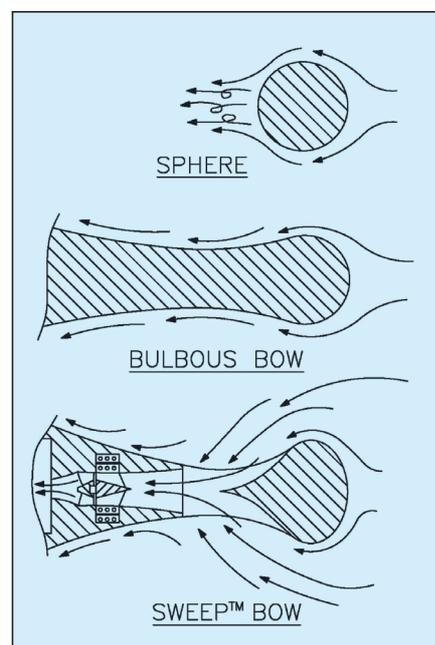
Now, the inventor has taken the concept a step further, and a new company formed by him and his colleagues, SeaSpeed SWEEP, is proposing that the Ship with Wave Energy Engulfing Propulsors concept, which draws on the SeaCoaster concept but with a number of important modifications, could be applied to larger, displacement hullforms.

It is well known, of course, that wave drag increases dramatically as ships operate beyond what is sometimes termed 'hull speed.' As such, the operating speeds of displacement hulls - except for some very high-powered military combatants - remain, as Mr Burg puts it 'embarrassingly low'.

Wave drag makes up 70% of total drag at 45knots on a 122m length waterline ship and, furthermore, wave drag has increased 25 times at 45knots over its value at 15knots for that 122m length waterline ship.

The bulbous bow is often employed to reduce wave drag, and is used on many ships where it reduces total drag by 10%-15% at high speeds. Friction-reducing air layers have also been employed on a few vessels; however friction drag makes up less than 20% of total drag for a 122m length waterline ship at 45knots, and air layers, while effective at low speeds where friction drag predominates, only help marginally at high speeds.

What the patent-pending SWEEP technology does is utilise inlet water flow into large water



Comparison between sphere, bulbous bow and SWEEP bow hullform, showing how the potential efficiency gains of the latter are realised.

propulsors to engulf or 'suck in' wave energy, thereby reducing wave drag. It does this by taking in water aft of mid-point on a bulbous bow where the water is turning inward, thereby accelerating and increasing the water flow that would normally be parasitic wave-making drag.

The sketch reproduced here shows water flow around a sphere, standard bulbous bow, and a SWEEP bow. Note that the water flow detaches from the sphere in high-drag eddies after following the contour of the sphere inward and aft of the sphere's mid-section. The standard bulbous bow takes advantage of this inward turning of the water as a means of absorbing or sucking in part of the wave energy while avoiding the separating eddies of the sphere, but the SWEEP concept takes this a step further, accelerating the wave-making water flow into a high flow propulsor(s).

The water flow into a SWEEP propulsor or propulsors is significant, with the water flow into a typical bow-oriented water propulsor(s)

of a 122m length waterline, 12,000tonne displacement vessel of the type described above being approximately 22,650m³/min. This tremendous flow of water into the bow-oriented propulsor(s) in a SWEEP vessel reduces the energy in the bow wave, thus reducing the power required by the vessel.

In order to maximise its efficiency gains, an optimum SWEEP design discharges the flow from the bow-mounted waterjet into an air layer beneath the hull (this air layer is similar in concept to the ALS, as mentioned above, where the air layer rises, moving from forward to aft, and is disposed aft of a displacement hull's submerged bow).

Little blower power required

Compared with some other concepts, such as an SES, this air layer requires very little blower power to be maintained. In a SES design, the ship's bow is at the water surface so that its blowers must supply air at sufficient pressure and flow to depress the water going from bow to stern, whereas the rising air layer in the ALS concept requires only around 15% of the blower power needed by a similar size and displacement SES. As a point of interest, notes Mr Burg, a very large SES can reach the point where its blower power requirements equal its propulsive power requirements.

What all of this means is that a SWEEP can be efficient over a large operating speed range because it takes advantage of ALS technology at low speeds, where friction drag predominates, and then takes advantage of SWEEP technology where wave drag predominates. The SWEEP concept actually utilises both ALS and SWEEP technology at all speeds. For example, the 122m SWEEP can obtain a total drag reduction of around 15%-20% at 20knots and a 40% reduction at 45knots, because it is reducing mostly friction drag at 20knots, while having a very large effect on the predominating wave drag at 45knots.

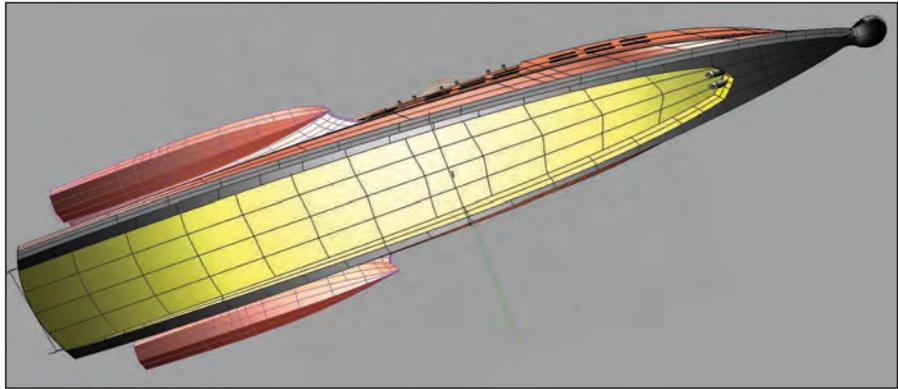
Discharging the bow waterjet flow into the air layer beneath the hull has another significant advantage compared with simply discharging underwater, because doing so avoids turbulent mixing losses that would occur if the discharge jet or jets were underwater. Yet another advantage of discharging into an air layer is that a steering and reversing system can be positioned at the jet discharge that is well forward in the hull, thus providing a very high level of steering and reversing ability.

Moreover, this can be achieved without any increase in high-speed drag since the steering and reversing systems do not make contact with the water during forward, high speed operation. The accompanying illustration shows an underwater view of the forward end of a SWEEP; note the waterjet discharges (without steering and reversing systems here to simplify the drawing) internal to the air layer.

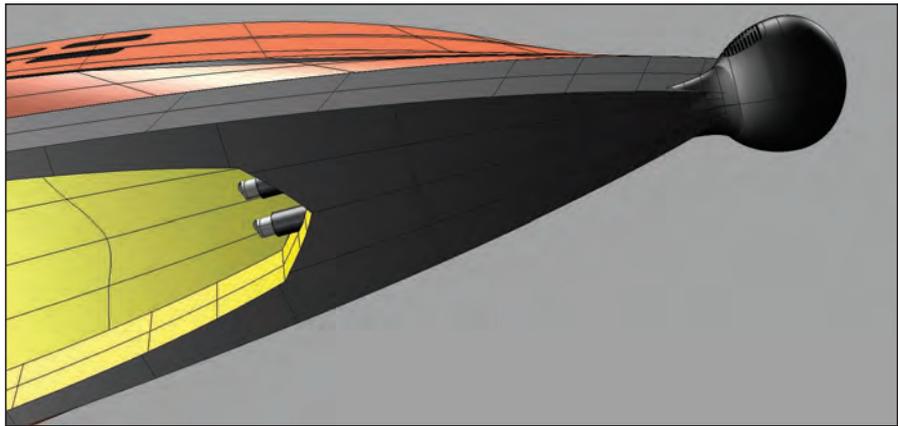
Another illustration shows an underwater view of the complete SWEEP that is presented only in part in the other figure. Note that the air layer rises, moving from bow to stern and, in this preferred configuration, extends aft to the stern.

Potential efficiencies

What, then, are the potential efficiencies to be gained by a SWEEP? Making a comparison of



A typical SWEEP hull, showing the air-lubricated space underneath.



Typical SWEEP bow section.

137m 2500tonnes displacement littoral combat ship (LCS)		
	35knots	45knots
Conventional	29,800kW	49,200kW
SWEEP	19,090kW	29,530kW
137m 3200tonne displacement ferry		
	35knots	45knots
Conventional	38,030kW	62,640kW
SWEEP	24,300kW	37,660kW
137m 12,000tonnes displacement cargo ship		
	35knots	45knots
Conventional	141,700kW	220,700kW
SWEEP	89,500kW	132,700kW

Efficiency comparisons of three ship types, expressed in propulsive power (kW).

several 137m high-speed ships having waterline lengths of 122m - conventional hulls versus SWEEP hulls - indicates significant reductions in powering requirements for the SWEEP hull.

These comparisons of 137m ships were made based on potential applications of the SWEEP concept to fill several high-speed needs including a littoral combat ship (LCS) at 2500tonnes, a vehicle/passenger ferry at 3200tonnes, and a commercial freighter of 12,000tonnes. The results, in terms of propulsive power required in kW, are shown in the table.

The blower power required to maintain the SWEEP's pressurised air layer is only a few per cent of its propulsive power, and if the blower

power is added to the SWEEP's propulsive power, the SWEEP still offers a considerable advantage. Studies show that the 122m length waterline SWEEP hull - including its air layer blower power - requires only approximately 63% of the power of a similar conventional hull at 35knots, and 60% at 45knots.

Mr Burg says he believes that the studies he has carried out to-date show that the SWEEP concept is technically feasible, and further analysis and model testing is planned as the next step in development. Tests and demonstrations of high speed SWEEP freighters, vehicle ferries, and/or military combatants will then follow.

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Good times are here again for Aker Finnyards

2005 brought many new orders for the Finnish shipbuilding industry. These have been reinforced by an ambitious new link with the large French shipyard Alstom Marine. Henrik Segercrantz reports.

A YEAR ago all three newbuilding shipyards in Finland were merged into Aker Finnyards. At the beginning of 2005, the orderbook of the company included only six new ships, and in such a precarious situation, the company was in the middle of a process to reduce its workforce.

Now, a year later, the situation looks quite different. Last year, Aker Finnyards secured a remarkable record total of 12 new orders, giving 11,800 'person-years' of work. At the turn of this year, the group's backlog was valued at €3.3 billion, with deliveries at all yards until mid-2008.

The total orderbook today includes 17 newbuildings and seven ship conversions. Other non-group Finnish shipyards include offshore constructor Technip Offshore Finland and the Turku Repair Yard, and together they employ some 4500 people. In addition, there are some 2000 subcontractors working at the yards.

In January this year, Norway-based Aker Yards, with operating revenues estimated at about Nkr15-Nkr18 billion (around €1.9-€2.2 billion) for 2005, made its surprise announcement that it will, in effect, take over the large French cruise-ship builder Chantiers de l'Atlantique, owned by the Alstom group (discussed in more detail in our Editorial Comment). This should create interesting new possibilities for the cruise-liner business (Atlantique's current LNG carrier contracts are not included in the sale); both Aker Finnyards and Atlantique have extensive experience of cruise liner design and construction. Yrjö Julin,

president of Aker Finnyards, will also head cruise ship construction taking place in France, as he already heads the cruise and ferries business area of Aker Yards.

In Finland, major newbuilding orders received last year include a third mega-size 158,000gt cruise liner in the Freedom series for Royal Caribbean International. The first of these ships, each of which is worth some €570-€580 million, is due for delivery from Turku in April this year (*Freedom of the Seas*), with the second in spring 2007, and the third in spring 2008.

Flurry of new ferry contracts

Aker Finnyards has won a flush of ferry orders recently, which started when Color Line confirmed an order for a second 75,000gt cruise ferry, a sister to *Color Fantasy*. This newbuilding, to be named *Color Magic*, is valued at €325 million and will be built partly at the Turku Yard with outfitting at Rauma, for delivery in September 2007.

In December, Color Line's orders for two fast passenger-car ferries were confirmed. They are intended for coastal traffic in Norway, for delivery from the Rauma yard in 2007 and 2008. The 211m long and 26m wide ships have a passenger capacity of 1800 and can take 400 cars. The order for the two ships is worth €232 million.

The 2800-passenger 48,300gt cruise-ferry *Galaxy* (discussed in a separate article in this feature) for Estonian ferry operator Tallink is due for delivery from the Rauma yard this spring. Last August, Tallink placed a new order for a fast, 27knot, passenger/car ferry for the Helsinki-Tallinn route. With a capacity of 1900 passengers and more than 2000lane metres of ro-ro space, that vessel, 185m long and 27.70m wide, will be able to complete the voyage in only one hour and 50 minutes. The value of this order is approximately €110 million. A few

days later fast-growing Tallink placed an order at Italian shipbuilder Fincantieri for yet another ship: a 29knot 2000-passenger and 2000lane metre ferry of 36,000gt.

In August 2005, French operator Brittany Ferries, an old customer of Finnish shipbuilders, booked a new order - for a trailer ferry for English Channel traffic, worth some €80 million, for delivery in autumn 2007. The ro-pax trailer design can carry mainly lorries at a speed of 23knots. The 165m long and 26.8m wide hull has 2.2km of vehicle deck space and 120 cabins. Both the Tallink and Brittany orders included options, and are to be assembled at the Helsinki yard from blocks delivered from Turku or Rauma.

In November, Viking Line placed an order - its first for some years and worth €120-€130 million - for a fast passenger/vehicle ferry, including options for two additional vessels. A total of 40MW of machinery power will give the 185m long and 27.7m wide vessel a speed of 25knots, and the ferry will compete with new Tallink tonnage on the route between Helsinki and Tallinn. Voyage time will be two hours 15 minutes. The ship will have a capacity for 2500 passengers as well as 240 private cars, in addition to trailers. Delivery is scheduled for January 2008.

In December, Tallink confirmed the order for a fourth ferry - a sister for *Galaxy* - from Aker Finnyards. This order is valued at €165 million. Large steel blocks will be fabricated at Rauma and Turku and transported by barge to Helsinki for assembly, with completion expected in the summer of 2008.

Brittany Ferries option converted to full passenger/vehicle design

In the same month, Brittany Ferries' ro-pax ferry option was replaced by a letter of intent for a different type of vessel: a full passenger/vehicle ferry. Last month (January),

In January, Brittany Ferries confirmed its December letter of intent for a second new ship but chose to change the design (utilising the same hull) from a ro-pax model to a full 1500-passenger/vehicle ferry, with 1100lane metres of vehicle space. She will be named *Bretagne II* and will sail on the Plymouth-Roscoff route.





Last August, Estonian ferry operator Tallink placed an order for a fast (27knot) passenger/vehicle ferry for the Helsinki-Tallinn route. This will have capacity for 1900 passengers and more than 2000lane metres of ro-ro space. The high speed will enable the voyage to be completed in one hour and 50 minutes.



In December, Aker Finnyards won an interesting order from Color Line for a pair fast passenger/vehicle day ferries to be built at the Rauma yard. They are expected to operate on Norwegian coastal routes.

this was confirmed to be a firm order, to be delivered in October 2008. The ship will work between Plymouth and Roscoff at a speed of 23knots, and space will be provided for 1500 passengers, with 1100lane metres of ro-ro space.

Other existing group orders already in progress include that with the Swedish B&N Nordsjöfrakt for three 15,000dwt container carriers, designed for paper transport using special Stora Enso container units (SECUs). All three vessels are due for delivery this year from the Rauma yard. A fourth Hamina class missile boat for the Finnish Navy's Squadron 2000 is scheduled to be completed next autumn.

Last summer, the Helsinki shipyard delivered a prototype icebreaker/supply/standby vessel, *Fesco Sakhalin*, to the Russian shipping company Far Eastern Shipping (FESCO). Speaking at the ship's launch, FESCO's chairman said that more ships of this prototype design might be ordered in the future. Another prototype, a 14,500dwt Arctic container vessel for Russian mining company MMC Norilskiy Nickel is currently nearing completion at the Helsinki yard (see separate article in this feature).

As compensation for the cancelled letter of intent for a Panamax-size cruise ship, plus one option, for Star Cruises' NCL, the extra capacity released at the Helsinki yard will now be used for assembling and outfitting two of the Tallink orders, also the Brittany Ferries' ro-pax order, and the Viking Line ferry, with deliveries in 2007 and 2008. Other potential orders which came to nought included that for Silja Line, which cancelled its letter of intent for two ferries, since the entire owning Sea Containers group was put up for sale. Further, the conditional contract with FS Ocean Club Ltd, for a luxury residential ship to be operated by Four Seasons Hotels & Resorts, did not materialise.

Good order book for repairs and conversions

Aker Finnyards, through its Lifecycle Services organisation, is also engaged in refurbishment projects, seven of which have been placed last year. Last year, the yard took part in the refurbishment and lengthening project of Royal Caribbean Cruise Line's *Enchantment of the Seas*, together with

Keppel Verolme Shipyard, in The Netherlands. Silja Line's *Silja Serenade* and *Silja Symphony* are currently undergoing refurbishment - mainly the public spaces - in cooperation with Turku Repair Yard.

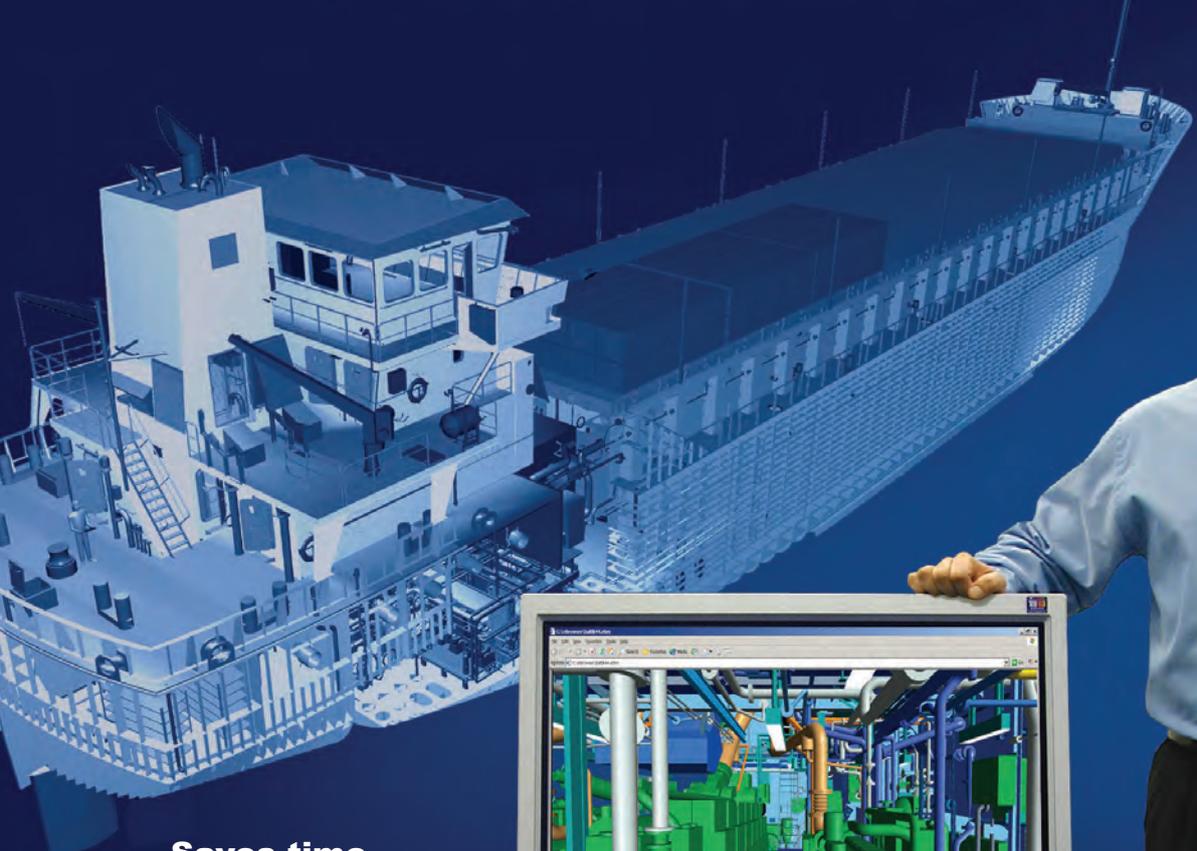
At the same time, four passenger/vehicle ferries owned by German TT-Line (*Robin Hood*, *Nils Dacke*, *Nils Holgersson*, and *Peter Pan*) are undergoing a retrofit programme, one ship at a time, at the Helsinki shipyard. The machinery and fuel systems will be converted for additionally using heavy fuel - an interesting move, since *Robin Hood* and *Nils Dacke*, when ordered in the early 1990s, were planned to be 'green' ships, burning low-sulphur marine diesel oil.

Clearly, Finnish shipbuilding is at the start of a new boom period, with important contracts arriving just in time to stave of large redundancies and consolidation. The brand-new link with Chantiers de l'Atlantique opens up interesting new possibilities for both Finland and Europe, while the former country remains ably supported by an army of active and experienced subcontractors with worldwide reputations. At the present time, the future looks very positive. 

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3D ship model by courtesy of Ferus Smit Shipyards, the Netherlands, www.ferus-smit.nl

V5.1

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

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The New Nupas-Cadmatic V5 allows global distribution of engineering work between several sites. The Nupas-cadmatic eBrowser enables all parties involved to view and check the 3D model and design information via the Internet. The eBrowser adds value to the entire ship project, easing communication and providing all project partners with access to the relevant information.

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Modular cabins and turnkey assignments from Piikkiö Works

ALONG with the many new orders recently placed for cruise ships and ferries, Piikkiö Works is also well booked with orders for its prefabricated cabin modules. As a new service, this also includes turnkey installation. Last year, Piikkiö Works received a major cabin module and its first turnkey installation order, for Tallink's third ferry at Aker Finnyards, *Galaxy* (discussed in a separate article in this feature).

The order included, in all, 1058 prefabricated cabins, plus the complete design and construction of the entire cabin areas. In addition to installation of the cabins and building of the cabin corridors, work includes the design and turnkey construction of the entire interior area, from the yard-built steel hull to completed cabin area. All these cabins have now been fabricated, and installation work is currently taking place at the Rauma yard.

Experience so far has been positive. 'We have now some 100 people working at the yard, and already half of the work is completed, meaning we are within schedule', Risto Vuorinen, sales manager at Piikkiö Works, told *The Naval Architect*. 'It is rational to combine construction and installation work to a larger entity. Work then becomes more efficient, and the yard's own resources can be utilised elsewhere. Being in charge of installation will also give us ideas on how to further improve our products for installation', he said.

At the end of 2005, Piikkiö Works also received a second turnkey order for the complete design, installation, and delivery of the passenger cabin areas for Color Line's second cruise-ferry at Aker Finnyards, to be named *Color Magic*, a sister to *Color Fantasy*. The passenger cabin installation area, with 1021 modular cabins, covers some 16,000m² in total. In addition, Piikkiö will also deliver 299 modular crew cabins, but will not build the crew cabin areas. Production of the grand total of 1320 modular cabins begins this spring.

In addition, the company will also supply cabins for the third Freedom-class 158,000gt cruise liner for Royal Caribbean International. The company has already supplied the cabins for the first in the series and is currently producing those cabins for the second ship. In all the order includes 2560 cabin modules for passengers and crew, and all 22 B-suites, with a size of around 36m². This order does not include installation, but it is one of the largest ever received by Piikkiö. Today, the company has enough work for at least one-and-a-half years - and even further, if several ongoing contract negotiations prove successful. 📍

Modular cabin construction under way at Piikkiö Works. In 2005, the company enjoyed net sales of some €50 million. Annual production at its two factories in Finland is some 6000 cabin units, including bathrooms.



Piikkiö Works has secured a contract for both prefabricated cabins and the entire turnkey installation order (passenger cabin areas) for Color Line's second new cruise-ferry, *Color Magic*. Seen here is a cabin corridor area on sistership *Color Fantasy*.





Costa Atlantica



Navigator of the Seas



Carnival Miracle



Victoria I



Birka Paradise



Color Fantasy



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Preferred for innovation

New features in Nupas-Cadmatic's ship design software

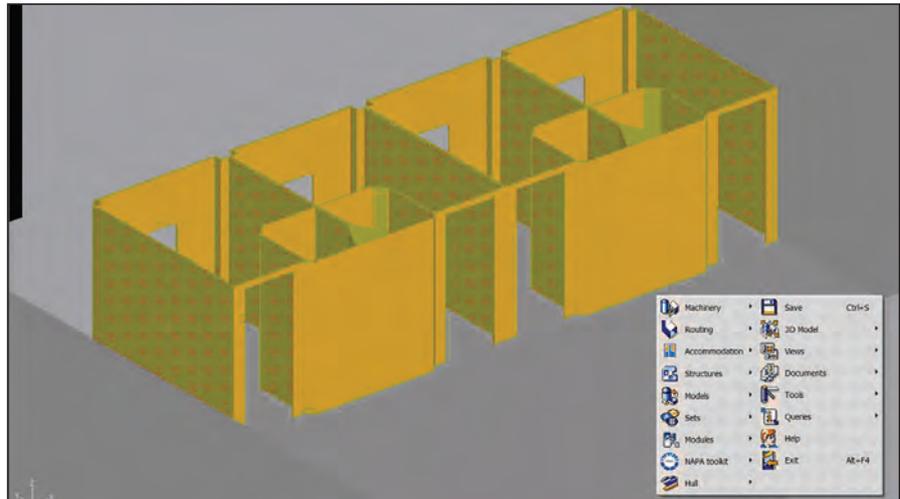
NUPAS-CADMATIC, the joint venture of Finnish Cadmatic Oy and Dutch Numeriek Centrum Groningen BV, has continued development work on its software product, with several new features aimed at further simplifying the ship design and construction process. The two companies' Machinery, Piping and Outfitting modules are intended for machinery layouts, piping and HVAC engineering, whereas the 3D Hull Engineering unit is a tool developed for modelling hull construction. Together, they form a complete ship design tool which is gaining increasing popularity among shipyards and design offices. Nupas-Cadmatic has now reached version V5.1, which was introduced in autumn 2005.

Version 5.0 of the software launched a completely new data-handling structure and database architecture for efficient distributed project design work. With the so-called COS database structure, design information is centrally collected in a master store, to and from which design data can be transferred to local or remote design offices through a check-in/check-out procedure. Through this client-server system, concurrent design of a ship can be efficiently distributed to multiple users in different locations. Shared data, such as common component library, project set-up, and a ship project's 3D model, and document data, are all stored in the master database server.

With Version 5.1, Nupas-Cadmatic has continued to streamline the efficiency of the software's distributed design capabilities. Through an eBrowser module, developed some time ago, design data can be sent over the Internet for approval or follow-up. The client only needs a free downloadable viewing module on his computer.

Basic information about specific items, such as pumps or valves, can be retrieved by clicking on them in the 3D model. With added capabilities in the AutoCad-Nupas-Cadmatic interface in Version 5.1, it is possible to both import and send full 3D model documentation using the eXchanger, also to export complete 2D documents to AutoCAD. With the large number of transfer plug-ins to AutoCAD, compatibility between Nupas-Cadmatic and several different formats, such as SolidWorks, AutoDesk Inventor and Catia, is made possible.

It is now also possible to send complete 2D drawings to the AutoCad dwf viewing format for review; in addition, dwg and dxf formats are available. The 2D drawing can be intelligently hyperlinked to any related data. This makes it possible to analyse project material more efficiently. The client can, for instance, click on a pump in the 3D eBrowser model to access a complete 2D document of that particular item, isometrics of the system, or can easily transfer to the 3D eBrowser environment from the 2D drawing view by clicking on an item or instrument symbol. The new capabilities allow very efficient viewing



An automated cabin creation using parametric input data. The new Basic Designer aims to save time at the beginning of a ship project, when possible alternative layouts should be studied for an optimal end-result.

of already filed project material. Both 3D and 2D material are easily accessed for review by simple software applications.

A new Basic Designer module was introduced with Version 5.1. It focuses on improving features in the early ship design phases. A ship's basic layout with outfitting and other components is built up in a modular way, and at the beginning of the process, a designer can make simple temporary space reservations for main piping routes, casings, and equipment not yet determined or found in the component library.

It is also possible to use various wizard-type tools to quickly and parametrically reserve spaces for cabins, staircases, lifts, and similar items. Ship design data stored in the data library can be used again in similar ship projects - the ability to automatically integrate the maximum amount of earlier design work into new projects is a key feature of Basic Designer. This ensures that the designer only needs to do project-dependent layout adjustments. Basic Designer is taken into use at the very beginning of the process and can be used in parallel with NAPA software.

Typical early design iterations, when for instance, the hull form or deck heights are still being adjusted, is automatically handled with Basic Designer, providing direct access to updated 3D layout data. Structural ship data acquisition is then fully integrated with the NAPA software. With Nupas-Cadmatic's Hull module, structural hull design is transmitted all the way to the steelwork line.

Version 5.1 brings a number of new features in the Hull modules, but further major developments in the near future also seem likely. New features include the possibility of importing hull shapes data via IGES, exporting to FEM software, renewed 2D functionality, production management, and a new 3D Hull Library concept. With future developments in sight, the hull block structure was firstly

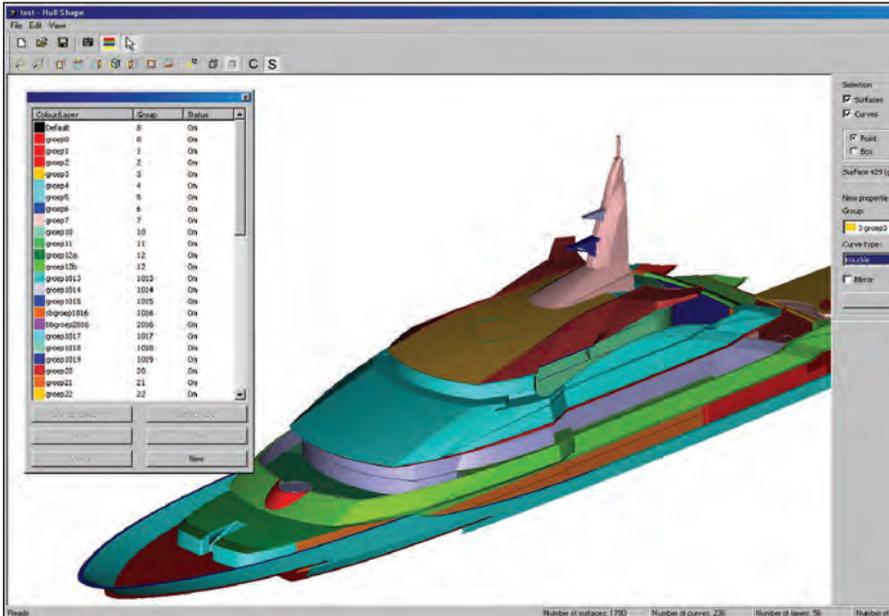
completely renewed to simplify and speed up the handling of large numbers of blocks in a project. The new structure enables an engineer to group blocks and divide them according to their characteristics such as hull, superstructure, foundations or even temporary.

With this new structure, it is easier for a designer to work with alternative ship designs; also, construction parts or a group of parts can now be copied more quickly and efficiently. When copying a complete block, all existing drawings will also be copied and adjusted automatically. The texts and dimensions in all drawings are changed automatically according to the new position of the block, which should save much time in the design process.

In addition, bracket creation has been automated further, making it possible for an engineer to create several brackets at once, of different size or type, by just one click of the mouse instead of creating time-consuming views for each bracket one by one - a significant time-saving feature!

The user interface and user functions of the 3D Hull Library are expected to be released in the next version. The 3D Hull library is a tool for the user to store any kind of structural part (or group of parts) in a library. The stored structural part(s) can be retrieved and positioned freely into the current ship model or another ship model, including parts information, such as cutting data, logistic data, and weights, directly available for production needs.

The 2D functionality is currently undergoing a complete facelift. The objective is to offer more user-friendly drafting tools which are comparable with AutoCAD. Also, a new tool is under development, which should make it possible to export 3D hull construction data directly as finite-element-model input data. A new production management feature, soon to be released, can automatically generate production drawings containing simplified

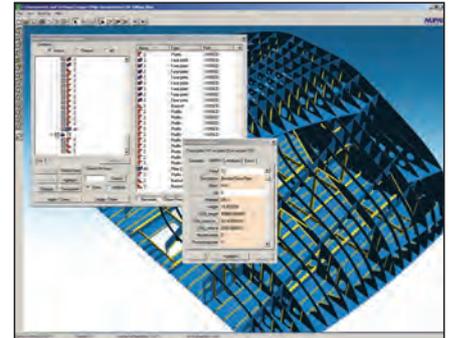


With the new IGES import tool, a variety of (surface-based) hull shapes such as hulls, superstructures, swimming pools, or tanks, can be imported easily, and construction can be modelled directly, based on the data.

information about work breakdown structure, logistics, and assembly order. The basic idea is to increase the overall efficiency of workshops.

The Hull Work Preparation Manager (*The Naval Architect*, July/August 2005, page 50) is a new tool, added to the Hull Viewer module, to further enhance the realisation of distributed 3D ship design and engineering.

The purpose is to streamline the information flow between planning, engineering, work preparation, and workshops, also to shorten the throughput of ships' several assembly stages. With Version 5 of Nupas-Cadmatic, a set of tools for automatic detection and assigning numbers to assemblies, panels and parts have been introduced. Components



The Hull WPM is operated like a web browser. Once a work breakdown structure has been generated by the software, the user can easily manipulate its structure by dragging and dropping items on the workstation screen, rename assemblies, panels, and parts, and also create new ones.

such as profiles, brackets, and collar plates are automatically assigned to the correct panel, and the complete work breakdown structure of a hull block can be determined fully and automatically by the software.

With the Hull WPM, the user is able to control the complete work breakdown structure of a hull block in a new simple way. The Hull WPM is available both as integrated in the Hull Viewer or as a standalone module, which is intended to be used between project partners, such as engineering offices and shipyards, or between the engineering and work preparation departments at the shipyard.



In February 2006 Aker Arctic will open a new ice model testing facility in Helsinki, Finland.



Aker Arctic- experienced developer of successful ice-going vessels



Aker Arctic Technology Inc. is a new company established in 2005 to continue the operations of the former Kvaerner Masa-Yards Arctic Technology Center (MARC).

The company now offers also full design and project support to ship-owners, shipyards and other operators.

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Preferred for innovation

New waste-water products from Evac

FOR many years, Evac Marine, today part of the Zodiac Group, has been known as a designer and manufacturer of vacuum-based waste-water collecting and treatment systems for the shipbuilding industry. In 2004/2005 net sales were €35 million, and some 8300 ships are currently in the reference list; the company claims it has a 90%-plus market share among cruise ships.

Some 900,000 Evac vacuum toilets are in operation worldwide but, according to the company, only some 45% of ships built annually have vacuum toilet systems, since vessels ordered in low-labour-cost countries tend to have gravity systems installed, which are considered more economic. Vacuum systems are installed only if specified by the owner.

Now, Evac wants to penetrate this sector of the market (which consists mainly of cargo ships), claiming that competition and technical development have shrunk vacuum system costs, in addition to those savings gained from cheaper installation costs. The company has therefore developed a new toilet, the Evac Classic, specifically for cargo ships.

In order to save costs, the number of parts has been reduced by half, compared with other models. This has been achieved through integrating components and through a simplified working action. With these changes, Evac claims it now has a competitive new product for both yards and shipowners, and in 2006-2007, the company aims to secure orders to fit the new product in some 60-70 new vessels.

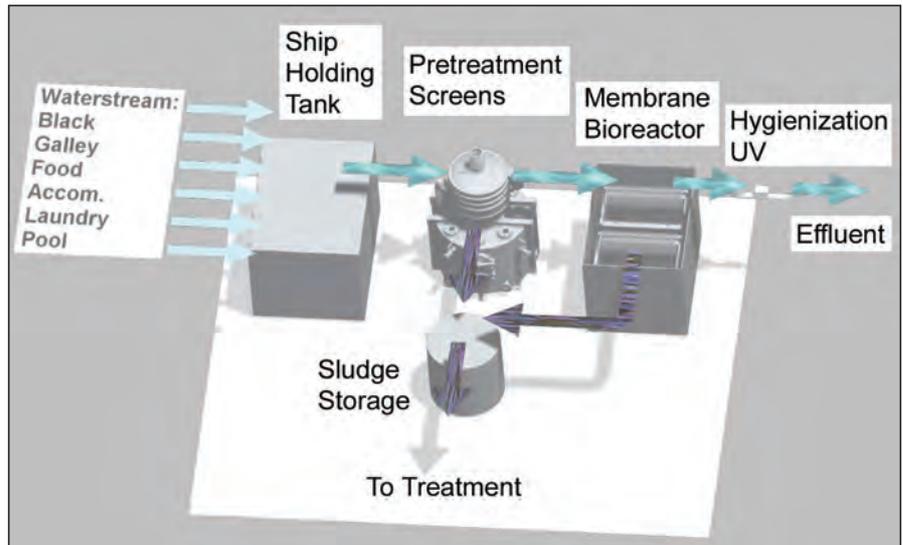
Entering the waste-water treatment market

Recently, Evac has also entered the waste-water treatment sector. Before deciding on which technique to employ, several alternatives were examined, after which a flat-sheet submerged membrane bio-reactor process was selected. Evac's membrane bio-reactor can process both black and grey water together, or alternatively, on large ships, only black water, also galley and food waste waters, since it is more economical to treat grey water separately on large vessels.

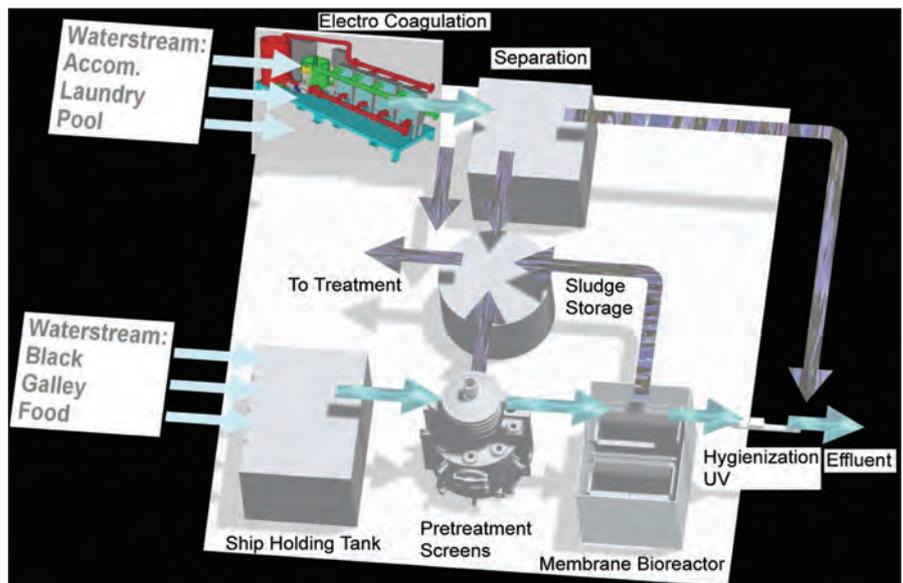
The Evac MBR, a single-stream system, is designed for all types of waste water and can be delivered on a common skid with its vacuum components. In the alternative dual-stream Zebra system, the membrane bio-reactor is used for treating concentrated galley waste and black water. Grey water from cabins and laundry water are treated in a separate electro-coagulation unit.

In the Zebra product range, the treatment process plant is custom-designed, combining standard equipment of optimal capacities. Evac's MBR products are IMO MARPOL-certified.

A pilot installation of the MBR type, treating both grey and black water, has been operating successfully on Finnlines' ro-pax ferry *Finnclipper* for more than a year. The



Evac's MBR membrane bio-reactor single-stream system can handle all types of waste water. Standard units are produced for all ship sizes.



In the Zebra dual-stream process, the membrane bio-reactor treats concentrated galley waste and black water. Grey water from cabins and laundries is treated in a separate electro-coagulation unit.

quality of the cleaned water is said to have been excellent, with less than 1% of organic materials and particles measured in all samples taken. Biological oxygen demand (BOD₅) has been less than 3mg/litre and total suspended solids (TSS) less than 5mg/litre, ie, below the minimum scale of measurement. No coliform bacteria have been measured in the treated water. These measurements have shown that the level of treatment secures a carefree disposal of treated effluent.

Advanced waste-water treatment plants are currently installed on cruise ships, naval vessels, superyachts, and specialised vessels and rigs operating in environment-sensitive areas. Evac estimates that the market will grow relatively rapidly due to environmental awareness and governmental actions, as well as tightened regulations on waste water generally. This year, Evac estimates to sell and install between four and six of its advanced treatment plants, and in 2007, to double that figure, at least. 

Power range increase for AC drives

THE AC drives manufacturer, Vacon, recently announced that it will expand its power range up to 5MW from a previous 3MW. Vacon AC drives above 2MW are all liquid-cooled, whereas in the lower ranges from 0.25kW to 2MW, drives can be either air- or liquid-cooled. According to the company, the control of a 5MW AC induction motor with a low-voltage (690V) AC drive is a notable technical achievement; it is claimed that 5MW is close to the maximum obtainable from any single motor of this type.

In typical applications requiring powers higher than 5MW, parallel motors are used. To date, Vacon has delivered some 4000 drives for marine applications - around 2500 of these are used in fan applications with 1000 as winch drives. Other typical drive applications include cargo pumps, compressors, steering gear, and propulsion trains. With its increased power range, Vacon aims at further boosting its marine sales - in 2004, the group reached total net sales of €128.6 million.

Vacon also recently announced that it has entered into a distributor and brand label agreement with Hyundai Heavy Industries. HHI will sell and market Vacon AC drives under its own brand through its own marketing channels. With this agreement, Vacon aims at strengthening its presence in the fast-growing AC drives market in Asia.

To date, one of the major single propulsion drive orders came to Vacon from its Norwegian partner Scandinavian Electric Systems (SES), in Bergen. SES will provide a diesel-electric propulsion plant for *Geo Celtic*, believed to be the world's largest purpose-built seismic research vessel. This vessel, an impression of which appeared in our January 2006 edition, page 18, is under construction at Bergen Yards for E Forland and is scheduled for completion by mid-2007.

According to SES, this is one of the largest low-voltage diesel-electric systems ever built, and as we reported, the plant is said to confirm that SES active front-end (AFE) solutions are finally accepted in the market. Propulsion equipment will be controlled by liquid-cooled Vacon AFE units. They represent Vacon's new common DC-bus product range, including three different types of front-end units, inverter units, and brake chopper units in the entire power range reaching up to 5MW from 380V to 690V.

The Norwegian order comprises four generators totalling 16,800kVA, electrical main and emergency switchboards, liquid-cooled active front-end AFE units, two electrical main propulsion motors, each of 4200kW, and two thrusters of 1500kW and 1200kW. *Geo Celtic* will have a length of 100.80m, a breadth of 24.00m and a gross tonnage of 12,215gt. A long-term charter has been agreed with the seismic company Fugro-Geoteam AS, the Norwegian part of the Geoscience Division of the worldwide Fugro Group, which currently operates nine seismic vessels.

Another new order for Vacon involves seven 2400kW liquid-cooled drives for *Sapura 3000*, a heavy-lift crane and pipe-laying vessel currently

under construction at Sembawang Shipyard, in Singapore. Vacon secured the order from its partner, the Dutch company Imtech Marine & Offshore, which will supply the complete electrical power and automation package for the vessel.

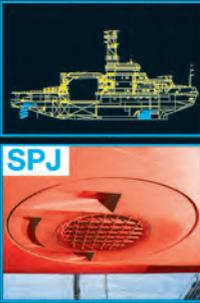
Sapura 3000 is a self-propelled, DP class 2 heavy-lift and pipe-laying vessel ordered by SapuraCrest Petroleum Bhd in a joint venture with Stolt Offshore S.A. The ship should be ready for work off Malaysia in early 2007. A propulsion system designed for dynamic positioning consists of seven azimuth thrusters, each with a power of 2.4MW, which will be controlled by liquid-cooled Vacon drives, adjusting both propeller rotation speed and direction. ⚙️

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New factory in China

IN January, less than one year after starting manufacture of its drives in that country, Vacon's Chinese arm moved to a new larger factory in Suzhou - approximately one hour's drive north-west of Shanghai. In line with growing demand in the Far East, the initial premises, also in Suzhou, quickly proved inadequate; luckily, more space, exceeding 5000m², was located in a neighbouring complex. Vacon has had an office in Beijing since 2000. At the same time, Vacon is expanding its Vaasa factory in Finland, and this operation should be complete this month.

Norilskiy Nickel - first of a new series of double-acting Arctic container ships

A new era in the evolution of the double-acting principle opens soon when Aker Finnyards completes what is hoped to be the first of a number of vessels to haul semi-finished metal products from Dudinka to Murmansk for the Russian metals company MMC Norilskiy Nickel.

At the end of February, a 14,500dwt Arctic container ship, the first of an eventual series to employ the Aker/ABB double-acting principle, will leave Aker's Helsinki yard for official ice trials. These will take place somewhere in the Kara Sea, where suitable ice conditions can be found. *Norilskiy Nickel* was ordered by the Russian mining company, MMC Norilskiy Nickel, and delivery to the owner, including the change of flag, is expected to take place in April. The contract was placed in August 2004.

This evolutionary vessel is the first dry cargo vessel utilising the double-acting concept developed by the Masa-Yards Arctic Technology Centre (MARC), the predecessor of Aker Arctic Technology. She will follow Fortum's Aframax tankers *Tempera* and *Mastera*, as well as the prototype (retrofitted) tankers *Uikku* and *Lunni* also several service ships and icebreakers. *Uikku* and *Lunni* have been transporting gas condensate successfully from the Russian Arctic since the 1990s and are still working there (under the names of *Varzuga* and *Indiga*); nevertheless, the performance of *Norilskiy Nickel* will be followed with keen interest by oil and gas companies, and others already operating or planning to operate in the Arctic.



Norilskiy Nickel is the first new double-acting dry cargo ship for Arctic operation. She was floated from the covered Helsinki yard in mid-December. Arctic Express is the operating brand.



As can be seen in this illustration, the new ship has a bridge extension at the aft end of the superstructure, for use when travelling astern into ice.

TECHNICAL PARTICULARS NORILSKIY NICKEL

Length, oa.....	164.31m
Length, dwl.....	160.24m
Breadth.....	23.10m
Depth, to main deck.....	14.35m
Draught at dwl.....	9.00m
Deadweight, 9m draught.....	14,500dwt
Deadweight, 10m draught.....	18,000dwt
TEU containers (special design).....	654
Gross.....	approx 16,000gt
Icebreaking capacity,	
stern-first.....	1.5m level ice
(with a snow layer of 200mm)	
Main machinery.....	Diesel-electric
/azimuthing electric pod propulsion	
Main engines.....	3 x Wärtsilä 12V32
Output.....	3 x 6000kW at 750rev/min
Alternators.....	3 x ABB, 3 x 8314kVA
Propulsion.....	1 x 13MW Azipod
Classification.....	Russian Maritime
Register of Shipping	
Ice Class JIU7 (most of hull);	
JIU 6 Bow (stern);	
JIU7 (Azipod)	

These will include Russian maritime officials and particularly the Russian Maritime Register of Shipping, with whom the ship is classed. *Norilskiy Nickel* will, during most of her year-round operations, sail independently from icebreaker assistance, transporting nickel semi-finished products and other export goods from Dudinka, on the river Yenisey, to Murmansk, with general cargoes on the return leg.

Unitising nickel transport

When the order was placed, officials from MMC Norilskiy Nickel announced that the company was in the process of improving logistics to secure better on-time and cost-efficient transport of goods to its customers, for which reason it needed new ships of modern design and technology. *Norilskiy Nickel* then decided to unitise its nickel transportation and said it would build its own new fleet of four-to-six icebreaking highly ice-strengthened cargo ships. *Norilskiy Nickel* is the first in this series and the first vessel for nickel transportation actually owned by MMC Norilskiy Nickel. The company has since announced that five such vessels, in an investment amounting to €450 million, will be built in 2008.

Norilskiy Nickel Group is the world's largest producer of nickel and palladium, and one of the largest producers of platinum. With the new ship, pre-rolled nickel plates on standard flats/frames will be loaded onto pallets (sized for TEU dimensions), which are transferred into special containers in the town of Norilsk. From here, they will be transported by train to the port of Dudinka on the Yenisey river, for the onward journey by sea to Murmansk and beyond.

The company has built a new container terminal in Murmansk, and has also set up a separate organisation, the Norilskiy Nickel Murmansk Transport Branch, to handle these operations. Estimates show that transport costs with the new ships should be cut by half, thanks to shorter turnaround times.

Currently, a normal round trip is approximately 17 days. Up till now, sea transport has been carried out by a fleet of SA-15-class vessels, built in the 1980s in Finland by the then Valmet and Wärtsilä Marine yards. These ships, owned and operated mostly by Murmansk Shipping Co, have needed icebreaker assistance in wintertime, despite their ice strengthening (icebreaker operation in

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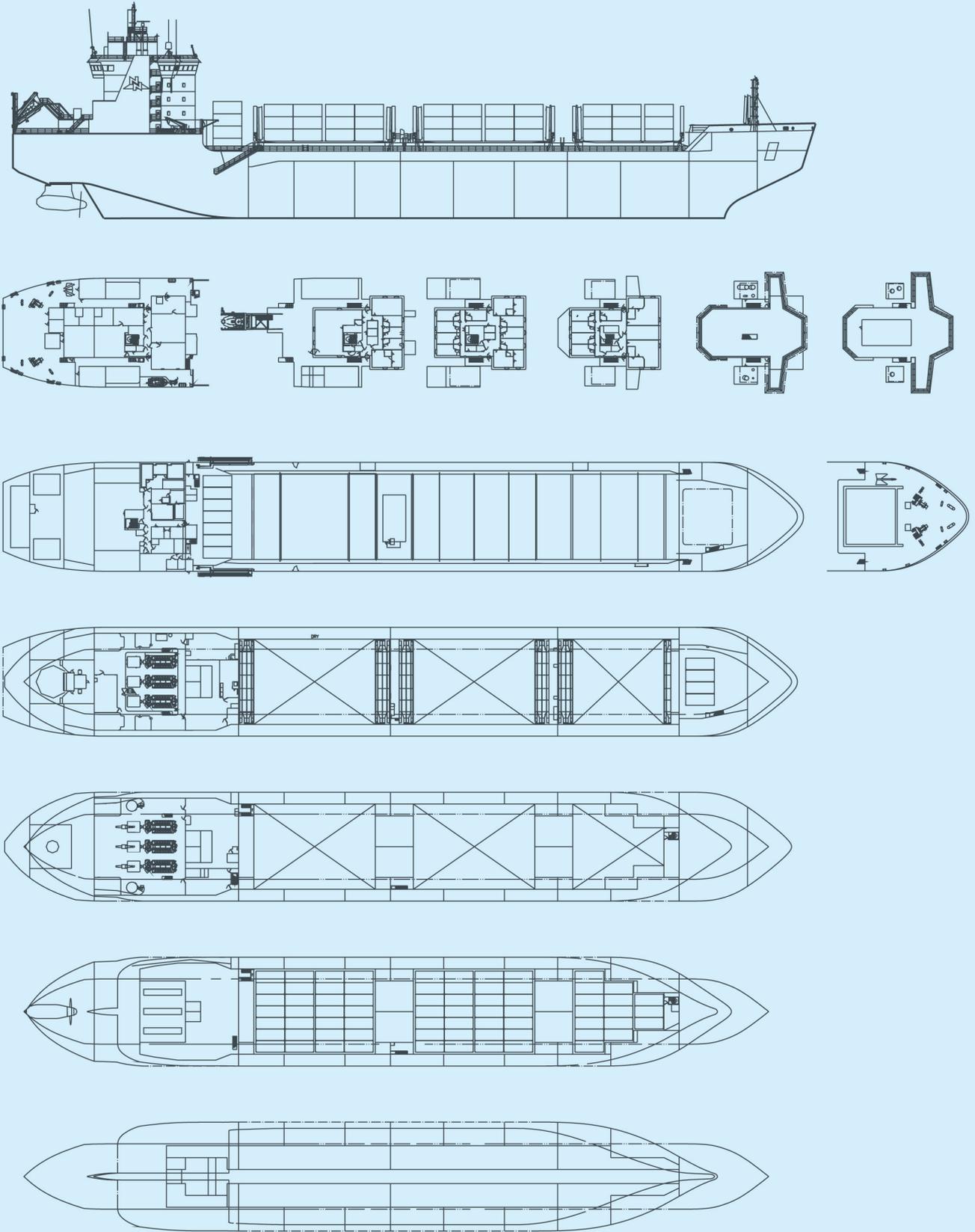
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General arrangement plans of the 14,500dwt/18,000dwt double-acting cargo ship *Norilskiy Nickel*, built by Aker Finnyards for MMC Norilskiy Nickel. She and her anticipated sisters (not yet ordered) will primarily be employed exporting semi-finished metal products from the port of Dudinka to Murmansk for onward shipment.



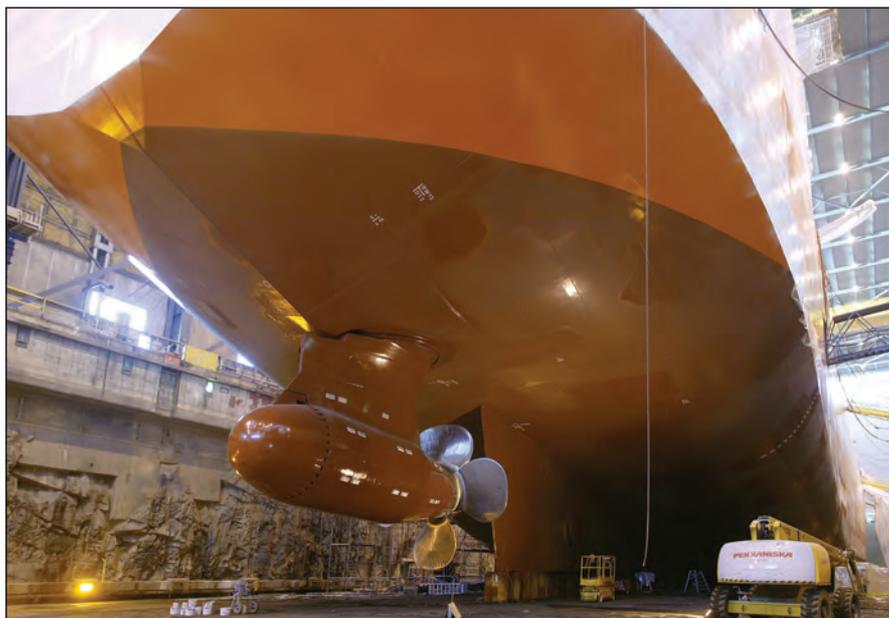
that area is handled by Murmansk Shipping). In early 2004, the contract between MMC Norilskiy Nickel and Murmansk Shipping Co for nickel transport was extended by three years - to cover the period before the new ships enter service.

Independent operation without icebreakers

The newbuilding should be able to operate independently without icebreaker assistance - sailing stern-first in the double-acting mode - in most ice conditions prevailing on the Dudinka-Murmansk route. With independent traffic, regular time schedules are sought, as much time will be saved by not having to wait for expensive icebreaker assistance.

Norilskiy Nickel will carry the Russian flag, with Murmansk as her home port. Her hull is constructed to Russian Maritime Register of Shipping JIU7 ice class, except for the stern, which will be built to JIU6 bow-class rules, which are more demanding than JIU7 requirements for the stern of a ship. The Azipod unit is also classed to JIU7 standards. Overall length is 164.31m, length at dwl is 160.24m, breadth 23.10m, and dwl draught is 9.00m. The main deck height is 14.35m from the keel, and at 9m draught, the deadweight is 14,500dwt or 18,000dwt at 10m draught.

Icebreaking capability of *Norilskiy Nickel* is 1.5m of solid ice, with a snow layer of 200mm, when moving stern-first. The ship is also fitted with a heavily cutaway icebreaking bow of approximately the same form as the

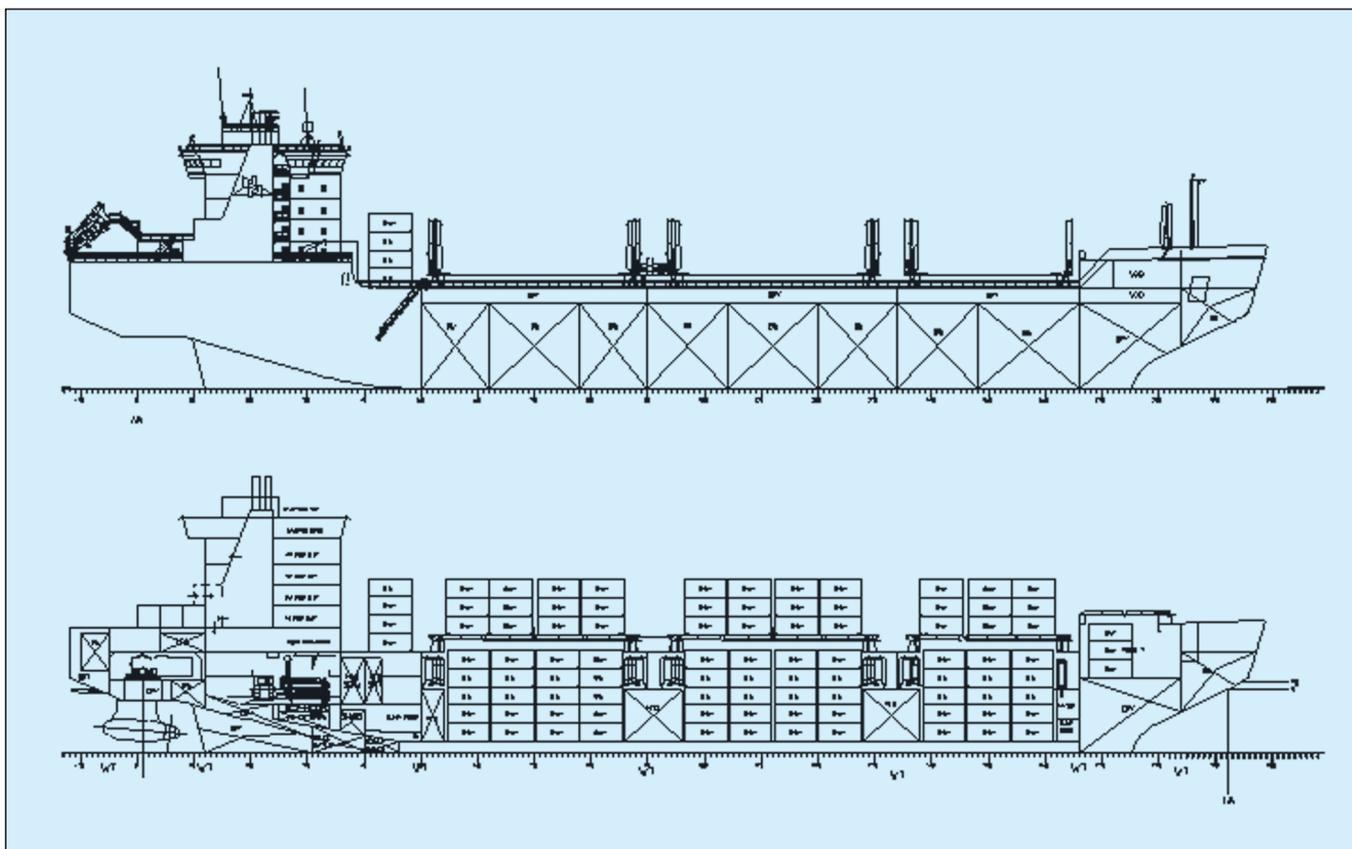


Norilskiy Nickel is fitted with a single ABB Azipod drive with a power of 13MW. The stern of the double-acting hull is fabricated to meet the Russian Maritime Register of Shipping's high JIU6 bow class, since the ship will sail stern-first into heavy ice. The Azipod itself is classed to JIU7 standard.

SA-15 class (although the Fortum tankers have bows optimised for open-water navigation, which is one of the general ideas of the double-acting principle). The ice trials

due to be made in March are anticipated to prove this icebreaking performance, with a minimum speed of two knots; other performance parameters will be confirmed to

Two profile views of the new ship, showing details of the machinery and cargo stowage. The latter features special half-height TEU containers.



establish the functioning of the ship, its machinery, and equipment in the prevailing Arctic conditions. Open-water service speed is anticipated to be 15.50knots.

The diesel-electric machinery consists of three Wärtsilä 12V32 diesel engines, each with a maximum continuous rating of 6000kW at 750rev/min, driving ABB alternators each with a capacity of 8314kVA (0.7cosphi) and feeding the 6.6kV 50Hz main switchboard. Current is supplied to a single ABB Azipod with a power of 13MW. The electric motor has double windings for redundancy.

Two stainless steel spare blades are carried on board for the 5.6m diameter propeller, stowed on the aft deck; they are designed to be bolted on in case of blade damage. ABB also delivered the main switchboard, propulsion transformers, two high-voltage distribution transformers, also propulsion control and remote control systems. In addition, there is a 750kVA harbour generator set and a 415kVA emergency generator, both supplied by Volvo.

Cargo-handling based on special half-height containers

Norilskiy Nickel can load up to a nominal 654 20ft TEU containers, although the heavy nickel will be transported in special containers with only half the height of a standard TEU box - 4ft instead of 8ft. The ship is fitted with one tweendeck, at a height

of 10.45m, for return loads, consisting of general cargo, machinery, and rolling units, much of which needs to be protected from the weather.

Due to the existence of a tweendeck, also due to need to transport occasional bulk cargoes, there are no vertical container cell guides. The container stacks obtain their support and fixings from longitudinal and side bulkheads. Longitudinally, there are three main cargo holds, each with a tweendeck, plus one smaller cargo hold forward, which is also suitable for transportation of hazardous cargo.

The size of the main deck cargo holds are from aft, 25.6m x 18.1m, 25.6 x 18.1m, and 19.2m x 18.1m. The main-deck hatch covers are of MacGregor design, built at Aker Ostsee shipyard, whereas the six tweendeck cargo hatch covers were supplied and installed by MacGregor.

Differing from the SA-15 class, no onboard cargo cranes (and no stern ramp) are installed, as new Liebherr mobile container cranes will be used exclusively in the port of Dudinka. Also in Murmansk, where cargo is transhipped for onward transportation, land-based cranes are used. As explained in our February 2005 article (page 48), the harbour at Dudinka often floods in early spring, and it is necessary to remove all equipment to nearby hills. Another feature omitted in the new ships is a stern ramp.

Norilskiy Nickel has a capacity for a complement of 18 persons, accommodated in single cabins. In addition, there are three double cabins and one cabin for the pilot. As required by

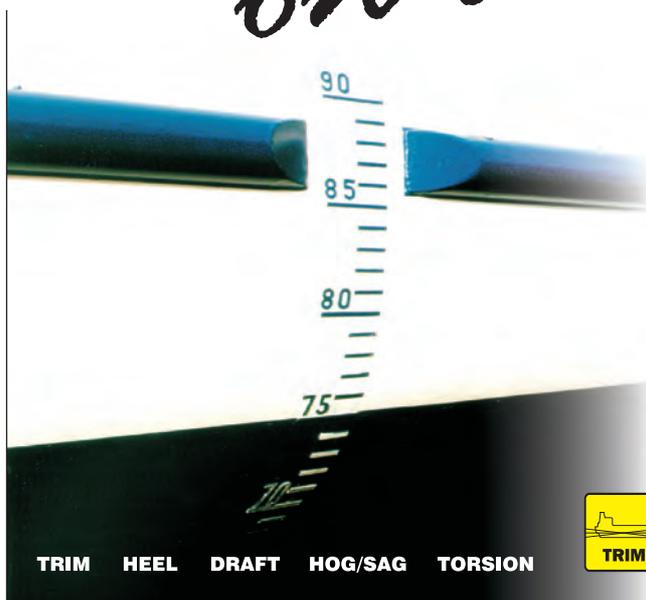
regulations for Russian Arctic ships, *Norilskiy Nickel* also has a sauna, a seawater swimming pool, and a gymnasium.

The ship's console-type bridge arrangement features a full set of navigation and ship-handling equipment and instrumentation, facing both forward and aft. The navigation package has been supplied by Kelvin Hughes, while the Damatic/Valmarine-type machinery control and monitoring system comes from L-3 Communications Corp (which recently acquired Valmarine). There is a free-fall lifeboat supplied by Ernst Hatecke GmbH, with a capacity of 25 persons, and a rescue boat from the same supplier, in addition to liferafts. Mooring equipment and deck winches have come from SEC - Groningen BV.

The contract value of the vessel was close to €70 million. The cargo part of the hull, forward of the engineroom bulkhead, was subcontracted to Aker Ostsee in Warnemünde, Germany, and towed to Aker Finnyards' covered Helsinki dock, where joining, assembly, and outfitting took place. Steel blocks for the aft part of the ship were built by Aker's block factory at the Turku yard.

These were shipped to Helsinki on barges, since steel block fabrication in Helsinki ended two years ago when the yard was changed to an assembly and outfitting facility. The building of *Norilskiy Nickel* reflects the new operating strategy of Aker Yards, to share the capabilities and resources between its yards for maximum efficiency. 

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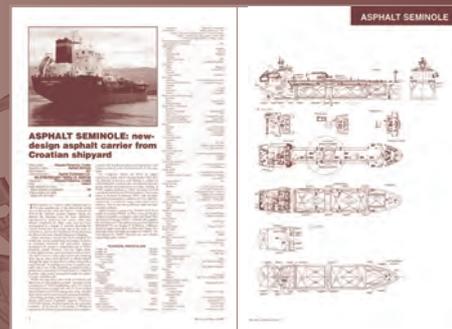
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Major new electrical orders for ABB

IN addition to prominent orders to supply electrical packages for three Arctic tankers being built at Samsung Heavy Industries for Sovcomflot (discussed elsewhere in this feature), ABB has recently delivered its systems for other Russian ice-going ships. Important references include the electrical power system and two 6.5MW Azipod propulsion drives for the icebreaker/supply ship *Fesco Sakhalin* (*The Naval Architect* July/August 2005, page 41). This purpose-built ship is now operating at the Sakhalin-1 offshore field in the Russian Far East.

Another significant project involves a 13MW Azipod propulsion drive plus electrical systems for the 14,500dwt Arctic container vessel *Norilskiy Nickel* (see separate article) for MMC Norilskiy Nickel. This special ship is planned for operation between Dudinka on the river Yenisey and Murmansk. Back in 1997 the product tanker *Uikku* pioneered Russian Arctic Azipod operations, by becoming the first non-Russian owned cargo ship to navigate through the entire North-East Sea route, equipped with a retrofitted Azipod.

ABB is also involved in other newbuilding projects at Samsung. The company has been awarded contracts to supply the complete electrical propulsion systems for six dual-fuel diesel-electric 153,000m³ LNG carriers being built at this Korean yard. Four vessels are for AP Möller and two for K-Line, with deliveries scheduled from late 2007 to late 2008. ABB will also supply electrical propulsion, power generation and distribution systems for two monohull drill ships: one for Norway's Mosvold Drilling and the other for Stena Drilling; these ships are based on a Saipem 10000 design. At the same yard, ABB will supply a similar package for a deep-water semisubmersible drilling platform ordered by Eastern Drilling.

At the end of November last year, ABB had an order backlog worth US\$140 million. This includes the three tanker Azipod installations at Samsung as well as electrical power systems for 11 ships and two semisubmersible drilling rigs, also the above-mentioned drilling vessels



The icebreaker-supply/standby ship *Fesco Sakhalin*, completed last year by Aker Finnyards, is equipped with two 6.5MW ABB Azipod propulsion drives. The vessel is operating at the Sakhalin-1 offshore field.

for Mosvold Drilling and Stena, where the ABB scope includes generators, thruster motors, main switchboards, and transformers. ABB has also received an order for total electrical power system packages for two semi-submersible drilling rigs for subsidiaries of Jon Fredriksen-controlled SeaDrill Ltd, which will be built at the Jurong Shipyard, with first rig delivery in early 2008.

Other contracts include those to outfit three vessels at the Aker Langsten shipyard in Norway. These include electrical propulsion systems for one well-intervention vessel and one anchor-handling, towing, and supply vessel for Island Offshore as well as for a similar ship for Farstad Shipping. Delivery of the equipment

will begin in late 2006. In addition, ABB holds orders for high-voltage switchboards for four container vessels to be built at Korea's Daewoo Shipbuilding & Marine Engineering (DSME) for the Hamburg-Süd Group, of Germany, and high-voltage switchboards and transformers for three LNG carriers being built for China LNG at Hudong-Zhonghua Shipbuilding Co.

Since the launch of the Azipod concept in 1990 - a technique which has revolutionised marine propulsion in some sectors - a total of around 150 units, ranging in power up to 20MW, have been ordered. To date, the total cumulative operating experience with Azipod systems exceeds 1.9 million operating hours. 

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New engines and growing orderbooks for Wärtsilä's ship power division

THE year 2005 was a busy one for Wärtsilä Corp. For the first three quarters of that period, the company notes that the decline in newbuilding orders for large vessels, caused by unwillingness to place orders since most yards are booked until 2008, has not affected its own order intake. The ship power business of Wärtsilä actually showed a remarkable 96.3% increase to €1444.5 million, compared with the previous year. Net sales for the nine-month period grew by 3.7% to €444.8 million.

In an important move recently, Wärtsilä entered into a strategic alliance with its licensee, Mitsubishi Heavy Industries, in the field of two-stroke engines. Mitsubishi is a well-established builder of Sulzer two-stroke engines, and to date, Wärtsilä has secured some 40 orders for the RT-flex50 engine, developed jointly with Mitsubishi.

Advances in the RT-flex engine range continue. Last autumn, Wärtsilä introduced two new low-speed diesel engines, in two versions: RT-flex82C and RTA82C, also RT-flex82T and RTA82T. The C-type engines are intended to power Panamax-size container ships up to 4500TEU with typical speed of 24knots. With cylinder dimensions of 820mm bore and 2646mm stroke, the RT-flex82C and RTA82C will be offered with six to 12 cylinders in-line, to cover a power range of 21,720kW to 54,240kW at 87rev/min to 102rev/min.

T-type engines are designed to provide correct powers and shaft speeds for the propulsion of large tankers, VLCCs, and ULCCs. Cylinder diameter is the same as for the C-type engine, but the stroke is 3375mm. These models, built with six to nine cylinders, cover a power range of 21,720kW to 40,680kW at between 68rev/min and 80rev/min, complementing well the range of propeller speeds offered.

The first engines of the new type are expected to be completed towards the end of 2007 in cooperation with Hyundai Heavy Industries. One main theme with the new engines is that they are standardised as far as possible, with the main variation being the different piston stroke. This allows similar components to be used in both versions, thus reducing design and manufacturing costs.

Wärtsilä RT-flex82C and RT-flex82T engines incorporate common-rail technology, with full electronic control of fuel injection and exhaust valve operation, whereas the RTA82C and RTA82T have traditional mechanically-driven camshafts with fuel injection pumps and exhaust-valve actuator pumps. The RT-flex versions have the added claimed benefit of no visible smoke emissions at all operating speeds, together with lower running speeds.

New contracts in the medium-speed sector

Lately, Wärtsilä has secured several important contracts for its medium-speed range. In November, the company won an order for six 32-series diesel engines with a combined power of 29MW, plus steerable thrusters and various



The first RT-flex50 engine (licence-built in Japan) was recently installed on Rederi AB Donsötank's 19,500dwt ice-strengthened bulk carrier *Credo*, under construction at Shanghai Edward Shipbuilding in China.

ancillary equipment, for a new offshore semi-submersible platform, *ORS Pioneer*, being built by Yantai Raffles, in China, for Offshore Rig Services AS. A consortium consisting of Wärtsilä, Siemens, and Kongsberg Maritime, is the main contractor for the platform's power plant, electrical, propulsion, dynamic positioning and automation systems, worth around €30 million. The total value of Wärtsilä's share of the order is about €15 million.

In October, a contract was signed to deliver six 32-type engines with a combined power of more than 40MW for what is believed to be the world's largest oil drill ship, to be built by Samsung Heavy Industries Co Ltd (illustrated on page 6 of *The Naval Architect*, January 2006). Ordered by Stena Drilling, the Stena Drill MAX design, with twin drilling derricks, is intended for oil and gas exploration in ultra-deep water down to 3000m, such as in the Norwegian and Barents Seas. Hull length is 228m and breadth 42m. Displacement of the vessel, to be delivered at the end of 2007, is 97,000tonnes.

During last year, Wärtsilä consistently marketed its capability to deliver complete propulsion packages. A recent example of a successful order was the contract received by the revived Bijlsma Shipyard BV, in The Netherlands, for the delivery of complete propulsion plants for two 350TEU container feeder vessels ordered by the Dutch VeKa Group. Giving the shipyard the benefit of

reducing the number of suppliers, Wärtsilä will deliver for each vessel a 8R32LN main engine, reduction gearbox, a 3.20m-diameter Lips CP propeller, and a Lips transverse tunnel thruster. The VeKa Group is involved in shipbuilding and brokerage for inland navigation and short-sea shipping. The Bijlsma shipyard, also a member of the VeKa Group, is an established customer for Wärtsilä, having only in 2005 already ordered 15 engines of the 20 and 26 types for its general cargo vessel newbuildings.

Wärtsilä was also recently awarded a contract to supply a propulsion plant of 11.5MW for each of two heavy-lift transport vessels to be converted for Fairmount Heavy Transport NV, Rotterdam. Originally semisubmersible barges, they are being converted to self-propelled heavy-lift transport vessels. For each, the delivery includes three Wärtsilä diesel-generating sets, two Lips steerable thrusters, and a Lips bow thruster.

Low-speed engines for new bulk carriers

Wärtsilä was recently awarded contracts to supply the new RT-flex50 common-rail low-speed engines, propellers, and Auxpac generating sets to Goodearth Maritime Ltd, India, for six Diamond 53-design 53,000dwt Handymax bulk carriers, to be built in India at Hindustan Shipyard in Visakhapatnam. Each ship will be fitted with a six-cylinder RT-flex50

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engine with a maximum continuous power of 9720kW at 124rev/min, together with a Wärtsilä FP propeller and three 645kWe Auxpac generating sets.

These are the first Diamond 53 ships to be equipped with RT-flex50 common-rail engines, which are the latest addition to Wärtsilä's series of electronically-controlled common-rail RT-flex engines for ship propulsion. The RT-flex50 engine has a power range from 5800kW to 13,280kW.

The first two RT-flex50 engines successfully completed their official shop tests last summer. In November, the first RTflex-50 engine was delivered to China. Built under licence in Japan, it was installed on Rederi AB Donsötank's 19,500dwt geared bulk carrier *Credo* recently completed by Shanghai Edward Shipbuilding. The six-cylinder model has a MCR output of 9720kW at 124rev/min, and it directly drives a 5.5m diameter Lips CP propeller.

This ship also has a 2000kW shaft-driven alternator, but - unusually - no frequency cyclo-converter; for this reason, the alternator will only be used when constant shaft revolutions are available. This interesting vessel, intended for Baltic operation, is strengthened to ice class 1A Super.

Advances in China

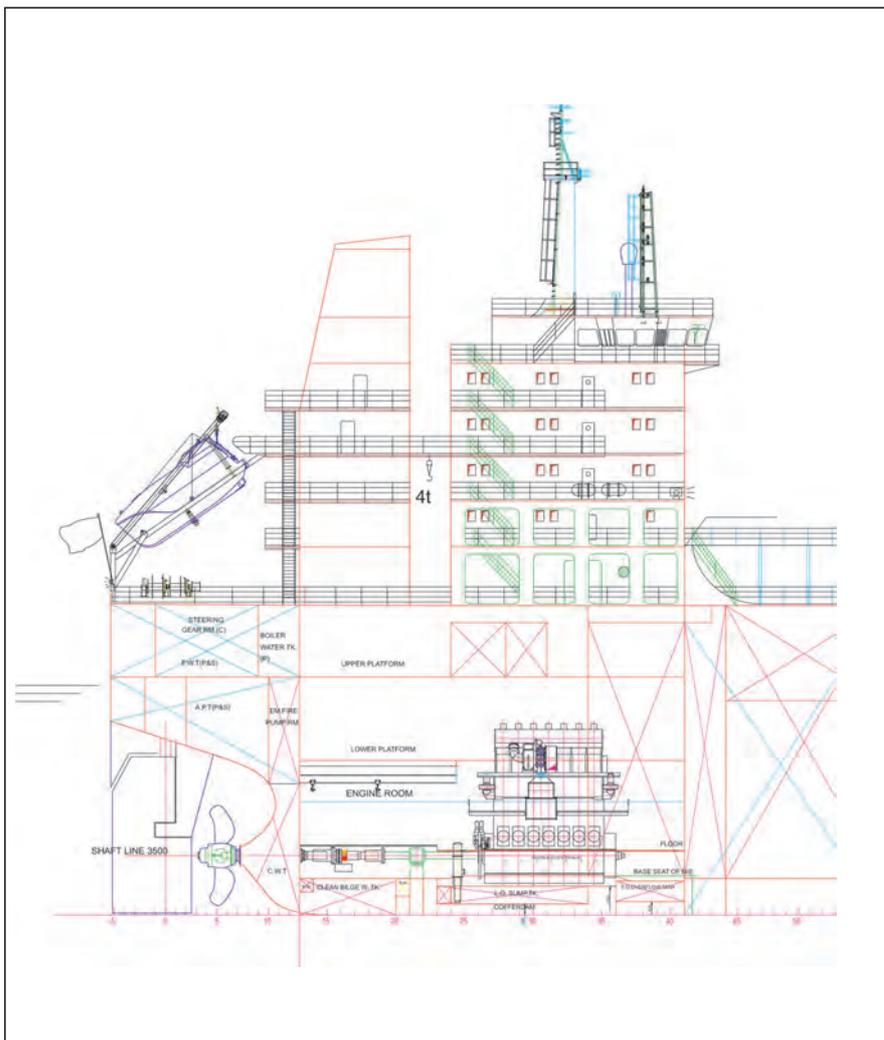
The first Chinese-built RT-flex50 engines, seven-cylinder models from Dalian Marine Diesel Works, are intended for two ice class 1A Super 52,000dwt product tankers ordered by Rederi AB Gotland from Guangzhou Shipyard International. Also for these two vessels, four Wärtsilä 20 Auxpac diesel alternators, Lips CP propellers, and bow thrusters will be delivered from Wärtsilä's newly opened thruster production plant in Wuxi.

Only recently, Wärtsilä opened a joint venture propeller manufacturing plant in China, at Zhenjiang, and is currently finalising a plant in Shanghai for building auxiliary generating sets in a joint venture with Shanghai Marine Diesel Engine Research Institute. In addition, Wärtsilä is setting up a factory for producing reduction gears in India.

Meanwhile, Wärtsilä continues supplying its new 46F large-bore medium-speed engines. Among among recent orders were a pair of engines for a 1700TEU open-top container feeder vessel for Dutch Wagenborg Shipping, to be built at IHC Holland (Kinderdijk shipyard) in The Netherlands. The 46F engine, launched in autumn 2004, comes in six-, seven-, eight- and nine-cylinder in-line configurations, and covers a power range of 7500kW to 11,250kW at 600rev/min. It has an output of 1250kW/cylinder; thus fewer cylinders are needed for a given output, resulting in a more compact design and reduced maintenance. The Wärtsilä 46F has common-rail fuel injection as standard.

Auxpac success

Last year, Wärtsilä was also successful in winning orders for its new Auxpac generating sets, introduced in 2004. These are factory-assembled, pre-commissioned standard sets of modular design, launched to overcome various problems that sometimes arise with third-party



Two 52,000dwt ice-class (1A Super) tankers for Rederi AB Gotland are being built at Guangzhou Shipyard International. These will be powered by the first Chinese-built RT-flex50 engines - seven-cylinder models from Dalian Marine Diesel Works. They will drive CP propellers.

packagers. Typical applications include general cargo and container vessels, tankers, and VLCCs.

Auxpac generating sets are supplied in medium-speed and high-speed configurations with outputs ranging from 60kW to 2850kWe for either 50Hz or 60Hz operation. The first two generating sets were delivered in April 2005, and at the time of writing, more than 200 sets were on order, 70 of which are destined for China. Wärtsilä supports the project management and installation of these sets, and provides all necessary documentation, which is said to be easy to use. Service and spare parts can also be supplied.

Dual-fuel engine update

Production of dual-fuel marine engines continues. Currently, Wärtsilä is supplying a total of 13 LNG carrier newbuildings with dual-fuel type engines. Last year, Wärtsilä received a major order for 24 50DF dual-fuel engines from Samsung Heavy Industries, to power a series of six 155,000m³ dual-fuel-electric LNG carriers - four for AP Möller and

two for K-Line, of Japan. Each ship will be equipped with one six-cylinder and three 12-cylinder engines, delivering a total power of 39.9MW.

Delivery of the first of this series is scheduled to begin early in 2008. Fifty-two Wärtsilä 50DF dual-fuel engines have so far been ordered for application in 13 dual-fuel-electric LNG carriers. In addition to Samsung, dual-fuel LNG carrier engines have been ordered by Alstom Marine (Chantiers de l'Atlantique) and Hyundai Heavy Industries.

According to Wärtsilä, dual-fuel-electric machinery concept for LNG carriers offers a very significant improvement compared with traditional steam turbines in terms of operating economy, exhaust gas emissions, and redundancy. At the same time, it maintains aspects such as safety, reliability, and maintainability at an appropriate level. Crewing of dual-fuel-electric LNG carriers should not be problematic either. Wärtsilä dual-fuel engines have also been selected for FPSOs, dual-fuel-electric offshore supply vessels, as well as onshore power plants.

Aker Arctic Technology - new ice laboratory for cold-climate projects

AKER Arctic Technology Inc (AARC), established a year ago by Aker, together with minority shareholders Wärtsilä, ABB Oy, and Norwegian Aker Kvaerner Engineering & Technology, has built a new model testing facility in the revitalised Vuosaari port area in Helsinki. This is specially designed to perfect ice-going ships and offshore structures, and to model offshore operations in cold regions. AARC continues the work of Masa Arctic Technology Centre (MARC) in offering services related to developing ships and structures for operation in ice, together with marine engineering, design, and consulting work, as well as model and full-scale testing in ice.

Today, as a separate independent company, AARC is offering its services globally on completely commercial terms. In addition to design and testing services, AARC is also developing its own portfolio of various conceptual ship designs for yards, shipowners, and offshore operators running ships and structures in cold waters. During 2006, net sales of the company are estimated to be at around €4 million.

According to Mikko Niini, president of the company, the market is very active today. 'Most of our current work is related to ships for Arctic offshore operations, primarily in Russian Arctic areas, on tanker designs for transporting oil from those areas', he says. 'Last year, we increased our team of professional naval architects from some 15 to 25, mainly from the (now closed) project design department of Aker Finnyards' Helsinki yard. This enables us to offer design and construction services for much larger projects than previously to external shipyards, shipowners, and operators'.

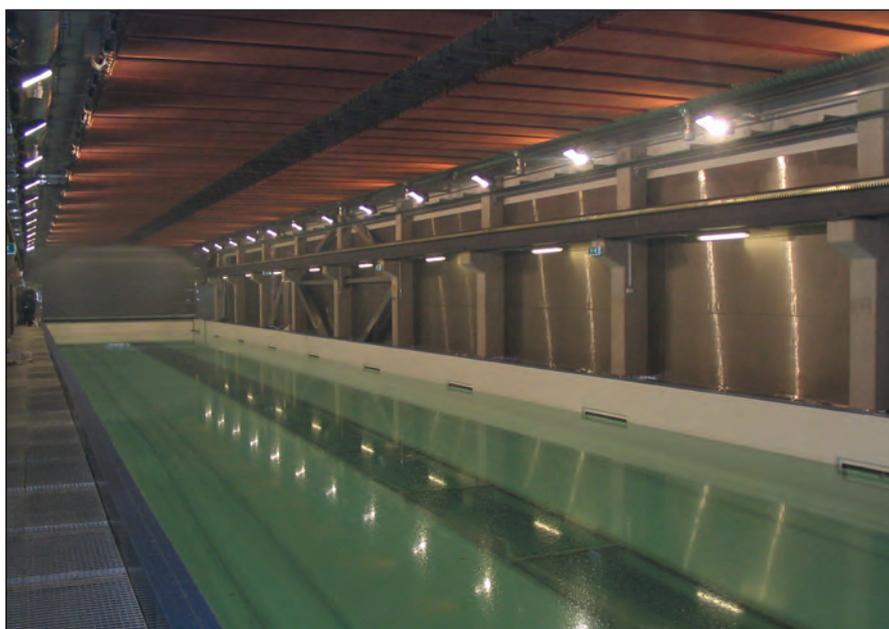
The new model basin is now undergoing final calibration tests, after which it will be fully commissioned. AARC's work is based on five decades of knowledge and experience accumulated from designing and constructing ships for ice navigation. It is believed that there is no other facility in the world with such a large full-scale test correlation database - the one most important asset for correctly predicting real physics from model testing. The previous ice model basin started operations in 1983, continuing the work of the first such facility dating from 1969. AARC's track record includes some 200 full-scale field tests and expeditions, 300 model test series, and 160 published papers at conferences and in journals.

More width for model basin

Capital investment in the new model testing facility and offices is nearly €10 million. The size new basin is 70m length (old: 77.3m), 8m width (6.5m) and 2.2m depth (2.3m). A decision to increase the width of the new basin was made so as to allow better possibilities for modelling offshore structures and operations. Typical of such tests are docking trials of ships against or close to icebound platforms, or those for oil or gas loading structures, to test the



The new ice model laboratory of Aker Arctic Technology, at Vuosaari. The model basin (below) is wider than the previous one, to allow better possibilities for modelling offshore operations.



design of the ship or caisson, or both. Along the entire length of the basin floor there is a glass window, to allow unobstructed visual data gathering.

As at the MARC site, AARC's new test tank uses two carriages - one testing carriage, to which the ship model is attached, and one working carriage, which is used for measuring ice properties and for test preparation work as well as for ice handling. This carriage is also used for spraying to produce the fine-grain model ice, developed and refined for more than 30 years by AARC and its predecessors, to scale down the various different ice properties found in different real conditions in Arctic, Antarctic, and Sub-Arctic areas, or in rivers and on lakes.

The carriages of the new laboratory run on rails attached at roof-height along the basin - a change from the old laboratory where the rails were in the traditional position: underneath the carriages, on the sidewalls of the tank. Another difference, compared with the earlier facility, is that the new laboratory uses environmentally sound CO₂ as its cooling media. Heat from the

cooling machinery is stored very efficiently in special transformers; this heat can be used for melting ice after a day of tests without need for external power. This saves an impressive 50% in power consumption.

'We can see future design work for AARC also involving Arctic LNG transportation, as well as with new activities in Russia's Yamal area, and in offshore developments around Sakhalin Island (Russian Far East), as well as involvement in many new activities in the Caspian Sea', believes Mr Niini. 'In all these cases, we have great opportunities to utilize the improved characteristics of the new model testing facility, which is additionally perfectly suited for shallow-water ice testing'.

As the first examples of AARC's expanded new strategy, Mikko Niini mentions the recent design agreements for Russian Arctic tankers at Admiralty Shipyards (to export oil from the Prirazlomnoye field), and for Samsung Heavy Industries (for tankers to operate from the Varandei terminal in the Pechora Sea). These projects are described in more detail in separate articles.

Tallink's *Galaxy* set for May delivery

IN October 2004, Aker Finnyards signed a contract to build a third large cruise-ferry for the Estonian Tallink Group, to be delivered in spring 2006. This is the biggest ship so far ordered by this ambitious owner, with a contract price of €165 million. The yard in Rauma has already completed two ferries for Tallink, *Romantika* (2002) and *Victoria* (2004). *Romantika* was presented in *Significant Ships of 2002*.

The newest ship, expected to be delivered in May, is intended for the Helsinki-to-Tallinn route, from where *Romantika* will be transferred to the Stockholm service when the new completion arrives. Following the order for *Galaxy*, Tallink has placed more newbuilding contracts with Aker Finnyards: for a fast passenger day ferry (last summer) for the same route, and, in December, for a sister to *Galaxy*. In mid-2005, Tallink also placed an additional order for a 36,000gt passenger/vehicle ferry from Fincantieri, in Italy. All orders include option agreements.

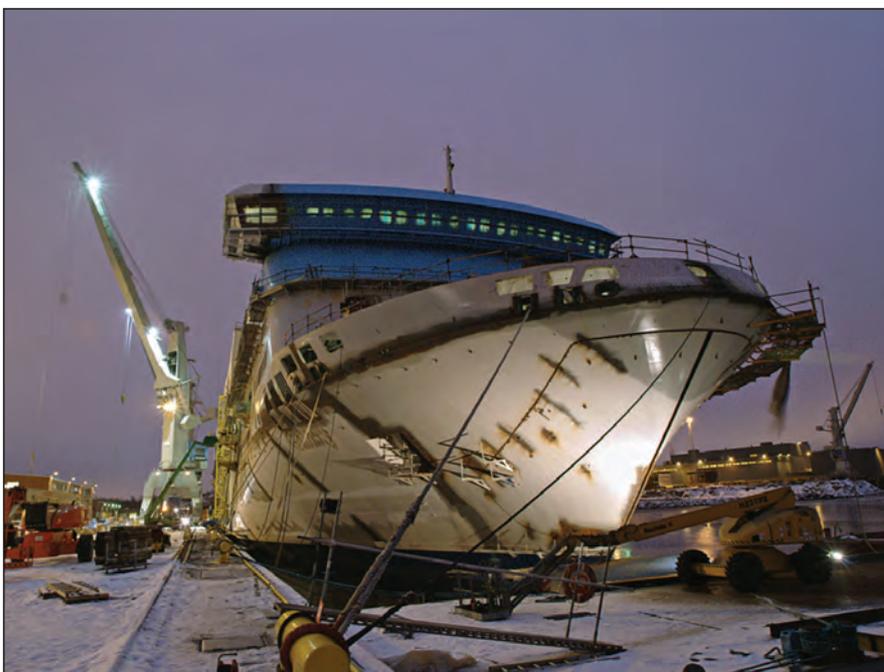
Last November, Tallink was listed on the Tallinn Stock Exchange for the first time, with the mean share price giving the company a market value of approximately €720 million. Some €125million-€155 million was raised through the public offering, and the operator's own capital was raised from €170 million to some €310 million. Net sales in the period ending August 31, 2005 were €260 million and net profit €30.2 million.

The guiding principle for *Galaxy*, as claimed by the owner, has been paying attention to passenger comfort and luxury, with maximum use of high-tech solutions onboard. *Galaxy* has a length of 212.10m, a breadth of 29m, and a gross tonnage of 48,300gt. The total number of passengers is 2800; 300 more than on the previous near-sisters.

Passenger accommodation is provided in 927 prefabricated cabins, delivered by Piikkiö Works. The number of crew cabins has been increased to 130 from 80; these include 14 cabins for officers. There are several restaurants and lounges offering various entertainment, together with a large conference centre with



An artist's impression of *Galaxy*, the third large new cruise-ferry to be built by Aker Finnyards for the Estonian operator Tallink. Further vessels are to follow. Ice strengthening is to 1A Super standards.



The 48,300gt *Galaxy*, seen here recently at Rauma during outfitting, is the next newbuilding for the Estonian Tallink Group, which is rapidly building up a fleet of ultra-modern ferries for its routes to Helsinki and Stockholm.

GALAXY AND ROMANTIKA: A COMPARISON

	<i>Galaxy</i>	<i>Romantika</i>
Length.....	212.10m	192.90m
Breadth, moulded.....	29.00m	29.00m
Gross.....	48,300gt	40,000gt
Deadweight.....	4850dwt	4500dwt
Passenger capacity.....	2800	2500
Number of passenger cabins.....	927	727 (740 on <i>Victoria</i>)
Number of crew cabins.....	130	80
Interior area.....	28,000m ²	22,000m ²
Area of public spaces.....	10,300m ²	8100m ²
Lanes for cars and freight units.....	1130lane metres	1050lane metres
Private cars, max.....	420	300
Propulsion machinery.....	4 diesel engines	4 diesel engines
Total machinery power.....	26,240kW	26,240kW

GALAXY, ADDITIONAL DATA

Length bp.....	194.40m
Depth to main deck.....	9.70m
Draught.....	6.30m
Speed, service.....	22knots
Classification.....	Bureau Veritas
Main engines.....	4 x Wärtsilä 16V32
Output.....	4 x 6560kW
Auxiliary engines.....	3 x Wärtsilä 6L32
Shaft alternators.....	2 x 2700kVA
Propellers.....	2 x Kamewa CP
Tunnel thrusters.....	2 x Kamewa,
Output.....	2 x1800kW
Rudders.....	2 x Becker flap rudders
Boilers.....	Aalborg
Fin stabilisers.....	B+V Industrietechnik
Air conditioning.....	Koja Marine
Air conditioning compressors.....	Carrier

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more than 450 seats. Air conditioning throughout has been supplied by Kojima Marine, the Finnish company that additionally has contracts to install equipment on *Galaxy's* sister and on the new Tallink fast ferry that will be built at Aker Finnyards' Helsinki complex.

Compared with the previous ship, public spaces have been re-arranged. The conference area has been moved from deck 9 aft to the forward end of deck 5. The discotheque is now placed aft on deck 10 (moved from deck 7). Passenger saunas with a swimming pool are on deck 2 amidships, and the numbers and types of restaurants have been changed.

Galaxy has nine lifts, all supplied by MacGregor, which also supplied six lifts each to *Victoria* and *Romantika*. There are five passenger lifts, each for 16 people or a load of 1200kg, together with one 1200kg service lift,

TURNKEY-DELIVERY SUPPLIERS GALAXY	
Cabin areas.....	Piikkiö Works
Public spaces.....	Merima, NIT
Galleys.....	Loipart/Electrolux
Lifeboats	Fassmer
Marine escape systems and liferafts	Viking
Lifts.....	MacGregor
Mooring equipment.....	Rolls-Royce
Cargo access equipment	TTS

and two 1500kg or 20-person capacity service lifts. All use Kone's compact MiniSpace technology and have a service speed of 1.0m/sec. The MacGregor Group was acquired by Kone

Corp in December 2004 and Kone Group's marine elevator business is today handled by Kone Marine, whereas MacGregor is now part of the separately listed company Cargotec.

The new cruise-ferry has 1130lane metres on one level for both private cars and lorries. As on the earlier vessels, propulsion is provided by four Wärtsilä 16V32 diesel engines totalling 26,240kW. These are connected in pairs to two shafts driving Kamewa CP propellers. Auxiliary power is provided by three Wärtsilä 6L32 diesel engines driving 2960kVA Leroy Somer alternators as well as by two Leroy Somer gear-driven alternators (2 x 2700kVA). The service speed will again be 22knots. Catalytic exhaust-gas units, supplied by Wärtsilä and manufactured by H+H Umwelt und Industrie Technik GmbH, are installed for reducing NOx emissions. ⚓

Hi-Fog MT4 - Marioff's newest concept for machinery-space fire protection

A RECENT major SOLAS improvement in fire safety was the requirement to have fixed water-based local fire extinguishing, in category A machinery spaces larger than 500m³ in volume, on all existing passenger ships of 2000gt or more. Since July 2002, a similar requirement has already been in force on new passenger ships with a gross tonnage exceeding 500gt, and on cargo vessels exceeding 2000gt; this complements the mandatory CO₂ or other type of total flooding system.

Statistically, most fires start in the engine room. Compared with CO₂ bottles, water-based firefighting systems can be released immediately, without having to evacuate a space, thus saving valuable time in the case of local fires. These new

regulations, requiring mandatory sprinkler systems, have kept Marioff busy over recent years. Some 200 Hi-Fog watermist retrofit installations have been made for cruise ships and ferries since the year 2000.

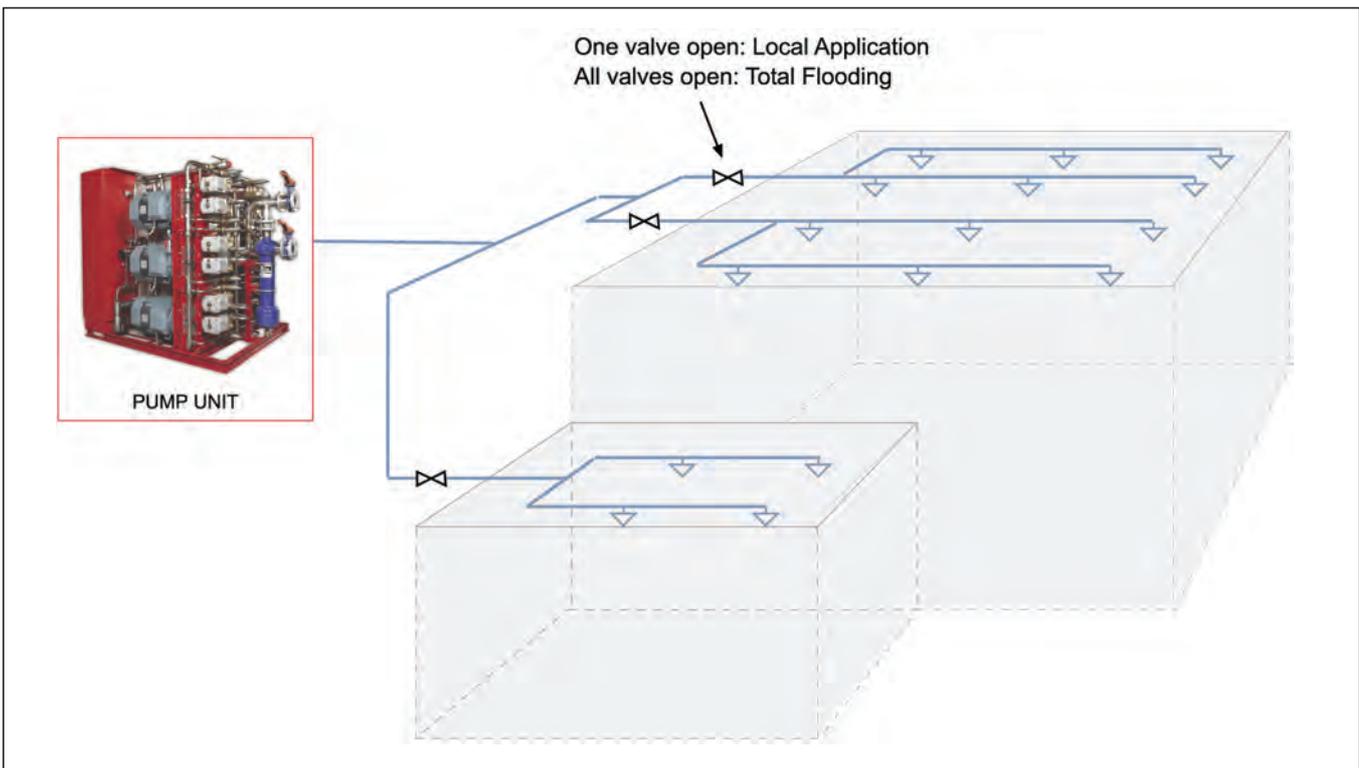
The principal benefits of using water only to extinguish fires in engine rooms have led Marioff to develop its own version of a total fire protection layout, which the company calls Hi-Fog MT4. This system has successfully passed the latest IMO fire test requirements, as defined in MSC/Circ. 1165, adopted in May 2005. Classification society type-approvals have already been issued by the major classification societies.

With Hi-Fog MT4, water-based total flooding fire protection is now available for vessels with

machinery spaces of approximately 4000m³ size, with a ceiling height up to 11m. The concept uses using a pump unit only - no pressure cylinders are required for redundancy or other purposes.

The system has been designed to provide both total flooding and local application, using the same pump unit, tubing, and spray heads. One particular additional benefit with water-based systems is that they can be tested regularly, to ensure proper working condition and to demonstrate operation to a crew. In addition to the passenger ship market, Marioff aims to penetrate the cargo ship sector with this new product. The first contracts have already been signed. ⚓

A simplified diagram, showing the components of Marioff's Hi-Fog MT4 total fire protection system.



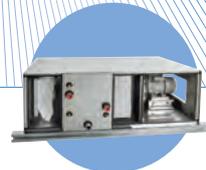
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Aker Arctic working with two new types of ice-class tanker

LAST August, Aker Arctic Technology announced that it had won a significant order from St Petersburg-based Admiralty Shipyards for the design and classification of two 70,000dwt Arctic shuttle tankers, to be built according to the Aker/ABB double-acting tanker (DAT) concept, whereby a ship sails stern-first into heavy ice, with its azimuthing drives turned through 180deg. The contract for these ships (reported in *The Naval Architect* September 2005, page 6), which are planned for the Prirazlomnoye oil field off Russia's northern coast, was originally placed by ZAO Sevmorneftegaz. This company holds the licence to exploit the field, which is located 60km offshore in the Barents Sea. Today, Gazprom owns Sevmorneftegaz.

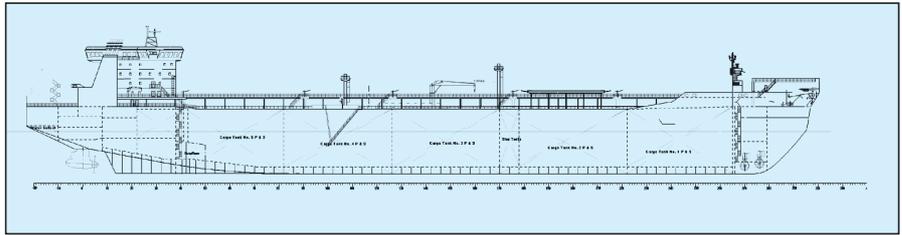
These tankers, the largest so far to be constructed by Admiralty Shipyards, follow the somewhat larger double-acting Aframax pair built by Sumitomo for Fortum (*Mastera*, presented in *Significant Ships of 2003*). They are being specifically designed to operate independently between the offshore oil production platform and a transshipment terminal in the Murmansk area. They will carry the Russian flag and will be classed with the Russian Maritime Register of Shipping, including ice class JIU6. Although these are the largest tankers at Admiralty, this yard has a bank of experience from building six smaller Arctic tankers of the *Astrakhan* type (*Significant Ships of 2000*).

The tankers are to have an overall length of 263m, a length between perpendiculars of 236m, a breadth of 34m, a depth of 21m, and a draught of 13.6m. The diesel-electric power plant will consist of four main diesel generators providing a total power of 25MW, supplying current to twin azimuthing pods (possibly ABB Azipods, although at the time of writing, a contract has not yet been concluded).

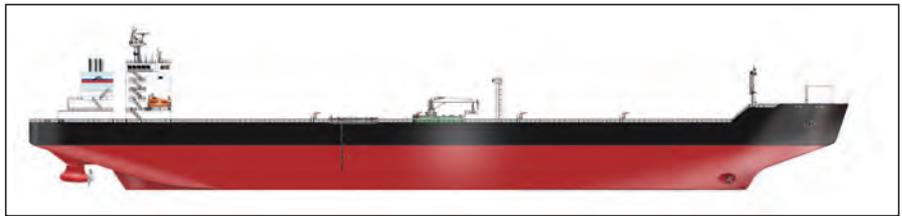
Each ship will be fitted with a dynamic positioning system, a helicopter deck, and a bow loading facility designed specifically for the demanding Arctic conditions of the area. Original delivery dates were to be 2007 and 2008, but these are now understood to have been put back to match completion of the Prirazlomnoye production platform. An order for transporting oil from Prirazlomnoye was granted in October to Russia's biggest shipping company, JSC Sovcomflot. The planned production capacity at Prirazlomnoye is 6.5 million tonnes annually (133,000 barrels daily).

More Arctic tankers from Samsung

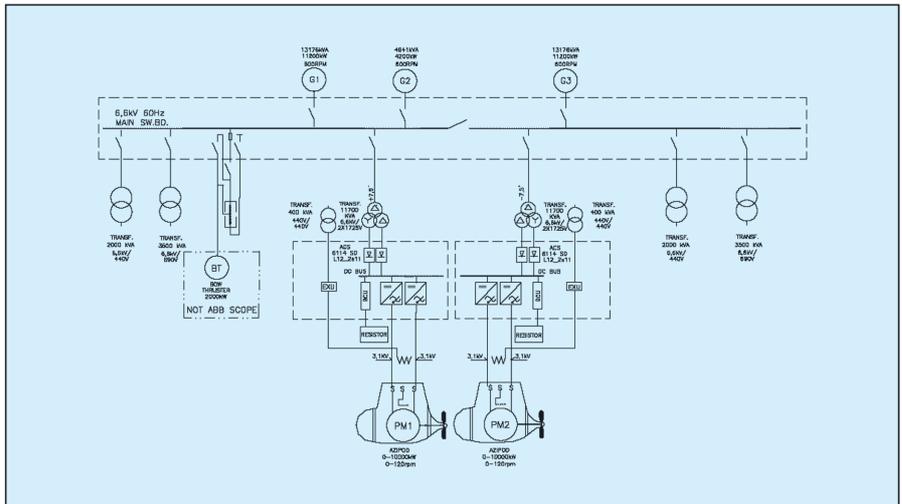
In November last year, more welcome work was secured by Aker Arctic Technology in association with Sovcomflot's order at Samsung Heavy Industries for the construction of three further ice-class Arctic shuttle tankers, also of 70,000dwt. These tankers, worth together US\$430 million, are intended for a practically independent shuttle operation between the Varandei terminal in the Pechora Sea and Murmansk, for export of crude oil from onshore oil fields jointly owned by Lukoil and ConocoPhillips. In November, Sovcomflot secured the transportation contract



An updated profile of the new Gazprom tankers to be built by Admiralty Shipyards.



A profile of the 70,000dwt tankers ordered by Sovcomflot at Samsung and intended for exporting crude oil from the Varandei terminal. This illustration shows the sharply cutaway bow - these ships will not be double-acting. Aker Arctic Technology will assist Samsung with the design.



Electrical system diagram for the Sovcomflot diesel-electric tankers, which will feature twin 10MW Azipod drives.

for this oil. Intended peak production from the joint-venture fields is 200,000 barrels/day, approximately 10 million tonnes annually.

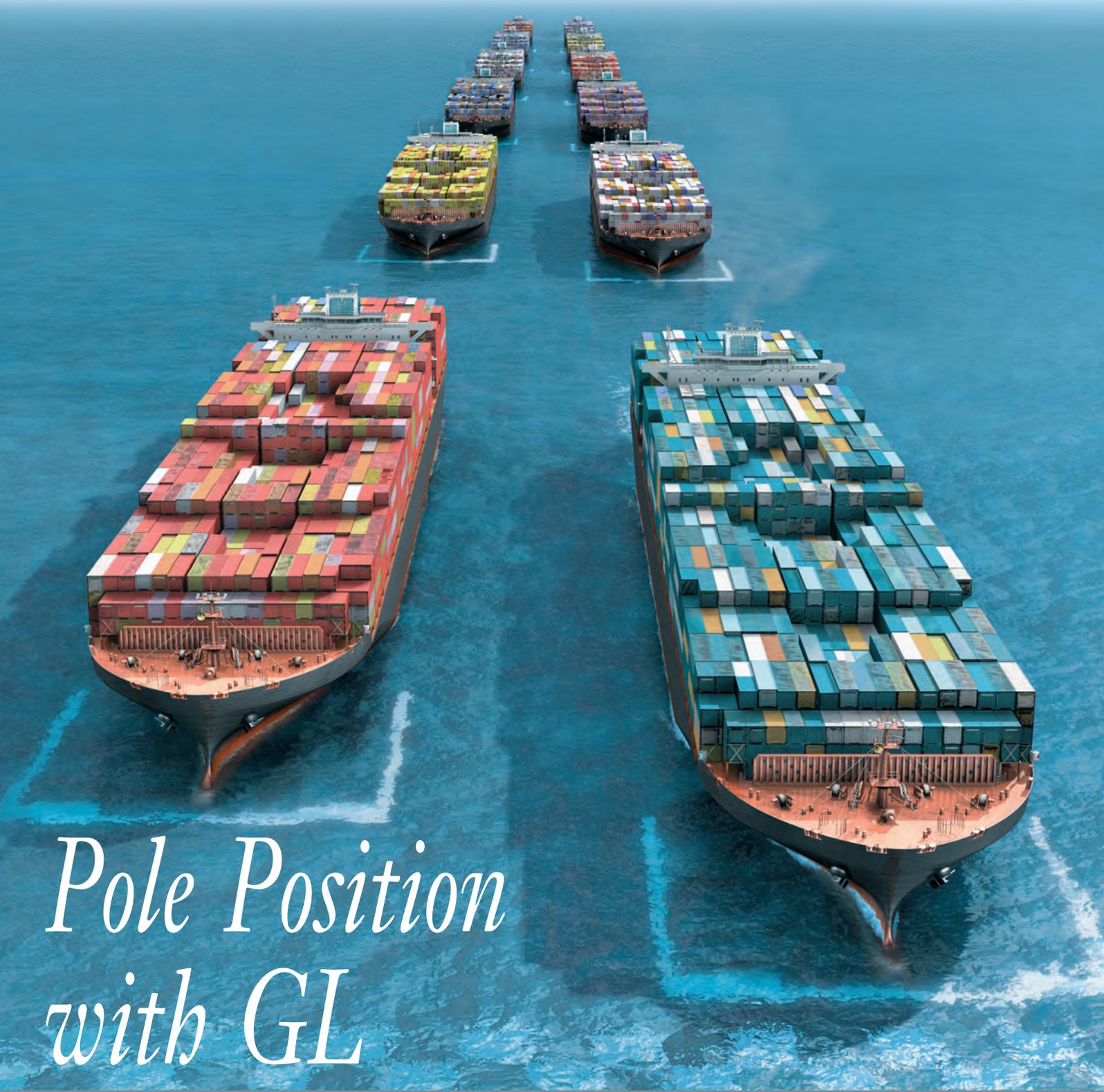
Although of the same size as the Gazprom ships at Admiralty Shipyards, these vessels will not be double-acting; instead, they will have an icebreaking bow and a hull form which will allow them to deal with ice up to 1.5m thick both ahead and astern. They are based on a conceptual design developed by Aker Arctic Technology, and Samsung will work under a cooperation and licence agreement with Aker Arctic, according to which the Finnish company supports the Korean yard in designing and constructing the vessels. The three tankers are due to be delivered at the end of 2007, spring 2008, and spring 2009. Plans are in hand to order a possible fourth vessel later.

The ships will be built to ABS class, except the hull, which will comply with Russian Maritime Register of Shipping ice class JIU6 standards.

They will carry the Russian flag, and each will be equipped with twin 10MW ABB Azipod drives supplied by diesel-alternator sets having a total power of 24MW.

Dynamic positioning systems will be installed, together with a helipad and an Arctic bow loading system. The overall length will be 256m, the moulded breadth will be 34m, and the draught 14m. A new loading platform for the Varandei terminal is currently being built in Kaliningrad by Lukoil; this is to be placed 20km off the coast and linked to shore by a 0.82m diameter pipeline.

In addition to the two 10MW Azipod propulsion units, ABB deliveries for each ship will include three main alternators (two x 11,000kW and one x 4200kW), a main switchboard, two propulsion transformers, two high-voltage distribution transformers for the propulsion drives, also propulsion and remote control systems. Ⓢ



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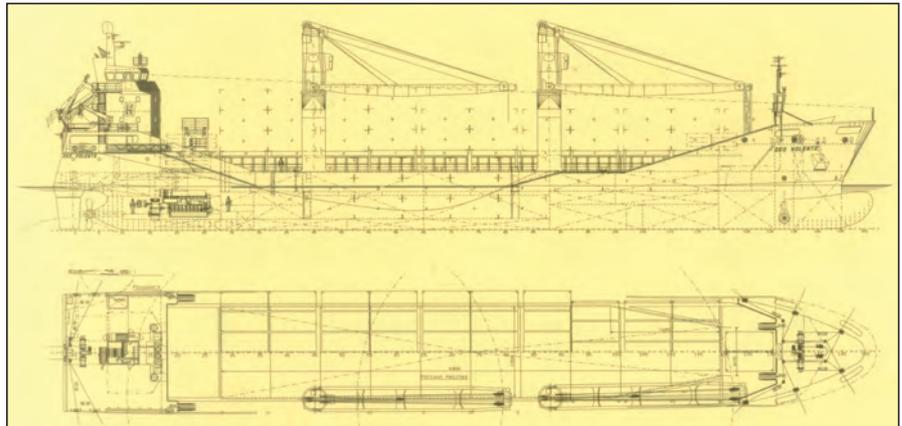
Deo Volente: new type of fast heavy-lift cargo ship

WHAT is claimed will be the fastest coaster with heavy-lift capacity and below 3000gt is currently being built, and is expected to be delivered at the end of this year. Designed by Conoship, of The Netherlands, *Deo Volente* will be owned by Hartman Seatrade, which specialises in transporting project cargoes and heavy-lift consignments. Hartman already operates an older ship with the same name. Model tests were carried out at MARIN's facilities, in Wageningen.

The ship will have a speed of 18knots, with a deadweight of approximately 3500dwt. Length overall will be 105.10m, the beam 15.60m, and the depth 7.40m. The main engine will produce 3500kW, a bow thruster 400kW, and a shaft generator 650kW.

The vessel will also be installed with two cranes of 120m each, which can lift 240tonnes in tandem. The obstruction-free cargo hold, with dimensions of 61.60m x 11.50m x 8.17m, give flexibility to load long items of project cargo. The hold has a capacity of 153,943m³ and the tanktop load will be 15tonnes/m².

This vessel is thought to be quite unique, compared with a ship of the same tonnage and volume, engaged in a similar role. The total fuel



Profile and upper deck plan of the 3500dwt *Deo Volente*, which is currently under construction.

consumption/mile will be less, due to a high speed in combination with a relatively low power input. A speed of 18knots is expected to be reached with less than 3000kW. ⚓

An artist's impression of the new 105.10m fast coaster vessel, *Deo Volente*, designed by Conoship.



TECHNICAL PARTICULARS

DEO VOLENTE

Length, oa.....	105.10m
Length, bp.....	98.20m
Breadth, moulded.....	15.60m
Depth.....	7.40m
Draught.....	5.81m
Deadweight (approx).....	3500dwt
Speed.....	18knots
Main engine.....	3500kW
Bow thruster.....	400kW
Shaft generator.....	650kW
Capacities	
Heavy fuel.....	402m ³
Gas oil.....	74m ³
Ballast water.....	2530m ³
Potable water.....	50m ³

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New tankers to be coated with advanced polymer material

Leading Danish operator Maersk (of the AP Møller group) will soon have a fleet of up to nine tankers protected with the patented MarineLine coating system from Advanced Polymer Coatings, Ltd, from Ohio, USA. Last month the Jiangnan Shipyard, in Shanghai, China, began coating a series of newbuildings; initially, the contract calls for MarineLine coatings on six 16,400dwt ships (hull numbers 2337 to 2342) - 14 cargo tanks and two slops spaces. Five of these new ships are already in various stages of construction.

In addition, there is an option in the contract for APC to coat an additional three ships at the same shipyard for the same owner. This project follows MarineLine coatings work already in progress at Jiangnan Shipyard. APC recently completed coating 14 tanks on its first assignment for Rederiet Stenersen, of Norway, on the 16,400dwt *Sten Baltic*. A second ship, *Sten Nordic*, was also finished in November 2005 with a MarineLine coating on 14 tanks. In total, Rederiet Stenersen will be coating four ships, with an option on a fifth ship.

The commercial team at Maersk conducted a cost-benefit analysis using APC's computerised analysis tool (which can be viewed at www.adv-polymer.com), and the team found the costs associated with the coating and application were quickly recouped. The coating also gave the ships the ability to carry a wide range of product and chemical cargoes including benzene, MTBE, palm and vegetable oils, phenol, acrylo-nitrile, methanol, and ethylene dichloride.

Contact: *Advanced Polymer Coatings, Ltd, Avon, Ohio, 44011, USA.*
Tel: +1 440 937 6218.
Fax: +1 440 937 5046.
www.adv-polymer.com

Hole-cutter and seal system simplifies stainless steel fabrication

The new Evergreen hand-held hole cutting system will overcome difficulties in drilling and



glanding stainless steel. The system is now available for the first time in the UK from Ardent, under a new distributor appointment.

This lightweight tool has been specifically designed for stainless steel, with an advanced cutter design and dual-speed gearbox. The hole seals and patches make the closing-off of unwanted holes easier, and eliminate the need for site welding.

The US-made Evergreen tool can cut through thicknesses of up to 5mm, as well as other sheet metals such as carbon steels, copper, aluminium, brass, and many plastics. By improving cutting efficiency and tool life, the hole-cutter reduces cost-per-hole costs. It is supplied complete with pilot drills and washers, extension, tools, and the other parts needed.

Two hole seal types are Quick-Seal, with internal pipe threads and producing weld-tight seals withstanding 5000lb/in² internal pressure, and the even faster Compression Seal, which gives a liquid-tight weld quality seal by tightening its nut around a pipe, tubing or EMT conduit slid through it. The Quick Patch seals off existing unwanted holes.

Contact: *Ardent UK Ltd, Unit 3, Becklands Close, Bar Lane, Rowcliffe, North Yorkshire YO51 9LS, UK.*
Tel: +44 870 162 5400.
Fax: +44 870 162 5410.
E-mail: info@ardent-uk.com
www.ardent-uk.com

New catalogue for decision makers

At the end of last year the 2006 HME catalogue was published. The book includes 170 Holland Marine Equipment member profiles, making it a valuable reference book for decision makers in shipyards, also for ship managers, operators and owners, main suppliers, and trading companies.

The company profiles contain all basic information about products and services, key activities of the company, contact persons, and agents. A separate products register, and a brands overview make the catalogue easily accessible. Furthermore the catalogue contains an annual report of HME, and information on developments in Dutch maritime supply companies.

The HME catalogue 2006 will be distributed worldwide by direct mail, through Dutch embassies, and by participation at exhibitions. There is no charge.

Contact: *Linda te Veldhuis, Holland Marine Equipment, PO Box 24074, 3007 DB Rotterdam, The Netherlands.*
Tel: +31 10 44 44 333.
Fax: +31 10 21 30 700.
E-mail: lv@hme.nl

New name for control system company

In January 2004, Stork-Kwant was taken over through a management buy-out by two managers, H de Keyzer and B Andreassen. As a result, Stork NV agreed to change the name of the company at

a later stage. The company is now called Kwant Controls BV, which was effective from November 2005.

Business remains as usual, and Kwant Controls will continue to focus its attention on supplying customers with control and ships' telegraph systems, and is still involved in development of new techniques, in cooperation with customers.

Kwant Controls' instrumentation range makes it possible to produce matching panels with man-machine interface for optimum control. All the company's instruments and systems meet ISO 9001:2000 quality standards, are MED Module D certified, and the vast majority has been type-approved by leading classification societies.

Contact: *Kwant Controls BV, PO Box 23, 8600 AA Sneek, The Netherlands.*
Tel: +31 515 413 745.
Fax: +31 515 22 478.
E-mail: kwant@kwantcontrols.nl
www.kwantcontrols.com

New sealing plug for fire safety

A new type of sealing plug, from Beele Engineering, The Netherlands, has recently been launched, with the name Slipsil. This is designed to provide fire-safe and gas- and water-tight seals or transits carrying single or multi-plastic metallic pipes.

For the purpose of manufacturing Slipsil, Beele Engineering has developed a new design together with a rubber grade to provide the compound used in making the plug. This plug has been redesigned so it is now said to be easy to install, and even very narrow tolerances do not affect the plug's installation. Slipsil can also be exposed to high pressures immediately after installation. The new plug shape enables a broad sealing range to be covered with a single plug type; this reduces the number of plug variants that are required on site.

Slipsil plugs can be used in a wide variety of temperature ranges, even as low as -50°C or as high as +180°C, enabling them to be used in steam applications.

Nofirmo is the rubber grade used to manufacture Slipsil. This compound cannot be consumed by fire, it is claimed, does not shrink, and when

continued

The new Slipsil sealing plug from Beele Engineering ensures can operate in temperature ranges from -50°C to +180°C.



The Ardent hole cutter and seal system.

exposed to flames it forms a protective layer with the char underneath. This means the rubber grade is traceable at all times.

Nofirno is resistant to adverse weather conditions, and is UV and ozone-proof. Under normal conditions, it will remain unaltered for a period of at least 20 years. It is also halogen-free and does not harden.

Contact: *Beele Engineering, Beunkdijk 11, 7122 NZ Aalten, The Netherlands.*
 Tel: +31 543 461 629.
 Fax: +31 543 461 786.
 E-mail: info@beele.com
www.beele.com

Low-speed diesel engines licensed

UE low-speed diesel engine technology from Mitsubishi Heavy Industries (MHI) has been licensed to Vietnam Shipbuilding Industry Corp (VINASHIN). With this move, MHI hopes to promote penetration of its UE engines into the emerging Vietnamese shipbuilding industry.

Under the agreement, MHI will provide VINASHIN with the licensing rights to manufacture its larger diesel engines. The contract applies specifically to the Mitsubishi UEC-LA, LS, LSII, and LSE range, with cylinder bores ranging from 330mm to 680mm. The licensing agreement also encompasses marketing and servicing of the engines in Vietnam. The licence period runs from 2005-2014.

Contact: *Mitsubishi Heavy Industries, Kobe Engine Works, Kobe, Japan.*
www.mhi.co.jp

Folding hatch cover sets serve Japanese cargo ship quartet

Two 13,400dwt and two 28,900dwt ro-lo cargo vessels, ordered from Shin Kochi Jyuko Co Ltd, in Japan, for the domestic owner NYK-Hinode Line, will be served by MacGregor folding hatch cover sets on the weatherdeck. Furthermore, the 28,900dwt vessels are specified with MacGregor stern ramps.

The four holds of the larger ships are specified with high-stowing covers arranged in panel-pairs forward and aft to offer the following clear openings inside the hatch coaming:

- hatch no 1, 2 + 0 panels, 14.4m x 12.6m clear opening
- hatch no 2, 2 + 2 panels, 23.2m x 18m clear opening
- hatch no 3, 2 + 2 panels, 27.2m x 18m clear opening
- hatch no 4, 2 + 2 panels, 23.2m x 15m clear opening.

Operated hydraulically by external cylinders, the covers are manually secured by quick-acting cleats and designed to be weathertight in the closed position. Container stack load ratings for the 13,400dwt vessels range from 48tonnes/20ft units and 60tonnes/40ft for hatches Nos 1 and 2.

Container stack loads for the 28,900dwt vessels are the same for No 1 hatch, for No 2 hatch 60tonnes/20ft, 75tonnes for 40ft, for No 3 hatch 50tonnes/20ft, 65tonnes/40ft containers,

and for No 4 hatch 72tonnes/20ft and 90tonnes/40ft. Sealing between cover panels and coaming is effected by sliding-type rubber packing on the panel acting directly on a stainless steel mating plate on top of the coaming.

MacGregor will also supply stern ramps for the two 28,900dwt ro-lo vessels, enabling car loading onto the tweendeck from the starboard side. The clear width is 4m, with a length of 25m; maximum load is 10tonnes, and the available wharf height is from -350mm to -4650mm, from the threshold.

Contact: *Hans Berg, sales manager, hatch cover division, MacGregor (FIN) Oy, Hallimestarinkatu 6, FI-20780 Kaarina, Finland.*
 Tel: +358 2 4121 407.
 Fax: +358 2 4121 256.
 E-mail: hans.berg@macgregor-group.com

China classification approval for VDR

The Kelvin Hughes Manta Digital S-VDR voyage data recorder was given type-approval from the China Classification Society at the Marintec China exhibition, held in December, where Kelvin Hughes was displaying the Manta Digital S-VDR, along with the new float-free data storage module. 'China has always been a very important market for us' commented Jonathan Field, head of sales and marketing. 'This new type-approval will enable us to supply systems to all our customers in China'.

Contact: *Kelvin Hughes, New North Road, Hainault, Ilford, Essex IG6 2UR, UK.*
 Tel: +44 20 8502 6887.
 Fax: +44 20 8500 0837.
www.kelvinhughes.com

Navigation equipment for five dry cargo vessels

A contract was recently signed between Transas and Palmali Shipping, Turkey, for navigation equipment sets for five dry cargo ships, which are set to be built at Krasnoye Sormovo Shipyard, in Nizhny Novgorod, Russia, as part of the new RSD17 project. Equipment to be supplied includes GMDSS, ARPA radar, VDR, UAIS, GPS, SSAS, echo-sounder, log, gyrocompass, and ECDIS. The contract is worth around €1 million.

The first vessel has a delivery date of November 2006, while this RSD17 project is expected to be completed in 2007. The 6270dwt dry cargo ships have been designed to transport all types of general cargoes, including standard containers, metal, grain, lumber, coal, and bulky and heavy cargoes.

Contact: *Transas, 10 Eastgate Avenue, Eastgate Business Park, Little Island, Cork, Ireland.*
 Tel: +353 21 4 710 400.
 Fax: +353 21 4 710 410.
 E-mail: information@transas.com

Corrosion protection for Techno Superliner

Japan's newly completed high-speed Techno-Superliner, *Super Liner Ogasawara*, planned to run a long-haul passenger and container service

from Tokyo to the Ogasawara Islands, but not yet in service owing to contractual problems relating to high fuel prices, has the twin tunnels for its Kamewa waterjets protected against corrosion by a Corrintec Alutek system from Cathelco. Since the two waterjet tunnels are very long - 2.3m - the design of the protection system set new challenges for Corrintec. Thus, the ferry is fitted with a twin 20A system with independent power units for each tunnel; this is said to be four times the current requirement of a typical fast ferry arrangement.

Extra features of the Alutek concept for this ship include pairs of monitoring cells, which measure the electrical potential near the anodes to control electrical conductivity in this area. In addition, the system incorporates pairs of 'shield' sensors, designed to detect any breakdown in the di-electric shield area which surrounds the anodes, thus ensuring that the widest possible distribution of current is maintained.

Contact: *Corrintec, a division of Cathelco Group, 18 Hipper Street South, Chesterfield, Derbyshire S40 1SS, UK.*
 Tel: +44 1246 246700.
 Fax: +44 246 246701.
 E-mail: sales@corrintec.co.uk
www.corrintec.co.uk

Chinese office for Viking

During December, an office in Shanghai was opened by the Danish specialist in lifesaving gear, Viking. The company has been selling liferafts to China since 1982, and its first authorised service station started up in 1997. The new division there, formally known as Viking Life-Saving Equipment.Trading (Shanghai) Ltd, is the company's 18th subsidiary.

Contact: *Viking Life-Saving Equipment, Saedding Ringvej 13, 6710 Esbjerg V, Denmark.*
 Tel: +45 76 11 81 00. Fax: +44 76 11 81 01.
 E-mail: viking@viking-life.com

First-ever 100% stainless steel padlock

What is believed to be the world's first 100% stainless steel padlock has been introduced by Castell Iso-lok. This lock has been designed specifically for use in hostile environments where there is a high possibility of corrosion.

All components of the padlock, including the unique, patented locking mechanism, which features no springs, are made from Grade 316 stainless steel and are guaranteed against corrosion. The padlock bodies are 35mm high. They are available in three different shackle widths of 5mm, 6mm, and 8mm, and two different shackle heights of 20mm and 50mm. For added security, the key remains captive when the shackle is open.

Contact: *Castell Iso-Lok, The Castell Building, 217 Kingsbury Road, London, NW9 9HP, UK.*
 Tel: +44 20 8511 1835.
 Fax: +44 20 8205 0055.
 E-mail: pshardlow@castell.co.uk

Expansion of group network

Since the management buyout of the Radio Holland Group in 2002, the company has been expanding and adding new locations in China,



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the Caribbean, Germany, and the USA. To date, the Radio Holland Group has 54 branches and still has more expansion plans.

With this worldwide network, Radio Holland can supply all required maritime electronics, spare parts and provide service and maintenance support at any location, 24 hours a day, seven days a week. The company is keen to further increase its service capabilities around the world such as in ports in the Far East, India, the Middle East, and Europe where it is not represented. Within five years the company hopes to have 70 to 80 subsidiaries around the world.

Radio Holland China is also officially the first European-based marine electronics service company registered as a foreign-owned enterprise in China. The Group recently opened a new service/sales working office in Tianjin.

Contact: Radio Holland Netherlands, Eekhoutstraat 2, 3087 AB Rotterdam, The Netherlands.
Tel: +31 10 4283387.
Fax: +31 10 4281498.
E-mail: info@radioholland.nl

New bearing for rudder steering linkage and deck equipment applications

ThorPlas, a new proprietary engineered (non-elastomer) thermoplastic bearing, has recently been launched by Thordon Bearings Inc. This has been formulated to complement the existing range of Thordon elastomer bearing grades and expands the range of applications where the company's bearings can be specified, while still maintaining many of the performance benefits.

ThorPlas allows greasing to be eliminated, and its strength and rigidity permits working pressures in an interference fit bearing up to 31MPa. The internal lubricants formulated into ThorPlas help reduce friction, resulting in smooth operation without lubrication and it can operate above and below the water line. It is also easily machined, is dust-free, and can suit any required dimensions. Installation is said to be quick and easy, using freeze-fit techniques.

As part of Thordon's StageGate new product development programme, Thordon has been test-marketing ThorPlas since 2003 and has many

installations in operation and working successfully. Typical marine applications for ThorPlas include steering-gear tiller arm and jockey-bar linkage bushings, fairleads and rope rollers, self-unloader booms, cranes and hoists, barge trolleys, davits and gantries, door and ramp hinge bushings, and hydraulic cylinder rod ends.

Contact: Thordon Bearings Inc, 3225 Mainway Drive, Burlington, Ontario L7M 1A6, Canada.
Tel: +1 905 335-1440.
Fax: +1 905 335-4033.
www.thordonbearings.com

Fast shipboard fire detection

Video smoke detection (VDS) is a fast and accurate technology that can detect a fire early on and pinpoint its exact location. Developed by an UK-based company D-Tec, it is now said to be making inroads into the marine market.

VDS is a camera-based fire detection system that is suited to large, voluminous structures and unmanned locations, such as engine rooms and holds. It is currently being trialled by navies worldwide on fighting ships, and has also been installed on a Statoil North Sea oil platform, where it is protecting a generating-set room. Such locations are challenging, since they are prone to heavy vibration and atmospheric contamination.

The Factory Mutual-approved system works by computer analysis of video images received from standard CCTV cameras that can also be used for surveillance purposes. It uses advanced image process technology developed by D-Tec and extensive detection and known false alarm phenomena algorithms to automatically identify the particular motion pattern of smoke.

The system alerts a control room operator to the presence of smoke in the shortest possible time, and because VSD does not rely on the proximity of smoke to the detector, it is not effected by distance. The system detects smoke by seeking small areas of change within an image. They are then passed through a series of filters that seek particular characteristics that are known to be associated with smoke behaviour.

Other, more traditional systems are claimed to be more unreliable and prone to false alarms as they cannot differentiate between smoke and

other sources of movement. Crew are also placed in less danger, and VDS shows the exact source of the fire, so no investigations are needed.

Also recently launched is FireVu, a VDS installation that can monitor a potential fire to ensure continuous fast response, as well as remote testing and diagnostics. This means that a VDS installation on board a ship can be monitored, including the alarm and video images, from a number of locations, on land or sea, anywhere in the world, as well as from the bridge of a ship on which the system is installed.

An entire fleet can, in fact, be monitored from any control centre. FireVu also allows VDS installations to be remotely maintained or reconfigured while a ship is at sea. This means a vessel remains protected at all times, and reduces port turnaround times.

Contact: D-Tec Ltd, Turner House, 9-10 Mill Lane, Alton, Hampshire GU34 2QG, UK.
Tel: +44 870 458 1517.
Fax: +44 870 458 1518.
E-mail: sales@dttec-fire.com

Cargo access gear for Brittany Ferries' new trailer ship

Cargo access equipment will be supplied and installed by MacGregor on Brittany Ferries' new trailer ro-pax vessel, currently on order at Aker Yards, which will be able to transport 120 freight vehicles at a cruising speed of 23knots. The 2200lane metre ferry is designed to work on routes from the UK to Cherbourg, in France, and Santander, in Spain. The 165m long and 26.8m wide ship will have 120 cabins, and is scheduled for delivery from Aker Finnyards' site in Helsinki in autumn 2007.

Freight-handling efficiency will be smoothed by a comprehensive hydraulically-operated ro-ro equipment package, based on stern access and a bow door/ramp. Clear deck heights of 5.2m are offered on the main deck and upper deck and 4.6m on the tanktop. The single-section main stern ramp/door has a length of 6.0m (plus 1.5m flaps) and offers a 19.8m-wide driveway into the main vehicle deck.

A side-hinged watertight ramp cover is arranged above fixed ramps accessing the lower hold. The two-section cover is 42m long and provides a clear opening width of 4.5m to the tanktop. A hoistable ramp (48m long plus 5m flaps with a 6.1m driveway) will serve between decks 3 and 5, closing weathertight in the upper deck when not transferring vehicles. Forward access into the main vehicle deck will be arranged over a three-section bow ramp with an overall length of 17.5m (including 2m flaps) and a driveway of 6.0m.

Also being supplied are: operating equipment for the bow door, one top-hinged forward door, two vertical sliding-type pilot/bunker doors, and two engine room hatches.

Contact: Karl-Axel Persson, MacGregor (SWE) AB, Box 4113, SE-400 40 Gothenburg, Sweden. Tel: +46 31 850 794.
Fax: +46 31 428 825.
E-mail: Karl-Axel.Persson@macgregorroro.com



A typical application for ThorPlas: in a self-unloader boom bushing. It is seen here during fitting at Grand Bahama Shipyard.



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Pride of America: a liner for Hawaiian cruising

AN interesting ship completion in the middle of last year was that of cruise liner *Pride of America*. She was originally planned - as reported in *The Naval Architect* May 1999, page 35 - to launch a new generation of US-built and owned passenger ships. The pair ordered would have been the first large passenger liners to be built in that country for approximately 40 years (since the two Moore McCormack liners *Brasil* and *Argentina* in 1958). Unfortunately, like other recent attempts by the US shipbuilding industry to compete on the international commercial market, the project collapsed.

Two 72,000gt ships, with possible options, were ordered from Ingalls Shipbuilding, Pascagoula - better known as a warship builder - by American Classic Voyages. The plan was for them to operate around the Hawaiian islands in the Pacific Ocean; since these are US territory, the implications of the Jones Act had to be fulfilled, ie, construction had to be in the USA, and the ships had to fly the US flag. The liners were to be known as the Project America class.

Some internationally respected names were recruited to assist with the project. These included Kvaerner Masa-Yards and Deltamarin, from Finland, and Tillberg Design, from Sweden. The project also had the backing of the then US president, Bill Clinton, who had set up a National Shipbuilding Initiative to resurrect passenger ship construction in the USA and to reduce shipyard dependence on military contracts. Ingalls itself planned to invest US\$130 million to upgrade systems and equipment to help build these giants.

Nonetheless, the whole project fell apart, American Classic Voyages filed for bankruptcy,



Pride of America, which joined the Norwegian Cruise Line fleet in June last year, was originally ordered in the USA but was eventually completed by Lloyd Werft. At Bremerhaven, the hull was lengthened by insertion of a new 31.46m mid-body to increase the passenger capacity from 1900 to 2700.

and a half-built first ship with much equipment on order or delivered, was left in Pascagoula. Eventually, a saviour was found in Norwegian Cruise Line, which in 2002 acquired the hull, with a goal of resurrecting the Hawaiian operation. NCL was able to negotiate with the authorities over the Jones Act implications, and at the end of 2002 a contract was made with the leading German repairer and converter of cruise liners, Lloyd Werft, to complete the ship.

This yard has already had experience of a similar operation: in 1999 it finished the construction, outfitted, and completed the hull of another NCL ship, *Norwegian Sky*, when that owner acquired the hull of *Costa Olympia*, work on which had been halted due to the bankruptcy of fellow German yard Bremer Vulkan (*The Naval Architect* May 1999, page 41).

The hull of the Ingalls liner was towed to Bremerhaven, and all equipment at Ingalls followed. Meanwhile, NCL had decided to lengthen the ship, from the original 256.03m to 287.49m, to boost the passenger complement from 1900 to 2700, and to add extra capacity to the primary machinery plant. A new mid-ship section was fabricated and inserted, and all went well; however, an unfortunate delay occurred during final outfitting when, during a storm, the hull developed a severe list while moored at the Lloyd Werft quay, and machinery spaces were flooded. Nevertheless, the ship was delivered in June 2005, and is now operating around the Hawaiian islands.

To try and attract a younger generation of cruise passengers, NCL's Freestyle concept was adopted, allowing passengers to move around the ship as they wish. The interiors have still been conceived by Tillberg but in

association with the UK consultancy SMC Design. There are 15 decks in all, divided into seven vertical fire zones. All public areas, together with passenger and crew cabins, and service areas, are protected by a Marioff Hi-Fog water-mist fire extinguishing system. A pair of Sperry folding fins provides roll stabilisation.

An American theme is retained throughout for the public rooms, featuring many of that vast country's regions; thus the Capitol atrium extends from deck 5 to deck 8, with Hawaii featuring in leisure facilities, and the *SS America* library displays artefacts, memorabilia, and a large-scale model of that 1930s liner. A theatre and show lounge on decks 4 to 6 is named Hollywood and has an Oscars theme. Two main restaurants are positioned aft.

Propulsion power is provided by a diesel-electric arrangement centred on six (originally planned to be four) Wärtsilä 8L46C medium-speed engines (six x 8400kW); these drive 10,120kVA Alstom alternators, which supply current to a pair of Kamewa/Alstom Mermaid azimuthing pods. Each of these has a 12,500kW output.

As part of its package, Wärtsilä also supplied resilient engine mountings, elastic shaft couplings, exhaust silencers, also fuel, lubricating oil, starting, and central cooling equipment. Provision has been made for the future fitting to the diesel engines of direct water injection or selective catalytic reduction (SCR) modules, should emissions regulations become even stricter than they are at present.

More information on *Pride of America* can be found in our newly published annual *Significant Ships of 2005*. 

TECHNICAL PARTICULARS PRIDE OF AMERICA

Length, oa.....	287.49m
Length, bp.....	259.10m
Breadth, moulded.....	32.20m
Depth, moulded to main deck.....	10.79m
Draught.....	8.00m
Gross.....	80,439gt
Displacement.....	45,400tonnes
Steelweight.....	17,300tonnes
Deadweight.....	8260dwt
Fuel.....	2200tonnes
Water ballast.....	2420tonnes
Potable water.....	1790tonnes
Passengers.....	2700
Crew.....	900
Main engines (diesel-electric).....	6 x Wärtsilä 8L46C
Output.....	6 x 8400kW
Alternators.....	6 x Alstom
Output.....	6 x 10,120kVA
Azimuthing pods.....	2 x Kamewa/ Alstom Mermaid
Output.....	2 x 12,500kW at 128rev/min
Speed.....	22.00knots
Joint classification.....	Det Norske Veritas and American Bureau of Shipping

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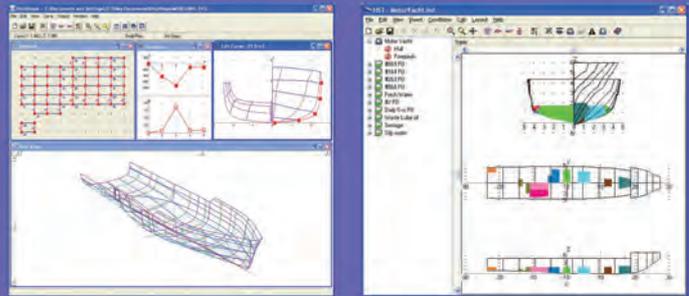


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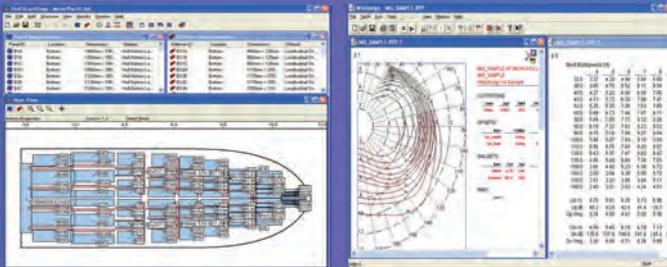
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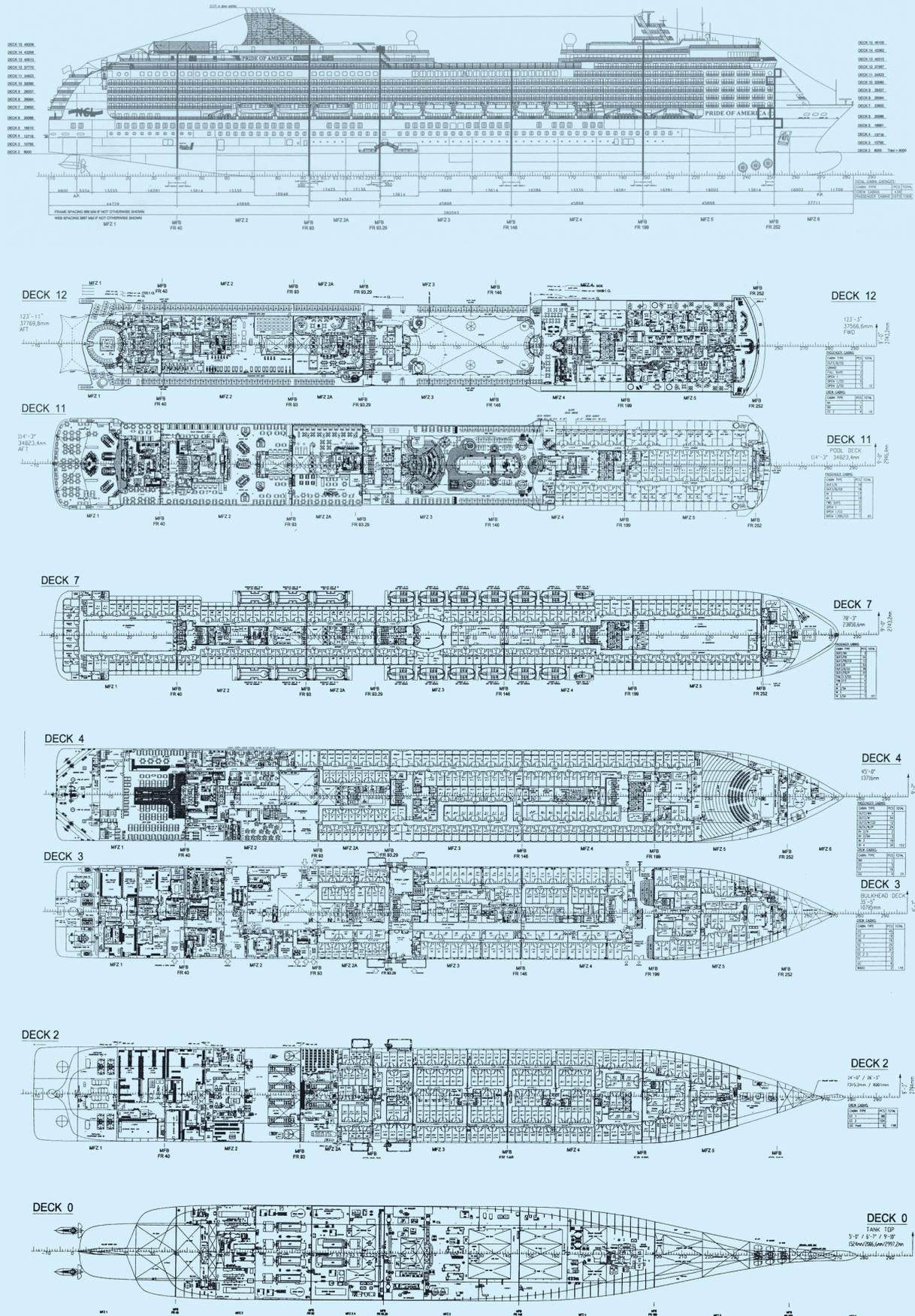


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Advanced waste-treatment solution for passenger ships

A TECHNICALLY advanced package of waste-treatment machinery, primarily engineered for ships with large complements such as cruise liners and cruise-ferries, is being successfully marketed to leading operators by the Norwegian specialist in this field, Scanship Environmental AS, based at Tønsberg. Customers include Royal Caribbean for its newest Freedom-class vessels with 5730 passengers and crew, on order at Aker Finnyards - the first, *Freedom of the Seas*, is destined for completion soon.

Other operators to specify these systems include NCL for its new ships at Meyer Werft, also for *Norwegian Jewel*, completed last year; and MSC, for various liners contracted at Alstom Marine (Chantiers de l'Atlantique) - including the newest 3800-passenger (plus 1400 crew) liners recently contracted there. Many ships built and under construction at Fincantieri, in Italy, also have Scanship equipment (but without the advanced waste water section). The two newest ships to be constructed at Alstom Marine, *MSC Fantasia*, and *MSC Serenata*, will have the first Scanship systems to be awarded Bureau Veritas type-approval for a Clean Ship notation.

Scanship's systems will treat all types of wet and dry waste generated on board a modern vessel. Modules comprise vacuum food-waste treatment, advanced waste-water purification, bio-sludge de-watering/drying, and an incinerator plant. A complete package is comprehensive and engineered to run on a continuous basis - including the incinerators (as far as permitted by legislation).

Sludge from food waste and waste water lines is dewatered separately then mixed in a bio-sludge tank. The following drying process is automatic, and the resulting product will, claims Scanship, burn easily in an incinerator along with dry waste. Should



Typical Scanship food-waste dewatering units.

incinerators not be permitted to operate due to restrictions, dried bio-sludge can be bagged for storage.

The whole operation is masterminded by a PLC (programme logic control) system, completely designed from scratch by Scanship itself. Touch-screen panels form the interface between operator and systems, and all screen displays have also been designed by the company. If required, Scanship personnel ashore can log into the system via satellite to analyse any problems reported by engineers on board a ship.

The package complies will all requirements currently in force, including those of the US Coast Guard and the Alaska Murkowski Bill (CFR 33, Part 159) for effluent discharges from the advanced water purification section. Permission for continuous discharge of effluent has additionally been granted to many cruise liners with Scanship systems, including when visiting Mediterranean ports.

For dry burnable and non-burnable waste, this is normally collected by trolleys from shops, crew areas, pantries, bars, and provision stores and taken to the principal

Food waste inside a collecting tank (left) and being dewatered in a screw press (right).



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The Scanship bio-sludge drying process comprises a contact dryer with hot-air scrubber, plus an air dryer with filter.

handling room, where it is sorted manually into: burnable waste, glass (which is crushed), steel and aluminium tins (compressed for recycling), and cardboard, paper, plastics, and general waste. From here, burnable waste passes to a hopper, where it is shredded to reduce the volume and improve the burnable value, and then to a silo, which feeds the incinerator. The Scanship incinerator, with its multi-secondary chambers for decomposing dust and toxic materials, is fully automatic and approved by IMO and MARPOL.

A special enclosed line using vacuum transport technology handles food waste fully automatically. Up to 20 feeding stations (operated by press-button) can be incorporated, and two separate lines are normally fitted; these can be linked via a cross-over line in the case of an equipment emergency. All waste ends up in two main collection tanks, which act as buffer zones and can separate out cutlery which may have accidentally been dropped into the chutes.

Before proceeding to the bio-sludge treatment plant, waste is dewatered in a screw press and mixed with waste from the separate advanced waste-water purification (AWP) line handling food-waste liquid, black, and grey water. This comprises mechanical separation, aerobic biological respiration, chemical precipitation with dissolved air flotation, tertiary micro-filtration, and finally ultra-violet sterilisation.

Solids (as sludge) are separated from the liquid, dewatered, and dried for final incineration or shore disposal. After this treatment, most of the resulting water can be pumped directly overboard in compliance with regulations, but a small quantity collected as solid sludge can be further processed further for incineration or bagging.

Official liquid sampling has shown that Scanship average results are well below the Murkowski standard, eg. <10mg/litre for total suspended solids and biological oxygen demand, compared with Murkowski's <30mg/litre requirements for each. Faecal coliform bacteria and total chlorine figures were below the detectable limit for Scanship's waste water. These figures mean that waste water can be discharged continuously. As an added bonus, effluent has US Coast Guard approval for use as ballast water if necessary. Scanship has also supplied larger-size ultra-violet sterilisation units for secondary treatment of ballast water during de-ballasting. ♻️



The Scanship dried bio-sludge silo, with its bagging unit in the foreground.

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Operational aspects of manoeuvring with pods

Podded propulsion has the potential to give many benefits, but can its advantages be exploited in the operational environment? Simon Burnay, manager - manoeuvring simulation products, at BMT SeaTech Ltd, a subsidiary of BMT Ltd, examines a recent suggestion for improving manoeuvring performance through the novel use of pods and looks at some of the practical aspects in relation to a master or pilot's perspective.

THE advent of podded propulsion systems - such as Azipod or Mermaid - has the potential to provide ships with many benefits, including fuel economy, greater internal space, and improved manoeuvrability. Improved manoeuvrability is achieved by the ability to direct the thrust of the propeller through 360deg and as such, greater forces can typically be applied when compared with conventional propeller-rudder-thruster configurations.

A typical 'pod' can generate very large thrust forces in any direction, giving an efficient means of providing control forces. However, where there are large forces, there is potential for problems, and as such, careful consideration must be given to the application of these thrust forces in relation to other factors such as the speed of the ship, engine shock loading, and possible structural implications.

There has been a recent suggestion for an alternative - and perhaps novel - method of using pods to reduce the stopping distance of a ship in emergency manoeuvres, such as a crash stop. The idea is to simply rotate the pods to 180deg (so they are pointing astern) and use ahead revolutions with pods reversed to provide net astern thrust.

Because thrust from the pod is directional, and noting that the thrust due to ahead revolutions is greater than that generated by the equivalent astern revolutions, it is reasonable that a reduction in stopping distance is possible by rotating the pods to 180deg. From a pure hydrodynamic perspective, this would be true: the resultant astern thrust is greater and it would be quicker to rotate the pods in this manner than reduce the revolutions from ahead and build the astern power thereafter.

However, to control the large forces generated by the pod, a ship is normally provided with a complex control system that assists in reducing noise and vibration and provides restrictions on:

- the power available to each pod
- the angle through which the pod can be turned
- whether the pods may be rotated individually or are synchronised
- engine load management defining the response of the propeller revolutions.

These controls have significant impacts on a suggested manoeuvre and are described in the following sections.

Mode of operation

As part of a podded propulsion installation, there are normally two distinct modes of operation that broadly relate to open-sea (high speed) and manoeuvring (low speed) usage. Each mode has a

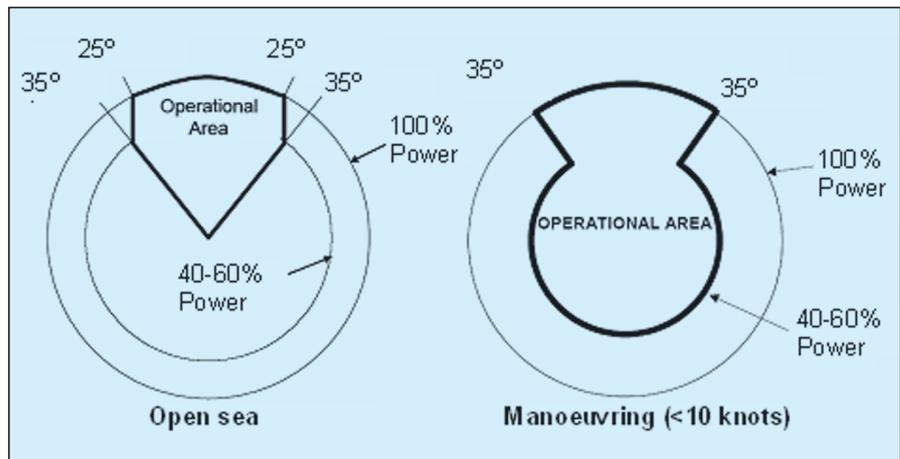


Fig 1. Typical limitations with pod operation modes (vessels may have alternative configurations).

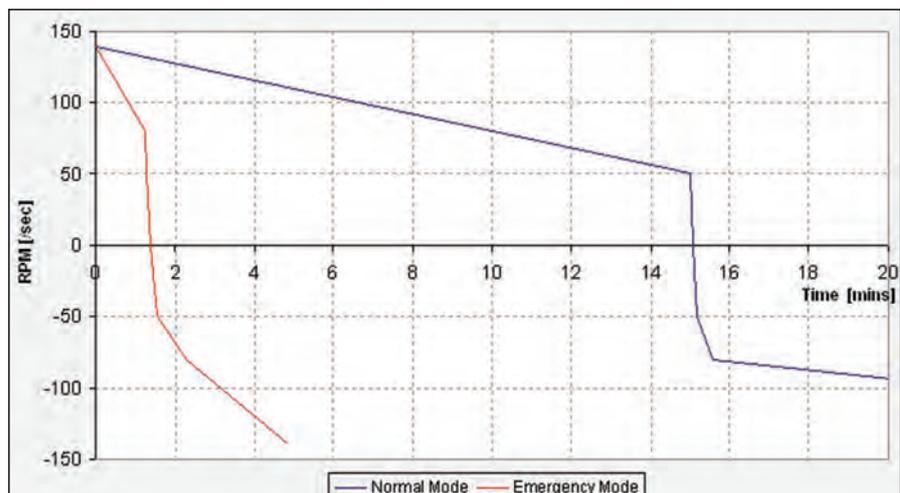


Fig 2. Typical normal operating and emergency engine load management programs, when applied to a 'podded' ship with diesel-electric propulsion.

different set-up that maximises the efficiency of pod control and ensures safe operation.

The open-sea mode, often called open sea, cruise or transit, typically allows full power to be applied to each pod but limits the steering angle of the pods to 35deg. In this mode, the pods are linked, and steering is achieved through a central helm wheel or autopilot. The open-sea mode is therefore used at higher speeds in open water where maintaining a course is the most important factor.

Manoeuvring modes typically limit the power to 40%-60% of the maximum and allow the pods to be rotated individually through 360deg once the ship's speed is less than a predefined value (typically 10knots). The 'manoeuvring' mode is

therefore normally used only at slower speeds and in close-quarters manoeuvring situations.

Fig 1 shows typical operational limitations placed on a pod according to the mode of operation (open sea or manoeuvring). These limitations are designed to limit the loading on the pod stock and the ship's hull. If the pods are rotated to angles greater than 35deg (once the speed has reduced), then the power is automatically limited to avoid structural damage caused by large thrust loads at high azimuth angles.

Therefore, the suggested crash stop manoeuvre of rotating the pods to 180deg whilst employing ahead revolutions would incur an immediate power limitation as 'manoeuvring' mode is



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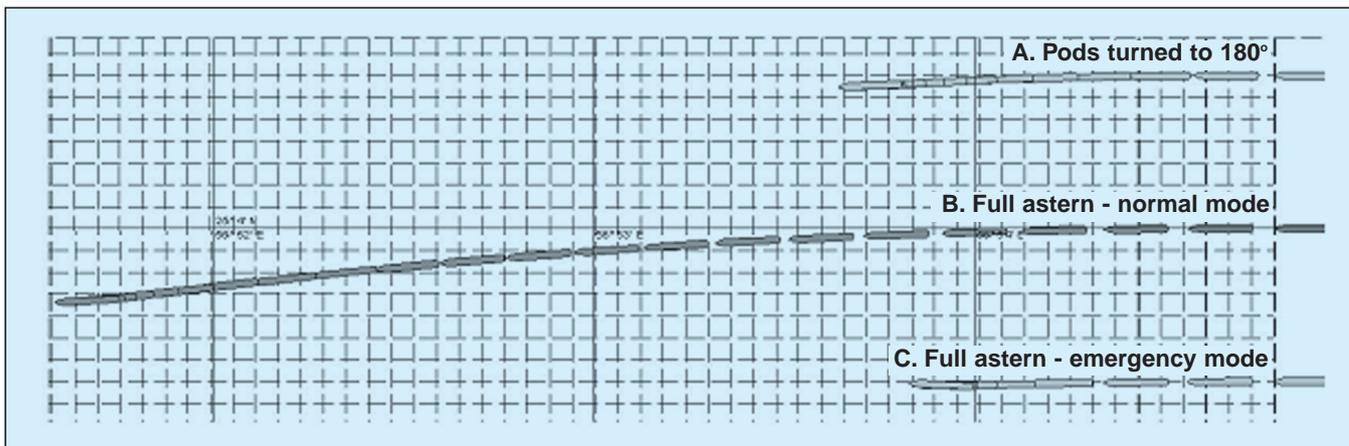


Fig 3. Crash stop simulations showing stopping distance for: A. pods turned to 180deg; B. full astern ordered with slow engine response; and C. full astern ordered with emergency engine response.

required to rotate the pods to 180deg. This power limitation means that less thrust is available to slow the ship.

Engine load management

Vessels with podded propulsion often have a number of engine load management programs enabled that are designed to limit shock-loading on the propulsion plant due to rapid or large changes in power demands and to optimise engine utilisation and fuel economy. These load programs effectively limit the rate of response of the propulsion plant and typically enable a faster rate of response at lower revolutions (and hence power) and then more gradual increases or decreases at higher power settings.

Fig 2 shows the time taken to achieve full astern revolutions for two typical load management programmes for a diesel-electric propulsion plant. This highlights the large difference in the response rates between normal operating and emergency modes which enables full astern revolutions to be achieved much quicker.

Rotating the pods at speed

If the pods are rotated to 180deg when underway, then dramatic changes to the hydrodynamic inflow to the propellers occur during the rotation. Each propeller's 'angle of attack' to the flow changes and there is a natural reduction in propeller revolutions (similar to that experienced in a turning circle trial) due to the mismatch of propeller load and the available engine torque during the rotation, although this effect is less significant for a diesel-electric propulsion plant.

Once the pods have settled at 180deg there will be a gradual increase in the revolutions to return to the demanded setting. This increase in revolutions will be dictated by the relationship between the propeller and engine torque when operating in reverse flow and more so by the engine load management program that defines the rate of increase of revolutions.

Using the pod controls

In a conventional crash stop, the master or pilot would request emergency astern power and then simply move the telegraph levers to full astern.

To perform a crash stop by turning the pods to 180deg, he or she would have to undertake several manipulations of the controls to achieve the desired effect. First, the manoeuvring mode has to be selected, then each pod rotated through 180deg once the speed of the ship has decreased sufficiently and then the RPM increased to the desired setting.

In an emergency situation the master or pilot is unlikely to want to undertake a series of relatively complex control manipulations. The amount of bridge team coordination required for other tasks (such as preparing the anchors) and the need for a greater spatial awareness in a stressful situation will place far greater demands on their time. Such methods could only work if the onboard computers can perform the series of control manipulations automatically, leaving the master or pilot free to concentrate on the situation unfolding.

It is also worth noting that the emergency response modes usually available allow the very rapid increase and decrease of revolutions for these situations, thus enabling rapid deceleration without the need for multiple control manipulations, as shown in Fig 2.

Net effect

One leading pod manufacturer has suggested that the crash stop can be performed by first reducing the ship's speed through selection of the manoeuvring mode (giving an immediate reduction in power) and then setting both pods to 35deg outwards and using the increased drag to slow the ship (other methods can be used to slow the ship). Once the ship's speed has sufficiently reduced, both pods can then be fully rotated, enabling ahead revolutions to provide the net astern thrust.

Based on BMT SeaTech experience of ships with 'podded' propulsion, the net result of these actions is that the following limitations would apply when performing a crash stop manoeuvre in this manner:

- a reduction in power available to the propellers due to use of manoeuvring mode
- a delay in fully rotating the pods to face astern until the ship speed has sufficiently reduced

- a transient reduction in power available to the propellers due to the steering angle of the pods during rotation
- significantly extended time to reach the demanded ahead revolutions when the pods are at 180deg, due to the decrease in revolutions during turning and the subsequent application of the load management program.

All of these, in our experience, would lead to an increase in stopping time when compared with the equivalent manoeuvre undertaken by selecting the emergency (crash stop) manoeuvre load program and ordering full astern. This has been confirmed by simulator trials with a leading cruise ship operator using validated mathematical ship models on the PC Rembrandt simulator and comparison with full-scale trials data.

Fig 3 presents track plots (on a 100m grid) for these simulated crash stop manoeuvres with a typical modern cruise ship with pods. The three vessel plots represent the suggested crash stop procedure using ahead revolutions and turning the pods to 180deg, a normal crash stop (using astern revolutions) with the normal operating mode and the normal crash stop using the emergency response mode.

It can be seen that the stopping distance of the crash stop with the pods turned to 180deg (plot A) is longer (by approximately 300m) than the same manoeuvre using the emergency response engine mode (plot C). However, turning the pods to 180deg does result in a reduced stopping distance when compared to simply ordering full astern with the 'normal operation' load management program because of the length of time taken to generate full astern revolutions from full ahead in this mode.

BMT SeaTech believes, that whilst these results show that the suggestion of turning the pods to 180deg in a crash stop is a good idea in principle, there are other factors that must be considered for such an approach to be truly effective in operation. The most important of these is the safety of navigation and the freedom of the master or pilot to conduct all other tasks required in emergency situations, without having to coordinate potentially confusing controls. ⚠

Twin boosts to the fortunes of Alstom Marine

A MAJOR boost to the fortunes of Alstom Marine (Chantiers de l'Atlantique), at St Nazaire, France, has been given by two recent events: one is the momentous agreement - discussed elsewhere in this issue - to link with Aker Yards to create a new European force in high-value-added tonnage (especially cruise liners) and the other is a recent contract to build two giant cruise liners for Mediterranean Shipping Co (MSC).

Following the completion in 2004 of Cunard's new flagship *Queen Mary 2*, the St Nazaire yard only had two medium-size liners, also for MSC, to work on (*MSC Musica* and *MSC Orchestra*, *The Naval Architect* May 2005, page 46), expected to be delivered in spring this year and 2007 respectively). Prior to that, in 2003, Alstom Marine had delivered two further vessels to the same owner: the smaller, 60,000gt *MSC Lirica* and *MSC Opera*, whose interior design was discussed in the May 2003 issue of this journal.

At the time of completion of *Queen Mary 2*, some concern was expressed over future orders; nevertheless, Alstom Marine's chairman, Patrick Boissier, was confident that owners would eventually be ordering new tonnage, and his prediction has come true with the new contracts. Although with a smaller gross tonnage (133,500gt), this new post-Panamax class will carry, at 3887 passengers, probably even more than Royal Caribbean's Freedom-class ships, the first of which is very close to delivery at Aker Finnyards's Turku yard. In addition, there will be a large crew of 1300. Most of the design work will be handled by the leading Italian consultancy Studio de Jorio, which worked on the two previous classes of MSC vessels.

New type of semi-gravity lifeboat davit to be employed

At least one subcontractor has announced its supply contract for the new MSC vessels: Umoe Schat-Harding will deliver six of its CTL38 tenders, 20 MPC32 150-person lifeboats, plus two MCB24 combined lifesaving and rescue designs. Included in the contract will be the design and supply of a new type of semi-gravity davit, the PD24DM, with lower weight, fewer components, and easier installation.

Since the new liners have post-Panamax dimensions, lifeboats can be stowed protruding from each ship's sides. This means that the new davits can be fitted slightly above the promenade deck; this will enable the shipyard, says Umoe Schat-Harding, to build in an extra cabin deck with outside balconies, thus contributing towards the extra passenger numbers.

Alstom Marine is, of course, also an expert in LNG carrier construction and is building three new-generation LNG carriers for Gaz de France, featuring the evolutionary CS1 cargo containment system. Unfortunately, this technology has proved problematical for the yard, and the first ship, the 75,000m³ *Gaz de France Energy*, originally intended to be delivered about this time last year, is still at the shipyard, having major repairs and alterations to the cargo barriers. ⚓



An impression of the very large post-Panamax cruise liners to be built by Alstom Marine for its existing customer, Mediterranean Shipping Co. They will have a huge capacity of 3887 passengers plus a crew of 1300.

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

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



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

Papers are invited on all relevant topics, including:



- Vessel Types: feeder ships: coastal and inland bulk carriers, tankers, container ships; passenger ferries, fast craft, 'split ship' concepts, barges, pusher tugs, refuse lighters, dredgers, waterway maintenance vessels, pollution control and other special service vessels.
- Design: low wash, low emissions, low noise, environmental constraints, cargo/passenger loading, height/width/draught restrictions.
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New tanker class employs electric-drive cargo pumps

GERMAN shipbuilder Lindenau has added yet another tanker design to its portfolio of 'green' ships already delivered - one of the newest being the 37,500dwt *Seychelles Pioneer*, presented in our newly published annual *Significant Ships of 2005*. The latest tanker is a 40,500dwt model, which continues the Lindenau safety tanker class 2010, and four orders have already been secured from German Tanker Shipping, an owner well-known to this Kiel yard.

All four vessels, which will have capacities of 47,000m³, will feature Hamworthy Svanehøj cargo-handling systems employing deepwell electric-drive pumps, and will be classed with Germanischer Lloyd. Deepwell drives, with the electric motor mounted on the weather deck, can provide a solution to today's demand for a simplified distributed pump layout connecting to the pump through a long drive shaft.

Hamworthy is making the benefits of deepwell cargo pumps available to ever-larger tankers by developing its electrically driven ranges. The Svanehøj CKL pump series comprises three models: the CKL 200 rated at 600m³/h, the CKL 250 at 800m³/h, and the CKL 300 at 1200m³/h to 1800m³/h. Control will be by the frequency-converter method, which will also be employed for the two tank-wash pumps.

The configuration on the new Lindenau ships will comprise 12 cargo/slop tanks plus a residue tank. The 10 main cargo pumps will be CKL 200 units, each yielding 600m³/h at 120mlc (metres liquid column). The two slop pumps will be of the DL design, capable of 250m³/h at 120mlc.

Combined with a double-volute pump house, the single-suction single-stage impeller of the Hamworthy Svanehøj CKL deepwell pump, which will be fitted to the new Lindenau tankers, is said to reduce axial and radial forces, and to minimise wear on pump bearings.



More ships at Fincantieri for Carnival group

THE mighty Carnival group has placed yet another block cruise liner order for its various member companies with its preferred partner, the giant Italian shipbuilder Fincantieri. At the very end of last year, a US\$2 billion contract was signed for four new ships. These comprise an 86,000gt design for Holland America Line (2044 passengers), to be constructed at the Marghera (Venice) yard, with an option for a sister, and a 116,000gt, 3100-passenger ship for Princess Cruises - a sister of *Emerald Princess*, which is already under construction at Monfalcone.

A third liner will be a 130,000gt giant to carry 3600 passengers - the new post-Panamax super standard - for Carnival itself, plus an option on a sister. Again, these vessels will be constructed at the Monfalcone yard. Finally, group newcomer, Costa Crociere, will secure an additional ship - a sister for the 112,000gt *Costa Concordia*. This will be built at the Sestri Ponente yard in Genoa, from where recent Costa ships, including the 105,000gt *Costa Fortuna*, able to carry 3470 passengers and featured in *Significant Ships of 2003*, have been delivered.

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Learning from experience - adopting a systems approach to analysis of marine incidents

V Pomeroy, from Lloyd's Register, and B Sherwood Jones, from Process Contracting Ltd, comment on the evaluation of evidence from marine incidents in such a way that the maximum volume of useful information is extracted to support the development of effective risk control measures through regulation and standards.*

THE authors recognise that ships and marine systems are becoming more complex and integrated, and that a 'system' includes its operators. Improvements in operational safety can be achieved by dealing with the 'relevant systems' that support operation. This view requires a different way of abstracting information from incident data. The methodology presented here provides a structured 'systems approach' which leads to the clear identification of the initiating points where a corrective action either in terms of regulation or operational procedure could reduce the associated risk, effectively and specifically.

In presenting some re-assessment of the information that has been presented in publicly-available formal and informal incident reports, there is no criticism intended of the investigators or their conclusions. However, by using the same base data, the authors demonstrate that other valuable information can be elicited, which could be important in preventing future different incidents.

The history of industrialised society is littered with examples where early warnings of hazards were ignored until sufficient hard evidence had been accumulated, often a very long time later. Some good illustrative examples are described by the European Environment Agency (EEA) (Ref 1) in a report which is based around the following four questions:

- when was the first credible scientific 'early warning' of potential harm?
- when and what were the main actions or inactions on risk reduction taken by regulatory authorities and others?
- what were the resulting costs and benefits of the actions and inactions, including their distribution between groups and across time?
- what lessons can be drawn that may help future decision-making?

The concept promoted by the EEA authors is one of precaution, and the evidence supports the argument that industrial society is not good at taking cognisance of early warnings, foreseeing future impact, and forestalling the inevitable consequences.

* Extracts from the paper 'Learning from experience - adopting a systems approach to analysis of marine incidents', presented at The Royal Institution of Naval Architects' international conference Learning from Marine Incidents 3, held in London on January 25-26, 2006.

Given the application of the 'precautionary principle' in marine legislation, the discussion by the EEA authors on the need to address risk, ignorance and uncertainty is relevant to the maritime community, as is the discussion on the 'level of proof' required to justify action.

Effectiveness and access to data

It is often assumed that most lessons from incidents will necessarily come from major events, which is generally assumed to be from those incidents that demand formal investigation and reporting. These will usually involve loss of life or pollution, or the recognition that avoidance of either of these outcomes was fortuitous.

Many similar incidents may not be reported in detail because the consequences were simply less dramatic. For instance, a loss of propulsion power at sea may require towing to a safe haven or repair at sea but a similar event close to shore or in the confines of a port can have far greater impact.

If lessons learned from marine incidents are to be of the highest value in terms of prevention, then it is imperative that information is gleaned from minor incidents as well as the major cases. This means access to formal investigations and informal, usually unpublished, work. In many cases, minor incidents are simply not recognised as significant, and any corrective action is dealt with by the operator and, maybe, the equipment supplier without any expectation of providing a learning opportunity for the marine community. To develop the capacity of the marine industry to learn from incidents, consideration has to be given to formal investigations by flag administrations and others, damage investigations supported by scientific and engineering analysis, and the collected wisdom of ships' staff, owners' superintendents, equipment suppliers, and surveyors.

Careful and thorough data collection is essential for the effective analysis of incidents. This can be time-consuming and is dependent on eliciting basic facts from all individuals who might have relevant knowledge. Data is also extracted from recording systems, written records and from technical investigations. For well over 50 years, Lloyd's Register has benefited from the systematic investigations of failures which has been carried out by its own expert investigation team, known throughout the marine industry variously as the Engineering Investigation Department, Technical Investigations Department and now the Technical Investigations element of Consultancy Services.

The reports of investigations carried out for marine clients are based on an assessment of available data and, usually, field measurements and supporting engineering analysis. In most investigations of incidents this level of investigative rigour is not found, with greater reliance on the records from operations and the recall of those involved.

The most accurate data is collected shortly after an incident, which requires access to people and the ship so that the investigators can proceed

before data is lost or recollections become more distant. Investigators are faced with a number of inhibiting pressures which constrain the effectiveness of the all-important data collection stage. Incidents usually involve insurance claims and there is increasing likelihood of litigation, and, of course, individuals involved will face the prospect of disciplinary processes and adverse consequences on their livelihood.

Investigations may be necessary to support insurance claims or to satisfy legal or political demands. However, these purposes may, themselves, restrict the learning opportunities and reduce the overall effectiveness of incident analysis in terms of preventing the occurrence of similar incidents.

In some industries, the adoption of a 'blame free' and often confidential reporting scheme has resulted in the systematic collection of incident information, although this necessarily suffers from a lack of substantive analysis of the facts. Some efforts have been made to introduce similar arrangements into the marine industry and these could be used to provide better early warning data, since individuals can report events which could have resulted in an incident but where circumstances precluded the full event development.

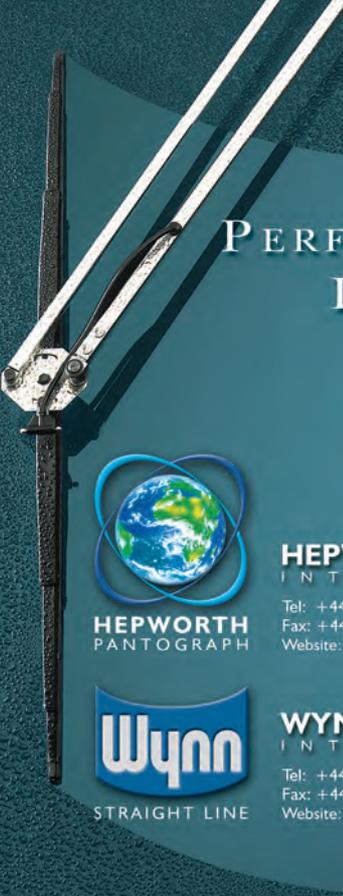
Reconstruction and analysis

Without doubt, the analysis of marine incidents provides an essential source of information to the regulators and operators. It follows that the incident reports must be credible, presenting well-analysed conclusions and recommendations. The scope of analysis and reporting is typically based around a few 'causes' and 'some contributing factors' - the 'causal field' is fairly narrowly drawn. There are some theoretical concerns with this, discussed later.

In practical terms however, it is unlikely that the maximum value can be extracted from an incident investigation if the conclusions and recommendations are specific to that incident and do not draw wider implications. The wider value may not sit comfortably in an incident report, but the learning value would suggest that it is incumbent on the investigators to disseminate their findings, including facets which might not have been significant for the incident under investigation but nevertheless indicate the need for some form of corrective action. The phrase 'learning from incidents' may be needed to complement 'incident analysis' and is used here.

'Hindsight bias remains the primary obstacle to accident investigation, especially when expert human performance is involved' (Cook, Ref 2). Dekker (Ref 3) has highlighted the need to reconstruct people's unfolding mindset as central to the analysis process. For a valid understanding of how an incident came about, it is necessary to apply the approach to latent errors at the 'blunt end' as well as active errors at the 'sharp end'.

It would normally be expected for human and technical factors to occur in concert. Whilst assigning causes to factors such as these may aid understanding, they may actually impede



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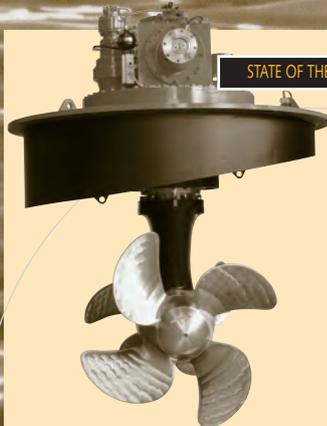


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learning from incidents. 'Loss of situation awareness' has appeared quite frequently in recent incident reports, brought about by factors ranging from loss of channel lights to the use of a mobile phone whilst on watch.

Johnson (Ref 4) concludes 'Most human factors' research is concerned with improving our understanding of human error. Very little of it can be directly applied to reduce the impact or frequency of those errors'. From the point of view of encouraging corrective or improvement actions, it is desirable to link the analysis to models of good practice. In the case of the 'sharp end', this would be a model of Crew Resource Management. Other models are appropriate to design offices, manufacturing facilities, and other places.

Information presentation

Any incident investigation will result in a large volume of data, some of which has little relevance to the conclusions. Many incident reports are very detailed, lengthy and written for the expert professional. The need for a full narrative is not questioned, but for maximum benefit the incident and its precursors need to be interpreted for a wide audience.

The use of some diagrammatic formats such as fault trees should be regarded as for the specialist only. The lessons learned must be presented so that the competent reader can draw conclusions of value.

Learning from incidents can only be effective if the learning outcomes are communicated effectively to the widest possible audience. It follows that there are benefits in adopting a format which is clear, logical and standard.

The logical approach to organising the information is user-centred, ie, by stakeholders. The understanding of the reader is significantly enhanced if he understands why things did happen that way; reconstructing the evolving mindset would appear to offer considerable value in this regard.

The importance of clear presentation is crucial when there are a number of links between systems and people. Of significance is identification of opportunities that were, for some reason, missed. This may be that information was not understood by the people involved or too much data was available and the interpretation placed on this was incorrect. Neither necessarily infers a lack of competence.

If the benefits of learning from incidents are to be achieved, then the information to be presented increases in scope considerably, to accommodate those shortfalls where there are lessons to be learned but which were deemed not to be among the causes or contributing factors.

Non-proximate causes

It sometimes appears that investigations take a long time and publication of the final report appears to be far after the event. In reality, investigators have to work quickly, before the evidence fades, and work patiently through the collected data. They need to consult with a large number of interested parties. They then have to reach conclusions which are robust and make recommendations which will have a significant impact if implemented effectively.

Since the focus is inevitably on a single incident, it is not surprising that it is rare to find

investigators making recommendations based on other than the proximate causes, which means that some information which could provide a learning opportunity is discarded as not relevant. Where prosecution is being pursued, it is also the case that investigators can do sufficient to achieve that aim but no more (of particular importance in relation to human error as a cause).

The consequence of various pressures on investigators to achieve a quick result is that some of the less obvious but nevertheless important lessons are lost. The authors, in conducting some paper studies, have found a number of cases where opportunities for learning have been missed.

This happens also in informal investigations where the pressure is to find a solution to the problem and not to investigate, for instance, how the circumstances arose in the first place. As an example, Fig 1 shows a broken section of shaft, with a keyway and a classic fretting fatigue fracture. The shaft mounted a flexible coupling, fitted on a taper and secured by a threaded retaining nut.

Investigation identified that the cone angle of the taper was unusually large and this demanded a carefully controlled fitting procedure, which was not apparently followed.

So the proximate cause of the failure is identified, but why did the designer choose the form employed and why was the fitting procedure not followed? In terms of avoiding recurrences, these lessons might be important. It has become apparent that 'drawing office rule of thumb' values have fallen into disuse and a number of cases where failure has resulted from details which would not satisfy these practices, with designers relying on calculations and analysis.

The authors believe that a great deal can be learned from studying the underlying factors in determining why things were done in a particular way. When a combination of factors is involved in an incident, this can make it more difficult to establish why decisions were made but, with an industry reliant on subcontracting and increasingly complex systems, understanding

the issues involved can help the regulator to decide where the most appropriate risk control measures can be targeted.

Structured analysis using a systems approach

A small literature has been identified that takes a systems approach to accident causation and analysis. It is not homogeneous. The authors have taken a systems approach in the following respects:

- relevant systems have been identified (see Annex A) and treated as systems
- a systems (rather than mechanistic) approach to causation is taken (see Annex B).

The approach to incident analysis adopted by the authors makes use of a spray diagram (Ref 5) or 'mind-mapping' format. This presents the data in an informal but structured form that is very compact. It also allows links to be drawn between the various elementary causal factors and for links to be brought together in standard groups.

This particular incident analysis activity does not need to identify the specific causal sequences or logic, enabling the use of simpler diagrams. It is recognised that this format may not suit all phases of incident analysis.

The format bears some similarities to accepted methods such as TRIPOD (Ref 6), event trees, and fault trees. The reasons for adopting this particular format were:

- simplicity and ease of understanding
- it draws out the multi-agent nature of accident causation and identifies the main groups of agents through the life cycle
- by focusing on the main groups of agents, the format is user-centred and allows the reader to concentrate on their particular area of interest
- it enables cause and contributory factors to be related to models of good practice, such as the approach developed under the EU funded ATOMOS project (rather than

Fig 1. A failed coupling shaft.



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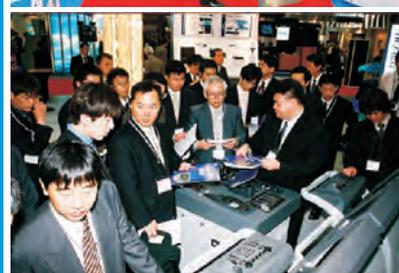
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models of failure such as generic failure types), and thereby supports the assimilation of preventative measures.

The base factual data, concerning the time history, activities, and actions immediately prior to the incident, is extracted from the reported source. In general, the authors have found this data to be in sufficient detail and completeness, professionally recorded and trustworthy.

A typical high level analysis for the grounding of *Royal Majesty* (Ref 7) is shown in Annex C to illustrate the methodology used by the authors. Further analysis of this incident has been presented previously (Ref 8).

Where the report highlights something as being a cause, this is identified on the mind map in red. Contributory factors are identified in blue. Where there are questions outstanding from the reading of the report, these are identified. There are a number of instances where correct mitigation or preventative action had been taken. These are identified with a tick.

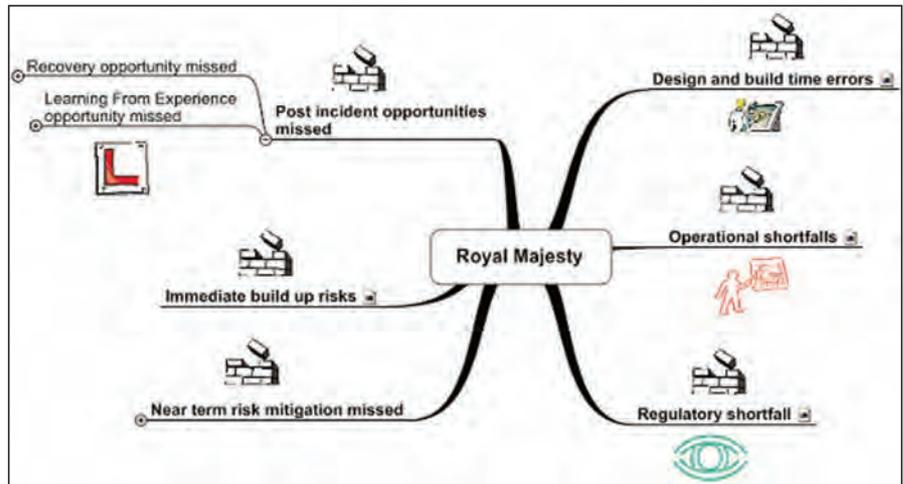
The approach taken to the incident analysis has the following characteristics:

- it assumes multiple causes
- it takes an event-tree approach, where successive 'barriers' to an incident have been breached, but does not make assumptions about the number of breaches required to bring about an incident or the temporal sequence of their construction or breaching
- Although Johnson (Ref 9) warns of the dangers of classification errors, it was decided to attempt a standard structure for attributing causes. It is believed that attributing causes to enabling systems through the life cycle is likely to be less obviously misleading than the types of coding scheme described by Johnson
- It is aimed at identifying potential preventative measures rather than in-depth analysis of causes. Although words such as 'shortfall' and 'error' are used, there is no attempt to assign blame. The interest is in understanding, but principally in corrective action at a systemic level.

Identification of mitigation measures

A key outcome of incident analysis is to support industry learning by identifying factors which would have mitigated the risks. To be effective, the mitigation measures must address the most elemental causal factors and not be targeted at some intermediate level. This means that the analysis has to get right back to those basic initiators. This increases the analysis and reporting burden and potentially requires expertise in all parts of the maritime community. However, the alternative is to miss vital opportunities. Further analysis can identify, at the basic level, causal factors which can be dealt with, often without incurring a massive cost penalty or increasing complexity.

Moving to 'learning from incidents' increases the number of lessons that can be learned from an incident. By structuring material around the stakeholders, it is intended that the transfer into good practice can be encouraged.



Annex C. Illustration of the presentation format: High-level analysis of the incident involving the grounding of the passenger ship *Royal Majesty* (Ref 7).

It is important that mitigation measures do not make the system more brittle (see Annex B). It is, furthermore, important that mitigation measures have general validity as there is no purpose in simply closing a unique stable door or introducing a measure which might prove counterproductive when applied more widely to different situations.

Learning opportunities from incidents must be applied wisely to ensure that the marine industry is well-served.

Experience from application of the structured systems approach

Two case studies are detailed in Annex C and Annex D. In each case the basic factual information is taken directly, and only, from the official investigation report. These working illustrations need to be read in association with the referenced report to gain a full understanding of the incident.

Conclusion

The need for incident analysis has been formally recognised, and its format codified. The next step, perhaps, is to improve the value of lessons extracted and their adoption by members of the maritime community.

Work by Lloyd's Register has indicated that a systems approach to reconstruction and analysis, combined with a simple compact presentation format, offers the potential to glean more information from an incident and to simplify the transfer to corrective or

improvement action. The number of marine incidents that are thoroughly investigated is relatively small and it is important to use these 'tales of what actually happens' to maximum effect.

Since each is, essentially, a sample taken at random, these represent an opportunity to dig beyond the immediate causes of the incident under investigation. The process described here provides an effective way to achieve the desired aim.

Annex A

Systems in the maritime community

The system elements/relevant systems have been identified in a number of ways, for example, Rasmussen (Ref 10) has government, regulators, company, management, staff, work. This and the Moray analysis (Ref 11) are based on approaches to analysing each system. The Lloyd's Register basis for identifying relevant systems was by 'systems of work' that affect the safety of operation. They are as shown in the accompanying Table 1.

The relevant systems have been variously portrayed as a hierarchy (Ref 10), a nested hierarchy (Ref 11), and as layered defences in depth (Ref 12). These representations present some conceptual difficulties and are graphically difficult to use for portraying the trajectory of an incident. They are perhaps more appropriate to sectors that are less

Table 1. Details of a typical base used by Lloyd's Register for identifying systems that affect safety.

Locus of shortfall	Relevant system(s)
Design and build time errors	Design office, shipyard, equipment manufacturer.
Regulatory shortfalls	Regulators eg, IMO, class, flag, port state control
Operational shortfalls	Company
Near-term risk mitigation missed	Crew
Immediate build-up risks	Watch
Post-incident opportunities missed	Crew, Rescue service

fragmented than the maritime sector, such as nuclear power generation. Fishbone diagrams may be more suitable but also bring with them some inappropriate conceptual background.

The dynamics of the interactions between regulatory system elements have been discussed (Refs 10, 13, 14) but are considered a second order issue here and not discussed further. The portrayal of such interactions would require a different format, such as an influence diagram.

Annex B

Systems, causation, and creating safety

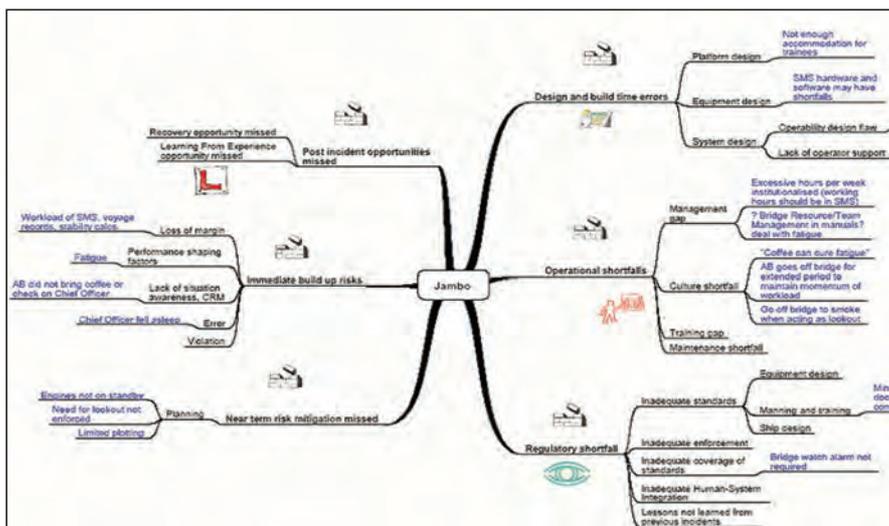
Incidents have large numbers of 'causes'. Wagenaar (Ref 15) has shown 'The number of causes in the 100 accidents ranged from 7 to 58 with a median of 23. The median number of 12 gates per network indicates that the number of steps between the remotest causes and the final consequence was fairly large-much bigger than even a very experienced chess player would consider in deciding about the next move. The analysis of 100 accidents at sea has brought us to the conclusion that the acts which lead to an accident are part of a complex causal network that cannot be overseen by the actors. Errors do not look like errors at the time they are perpetrated, and the accidents that are caused by them look impossible beforehand'. The number of causes identified was considered to be conservative because of the source data used.

Complex systems are not inherently safe (Cook, Ref 2); people continually create safe systems by local adaptations. With hindsight, some of these adaptations can look like errors.

Taking a limited view of 'cause' may do something to prevent a re-occurrence of the identical incident but may do little to prevent the next one. Even this may be optimistic. 'Views of 'cause' limit the effectiveness of defenses against future events. Post-accident remedies for 'human error' are usually predicated on obstructing activities that can 'cause' accidents. These end-of-the-chain measures do little to reduce the likelihood of further accidents.

In fact that likelihood of an identical accident is already extraordinarily low because the pattern of latent failures changes constantly. Instead of increasing safety, post-accident remedies usually increase the coupling and complexity of the system. This increases the potential number of latent failures and also makes the detection and blocking of accident trajectories more difficult.' (Cook, Ref 2)

The mechanistic analysis of the coupling shaft in Fig 1 is appropriate; such a process could conceivably be described by equations. However, such an analysis is not appropriate to the bridge, the design office or a fitting shop. Weinberg (Ref 16) points out the limits of mechanistic analysis and statistical analysis and the use of system to fill 'the yawning gap in the middle'. The idea of strict causality and the treatment of counterfactuals then changes.



Annex D. Assessment of the incident involving the loss of *Jambo* (Ref 18).

The authors propose that active failures (and hence incidents) occur when the demands of earlier shortfalls exceed the resources available to create safety; 'an accident waiting to happen' is a fair summary of the build up to many incidents. The systems approach gives philosophical support to 'learning from incidents'. The specific causal path attributed to an incident assumes less importance, and the shortfalls identified that were not deemed directly causal become worthy of consideration.

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Azipull thrusters for new coastal tanker

THE RMK Marine shipyard in Turkey is currently involved in a most interesting project to build a small 4200dwt (5200m³) coastal product vessel for Norwegian owner Bergen Tankers. This has been designed by Rolls-Royce member NVC-Design (Nordvestconsult), based in Ålesund, and the most innovative feature is the specification of twin Ulstein Aquamaster Azipull azimuthing propellers (another new larger tanker recently built in Turkey, the 15,000dwt *Puli*, also has azimuthing main propellers but these were conventional types from the Ulstein stable and of a different design, as discussed in *The Naval Architect* June 2005, page 11).

A tailor-made hull, just 92m long, was developed to accommodate the diesel-mechanical propulsion plant with its forward-facing propellers, and the thrusters plant has enabled an increase in cargo volume of between 5% and 7% to be achieved by moving the engineroom bulkhead further aft. The new ship will operate into small Norwegian ports, often with difficult access, thus the azimuthing propellers and a 500kW tunnel bow thruster will aid efficient manoeuvring.

In developing the hullform, NVC-Design had to ensure that the tanker would have good course-keeping ability - often a problem for

ships of this type. The Azipulls will however help greatly, since their hydrodynamically optimised underwater units provide substantial rudder area. Even so, a major

programme of computational design and model testing was undertaken to ensure that course stability is well in excess of IMO's zig-zag test requirements. 



Last month, we illustrated (page 24) two of three new 100,800dwt ice-strengthened tankers (*Pavel Chernysh* and *Captain Kostchev*), built by Hyundai Heavy Industries for Primorsk Shipping. Here, we show the newly developed Hyundai-Transas intelligent bridge system (HTiBS), which is installed on this trio; it is seen at the Neva 2005 exhibition in St Petersburg. This interesting advanced package is expected to become the first navigation concept to be accepted by Det Norske Veritas to meet its NAUT-AW class C notation. The third ship in the series, *Viktor Titov*, is presented in *Significant Ships of 2005*, which is published this month.

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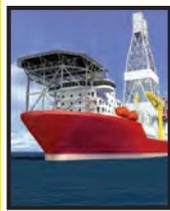
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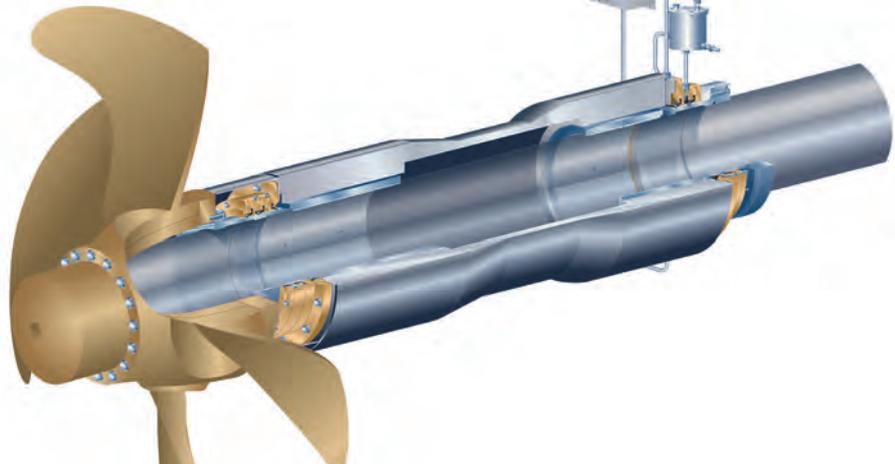


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Factors affecting future container liner dimensions

IN our November 2005 issue, we reported on the planned new design for a twin-screw 13,000TEU container liner conceived by Hyundai Heavy Industries in conjunction with class society Germanischer Lloyd. Some of the important influences on the determining features of this mammoth - which could probably offer transport costs reductions over smaller designs of around 13% - and the likely advances ahead were revealed by GL in Hamburg at the end of November.

Jan-Olof Probst, manager for the container sector, gave a timely reminder, for those who had forgotten, of the very large percentage of containers that today are carried on deck - around 50%. This compares with only 35% on the high-sided liners of the early 1970s when the same figure was 35%, and has been made possible only by a wider mid-body and broader fore and aft sections.

It is interesting to record that today, post-Panamax liners are able to dispense with most ballast water in the fully loaded condition - many smaller vessels still have to sail with up to 10,000tonnes of ballast to ensure sufficient stability. At the same time, an 8000TEU (post-Panamax) ship can actually only carry around 6000TEU if they are all loaded to the industry-average 14tonnes weight.

GL's largest vessel in service is *MSC Pamela*, first of nine 9200TEU liners ordered by German owner Claus-Peter Offen from the Samsung yard in Korea; she was delivered in July 2005. A further four ships have been ordered by the Mediterranean Shipping Co (MSC), which is also today the owner of *MSC Pamela*. At the time of writing, this is the largest container ship ever in service; it is however interesting to record that she was originally planned to be (and ordered as) a 8200TEU design but at the end of 2003, capacity was hoisted and the hull re-modelled in anticipation of a boom in freight.

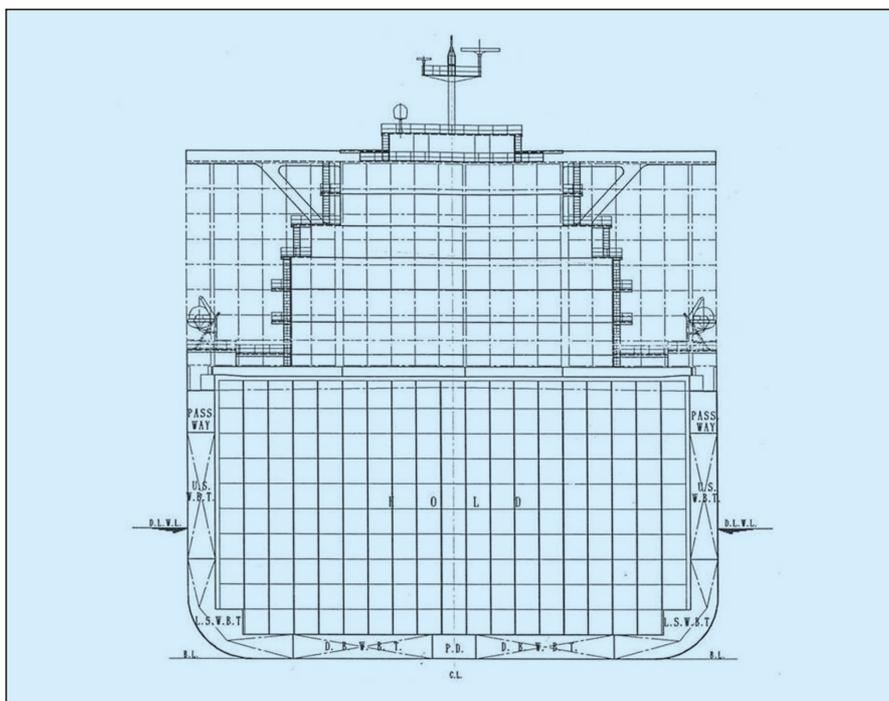
Expansion was achieved by increasing the breadth from 42.80m to 45.60m, allowing for 16 rows in the holds and 18 on deck. Since the moulded depth was also increased to 27.20m, a more satisfactory hold/deck ratio was also achieved with more than 50% of the boxes now stowed in the holds - in 10 tiers, with a further seven on deck. Sockets are provided for 700FEU boxes.

Important influences on future container designs will be the introduction by August 1, 2007 of mandatory positioning of fuel tanks inside double skins (already being achieved by some owners by placing most of these tanks transversely between holds), and an expectation by GL that average container weight will grow. Forward-thinking owners are already building in design margins so that a maximum 15.00m scantling draught can be maintained.

As revealed on the GL/Hyundai 13,000TEU proposal, the wheelhouse and accommodation block is most likely to be placed well forward. From a naval architect's perspective, this is good news, since it will help to restrict hull



The largest yet: *MSC Pamela*, capable of loading around 9200TEU/9500TEU and the first of a series of 13, was completed last year by Samsung for Mediterranean Shipping Co. When the next jump is made to 12,000TEU or 13,000TEU, it is likely that the deckhouse will be shifted forward, and twin propellers will be specified.



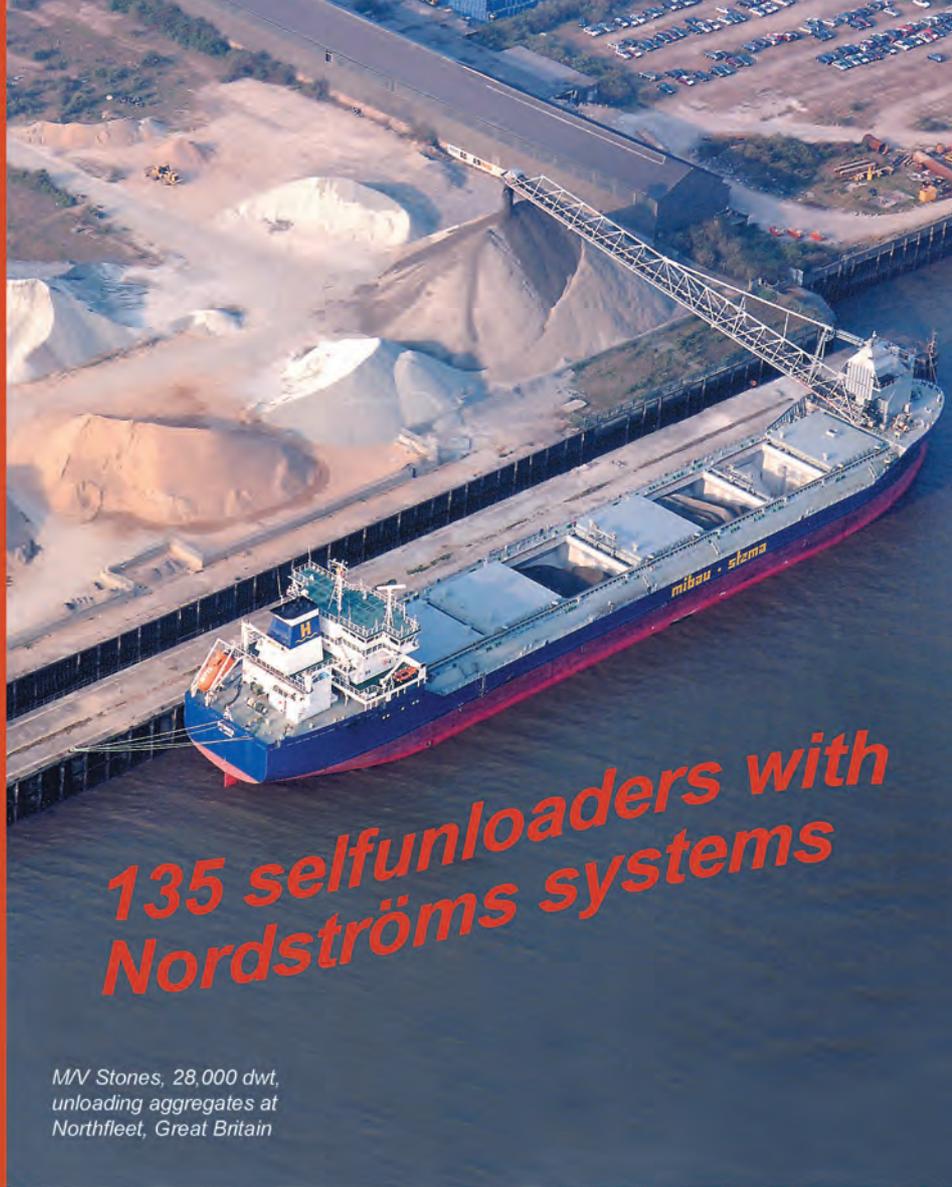
Proposed cross-section of a GL-classed 12,500TEU twin-screw container ship, with a breadth of 54.20m but still with a scantling draught of 15.00m, as on a 9500TEU ship.

deflections and limit stress. Navigating officers will also have a much improved forward view. Some questions have been raised over the positioning of the main fuel tanks under this deckhouse but since any fuel there is unlikely to be heated to any great degree, the risk of fire is minimal. GL believes that this ship concept could be expanded to accommodate 15,000TEU, if an owner required such a figure.

Although a single main engine and propeller are in theory perfectly possible for giants of this size, draught restrictions might make such a propeller less desirable. A most interesting alternative could be the ABB/Samsung proposal of a single main engine and propeller

supported by an electrically driven Azipod behind (*The Naval Architect* October 2001, page 6), however, quite a lot of extra cost would probably be involved.

Twin screws - as Hyundai proposes - represent a good, well proven compromise, providing a high degree of redundancy. *The Naval Architect* is additionally informed that large engine builders, such as Hyundai, which have tooled up their works for a maximum diesel engine bore of 980mm, are not very interested in investing in additional equipment to build only a few engines with bores beyond 1000mm. Of course, the gas turbine is still waiting in the wings! ⚓



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Busy times for Tsuji at Japanese yards

THIS year Tsuji Heavy Industries will manufacture more than 50 shipsets of all-electric wood-chip unloader systems to major Japanese shipyards Oshima Shipbuilding, Sanoyas Hishino Meisho, Tsuneishi Corp, Imabari Shipbuilding, and Shin-Kurushima Dockyard. Each system will consist of a set of four-rope grab cranes with special grab buckets, hoppers, and a deck and shuttle conveyor.

The electric-powered cranes, with extended cabin designed for a better cargo-hold view, are inverter-controlled, using technologies also employed in Japan's *shinkansen* 'bullet' trains.

Tsuji claims that the electric system performs better than electro-hydraulic cranes in extreme weather conditions. The company also says that the patent-pending cranes offer major benefits over traditional electro-hydraulic type machines, including:

- around 20% less energy consumption, less running and maintenance costs, and less damage to the environment
- smooth and exact acceleration and deceleration, precise handling movement
- sound and vibration reduction (complying with international noise pollution regulations).

Gantry cranes for Saga

The first shipset of 42tonne gantry cranes for Norwegian company Saga Forest Carriers' latest 46,500dwt open-hatch bulk carrier *Saga Adventure* was delivered to Oshima Shipbuilding in September 2005, and the next set is currently under final assembly at Tsuji

In this special feature, James Verrinder rounds-up 2005's major orders from the cranes and cargo handling sector, and examines the latest lifting technologies available.

Heavy Industries' works. The cranes, part of a nine-shipset order programme, are all inverter-driven with frequency controls.

A new feature on these designs is a detailed performance monitoring system, developed by Tsuji and Fuji Electric. On the control panel, information is displayed on crane status, and faultfinding, and extensive trouble-shooting assistance is provided.

Tsuji will also design and supply the twin 75tonne lifting capacity cranes for Mitsui OSK Lines' two 12,000dwt heavy-lift ships project at Honda Dockyard, with deliveries set for May and August 2006.

These cranes will be able to operate individually, or in synchronisation, to reach a combined capacity of 150tonnes. The units will be positioned between two long box-shaped holds, and offset to port.

The new vessels will be used for the transport of steel products, plywood, and project cargoes for the owner's Asian routes. As a result, the cranes will be equipped with a speed-change system, allowing them to unload general cargo at high speeds. The cranes will also be fitted with a precise cargo positioning system and acceleration/deceleration control. 

Cranes like these pictured (2 x 75tonnes) will soon be installed on Mitsui OSK Lines' two 12,000dwt heavy-lift ships, which are currently building at Honda Dockyard.

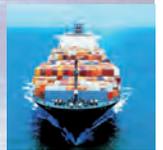


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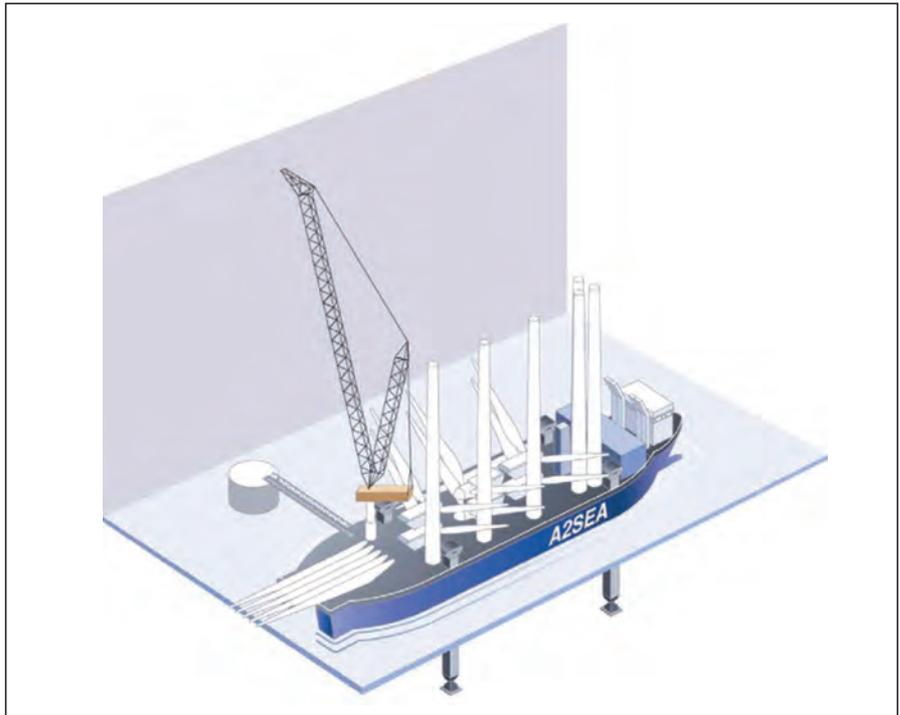
Conversion includes 1250tonne crane

PLANS to construct a crane ship with a lifting capacity of more than 1250tonnes took a step closer to reality in late 2005 following A2Sea's acquisition of *Sea Installer*. The company specialises in construction of offshore wind farms and, once converted, will use the new vessel to transport up to six 5MW turbines to offshore sites and install them.

The ship's 1250tonne capacity pedestal-mounted Liebherr or Demag crawler crane upper will have to be mounted further aft than on A2Sea's existing two ship cranes to allow the boom to be stowed in transit. *Sea Installer* already has two 63tonne hydraulic deck handling cranes and built-in pumps capable of pumping in up to 2000tonnes of water for ballast.

Other conversion work will include lengthening of the hull from 105m to 140m, widening the beam from 20m to 32m, together with the fitting of sponsons, jack-up legs, dynamic sensing, and accommodation units. According to A2Sea, the standard jack-up legs will allow the crane to operate in water depths up to 35m but these can be extended by another 10m for working in deeper water.

The vessel is currently in Singapore. Although no shipyard has yet been selected for the conversion work, A2Sea expects the ship to enter service some during 2006.



An impression of *Sea Installer* in her working mode and showing one possible version of the crane that she will carry. The vessel is set to be converted to allow the transport and installation of six wind turbines.

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(RINA)

New customers for cement handling system

LAST year was a successful one for BMH Marine, which found several new customers around the world for its Nordströms cement-handling system. In November, it was awarded the contract to supply a Nordströms system to be installed on a 20,200dwt newbuilding at Labroy Shipbuilding & Engineering Pte Ltd, in Singapore.

This cement handling system has a loading rate of 1000tonnes/h mechanical and 2 x 400tonnes/h pneumatic. Discharge rates are 4 x 300tonnes/h pneumatic, and up to 450tonnes/h when unloading mechanically. The contract is the customer's third order for a Nordströms system to be installed in a 20,200dwt newbuilding in Singapore.

Previous contracts were signed in July 2004 and January 2005 (as reported in our February 2005 feature).

In Poland, BMH Marine won a contract in June from SMT Shipmanagement & Transport Ltd to supply a Nordströms system. This equipment was ordered for a 23,000dwt bulk vessel to be converted into a cement carrier. Capacities are 1000tonnes/h for loading mechanically and up to 600tonnes/h for unloading pneumatically. Delivery is scheduled for early 2006.

In May last year, China Harbour Engineering Co (Group) also placed an order with BMH Marine for the supply of a Nordströms material-handling system for one floating

offshore transshipment barge and two 10,500dwt self-unloading barges. These barges, to be built in China for Whyalla Transshipment Inc, will have an unloading capacity of 5000tonnes/h each. The cargo to be handled is iron ore. 

Increased capability on CAD/CAM software

A CRANE and deck cargo handling module has been released by Autoship Systems Corp for its Autoload 6.0 software. This module allows a user to simulate the process of loading heavy or oversized cargo. Graphical stowage of cargo on deck is also included in this new plug-in.

Using the crane module's set of functions, the user is able to move cargo from the berth to its position onboard the vessel, utilising the module's drag-and-drop capability. Two choices are possible: cargo can be hooked to the crane, and then either graphically dragged to its final location on the vessel, or coordinates of the final cargo location can be typed in. Vessel stability and strength are automatically updated. 



Sandnes, a 28,400dwt re-modelled vessel built by Sietas Schiffswerft, Germany, and delivered to Reederei Hans-Jürgen Hartmann in 2005, is equipped with a Nordströms gravity-type self-unloading system for handling aggregates, with a rated capacity of 3000tonnes/h.

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Bespoke crane orders for dredger and trans-shipment operations

AMONGST recent contracts for Austria-headquartered manufacturer Liebherr was one to supply a special travelling deck crane for installation on the new mega cutter/suction dredger *D'Artagnan*. This interesting vessel was built by IHC Holland Merwede and is presented in *The Naval Architect* November 2005, page 30, and in *Significant Ships of 2005*. The customer, Belgian owner DEME, requested a design for a travelling crane to carry out repairs and maintenance on the dredging equipment as well as the handling of heavy weights. Liebherr provided a tailor-made solution in association with both shipyard and owner.

As a basis for the order, Liebherr used its CBW-type electro-hydraulic ram-luffing deck crane. The straight-fix boom was redesigned as a curved-fix boom with an auxiliary hoist, allowing sufficient outreach for, amongst other tasks, replacing the cutter head at the bow. Lifting capacity is 40tonnes, and the crane has a maximum outreach of 23m and a minimum of 18.15m.

Dredging operations have to be stopped during replacement of the heavy cutter; therefore the jib was designed in the shape of a bow in order to ensure that the distance between the lifting gear for the special cutter and the tip of the jib is kept to a minimum, thus avoiding extensive swing of the cutter during lifting due to heel and trim conditions. An additional remote control system was delivered, allowing the operator to observe the maintenance operations more closely and so increase efficiency and safety.

Meanwhile, in the Ukraine, a Liebherr CBG 25/30 Litronic floating cargo crane, mounted on an eccentric platform on the crane barge *Atlas-1*, has recently completed its first season transferring coal, sulphur, and grain between Volga and Don river barges and Panamax-sized vessels. This is the first time that Liebherr has installed a CBG 25/30 bulk handling system on a 10m eccentric arm, and the company claims that the design 'fully satisfies the customer's demand for heavy-duty offshore transshipment'.

The positioning of the crane, with its 7.5m cabin extension, alongside the vessel, ensures high safety in operation and allows efficient grab handling due to the improved visibility. The configuration allows shortening of the boom from 40m to 30m, which reduces grab swing and consequently increases productivity in transshipment operations, with up to 40 cycles hourly. The floating crane is certified to Lloyd's Register standards.

For this crane design, Liebherr can offer specific offshore options, including special heavy-duty hoisting winches, a strengthened boom, heel trim alarm systems, and emergency operation functions. These features would allow crane operation under heavy sea state conditions with wave heights up to 2.5m.

With a maximum lifting capacity of 25tonnes in grab operation at 30m working radius (plus 10m for the eccentric arm), the crane on *Atlas-1* is achieving an average rate of 750tonnes/h in calm seas and approximately 600tonnes/h under more



D'Artagnan, believed to be the largest ever self-propelled cutter suction dredger, is installed with a specially modified Liebherr travelling deck crane (seen here) that is able to deal with exchange of cutter heads at the bow.



Pictured here is the Liebherr CBG25/30 Litronic crane at work on the Ukrainian crane barge *Atlas-1*. Trans-shipment rates of up to 750tonnes/h (40 cycles) are being achieved, and an order has been placed for a second crane to be installed on a new barge.

difficult conditions. For cleaning up ship holds, the Ukrainian owner Transship Ltd uses bulldozers and wheel loaders, which can be lifted onboard with the crane in hook operation (with a maximum lifting capacity of 30tonnes, up to 26m working radius).

As a result of the successful operation with *Atlas-1* and the performance of the Liebherr floating cargo crane, Transship, based in Odessa, has placed a second order for a new crane barge *Atlas-2*, which will start operation in early summer time this year.

New production facility

Liebherr has established an additional production site for maritime cranes, with a total area of

220,000m², in the harbour area of Rostock on the German Baltic coast. Production commenced here in mid-March 2005 and is currently concentrated in one workshop in which steel construction, mechanical assembly, and painting are carried out. A large assembly workshop and the administration building were completed at the end of 2005.

Due to the positive order situation in the maritime market, Liebherr-Werk Nenzing decided to start production in Rostock earlier than originally planned. At the present time, 214 employees are employed there, 50 of which are contractors. Further employees are being trained at the headquarters in Nenzing. 

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Record orders for MacGregor cranes

THE crane division of the MacGregor group is currently enjoying a record backlog of around SwKr1.2 billion for deliveries between 2006 and 2008. Amongst many interesting orders from around the world for this energetic company was a contract to supply one 30tonnes and two 80tonne cranes for each of four ships to be built by Xingang Shipyard in China for the Swiss owner, Enzian Shipping.

Earlier, the same owner booked two 80tonne cranes for a series of three 12,061dwt/12,578dwt multipurpose ships ordered from the Kyokuyo Shipyard in Japan. The first vessel, *SCL Bern*, entered service a year ago. The GL8010/4530/4033-3 cranes on the latter ships are mounted on pedestals built into the port side structure. A 17m long beam allows a joint lift of 144tonnes when required, and frame spreaders of 36tonne and 50tonnes are also supplied.

Meanwhile, Singaporean shipowner Pacific International Lines has ordered two 45tonne slim-type cranes for container handling onboard

new vessels that will be built at another Japanese yard, Shin-Kurushima. The same shipowner already has a number of crane products supplied by MacGregor onboard its vessels.

Staying in the Far East, Polish/Chinese shipowner Chipolbrok has ordered 150tonne-capacity twin cranes for three existing vessels. The vessels will be refurbished to extend their operational lifetime; Chipolbrok already has MacGregor's heavy-lift cranes onboard some of its latest newbuildings, such as *Wladyslaw Orkan*, illustrated on page 59 of our February 2005 issue. This shipowner has concentrated on project loads with high lifting capacity requirements.

A spokesman from MacGregor commented that, although 'the tanker market has been relatively slow', the company has secured orders for hose-handling cranes onboard two new vessels recently. These ships will be built at Hyundai Heavy Industries, in Korea, for Teekay.

Finally, last June, MacGregor secured its largest-ever container-handling ship crane order from Korean shipbuilder Hyundai Mipo Dockyard. This US\$37 million order involves a massive series of 26 container vessels for two German owners, each with a capacity of 1800TEU. Twenty of the ships are for Reederei Claus-Peter Offen and the remainder have been contracted by the Conti group.

Each 28,200dwt ship will be equipped with three GL-type cranes with lifting capacities up to 45tonnes. Two units will be able to lift 45tonnes at 26m outreach or 40tonnes at 29m, while the third crane can handle 45tonnes at a slightly longer outreach of 27m or 40tonnes at 30m. All these cranes will be assembled by MacGregor's Korean production partner, Hochang Heavy Machinery and Industrial Co, in Ulsan, Korea; the last one should be delivered in July 2008. 

Dock lift and walking beams can ease yard problems

AN alternative aid to shifting ever-larger ship sections around a yard and into a building dock is the Goliat Docklift concept, operating in association with dual-walking-beam (DWB) technology, both of which have been developed by TTS Materials Handling, a member of the Norwegian TTS group. This interesting method aims to avoid shipyards having to spend large sums of money on new docks and goliath cranes.

Some 30 years ago, block sizes of 30tonnes or 50tonnes were fairly common but today sizes have leaped to 300tonnes or 600tonnes, with some yards already lifting sections up to 1200tonnes or 2000tonnes. In the case of the Korean yard Samsung, for example, blocks up to 2500tonnes are today being lifted into a floating dock for assembly, as reported in *The*

Naval Architect October 2005, page 40. By such methods, Samsung hopes to deliver a Suezmax tanker in only seven months from the start of steel cutting, with even more optimistic targets in the future, aided by a newly ordered additional floating dock. Floating docks are being used by this Korean giant to overcome existing construction dock capacity problems at a time of a large order book.

Meanwhile, Namura Shipbuilding in Japan is, according to TTS, shrinking dock time to only 21 days by assembling larger sections. Another Korean yard, Hanjin Heavy Industries, is also aiming to lift 2000tonne blocks.

The Goliat Docklift system, in association with dual walking beams, claims to be able to lift the same loads (up to 2000tonnes) into a building dock, but for a more modest

investment. DWB transporters - designed in 100tonne, 200tonne, and 400tonne sizes - would move blocks to a dockside where a Goliat Docklift arrangement, operating in a somewhat similar fashion to a shiplift, would lower each one into the dock. Once here, dual walking beams can again be employed to move the block to the ship and position it accurately in six axes.

The largest Docklift system is at the Zaliv yard, in the Ukraine, although the equipment is not yet believed to be in operation. It comprises a 2000tonne Goliat Docklift and 10 dual walking beams, each of 200tonne capacity. Six beams are believed to be in use at the present time. Because the Docklift is not operational, blocks up to 590tonnes are currently lifted into the dock by two 320tonne gantry cranes, as reported in our January 2005 issue, page 22. 

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New production facility for increased Asian presence

A CHINESE facility which is set to produce Wärtsilä Auxpac 20 units, is nearing completion. This summer the first generating sets will roll out of the new assembly plant in Shanghai, beginning a joint venture between Wärtsilä and the Shanghai Marine Diesel Engine Research Institute (SMDERI). The 50/50-owned company will be named Wärtsilä Qiyao Diesel Co Ltd.

SMDERI, an affiliate of the Chinese shipbuilding group CSIC, is currently known for diesel engines, engine room and automation equipment, also noise and vibration reduction solutions. Located in the Lingang Industry Zone in Shanghai, the new factory has an area of more than 8000m², including offices. The facility will employ more than 100 people when its phase 1 capacity has been granted.

Auxpac medium- and high-speed marine generating sets were introduced to the market at the end of 2004. They are supplied as pre-commissioned standard modular packages. The high-speed range covers an output from 60kWe-1630kWe, while medium-speed power run from 520kWe to 2850kWe. The latter series (based on the Wärtsilä 20-series engines) run on heavy fuel, and the high-speed range on marine gas oil. The high-speed sets are based on cooperation with Volvo Penta, through which Wärtsilä will sell and service large Volvo Penta engines for commercial shipping applications.

Wärtsilä has recently enhanced its Auxpac range by increasing the output to 2850kWe (3625kVA) and now offers a suite of technical modifications which have not only improved price and performance, but also lowered lifecycle costs. A new fuel system makes it possible to feed fuel with the same parameters as the main engine, allowing generators to be connected to the main engine fuel supply.

To speed up and simplify installation, the water cooling system on the Wärtsilä 20-series has also been remodelled, halving the number of connections required to two, as well as saving engine parts. In addition, the engine design has been improved, including a simpler lubrication oil sump. All of these changes have aided Wärtsilä in reducing prices, it is claimed.

Another new feature is replacement of the hydraulic-mechanical speed governor with an all-electric unit. The governor, developed by Wärtsilä, provides a gain in performance areas while the new actuator provides a faster, more

At the end of last year, from December 6-9, the Marintec China exhibition was held in Shanghai, China. It was a record-breaking event, with 1032 exhibiting companies attending, and 30,097 visitors registered. Over 70% of exhibiting companies came from abroad, underlining the international profile of what is now regarded as the definitive maritime trade fair in Asia. The show conclusively reinforced the technological exchange between the international and Chinese maritime industries. *The Naval Architect* attended the exhibition, and this report details activities of some of the many European companies working, and expanding their businesses, in Asia.

accurate response. Improvements of up to 30% in load response have been confirmed in tests. A new control system also provides for isochronous load sharing.

A full range of service support for the Auxpac range includes commissioning, maintenance, and spare parts. One of the features of this is the availability of advanced condition monitoring analysis to support planned maintenance.

This works by exploiting data made available by the electronic control facilities on the diesel engines. Data from each generator set's proprietary dual-redundant CANbus network is collected, exported, and analysed by an optional software package named CMB Expert.

This can be performed locally on a shipboard PC or by remotely transferring the data via a satellite link to a Wärtsilä service centre. If spares are required, they can then be sent to the ship's next port.

First deliveries

There are currently more than 200 Auxpac 20 sets on order, 70 of which are destined for ships under construction in China. The first Chinese-built Auxpac sets are likely to use four-cylinder Auxpac 20 engines with an output of 645kWe, and the six-cylinder versions with outputs of 875kWe and 975kWe. These will be for delivery to both domestic shipyards and for export, for installation in Handymax bulk carriers and product tankers. 

An artist's impression of the new assembly plant Wärtsilä Qiyao Diesel, in Shanghai.



Turbocharger companies join force

A NEW joint venture between ABB and Jiangjin Turbocharger Plant (JTP), named ABB Jiangjin Turbo Systems Co Ltd, has recently been set up for the production, sales, and servicing of ABB turbochargers in the Chinese market. The partnership became active on January 1 2006.

The company will be headquartered in Jiangjin and combines JTP's factory in Jiangjin in the municipality of Chongqing with both partners' sale and service stations along the coast, including those in Hong Kong.

JTP is a subsidiary of China Shipbuilding Industry Corp (CSIC) and has been ABB's licensee

for turbochargers in China since 1978. By joining forces, ABB and JTP hope to further strengthen their positions as a prime supplier of turbochargers to the Chinese market. ABB Jiangjin Turbo Systems Co Ltd, employing approximately 500 people, will be under ABB management and fully integrated into ABB's worldwide network. 

Flush of new orders in Chinese yards

FOR over 30 years, MacGregor has been working in China, and this commitment to the country is paying off, with equipment and services being supplied by the company for newbuildings at a number of Chinese yards. Typical of these is a contract for the design and supply of key components for lift-away hatch covers for 15 container ships (plus an option for two more) being built at the Huanghai Shipyard. These 600TEU vessels (hull Nos HCY37-41 and HCY44-53) are destined for Intership Navigation, of Cyprus. Negotiations are underway that may lead to MacGregor cranes also being installed on some of these hulls.

The lift-away covers can be operated in a non-sequential order. Each shipset will comprise 12 panels arranged to serve three container holds in either three, four-, or five-panel configurations. The panels are designed to accept container stack loads of 55tonnes/20ft units and 70tonnes/40ft units for carrying cargo on deck. Supporting the hatch covers will be MacGregor Flexipad replaceable bearing pads.

Additionally, the company has received a similar order for lift-away covers from the Chinese shipowner Dalian Jifa Bohai Rim Container Lines, which has booked three 600TEU container ships (hull Nos HCY31, HCY34, and HCY36) from the same yard. The main difference between this project and the one above is that in this case the vertical stoppers use steel pads.

MacGregor is also supplying hatch cover outfits for another series of 600TEU container vessels for V-Ships, which are being built at the Huanghai shipyard as well. For this order, the hatch cover concept is different, accommodating longitudinal coamings.

Four 11,800dwt multipurpose container vessels ordered from Xingang Shipyard by Swiss shipowner Enzian Shipping feature MacGregor cranes, hatch covers, and lashing equipment. The ships have capacity for 711TEU, and have three holds.

Three MacGregor GL-type cranes will be carried, and these will be installed on the port side. The forward two can handle 80tonnes at a maximum outreach of 20m, 60tonnes at 24m, 45tonnes at 30m, and 40tonnes at 33m (GL8020/6024/4530/4033-2 models).

The aft GL45/28/4033-2 crane has capacity for 45tonnes at a radius of up to 28m, and 40tonnes at up to 33m. Both cranes and crane jibs are specially designed for efficient cargo operations on both sides of the ship. Heavy lifts of up to 160tonnes will be handled on the port side, and normal cargo operation will be handled from the starboard side.

Hatch cover outfits comprise a combination of Foldtite and lift-away covers on the weatherdeck, and lift-away covers on the tweendeck. The hatch covers are manually cleared and weathertight.

Hold No 1 has a clear opening of 20.3m by 10.8/7.0m and uses two high-stowing folding panels at the aft end and a lift-away panel forward. Hold No 2 provides a clear opening of 39.2m by 17.9m and employs four high-stowing folding panels (a pair at each end) and two lift-

away panels. Hold No 3 has a clear opening of 25.9m by 17.9m and features a pair of high-stowing folding panels and a pair of lift-away panels. Covers on the aft two holds can withstand uniformly distributed loads of 3.5tonnes/m², and the three panels on No 1 have design loads of 4.6tonnes/m² (forward), 4.14tonnes/m² (middle) and 3.77tonnes/m² (aft).

The tweendecks covers are non-weathertight, and the short panels can be used as grain bulkheads. There are 13 panels: three in No 1 hold, six in No 2, and four in No 3.

A series of six 17,300dwt multipurpose cargo ships being built by Hudong-Zhonghua Shipyard for Wagenborg Shipping (two) and Beluga Shipping (four) are a repeat order of vessels previously ordered by Wagenborg (hull Nos H1362A - H1365A). MacGregor's scope of delivery for hatch covers comprises design and key components. The company is also supplying lashing equipment on hatch covers, and in cargo holds.

Weatherdeck hatch covers are the high-stowing folding type, operated by external hydraulic cylinders and bell-crank arms, while tweendeck covers are lift-away panels. The two-hatch ship uses four panels to close No 1 hatch, which has a clear opening of 35.9m by 17.75m, while No 2 has two forward panels and four aft to close an opening that is 52.2m long and 17.75m wide. Container stack loads are 50tonnes for TEU and 60tonnes for FEU.

The ships have a 962TEU capacity. MacGregor container lashing systems include container fittings in the tanktop, on the tweendeck pontoons and on the upper deck hatch covers. General cargo fittings include 10tonne SWL flush lashing eyes in the hatch coaming and on the end bulkhead in the cargo holds, and timber lashing eyes on the hatches.

Finally, four 10,000TEU carriers, ordered by China Ocean Shipping Group Co (COSCO) from Hyundai Heavy Industries, Korea, are claimed to be the world's largest container ships with a declared capacity. MacGregor is providing the hatch cover design and key components for these vessels. The ships are set to be delivered between late 2007 and mid-2008.

The vessels have a length of 334.0m, a beam of 45.6m, and a design draught of 13.0m. Speed is 25.8knots. Each of the 10 holds are located forward of the accommodation block, and there are two more aft. Each shipset of hatch covers comprises 78 lift-away panels; maximum weight of a panel is 40tonnes.

Manufacturing and aftersales

Heading up MacGregor's container lashings equipment manufacture in China is Dalian Shidao Marine Fittings (DSMF), located in Dalian. A new 15,000m² factory is planned to come on stream soon, for the manufacture of hatch cover and lashing components. For the aftersales market, MacGregor lashing components are being manufactured by Sundo Industrial Co Ltd at a newly built factory in Liyang specially designed for production of lashing components. Ⓢ

Class societies team up on yard quality

ITALIAN classification society and Certification group RINA and the China Classification Society (CCS) have joined forces to deliver quality management system expertise to small and medium-size Chinese shipyards, which intend to build ships for the international market. The two class societies have set up a joint venture company, Yizhong Marine Technical Services, based in Shanghai. This will assist between five and ten yards in its first year.

The yards, suitable for building ships up to 50,000dwt, are those which currently build only to internal Chinese standards but which wish to enter the international shipbuilding sector. Yizhong will train management teams and help them set up and run a complete quality management system capable of building ships to international classification standards.

The first yards scheduled for assistance have been identified, and it is expected that systems will be in place at least five of them within a year. RINA sees this as the first step in developing wider services within China. It already has an extensive industrial certification and expertise-sharing programme in India, and it hopes to share that experience with growing businesses in China. Ⓢ

New factory for interior panels

THE interior accommodation company, Inexa, based in Denmark, recently established TNF Interior products in China, by starting production at a factory which, the company claims, will be the largest panel manufacturing plant in the world. This factory, located in Nantong, with an area of 40,000m², will be ready to start production this month (February). The facility will become Inexa's primary factory for producing TFN Magic - a specialist interior wall finish, created to replace PVC walls - but the secondary factory will remain in Denmark.

This move was made by the company to increase its business in the Far East region, and as a good logistical base. Inexa believes that China will soon be building new-generation river passenger vessels, and sees a good market for its prefabricated cabins. Bathroom units are also starting to be produced in China, due to a cooperation agreement with a company in Shanghai. Ⓢ

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Twin-skeg hullform for Tarbit newbuilds

BUILDING to a Skipskonsulent design in China are two 25,000dwt, IMO Type II chemical/products tankers for the Swedish owner Tarbit Shipping AB, with deliveries from Shanghai Edward Shipbuilding scheduled for the second quarter of 2006 and end-2006/beginning 2007.

This SK4226 design follows those other Skipskonsulent tankers discussed in our January edition, page 16, in having a high level of emphasis on safety in coastwise trades, featuring a twin-skeg hullform with redundancy in the form of twin medium-speed engines, two CP

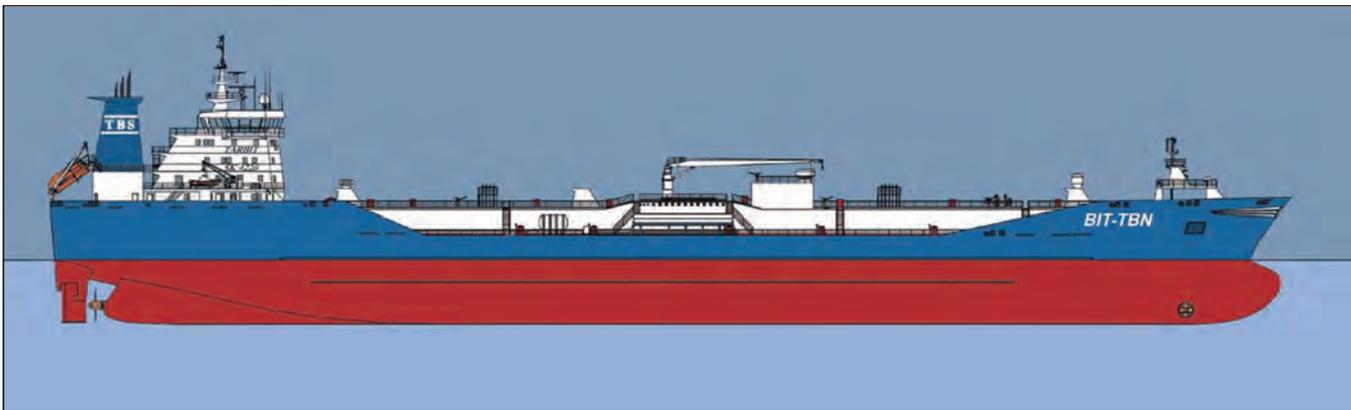
propellers, two rudders, and a 450kW bow thruster. All these should give excellent manoeuvrability, and with a hullform designed for minimum resistance, a trial speed of 17.00knots (service speed 16.00knots) is anticipated.

The tankers are being strengthened to Ice Class 1A and have a cargo capacity of 26,900m³. They are also designed for a short turnaround with the latest 'super stripping' cargo handling features. Eight segregations are possible, with a discharge rate of 3000m³/h when eight of the 16 x 375m³/h submerged pumps are running.

TECHNICAL PARTICULARS SK 4226 TANKERS

Length, oa.....	177.10m
Length, bp.....	167.00m
Breadth, moulded.....	26.00m
Depth, to main deck.....	12.80m
Draught, design.....	9.20m
Draught, scantling.....	9.70m
Deadweight.....	25,000tonnes
Cargo capacity.....	26,900m ³
Main engines.....	2 x 5850kW
Classification.....	Germanischer Lloyd
	+ 100 A5 E3, NAV-OC, ESP, INERT,
	IW, RP2 50%, Oil Tanker, and
	Chemical Tanker, Type II, + MC AUT

Profile of Skipskonsulent's SK 4226 design for Tarbit Shipping.



Chinese facility expanded for increased output

CATERPILLAR has expanded its global presence by added investment into one of its key engine manufacturing facilities in China, Caterpillar Motoren Guangdong Co Ltd. Some time ago, the facility began producing MaK M25 marine engines for propulsion and genset applications (MaK has been a member of the Caterpillar group for a few years now). Manufacturing for this medium-speed engine is now closer to the growing number of Asian shipyards, reducing delivery times and transportation costs for customers.

Expansion of operations at Caterpillar Motoren Guangdong is part of Caterpillar's long-term and ongoing strategy to be a global manufacturer of diesel and natural gas engines. The company is focused on expanding its presence in China and now operates 13 facilities/joint ventures in the country, with more than 4300 people employed in China.

Located 12km from Guangzhou, Caterpillar Motoren Guangdong manufactures, tests, and supplies medium-speed MaK engines. This site has produced MaK M453C in-line diesel engines for ship propulsion, genset use, and power plant operation since 1996. By adding manufacturing of the smaller MaK M25 engine, the facility has expanded its medium-speed engine production.

The M25 features a power range from 1800kW (2450bhp) to 2970kW (4040bhp). It has a bore of 255mm and a stroke of 400mm,



Caterpillar Motoren Guangdong has recently been upgraded, and is now producing the MaK M25 engine series.

with speeds of 720rev/min and 750rev/min. With the addition of M25 production has come a comprehensive upgrade of Caterpillar Motoren Guangdong's assembly line capacity, test beds, and quality control operations.

Being part of the global Caterpillar production and quality management system, Guangdong operations provide the same products as the other Caterpillar marine engine manufacturing sites located in the USA, Germany, Belgium, and the UK. In fact, the

M25 engines being assembled in Guangdong utilise component packs completely supplied by Caterpillar Motoren, in Germany, thus helping to guarantee identical engine quality.

Guangdong operations represents the largest medium-speed engine manufacturing site in Southern China, according to Caterpillar, and the facility is poised to reach high production levels in 2006 to meet the increasing demand for M25 engines in both domestic and international marine markets.

Volcan de Timanfaya: modified for night service

IN our annual publication *Significant Ships of 2004*, we presented an interesting 17,343gt passenger/vehicle ferry, *Volcan de Tamasite*, built by the Barreras shipyard at Vigo in Spain. She was the first of two new-design sisters ordered by the Armas group, for services between the various ports of the seven main islands of the Spanish Canary group, off Morocco, West Africa.

Emphasis is placed on a high standard of amenities for an enjoyable trip, mainly on day voyages, only for up to 1466 passengers. Features included a fine panoramic lounge forward on Deck 6 and a further lounge with radiused windows on the same level at the stern, with an upper level on the deck above.

Although largely identical, her sister, *Volcan de Timanfaya*, has been created with some interesting modifications to provide comfortable accommodation on night services. In essence, this requirement has called for replacement of the forward panoramic lounge on Deck 6, together with the large area of Pullman chairs immediately aft of this space, by passenger cabins. These comprise 46 four-berth cabins, eight for two people, and two three-person cabins for disabled passengers. All have private toilet/shower units. As a result of this alterations, the passenger capacity is reduced to under 1000 - the total complement, including crew, is actually 1000; these figures compare with 1466 passengers on the day-service *Volcan de Tamasite*.

Supporting facilities include a cafeteria on Deck 6 and a two-level snack bar on Decks 6 and 7, as well as various lounges, but there is no waiter-service restaurant, although a galley is placed on Deck 7 to service the passenger and crew self-service units. Other features include a shop, gaming room, video room, and a nursery. On the open upper deck are a swimming pool, with bar and changing rooms, also a solarium.

Passenger comfort is ensured, as on *Volcan de Tamasite*, by a pair of folding fin stabilisers, but the lifesaving outfit has been modified to suit the reduced number of passengers. On the new



Although mainly similar to her sister, *Volcan de Timanfaya* has been specifically modified to provide night services in the Canary Islands group by replacing forward lounges with 56 passenger cabins.



One of the cabins against the sloping forward bulkhead on Deck 6.



One of the 45 four-berth passenger cabins. The upper berths can be stowed against the bulkheads if necessary.

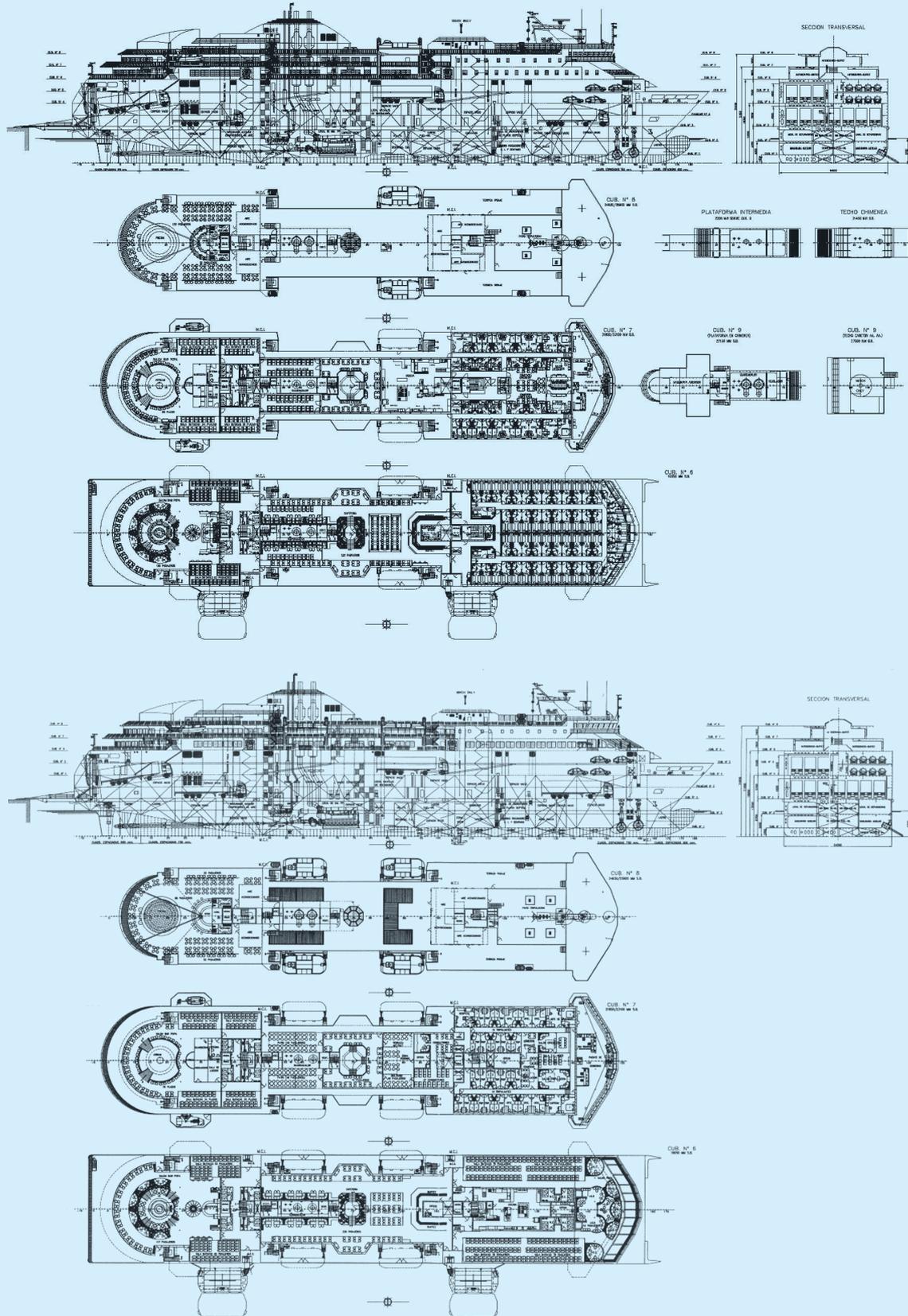
TECHNICAL PARTICULARS VOLCAN DE TIMANFAYA

Length, oa.....	142.45m
Length, bp.....	125.00m
Breadth, moulded.....	24.30m
Depth, to main deck.....	8.35m
Draught, design.....	5.70m
Draught, scantling.....	6.00m
Deadweight, design draught.....	2900dwt
Number of decks.....	8
Complement (passengers and crew).....	1000
Cars.....	404
Trailers.....	69 x 16m
Speed, service.....	21.00knots
Classification.....	Bureau Veritas 1 + Hull, 1 + Mach, Ro-Ro Passenger Unrestricted Navigation, AUT-UMS

ship, it is centred on four Viking marine escape systems (two to port and two to starboard), each designed for 175 people. These are supported by two 150-person enclosed lifeboats and a pair of fast rescue boats - two different types - mounted towards the stern.

To reflect the mainly night voyages being operated, service speed has been reduced by one knot to 21.00knots, compared with her sister. The propulsion plant, twin Wärtsilä 8L46C medium-speed engines driving Rolls-Royce CP propellers, remains the same.

Profile and plans for Decks 6, 7, and 8 on *Volcan de Timanfaya* (top), compared with the same decks on her earlier sister *Volcan de Tamasite* (below).



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Autoship 9 released

THE well-known ship hull design program, Autoship, has recently been given a major upgrade, and the program now incorporates entirely new design aids. Some of the main features are detailed below.

Feature patches

A major limitation of NURBS-based surface design is that if a designer wants to introduce additional control in one region of a surface he must add complete new rows and/or columns of control points. This proliferation of vertices makes it difficult to produce a fair surface. Autoship 9 introduces a system of local shape control on a surface without dealing with unwanted control points.

A feature patch has default or user-defined boundaries. It can be shaped by one or more control points, and the patch blends at its edges to the shape of the parent surface. The blend transition may be positional, tangent, or curvature continuous.

When a surface has a patch applied, it is still fully editable using only the original control points. When the parent surface shape is changed, the patch moves with the change, retaining its own shape. Patches may overlap and be nested.

Edge Mate

Ship hulls and superstructures are often designed as several surfaces, which must be joined at their edges without leaving gaps. The Edge Mate facility allows all or part of one surface to be matched exactly to all or part of another surface's edge with full control over the shape of the transition. The user can choose positional, tangent or curvature continuity from one surface to the other. The portion of the surface used to make the transition is user-controlled. When only part of an edge is mated, there is full user control over the transition area at the end of the mate. Any or all of the edges of a surface can be mated.

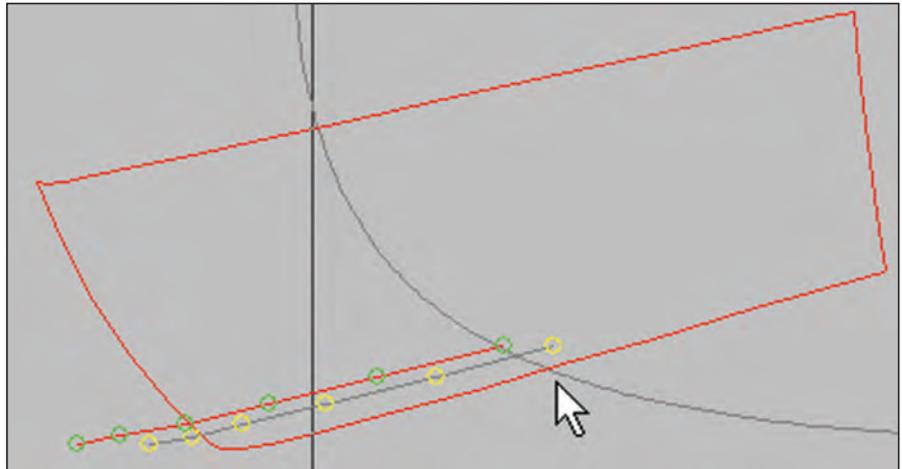
Project integration and export

Surfaces which incorporate feature patches and/or Edge Mates are fully integrated into an Autoship project. They are contoured, intersected, trimmed, meshed, and rendered, just as any other surface. They also export exactly via IGES, making transfer of designs from Autoship to other programs simple and accurate.

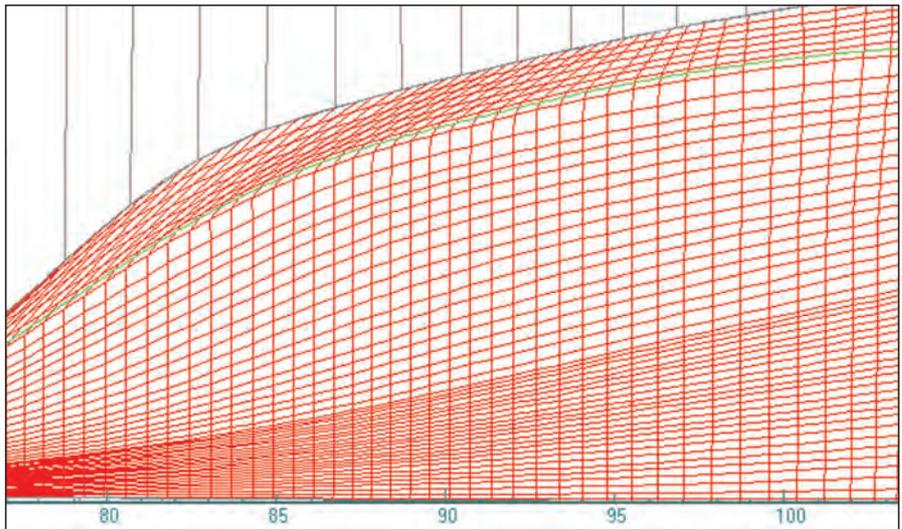
Additional features

In addition to these major tool additions, Autoship 9 incorporates other significant advances. These include:

- a revised Navigator for organising and accessing model components. Points curves and surfaces can be organised into collection trees for fast access
- edit planes. Define a plane oblique to the coordinate axes and edit with respect to that plane. Edit in the 3D view with respect to one of the principal planes or an oblique plane which users define
- alternate main screen layouts
- surface colour. Make it easy to pick out one surface in a complex design by assigning it

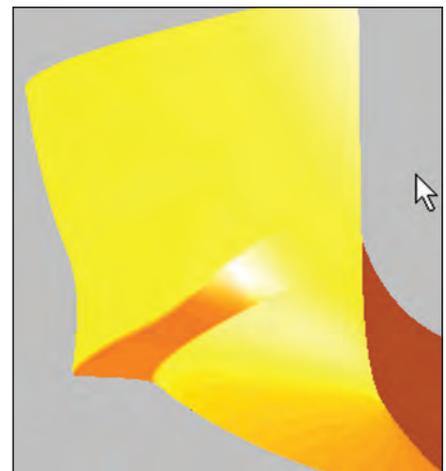


Oblique view of a feature patch applied on a boat hull. There are two rows of control points on the patch, one of which (green circles) is a chine.



Curvature-continuous blend between flat of side and bow surfaces.

- a colour. This is for outline drawing, not for rendering where Autoship's system of surface finishes still applies
- translucency in rendering
- single button operation to create station contours from baseline data
- increased use of context menus to speed access to operations.



A rendering of a boat hull, showing the spray rail introduced as a feature patch.

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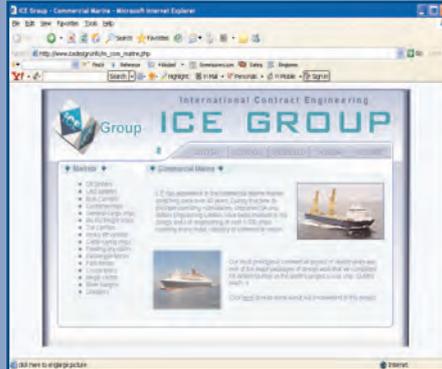
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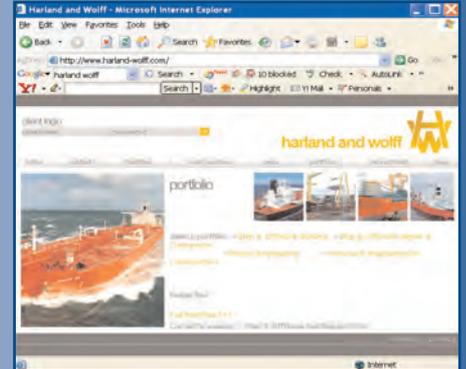
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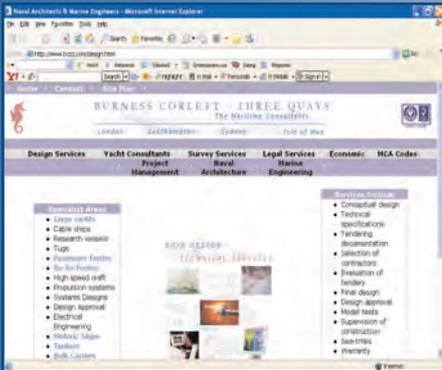
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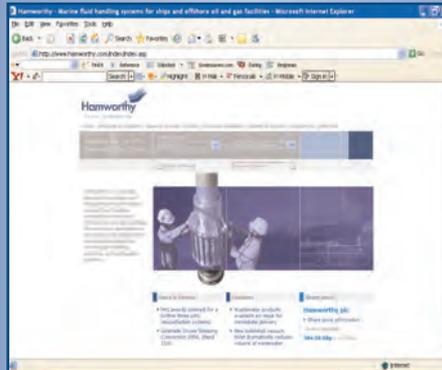
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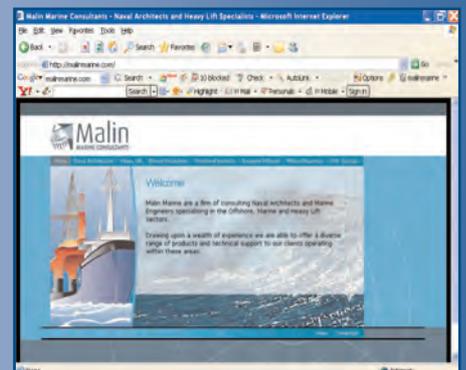
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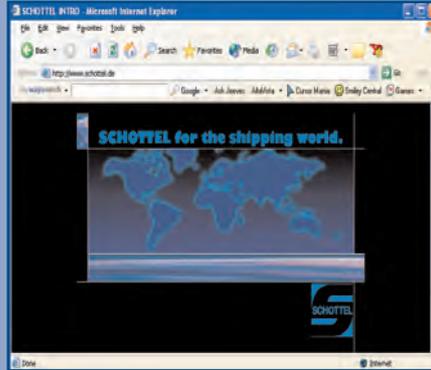
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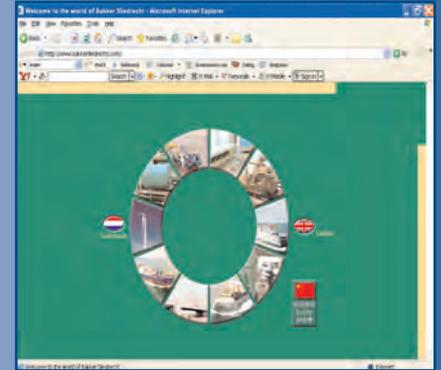
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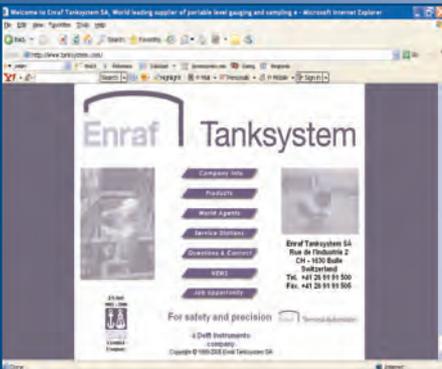
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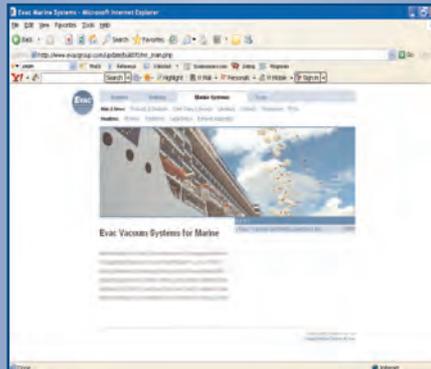
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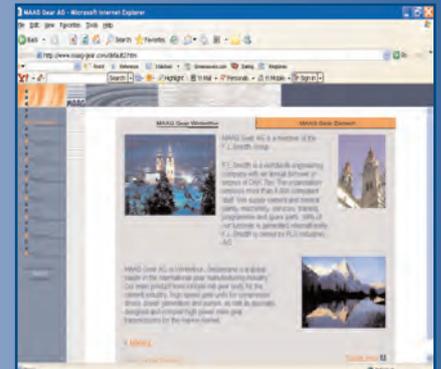
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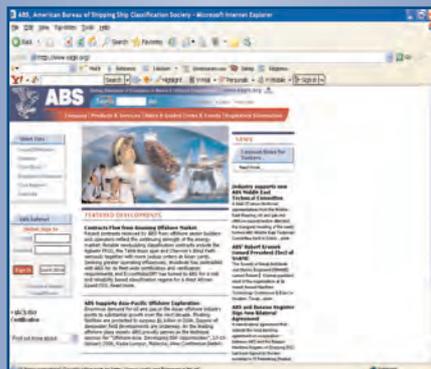
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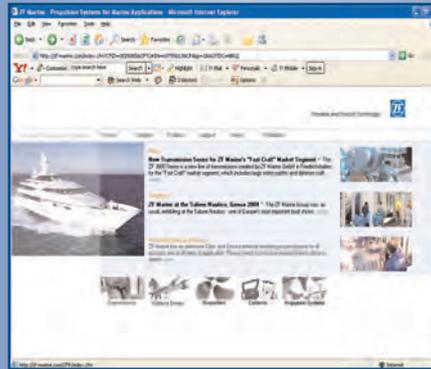
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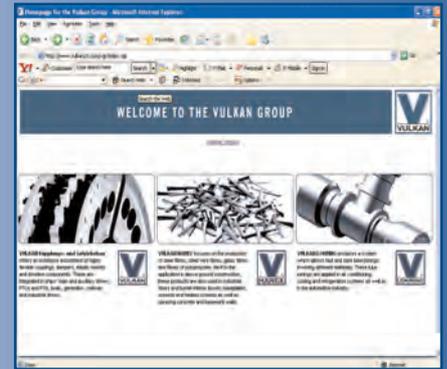
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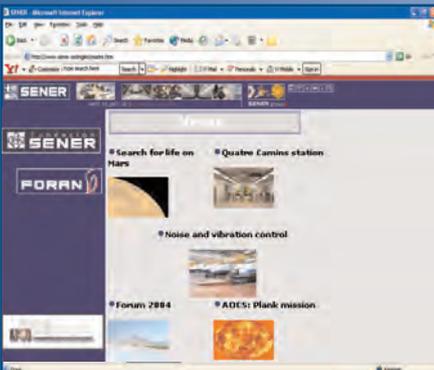
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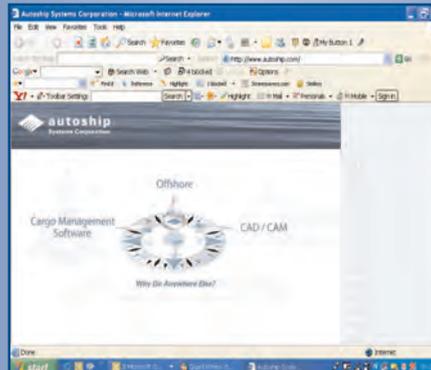
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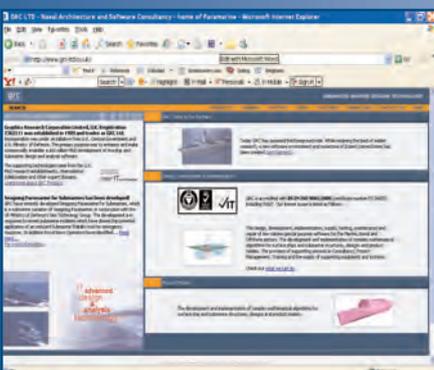
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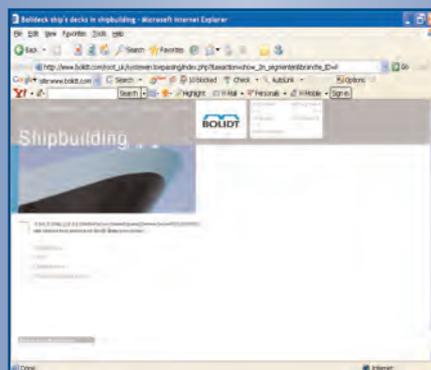
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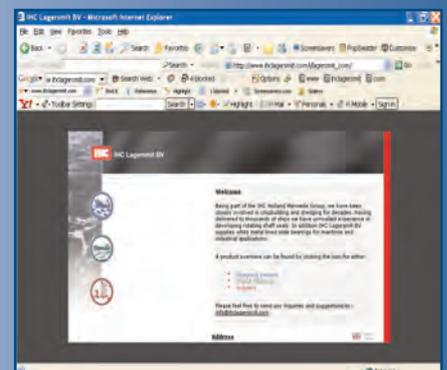
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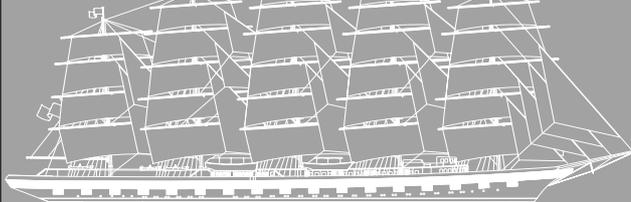
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