THE NAVAL ARCHITECT

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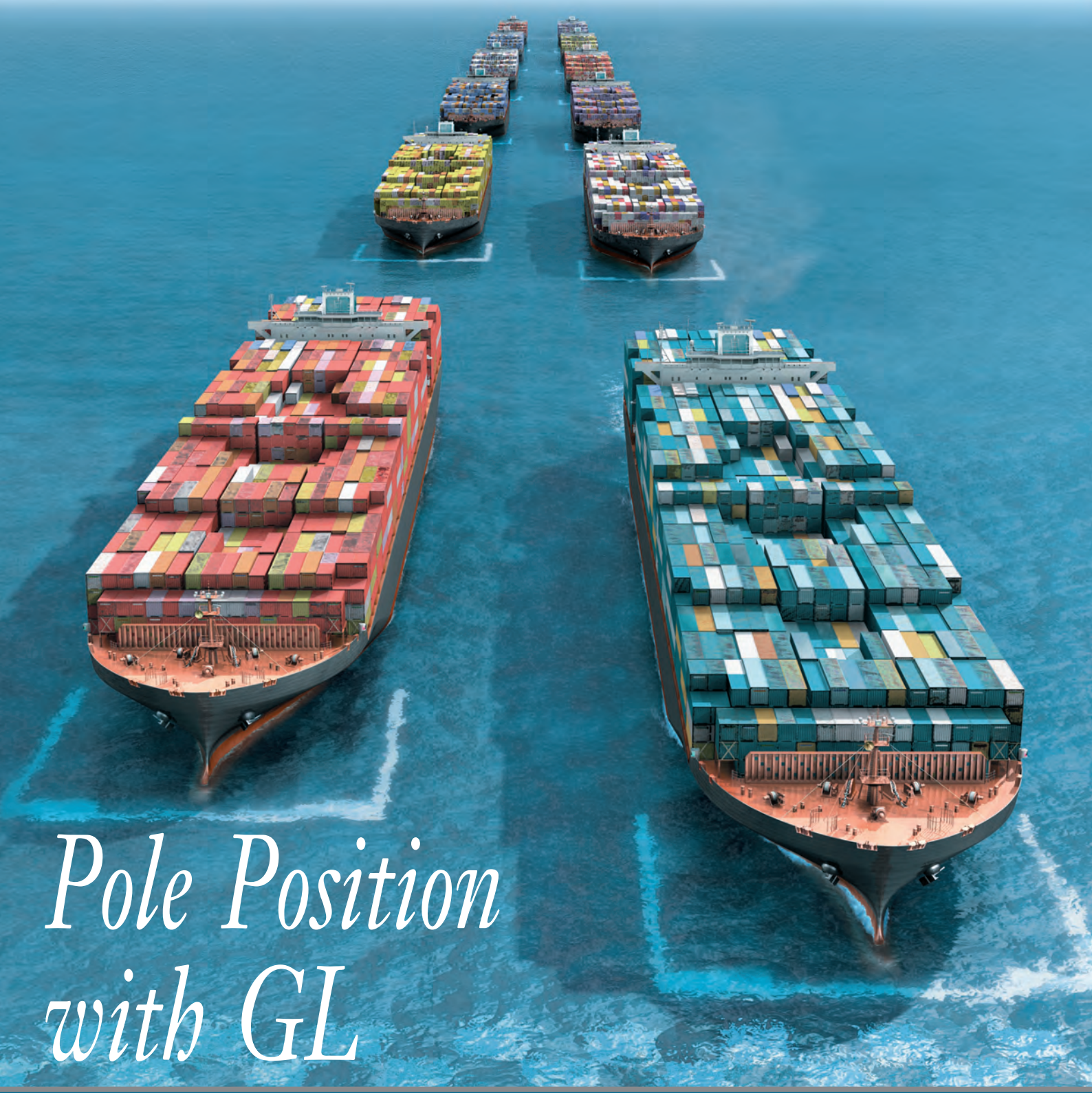

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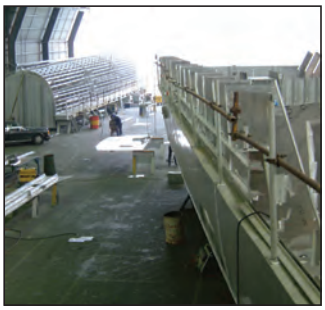


In Australia, much work by Revolution Design has been put into a new 112m wave-piercing catamaran planned to carry a large freight payload at high speed. Fuel modules for the prototype are seen here under construction at the Incat Tasmania yard, and a detailed examination of this proposed ferry's evolution begins on page 6 of this issue.

SPECIAL FEATURES

REGULAR FEATURES

Orcelle: pioneering a pure green revolution

IT is rare for a shipowner to take a public stance on future ship design, especially in today's highly competitive environment. Full marks must therefore be given to Scandinavian giant WalleniusWilhelmsen - a company jointly owned by Wallenius Lines, from Sweden, and Wilh Wilhelmsen ASA, from Norway - for the creation of E/S *Orcelle*, a totally 'green' concept-ship for the future (E/S stands for environmentally sound).

Orcelle arrives on the scene at a time when much interest is circulating in the industry, including through the pages of this journal, about future directions for alternative marine propulsion technology, some of this stimulated by possible decreased oil reserves but more publicly by the polluting effects of so-called 'greenhouses gases' and 'global warming'. In line with this, readers will be aware that close attention is being focussed today on minimising emissions levels from marine engines, and indeed a lot of success has already been achieved here and in general marine pollution-avoidance.

Nevertheless, the remarkable feature of *Orcelle* is the total elimination of any combustion technology (equalling zero gas emissions); instead, the vessel would be powered by a combination of sails, solar panels, fuel cells, and - most revolutionary - waves! Scandinavia generally is, of course, well in the vanguard of environment responsibility, and particularly so in the marine world. Given this, it is perhaps not so surprising that WalleniusWilhelmsen employs a special vice-president, Lena Blomqvist, in charge of environmental and fleet performance.

Pure radicalism: the *Orcelle* concept-ship would be powered by a combination of solar panels with associated sails, fuel cells, and oscillating fins supported by the pentamaran stabilisers. No combustion technology would be onboard.

From such a philosophy, this progressive company has instigated a number of important initiatives, with impressive success. For example, it is already purchasing more expensive low-sulphur fuel (60% of its requirements) - in advance of new limits set to be enforced in 2006 - and claims that between 2001 and 2004, it achieved, by various means, a 10% reduction in fuel consumption for every cubic metre of cargo carried. At the same time, NOx reductions in its fleet have been shrunk by 12% over the past five years, and sulphur emissions by 22.2% (2000-2003). It is also working with the World Wildlife Fund and other 'green' organisations, including Save the North Sea. Two ships in the fleet are also testing out CASS (combustion air saturation system) as a means of significantly reducing NOx even further.

Many green policies can be seen on the company's newest trio of car/truck carriers ordered from Mitsubishi: *Torrance, Toledo*, and *Toronto* (the last to be delivered this summer), and the operator is working with Alfa Laval in the development of an advanced purification systems for water ballast (the transfer of which is currently of concern to many). This is expected to he ready next year.

The thoroughly radical *Orcelle* has been conceived by the globally known Barber Marine Consultants, which is the technical arm of WalleniusWilhelmsen. One of the main drivers behind the concept has been the albatross, a bird which, it has been calculated, derives 80% of its flying energy from the wind. A good starting point has been the relatively light cargoes carried by the fleet - clearly not all the proposals would be applicable to tankers and bulk carriers. Nevertheless, students of the future will be fascinated by the specification of a pentamaran hull (already chosen by Nigel Gee for his fast container-liner and ro-ro ferry proposals); this would be fabricated from aluminium and recyclable thermoplastic composites.

Students will find most eye-opening of all the attachments to the hull base - 12 oscillating flaps supporting at their outer ends by the pentamaran stabilisers. These are designed to harness wave energy - for direct propulsive power (a Norwegian patent apparently exists for a fin propeller), or for transformation into mechanical or hydraulic energy; the fins will additionally contribute to stability.

Barber recognises that even green ships will need to manoeuvre in and out of port, so the hull will also be equipped with two (one forward and one aft) retractable azimuthing pods. They would be driven by energy stored in hydrogen-powered fuel cells, whose only by-products are water and heat.

While fuel-cell technology is rapidly advancing, especially in the motor industry, production of the necessary hydrogen still needs more work - for its part, WalleniusWilhelmsen hopes that this be can solved through *Orcelle's* solar, wind, and wave units. Another technology that could possibly be harnessed is flywheels to store mechanical energy. The combined solar panel and sail units would be raisable from a horizontal position, and the rigid sails can be rotated to catch the optimum amount of wind.

An ideal *Orcelle* design used by WalleniusWilhelmsen for vehicle transport would have an optimum cargo capacity of 85,000m^2 and 13,000dwt - 50% larger than today's modern car carriers, but still capable of 15knot service speeds. There would, of course, be no need for fuel tanks!

Orcelle is unlikely to be built in the idealistic form proposed - as the company itself freely admits - but the bold concepts envisaged deserve serious consideration in a world that relies (totally in some parts) on shipping to provide many of its everyday needs. This Scandinavian leader is putting its money where its mouth is - it believes that the shipping industry must make more effort to develop sustainable, but still viable and cost-effective, ocean transport.

Wilhelm Wilhelmsen calculates that another 15 years or so development work will be needed, including solving the tricky problem of hydrogen storage, and expects that the first real ship could be delivered in 2025. Many other questions need to be factored in, including the commitment by other - mostly conservative - owners to cooperate, and higher costs, at least initially.

Shipyards may not be too interested at a time of full order books, but when the next downturn comes, a spark may be lit. In Japan, the philosophy has been to build a small testbed first, but Barber team leader Per Brinchmann believes that the industry should be examining full-scale merchant ships right at the start - with a good push from shippers (already checking the green credentials of their cargo carriers), national and international authorities, and the public.

This journal has often championed radical proposals for ships of the future, and has sometimes been ridiculed for its pains. Although in a pure idealistic format, *Orcelle* deserves the support of the industry worldwide; indeed, may be the time has even come for us all to adapt if our world is to survive. ⚓

More illustrations of *Orcelle* appear on page 14 of this issue.

14-cylinder low-speed engines have arrived

ORDERS have been placed for the first-ever 14-cylinder low-speed diesel engines. Although considered by enginebuilders a few years ago and now in their catalogues, the first practical realities have arrived with a contract at **Wärtsilä** to power four 8600TEU container liners to be built - two each - at **Hyundai Heavy Industries (Ulsan)** and **Hyundai Samho Heavy Industries** (the former Halla yard), all for **Hyundai Merchant Marine**. Ship deliveries are planned for the first quarter of 2008.

The chosen 14-cylinder Sulzer RT-flex96C models, with a length of around 25.91m, will be built under licence by Hyundai; each will develop the enormous MCR output of 80,080kW. This high output is reflected in a faster than normal service speed - 27knots. Although the engine speed for this contract is not given, Wärtsilä's catalogue quotes 102rev/min at this output.

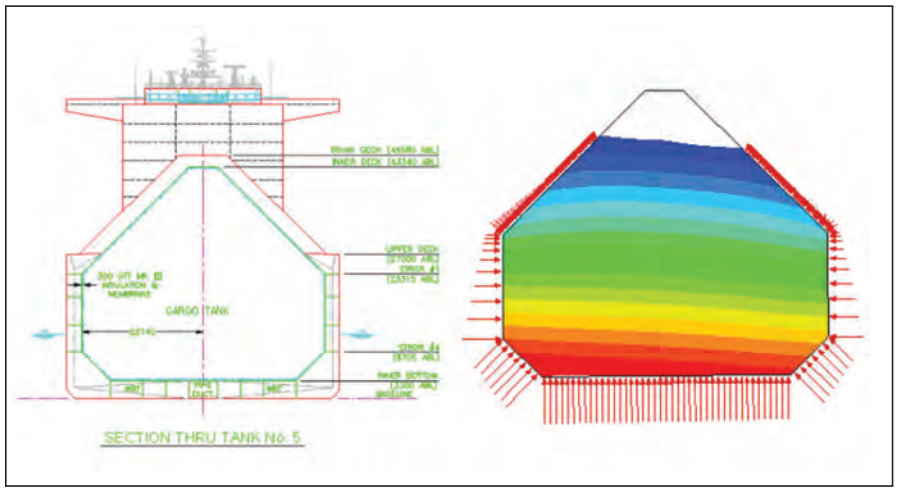
Special care has been taken over the design, particularly to ensure greater structural stiffness and rigidity with reduced stress. While the crankshaft of the RT-flex96C design has sufficient torque capacity for 14 cylinders, the steel has been upgraded to enable an increased shrink-fit for a greater design margin. The thrust bearing structure, with a mid-gear drive, has been revised to reduce deformations and stresses, even with the increased thrust. Electronically controlled, common-rail fuel systems will be included.

Similar high outputs are offered by **MAN B&W**, with its K98ME electronically controlled and camshaftless design; a 14-cylinder model can match the power of Sulzer's engine but at a lower speed of 94rev/min. On the other hand, the Copenhagen designer's 14-cylinder and larger-bore new K108ME-C model can develop 97,300kW, also at 94rev/min.

To date, none of these particular engines have yet been ordered, but given today's trend, we can probably expect some very soon; however, orders have been very recently placed for four engines (four plus four options) of the 12K98MC-C type (68,520kW at 104rev/min). These will be built by Mitsui in Japan to power 8500TEU container liners ordered at Hudong-Zhonghua in China by China Shipping Group.

GEEST TAKE-OVER - The enterprising European short-sea container-ship operator Geest North Sea Line, whose most recent innovation has been a decision to optimise all its operations on the 45ft pallet-wide container, has been acquired by the Icelandic shipping-to-logistics company Samskip, under a mutual agreement. Geest had been hoping to expand into the Baltic Sea area and needed a partner, which it has now found. Geest's first ship specifically designed for 45ft container operation is the 804TEU *Geeststroom*, delivered at the turn of this year by Damen Shipyards and featured in *Significant Ships of 2004*.

ABS APPROVAL FOR NEW LNG TANK - Following its approval for the Ocean LNG cylindrical cargo tank for liquefied natural gas carriers (*The Naval Architect* January 2005, page 4), the class society ABS has now approved a second novel alternative design. This is the Prism/Pyramid technique, created by the leading oil and gas company ConocoPhillips; its key feature is a unique form, designed to shrink free-surface area, and thus reduce high-impact sloshing loads and resonance periods. Impact-pressure reduction is considered by ABS to be one of the most critical factors when designing LNG carrier containment systems.



Cross-section through and model-test pressure results from the new ConocoPhillips Prism/Pyramid LNG cargo tank proposed for very large ships in the 200,000m³ range. Approval in principle has been given by ABS.

Model tests for the Prism/Pyramid were carried out at Marintek, in Trondheim, Norway, where impact conditions and ship motion responses were calculated with North Atlantic conditions in mind. In conjunction with these tests, ABS applied its proprietary numerical simulations tools to perform complex calculations to predict dynamic and sloshing pressures.

The Prism/Pyramid concept is aimed at very large ships, with the model tests centred on a 235,000m³ vessel with four cargo tanks rather than five or six tanks as originally planned for such giants. Irregular wave conditions were simulated with three filling levels and various ship headings. Test results showed the design to be acceptable and loads were equal to or less than those experienced on a traditional 138,000m³ ship.

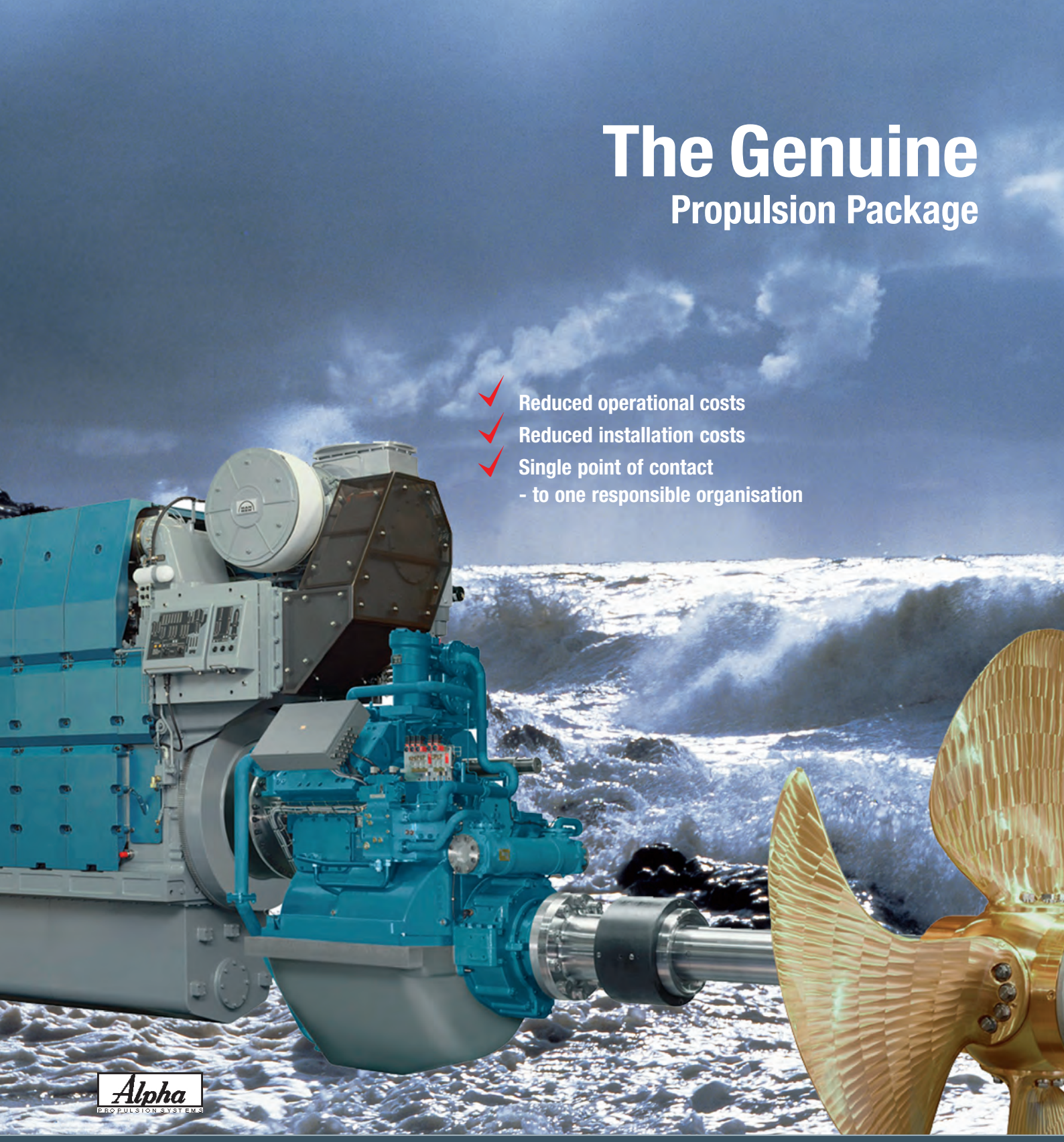
NAVAL ARCHITECTURE 'SAFE'? - Many may believe that the profession of naval architect is a physically safe and comfortable occupation, cocooned in front of a CAD screen. Unfortunately, this is not always so, as a recent sad but rare accident in Germany demonstrates. A British naval architect was witnessing (on the quay in Bremerhaven) a routine inclining experiment for the new cruise liner *Pride of America* when he was fatally struck by a hawser, which had parted.

A past-president of The Royal Institution of Naval Architects (Sir John Parker), along with this journal, tried to promote sea-going experience for naval architects within the industry, to gain a practical insight into the realities of ship operation, but this proposal has largely fallen on deaf ears. Shipbuilding, repairing, and operation are dangerous callings, as the editorial team of *The Naval Architect* can also testify from first-hand experience of visiting ships under construction. Safety must remain a prime concern for all.

LR AND NAPA LINK - The Finnish consultancy Napa and the class society Lloyd's Register have signed a landmark contract to extend the use of the ship modelling software package NAPA. LR has adopted the NAPA system for statutory compliance calculations for all classed ships worldwide, while Napa has also committed itself to develop new NAPA Manager applications specifically for LR use.

PRODUCT TANKER ORDER FOR BRAILA - The Braila Shipyard in Romania, today part of the Aker Yards group, has recently secured an interesting order to build six 15,000dwt/18,000m³ product tankers for six Cyprus-based 'single-purpose' owners and with management by Marlow Navigation, also in Cyprus. Design work is being handled by Brevik Engineering in Norway, a subsidiary of the Aker Brevik Shipyard, and hulls will be 140m long and 22m wide. The first ship should be delivered in May 2006.

SA15-CLASS ARCTIC SHIPS - We have been asked to point out that the SA15-type cargo ships mentioned in our February 2005 article (page 48), which have been operating successfully in the Russian Arctic for 20 years, were mainly built by Wärtsilä; only a few later ships in the 19-vessel series were constructed by Valmet. A prototype replacement is now being built at Aker Finnyards's Helsinki covered site.



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Evolving a 112m long wave-piercing catamaran freight ferry

After successfully introducing the 96m and 98m passenger car and cargo ferries, the Australian builder Incat believed it was time to offer a viable alternative for fast freight transport by sea*. The proposed vessel, a 112m long concept craft, is a large wave-piercing catamaran, specifically orientated to carrying large payloads at speeds in excess of 40knots. The vessel is to be as versatile as possible in order to service demands of the commercial passenger, freight, and military markets. Diesel power is employed to keep capital and operational expenditure attractive to prospective clients. Overall size of the vessel is optimised to suit 9000kW diesel engines available in the near future.

THIS wave-piercing catamaran provides, it is claimed, unequalled carrying capacity, speed, range and efficiency for a high-speed vessel in both commercial and military options. Revolution Design has achieved this by careful scrutiny of previous designs and application of a rigorous design approach to weight minimisation and optimising the planform of the vessel for strength, sea-keeping, and increased carrying capacity in excess of any high-speed vessel on today's market.

Transverse and vertical accelerations have been reduced considerably by optimisation of ride control systems and hull positioning, while operability has expanded due to increased design wave heights and certification to Det Norske Veritas R0 standards as a cargo vessel.

The 112m vessel has been designed as a quantum leap in capacity, seakeeping, and efficiency for high-speed craft. The initial design target, for the commercial vessel, was to design and construct a wave-piercing catamaran capable of carrying 1000tonnes payload economically, at a speed of 40knots, to compete with the newly emerging ro-pax market. In addition to this, it was considered that the vessel should be capable of carrying up to 1600tonnes at a reduced speed. This is known as the 'overload condition' and would make the 112m vessel more commercially attractive to operators with a freight requirement that relies more on efficient transport of high payloads than top speed.

To achieve, or even get close to, this design target meant that extreme measures would be necessary to enable the vessel to be designed and built with a comparatively light weight compared with previous craft. Some previous 96m vessels had carried the equivalent of 100% of their weight in payload.

This new vessel would be required to carry up to 125% of its weight in payload if it was to meet the design target in overload condition. Nowhere in the global high-speed light craft industry had this high ratio of payload-to-vessel weight been contemplated, with typical vessels carrying 35% to 50% payload weight compared with their own weight.

Vehicle deck loadings have been increased by 50% without significant increase in weight. The standard commercial single-axle load for trucks is now 12tonnes for the full length of the vehicle deck, with an 18tonne axle load from transom to mid-ships. The mid-ships restriction on the 18tonnes does not prevent it driving forward to turn in harbour. The deck is rated for the M1A1 Abrams tank as well as the RTCH when empty, which has a 30tonne axle load.

Overall loading capacity is greater with more car lanes and truck lanes. The 112m has 12 car lanes or eight truck lanes across the breadth of the vessel. This compares with 10 and seven on the 98m vessels. The length of the main deck has been increased considerably and extends much further forward for heavy axle loads than before.

The deck area available on the 112m at heavy axle loads is 1408m^2 compared to 976m^2 on the 98m. Over 2000m^2 is also available for cars in addition to the main deck using fixed and hoistable mezzanine ramps.

Garage height on the main deck has been increased to over 6m to enable double-stacked containers on Mafi trailers or a campervan on the main deck with a car on the mezzanine level. It also gives enough room to remove the height restriction on previous military vehicles for RTCH unloading and 'swing-thru' trucks.

Range for military applications is huge, with six large fuel tanks available, also giving the operator flexibility with trimming the vessel. A total of 800tonnes of fuel gives the vessel a range of 4800miles at 37knots carrying a payload of 700tonnes.

Powering and efficiency

The concept design involved finding the very best combination of ship size and weight compared with performance, efficiency and intended use. The original version of this design was a 110m vessel but under commercial pressure, this grew to a gas-turbine-powered 120m passenger/car vessel with a top speed of 60knots. The concept has since been revised back to the 112m which, at this point in time, represents the best compromise between performance and structural weight.

The final hull shape and lines are the result of research into how changes in wetted surface, transom immersion, and trim affect the hull resistance at different loading conditions. Preliminary hydrodynamic analysis resulted in significant width increase of the hulls, thus reducing the length-to-beam ratio compared with current wave-piercing designs.

Increasing the overall hull spacing and selecting waterjets with steep thrust curves and high mass flows will ensure excellent manoeuvrability of the vessel, with no requirement for bow thrusters,

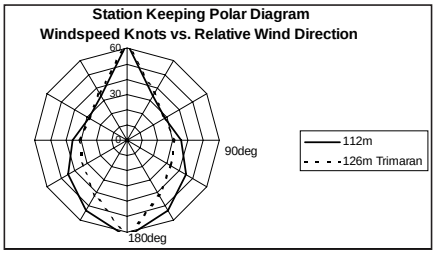


Fig 1. Manoeuvring polar plot.

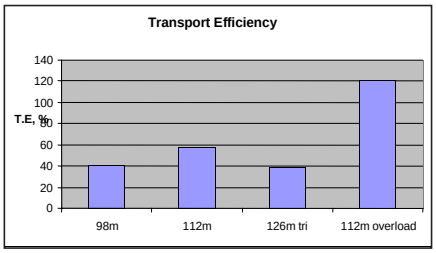


Fig 2. Transport efficiency comparison.

despite increases in mass and lateral area due to the larger vessel. Fig 1 compares polar windspeed plots for the 112m vessel against published data for the new Fred Olsen, Austal-built 126m trimaran [Ref 3].

New 9000kW engines represent the latest in technology for medium-speed machinery, and the 112m hull geometry has been optimised for speed and efficiency using four of these engines. The vessel represents the maximum available capacity for 9000kW/engine. It is likely that if these engines are successful in service, then the power rating may be increased to 10,000kW, allowing higher average speeds.

Based on a total installed power of 4 x 9000kW, the transport efficiency of the 112m is 57%, compared with 40% for the Incat 98m design. The transport efficiency is defined as: (payload x speed/power required). In overload condition the transport efficiency increases to 120%.

Fig 2 illustrates the 112m transport efficiency defined in this way for both normal, 40knot speed, and overload condition at 25knots, alongside an Incat 98m design and an estimate of the Austal-built 126m trimaran, carrying 600 tonnes at 40knots.

Global design

Design wave conditions

The design significant wave height on all high-speed craft built to date has been approximately 5m. This is a historical wave height and is thought to be the maximum height that will build up in a three-hour period, which is the longest a high-speed craft (HSC) should be away from a safe haven.

Military use dictates something else; conventional ships designed to SOLAS rules are typically planned for a 13m significant wave height, and this is what has been used for the 112m vessel, effectively giving it unrestricted operating conditions.

This improves the survivability of the vessel significantly in a military role. As will be shown,

* Extracts from the paper 'Evolution of the 112m Wave-piercing Catamaran Design' by G Davidson (director and principal structural design engineer) and T Roberts (director and R&D development manager), both of Revolution Design, Australia, presented at The Royal Institution of Naval Architects' conference High-Speed Craft: Design and Operation, held in London on November 17-18, 2004.

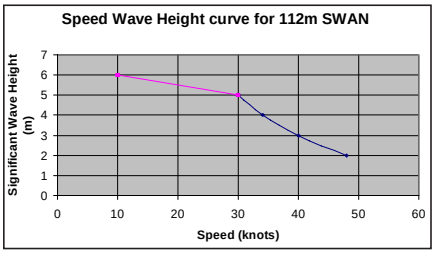


Fig 3. Speed waveheight for R1 certification.

the 112m design strength and robustness is improved dramatically over previous designs, and the increased operational parameters did not present any significant problems.

The commercial R1 speed waveheight restriction, as specified by Det Norske Veritas, has an upper limit of 6m, as shown in Fig 3.

It must be realised when viewing the chart in Fig 3 that this represents the worst combination of heading and wave period. At other headings and wave period the loads would be less and speed could effectively be increased.

Global hull girder configuration

When work for the 112m model commenced, an intensive concept design period was initiated to determine the best overall configuration of the vessel. All designs are a compromise and the best solution from a structural perspective was not necessarily the best from an operator's perspective. Military requirements and future flexibility were key design drivers.

Revolution Design was confident that a large gain in payload carrying capacity would be possible, provided the vessel could be built with sufficient strength in the right areas, without compromising weight. Thus a large increase in ship girder depth was introduced for the first time into the wavepiercer design. As a consequence of this, the increased height inside the vessel would allow loading of double-stack freight containers on cassettes or MAFI trailers, giving flexibility in cargo carrying due to an increase in maximum height restrictions on the main vehicle deck.

Many variations of the mid-ship sectional shape were studied to optimise the structure for longitudinal bending and various configurations for torsional loadings. The vehicle deck was both lengthened and widened out to Panamax dimensions to increase capacity, and a greater turning circle forward as a result enables large semi-trailers to turn.

Beam-sea seakeeping

The original mid-ship section consisted of the hull separation similar to that of the 98m design but with the increased overall beam (Fig 4).

As a result of a seakeeping simulation run in the Wasim program by DNV [Ref 1], the hull separation was increased to that shown in Fig 5.

In the seakeeping analysis the hull separation of the models were increased 4m and 8m and also reduced 4m from the original. The trend observed was that it was beneficial to increase the hull separation by 4m but marginal increases occurred after that, as illustrated in Fig 6.

With the hull separation increased by 4m, resulting transverse accelerations decreased by 25% and the vertical by 15% [Ref 1]. The reduction in accelerations primarily comes about due to the decrease in roll angle. It should be noted that acceleration increases with a reduction in hull separation. The final mid-ship section configuration in Fig 5 represents the 4m increase in hull separation.

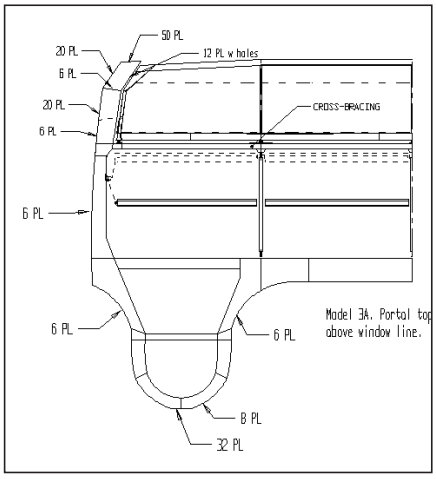


Fig 4. Original mid-ship cross section.

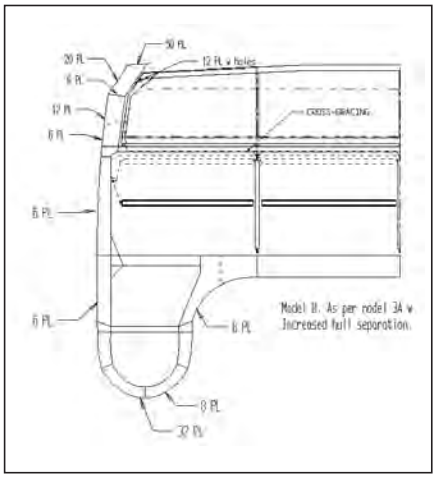


Fig 5. Revised mid-ship cross section.

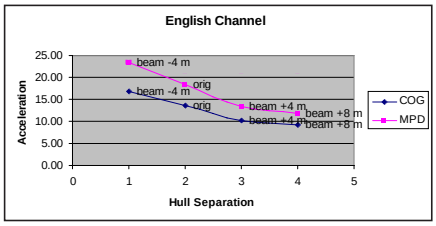


Fig 6. Seakeeping results with variation of hull separation.

Head seas and tunnel height

Another study looked at the effect of raising the tunnel height to reduce the slamming forces and longitudinal bending, and to reduce the resultant vertical accelerations. Although desirable to increase the tunnel clearance to reduce slamming loads, practically it may not be so, eg, raising the tunnel clearance means increasing the vertical height between vehicle deck level and the wharf or in case of the military a very low pontoon. Safety in following seas may be compromised if the tunnel clearance is excessive. The increase in tunnel clearance may also unnecessarily increase structural weight.

A compromise reached with the 112m design was to increase the tunnel height forward only; the shoulder area of the centre bow was lifted significantly (Fig 7), while the centreline area was left relatively close to the water to ensure early immersion and subsequent damping and motion control. Part of the flat cross-structure aft of the centre bow was also raised in the process. Shaping of the centre bow shoulder area was also done to eliminate flat surfaces, which can produce very high accelerations and pressures.

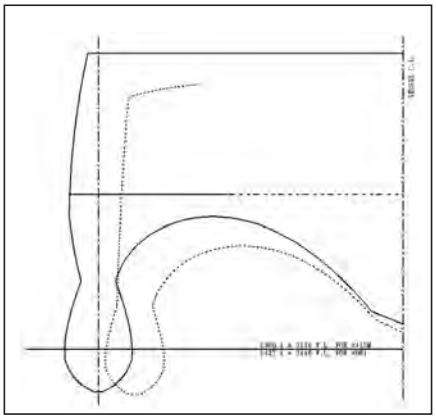


Fig 7. Comparison of tunnel clearance between 98m and 112m vessels.

The increase in shoulder height reduced vertical accelerations by 8% and longitudinal bending moments by 20%. The 8% reduction in vertical motions is not the overall improvements from the 98m; it is just a 112m comparison with raised tunnel clearance versus a 112m without the raised tunnel clearance.

Motion-sickness index (MSI)

Once the overall beam was finalised, Maritime Dynamics [Ref 2] was commissioned to study the seakeeping performance, using the existing 98m vessel as a benchmark.

The addition of an 8.6m^2 retractable T-foil provides large improvements in the ride quality of both 98m and 112m vessels, particularly in higher waves. The net result is that the 112m vessel, when fitted with a retractable T-foil and new trim tab design, has an average motion sickness incidence in 3m waves of 3.8%, compared with 5.3% for the 98m vessel; in 4m seas, the average MSI for the 112m vessel is 10.0% and for the 98m vessel it is 13.9%.

This overall improvement in MSI has been achieved from a new, more powerful ride-control system, combined with the hull shape and greater volume of the 112m vessel.

Structural design

High global design loads and a desire to keep structural girder construction to manageable plate thicknesses initiated a structural design review and analysis procedure to find the best possible solution for global strength and economy of construction.

Longitudinal strength

The configurations tried for optimum longitudinal strength were:

- similar configuration to 98m
- fully rigid superstructure to hull
- flexible superstructure but side hull extending to roof height

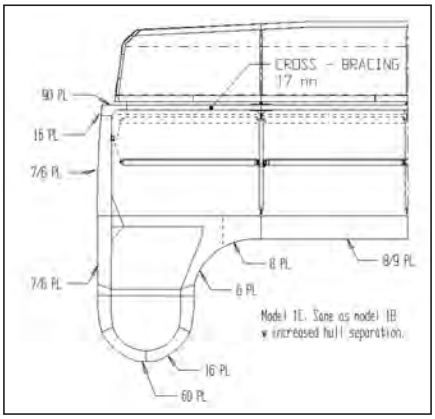


Fig 8. Configuration similar to 98m design.

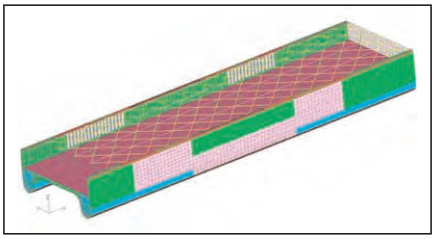


Fig 8a. Configuration similar to 98m design.

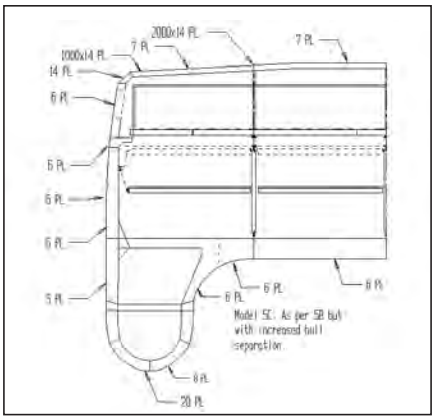


Fig 9. Fully rigid superstructure.

- no overhead structure, all strength in bridge deck structure.

A configuration which is similar to the 98m model is shown in Figs 8 and 8a. The disadvantage with this arrangement was the very thick plates required at keel and portal top. A costing analysis determined that butt welds greater than 40mm in thickness were uneconomical.

The fully rigid superstructure shown in Figs 9 and 9a should in theory provide the strongest mid-ship section for longitudinal bending. The roof of the superstructure is rigid and should provide large section modulus. In practice though, shear lag renders most of the roof structure ineffective for section modulus. The numerous windows required for passengers create structural problems.

The cabin itself is mounted on isolation mounts similar to current vessels, effectively creating a second cabin inside but this adds complication and weight. A disadvantage is the lack of flexibility in changing from commercial variants to military variants, which was considered crucial with this vessel. A rigid

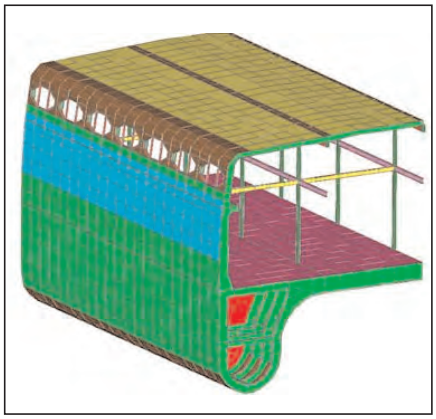


Fig 9a. Fully rigid superstructure.

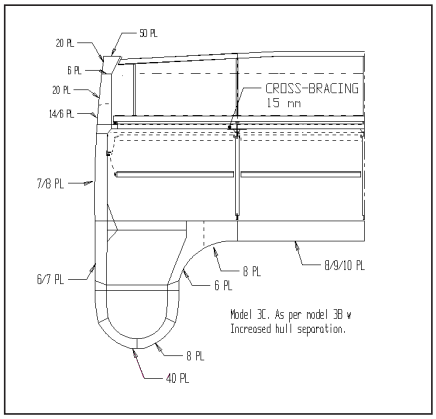


Fig 10. Flexible superstructure with side hull extending to roof height.

superstructure makes it difficult to reconfigure the superstructure cabin to allow the addition of a flight deck.

In the configuration shown in Figs 10 and 12, the superstructure is still flexible and the side shell is extended up to roof height which gives added section modulus for longitudinal bending. No increase in strength for torsional loadings is created. Once again, windows in the side shell create problems.

The configuration in Figs 11 and 11a uses the bridge deck structure to provide all strength for torsional loadings. For this reason, the depth has been increased substantially, so much that it becomes a car deck. This configuration though is very heavy and does not provide the stiffness of the other configurations shown.

Torsion

A critical wave-induced load for a catamaran is torsion. The typical wave-piercing catamaran has used horizontal cross-bracing to achieve torsional stiffness while keeping weight to a minimum and allowing service access to the superstructure cabin.

Three variations were tried to find the best torsional configuration:

- all cross-bracing from transom to bow
- all plate and stiffener from transom to bow
- a hybrid of the two, with cross-bracing in the mid-ships area and plate in the fore and aft area.

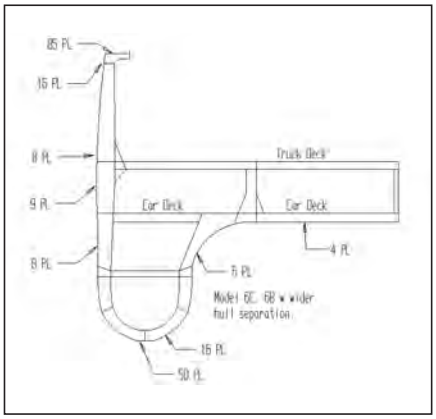


Fig 11. All strength in bridge deck structure.

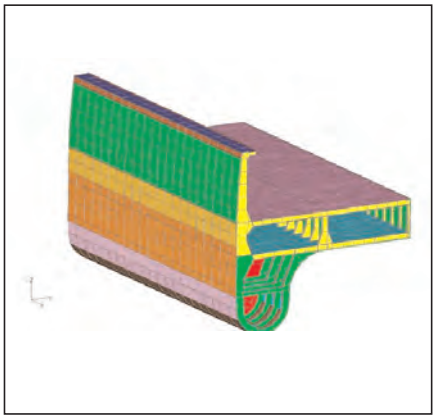


Fig 11a. All strength in the bridge deck structure.

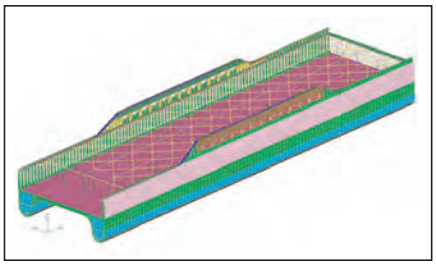
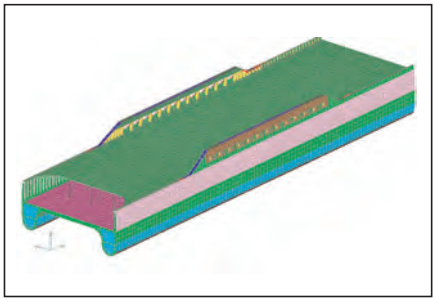


Fig 12. All cross-bracing.

Fig 12 shows the configuration of all cross-bracing. Note that this version shows the raised side shell as in Fig 10. Various box model configurations were tried with the torsion variations versus the variations for longitudinal bending.

Cross-bracing produces the lightest structure for torsional loadings. It also provides access

Fig 13. All plate version.



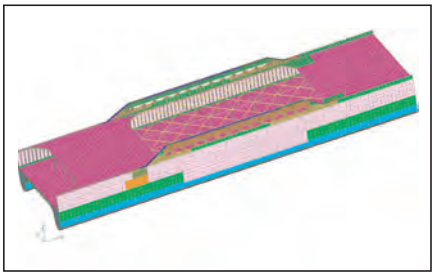


Fig 14. Hybrid of cross-bracing and plate.

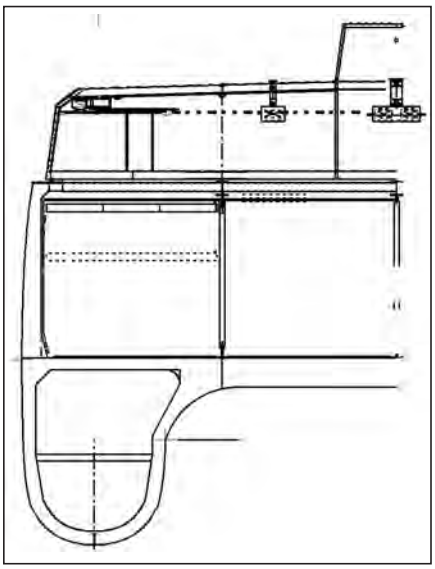


Fig 15. Final mid-ship configuration.

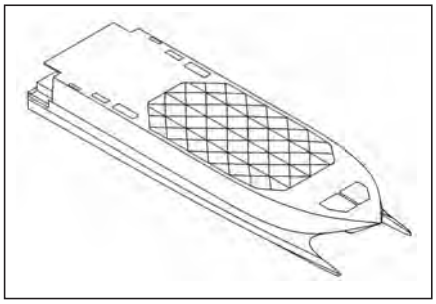


Fig 16: Final hybrid torsion configuration.

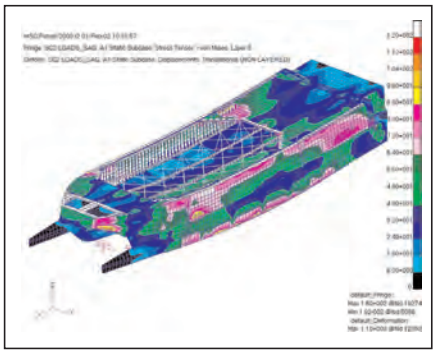


Fig 17. Final-design finite-element analysis model in longitudinal bending.

from below to the resiliently mounted superstructure for services, ie, plumbing and electrical.

All-plate fabrication provides a very stiff structure for torsion; it is also heavier than cross-bracing. An added disadvantage is the lack of access to the underside of the superstructure for services.

In wave-induced torsional loadings, the aft and forward ends of the vessel usually deflect more and hence that part of the structure will see greater stress levels. This has been proven with in-service monitoring of previous vessels, as well as FEA of current and past designs. Load distribution was achieved with plated areas fore and aft and the cross-bracing in the middle. Access for the majority of the superstructure for services is maintained with toilets blocks and food areas located within the cross-bracing region.

The aft plated area also serves as a flight deck for military versions of this vessel. The hybrid version provides the stiffness of the all-plate configuration but the light weight of the all cross-bracing version.

Final configuration

The final configuration adopted was the hybrid torsional arrangement with a modified version of the 98m-style mid-ship cross-section. Due to the increased ship girder depth mentioned earlier, the stiffness and section modulus has increased significantly (Figs 15 and 16). Plate thickness remains at a maximum of 40mm.

The resulting structure is able to handle the high speeds in moderate sea states and slow speeds in high sea states, to provide a robust reliable design that offers significantly greater survivability than previously.

Since the design studies mentioned above, the 112m design has evolved into a mature design with full production drawings completed for a significant portion of the vessel, and indeed four modules (two fuel tanks and two engine-room units) are currently under construction at Incat Tasmania shipyard.

Local strength

Up to 15 years experience with 35 or more vessels over 74m in length, has given valuable insight to machinery loads and cycles. Jet ducts and flanges have been sized conservatively with machined detail in critical areas to increase fatigue life. The thrust bearing is situated in the jet room on its own foundation machined from solid plate. Gearbox and engine foundations are designed for high stiffness and machined from plate where necessary.

Water-jets input massive energy into the vessel, with high numbers of cycles. Blade-pass, fundamental, multiples of blades pass, and engine natural frequencies all add to the number of cycles. In fact, the number of cycles for machinery exceeds the number of cycles from global wave loading in the first year of operation. For the jet duct, additional loads from steering and manoeuvring are also present.

Detailed finite-element models are made of the entire jetroom and engineroom, and further refined models of the individual foundations are made. Solid elements are used in way of the foundations with the fillet welds themselves modelled.

Fatigue is calculated based on 20 years commercial service at up to 6000 operating hours annually. SN curves of known details and the hot spot method have been utilised to determine fatigue life of specific areas.

Each compartment of the vessel has been modelled using a 3D finite-element analysis model with refinement in necessary areas. Slamming and sea loads are well defined from experience on a number of vessels and operating hours. Different combinations of symmetric and asymmetric sea and slamming pressures are applied to the under and above water structure.

Fuel, cargo, and vehicle loads are applied to the vehicle decks. Structure natural frequencies are checked against machinery frequencies and modified where necessary.

Conclusions

Considerable experience with wave-piercing catamaran service and designs has culminated in a vessel with unprecedented capability compared with previous wave-piercing catamaran designs:

- 20% greater operations window and R0 certification
- 25% increase in transport efficiency
- 50% increase in axle loads on vehicle deck
- 20% greater station-keeping and manoeuvring ability
- 25% reduction in motions and motion sickness index
- 30% increase in deck area
- 100% increase of available deadweight in overload condition.

This has been achieved by strict attention to weight reduction through a series of design studies on global and local structure. The overall vessel size and capability has been designed around the new generation of medium-speed diesel engines, in order to provide the most economical solution for carriage of large payloads at high speed. Consideration to the building cost by controlling maximum plate thicknesses has been shown to be of considerable benefit when used as a design target.

References

1. Det Norske Veritas, 'Beam & Wet Deck Variation Study', Report No 00-0346, 13-9-2000.
2. Maritime Dynamics Report MDR-7078 02, 'Comparative study of the ride quality of an Incat 98m and 112m catamarans'.
3. 'Coming to a port near you: the 126m trimaran', *The Naval Architect*, September 2004.

Value and innovation for ferries

A NEW one-day conference that aims to provide a 'stimulating blend of academic analysis and commercial experience' to those involved in the ferry industry is to be held in June this year in London. It is being organised by Greenwich Maritime Institute (part of the University of Greenwich, which has been involved in the Exodus escape simulation program for passenger ships) at the Old Royal Naval College in Greenwich on June 23, 2005, and will, the organisers hope, bring added value and innovation to the industry.

The ferry sector is currently being challenged by low-cost airlines, which are depressing ferry financial results, also by alleged views by the public of high cost and perhaps questionable service. The conference, which is entitled 'Challenges in 21st Century Passenger and Freight Transport - Delivering Value and Innovation in the Ferry Industry', will also be examining the freight sector. Contact: Professor Sarah Palmer, Director, Greenwich Maritime Institute, University of Greenwich, London SE10 9LS, UK. Tel: +44 20 8331 7688. Fax: +44 20 8331 7690. E-mail: conferences@shipshapeinternational.com

New Marin-Ark contracts

THIS month, the UK lifesaving equipment company RFD will retrofit two 321-type open-deck Marin-Ark vertical escape chute systems to the 1989-built 1380gt Norwegian ferry *Fosen*, which is operated by Fosen Trafikklag. If Fosen secures government permission for an additional passenger route, then a second vessel, the 3447gt *Trondheim*, completed in 1992, will also be retrofitted with two similar systems.

Other new Marin-Ark installations will be retrofitted in June this year to a ro-ro ferry operated by the Greek company Hellas Flying Dolphins. This particular ship will have no lifeboats, and the 430-type Marin-Arks will provide the sole means of evacuation.

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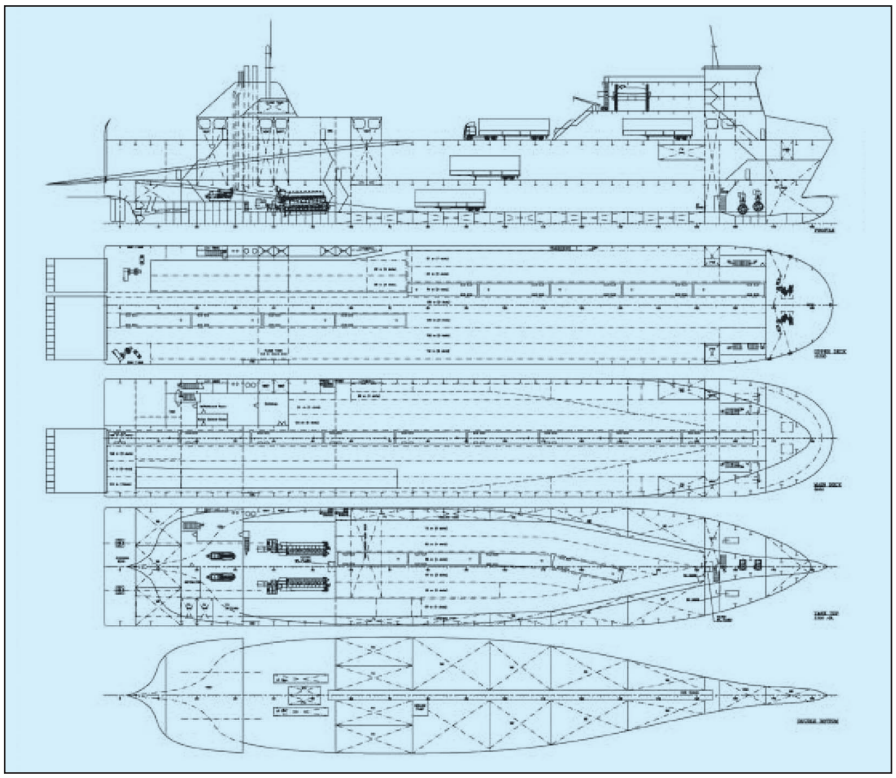
New Seatruck ferries designed by Knud E Hansen

LAST month, a new order was placed by Seatruck Ferries - a member of the Bahamas-based but Danish-originated Clipper Group - with the Spanish builder Astilleros de Huelva for two ro-ro freight ferries. They will replace two current ferries, *Riverdance* and *Moondance*, on the Heysham (England)-Warrenpoint (Northern Ireland) route across the Irish Sea. The leading Danish consultancy Knud E Hansen has created the general concept, which is based on a quite modest size compared with some recent Irish Sea ships but is the maximum suitable for this particular route. Work is now proceeding on the basic design for the shipyard. New terminal facilities are planned by the harbour authorities at both ends of the route.

When delivered in 2007, the new pair will provide a twice daily service, providing space on three decks for up to 120 standard trailers on a total lane length of 1830m. A fast service speed of 22knots will reduce current crossing times from nine hours to six and a half hours, and will enable much later evening sailing times, with earlier morning starts, as well as providing a power reserve for bad weather. In 2004, Seatruck was named Irish Sea shipping line of the year for its high levels of service.

Full details of the new vessels are not yet available but the ships will have a length overall of 142.00m, a breadth moulded of 23.00m, and a scantling draught of 5.70m. Deadweight at the latter draught will be 5200dwt. The main machinery has not yet been chosen but there will be twin propellers driven by medium-speed diesel engines, of either MaK, MAN B&W, or Wärtsilä make. Classification will be to the standards of Det Norske Veritas.

An elevation of the new 5200dwt Seatruck Ferries freight ships to be built by Astilleros de Huelva for the Heysham-to-Warrenpoint service.



General arrangement plans of the new Seatruck Ferries, which are being designed by Knud E Hansen.

TECHNICAL PARTICULARS
SEATRUCK FERRIES

Length, oa	142.00m
Length, bp	133.00m
Breadth, moulded	23.00m
Depth, moulded to main deck	8.50m
Draught, design	5.20m
Draught, scantling	5.70m
Deadweight, design draught	3800dwt
Deadweight, scantling draught	5200dwt
Lane length	1830m
Speed, service	22.00knots
Classification	Det Norske Veritas +1A1, Ro-Ro/Container, E0, DGP, TMON, ICS

More orders for ro-ro equipment

SWEDEN'S TTS Ships Equipment AB, Gothenburg, part of Norway-based TTS Marine ASA, has received two contracts for delivery of ships equipment for a total of four car carriers. The contract, with Daewoo Shipbuilding & Marine Engineering (DSME), Leif Hoegh A/S, and Croatia's Uljanik Shipyard (Ray Shipping) involves deliveries to two car carriers each. Since May 2003, TTS has landed contracts for 45 car carriers in total, with a value of approximately NKr590 million.

The deliveries to Daewoo include construction and supply of key components to the ro-ro access systems including internal car decks and ramps, as well as stern/quarter and side ramps for the loading and discharge of vehicles. The delivery of the equipment is scheduled for February and May 2007, respectively.

Equipment to Uljanik includes construction and complete supply of the ro-ro access systems including internal ramps and doors, as well as stern/quarter and side ramps for the loading and discharge of vehicles. The delivery of the equipment is scheduled for January 2006 and August 2007, respectively.

The DSME contract brings the total of car carriers building at this yard for Norway's Leif Hoegh to 12, each vessel capable of transporting some 6000 units. Deliveries begin this year and go through to 2008. Meanwhile, Israel's Ray Shipping currently has four 4900 unit capacity car carriers building at Uljanik, this latest option for a further two vessels taken up as the construction work on the first vessels nears completion.

Orcelle: a totally green concept for the future

A GLIMPSE into the future of commercial shipping - or at least how one major Scandinavian operator sees it - is revealed by a new concept ship designed by Barber Marine Consultants, the naval architectural arm of WalleniusWilhelmsen, the leading carrier of export cars and other vehicles. The company does not believe that the ship, as illustrated here, will actually be built in this form, but the various revolutionary technologies proposed do seem likely to play an increasing role in future vessels, as concerns focus on pollution, declining oil reserves, greenhouse gases, and global warming.

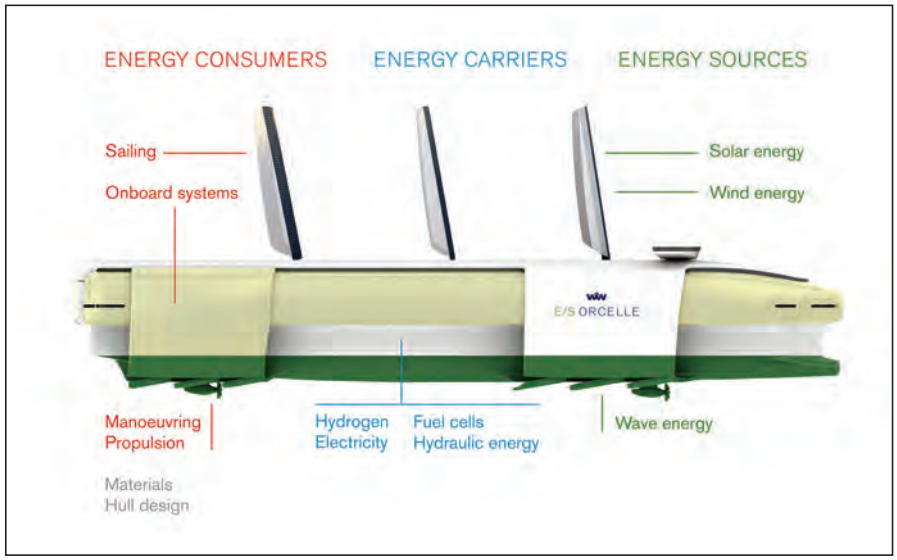
The pentamaran *Orcelle*, named after an Irrawaddy dolphin species currently being threatened, is planned to have no combustion technology onboard at all - and hence no fuel tanks and no emissions; instead, all required energy will be generated by wind, solar panels, or fuels cells and - most remarkable of all - wave power. The combined solar panel/sail units can be stowed horizontally, and rigid sails (on the panel edges) can be adjusted to attract maximum wind. Energy activated by 12 oscillating fins could be converted into mechanical, electrical, or hydraulic energy.

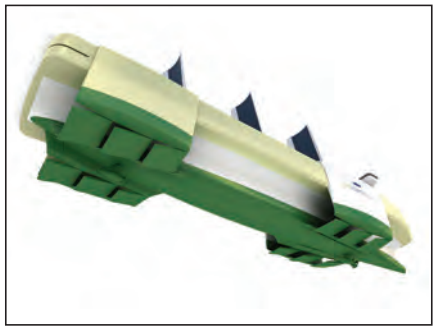
WalleniusWilhelmsen anticipates that much of the energy could come from fuel cells but these require hydrogen, the production and storage of which is not yet solved (a large volume is needed), although experimental fuel-cell systems are running at various places (*The Naval Architect* March 2005, page 24). Fuel cells could be used for approximately 50% of *Orcelle's* needs, such as driving the two retractable propulsion pods for use when entering or leaving harbour. The company notes that fuel-cell technology is currently advancing very rapidly and for its own part hopes to be testing a fuel-cell auxiliary unit by early 2006 in conjunction with Det Norske Veritas.

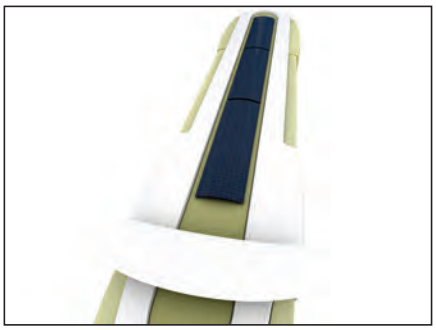
This Scandinavian company is fortunate in that its principal cargoes are export cars and other vehicles, which are generally fairly light cargoes. For that reason, a slim hull with pentamaran stabilisers has been chosen, allied to the use of aluminium and thermo-plastic composites for hull construction (and eventual recycling). Calculations show that a typical *Orcelle* could carry 10,000 standard cars - more than today's largest ships under construction (8000 cars). However, it is recognised that such features may not be applicable to tankers and bulk carriers, and that more work is needed to perfect some of the proposals.

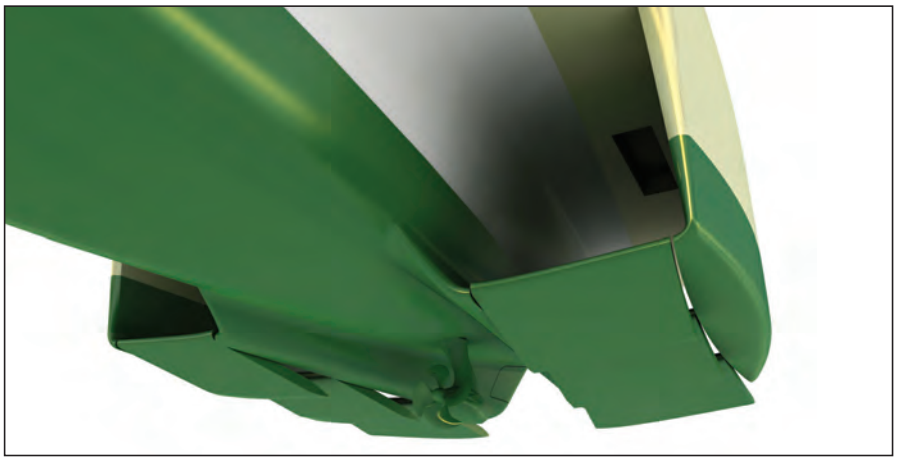
WalleniusWilhelmsen already plays a leading role on the 'green' scene, for example, by purchasing low-sulphur fuel in advance of the regulation date next year. It is now doing its best to alert the marine world as to the need for alternative technologies, and would be very pleased if an *Orcelle*-type vessel was sailing by 2025.

See also Editorial Comment, page 3.









A collection of *Orcelle* model views, showing various key features of the futuristic concept: sails, solar panels, auxiliary pod propulsors, and oscillating fins to capture wave energy.

TECHNICAL PARTICULARS
***ORCELLE* CONCEPT-SHIP**

Length, overall	250.00m
Breadth, moulded	50.00m
Depth	40.00m
Depth, with sails erected	95.00m
Draught, design	9.00m
Speed, design maximum	20.00knots
Speed, design service	15.00knots
Lightweight	21,000tonnes
Deadweight, max	13,000dwt
Vehicles	10,000 standard cars
Cargo deck area	85,000m²
(eight decks, three adjustable)	
Solar panels	3 x 800m²
Sails	3 x 1400m²
Fins	12 x 210m²
Maximum energy output	
Solar panels	2500kW
Fuel cells	10,000kW
Auxiliary pod propellers	2 x 4000kW

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Denmark maintains strong maritime cluster

DANISH Maritime was formerly the Danish Shipbuilders Association, but with the sharp decline in the number of shipyards in this country, the association has widened its scope to include Danish providers of marine equipment and services. It is not a large association, with some 17 member companies, but it maintains offices in Copenhagen and Brussels with a full-time staff and manages to represent the industry's interests at local and international levels. Shipping and shipbuilding are important sectors in Denmark, representing a significant proportion of national turnover.

Although only one major shipyard remains in Denmark - A P Möller Group member Odense Steel Shipyard - Danish Maritime nevertheless presents some interesting statistics about Europe's position in world shipbuilding. Most refer to the total tonnage built, and using this measurement, Korea, Japan, and China appear by far - unsurprisingly - to be the leading shipbuilding regions. However looking at relative turnover, figures quoted by Danish Maritime suggest that the European shipbuilding industry is worth considerably more than its rivals. For 2003 (the latest figures available), EU member states stand at US$12,503 million against South Korea's US$10,659 million; Japan's US$10,527 million; and China's US$3602 million.

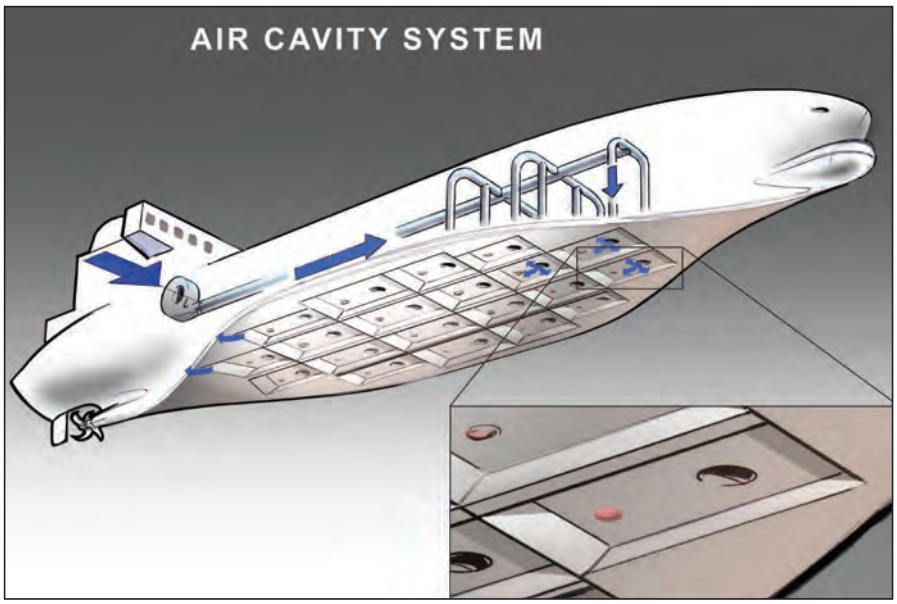
Looking at Europe as a whole, rather than just 2003's 15 EU members, the situation is even more favourable. Against this background, Danish Maritime feels it is right to be upbeat about both Europe's, and Denmark's, prominent role. The situation may not be quite as strong as it seems though, because - according to Danish Ship Finance - the EU state subsidy scheme has provided encouragement for ships to be built in Europe, which may have distorted the picture.

European yards have also suffered recently as European currencies have appreciated against the dollar. However, the EU has extended the subsidy deadline by one year, to the end of March 2005, which could give a further temporary boost to European yards, while the current tight capacity at Asian shipyards could benefit European - and thus Danish - yards (as *The Naval Architect* noted in its March Editorial Comment).

Danish Maritime's member companies include such well-known names as MAN B&W Diesel, Hempel, and naval architectural consultancy Knud E Hansen. Smaller companies include Acta, producing cranes; Bladt Industries, making offshore structures; Damcos - a new offshoot of Danfoss, manufacturing valves; security specialist Falck; Mærsk Container Industry, another part of the Möller group, making refrigerated containers; Petersen & Sorensen Motorværksted, which repairs machinery; valve company Pres-Vac; and YIT, which undertakes electrical installation on ships.

Other remaining shipyard members are Aarhus Shipyard, now carrying out mainly repair work; Danyard Aalborg, involved in naval vessels and superyachts; Karstensens, which builds fishing vessels and carries out repair work; Soeby, which undertakes repair work as well as building patrol boats and small ferries; and Ørskov, a former shipbuilder which sadly today only carries out repair work. Within this structure, Odense Steel Shipyard, claimed to be one of Europe's largest and most modern, is in rather a different class. Its output has recently centred on large container vessels, while it has strengthened its position through the Möller acquisition of other shipyards in Estonia, Lithuania, and Volkswerft Stralsund in Germany.

A new container liner, *Safmarine Nomazwe*, recently delivered by Odense Steel Shipyard, which is Denmark's sole remaining large shipbuilder. The company enjoys a good order book, mainly for similar large container ships.



A most interesting project currently being examined by the naval architectural consultancy Knud E Hansen for the DK-Group is a so-called air-cavity vessel. This is an air lubrication concept installed in the bottom surface of a hull to lower hydrodynamic resistance and save fuel. Model tests are being carried out at Lyngby by Force Technology.

Calculations show that construction costs incorporating such a feature could rise by 0.1%-0.3% but that the efficiency gains would enable these to be recovered within only one or two years. The main target is large commercial ships (new or existing), including cruise liners, tankers, container ships, ro-ro ferries, and yachts. Current tests are focussing on an Aframax tanker.

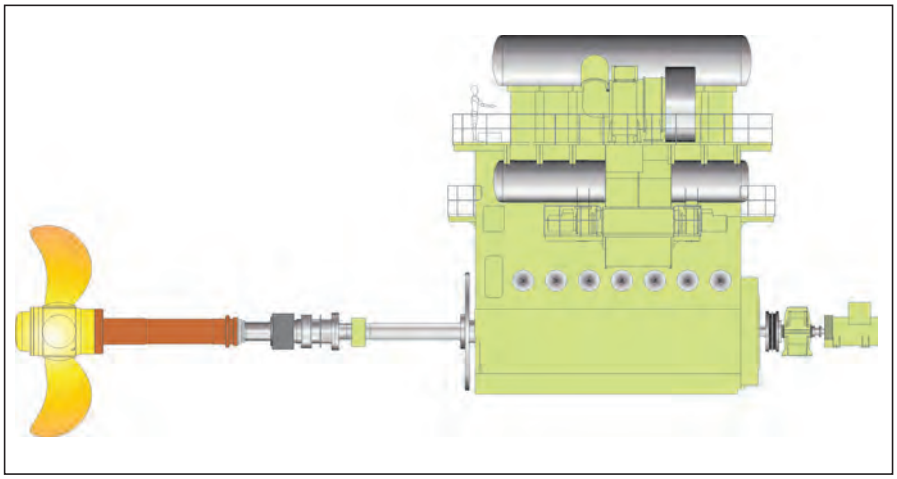
Alpha package for new fruit-juice tanker

THE Frederikshavn factory of MAN B&W Alpha Diesel has recently been working on another of its interesting propulsion packages, this time for a new fruit-juice tanker under construction at Kleven Florø in Norway - a yard which has built this type of specialised vessel previously. The new ship, for the Swiss operator, Atlantship SA, will be powered by a MAN B&W 7S60MC-C two-stroke engine; it will drive an Alpha VBS1800 CP propeller and will be equipped with Alpha controls. Off the forward end, an alternator will be driven through a flexible coupling and gearbox.

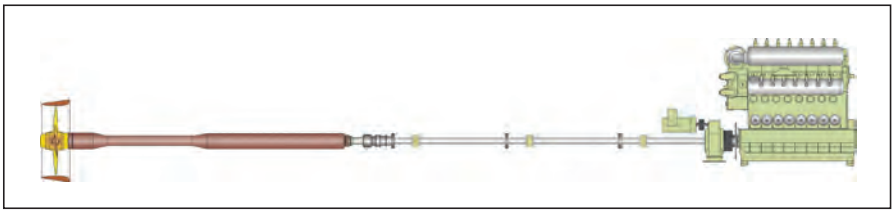
The VBS1800 (1800mm hub diameter) is the largest propeller so far from the Frederikshavn plant; however, designs are ready for a VBS1940 hub series for even greater outputs and diameters. In recent years, Alpha has noted a radical increase in orders for large CP propellers with associated controls.

Another new order for VBS1800 propellers has been those to be installed in four 47,400dwt product tankers building at the STX yard in Korea for Sovcomflot. Each will be powered by an STX-built MAN B&W 6S60MC-C engine. Ship deliveries stretch from February 2006 to July 2007.

The Alpha works is also supplying many propellers and control systems for linking to large-bore, four-stroke engines built at the group's Augsburg plant. Typically, these use propellers of the VBS1460 and VBS1380 types, which match L58/64 and L48/60 medium-speed engines in various cylinder configurations.



An impression of the propulsion train for the new fruit-juice tanker ordered by Atlantship from the Kleven Florø yard, showing the 7S60MC-C engine, VBS1800 propeller, and alternator driven off the free end.



A diagram illustrating one of the two propulsion trains to be supplied by MAN B&W's Alpha division for a new Chinese ocean-going salvage tug. The most interesting feature is the unusual specification of two-stroke S35MC engines.

Two-stroke engines for new Chinese salvage tug

Although tugs are not normally a subject covered by this journal, one particular new ship, ordered in China at Wuchang Shipyard, deserves special mention because of the most unusual propulsion plant: two 5920kW two-stroke engines from the MAN B&W Alpha stable. This ship is actually quite large (89.90m length overall) and planned for ocean-going work by Shanghai Salvage Co (operation will be by Shen Hua Shipping, based in Hong Kong); it will be classed with the China Classification Society.

The Alpha factory is supplying one of its complete propulsion packages for this ship, at the heart of which will be two 8S35MC crosshead engines, each developing 5920kW at 173rev/min. For this tug, Alpha is also designing and manufacturing two of its VBS1080 CP propellers of 3.70m diameter, which will have outward-turning medium-skew blades, with profiles optimised for working in nozzles.

Included in each transmission line will be a Flender GUG1200 tunnel gearbox with a power take-off for a 1160kW alternator. Each propeller shaft will comprise a 17m tailshaft, an oil distribution unit/coupling flange, and three 6m long intermediate shaft sections.

An Alphatronic 2000 control system, with two bridge stations and one in the engineroom, will be fitted. This will include interfaces to a power management system and a Kongsberg Simrad joystick unit, which will coordinate the control of propellers, rudders, and tunnel thrusters. All equipment from Frederikshavn is scheduled to be shipped to China between June and August this year, and the tug is expected to be delivered in April 2006.

A fine photograph of a typical Alpha CP propeller - a VBS1560 model - in the Frederikshavn works.

Data for ship designers from onboard decision tool

TWO Danish specialists have joined forces to develop SeaSense, which they describe as a real-time onboard decision support tool, to manage wave-induced structural loads and ship motions. The system has been jointly developed by Force Technology (formerly the Danish Maritime Institute) and Lyngsø Marine. The project has been partly financed by the Danish Ministry of Science, Technology & Innovation; other partners are the Danish Naval Material Command, A P Möller, and the Danish Technical University.

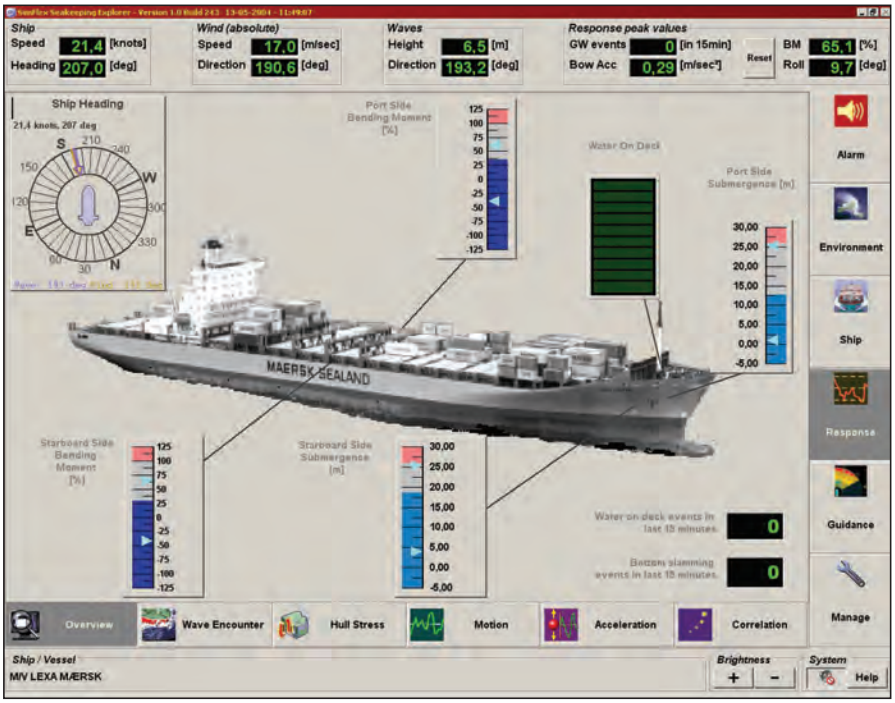
The prime function of SeaSense is to meet the challenge of navigating a large, fully-loaded ship in heavy seas, particularly at night time, from a bridge situated several hundred metres aft of the bow. The officer of the watch has to sense the effect of weather and waves in order to navigate the ship without undue structural loading and local accelerations, while minimising the amount of green water on deck.

To help do this, the system is designed to provide an accurate estimation of the actual sea state, precise information about the actual longitudinal hull-girder loading and the seakeeping performance of the ship. It can also make recommendations about speed or heading changes. This, according to the developers, allows the master to make an informed decision about operating the ship within acceptable limits.

In order to gather and process this information, SeaSense employs various innovative purpose-developed sensors. It is this which is claimed to distinguish SeaSense from other structural monitoring systems, which tend to rely on mathematical models and simple sensors.

The newly-developed sensors look in detail at relative wave motions, green water on deck and structural loading of the hull girder. The sensor signals are combined with information from other traditional sensors onboard, and all sensor information is then fused together in one mathematical model capable of estimating the actual wave spectrum.

This, says the developers, makes it easy for the crew to operate the vessel within predefined structural and seakeeping criteria. SeaSense will alert the crew in case of critical values and/or critical trends, propose alternative speed and heading combinations, and predict the consequences on seakeeping performance. The system was tested on a Danish Navy vessel for eight months prior to a prototype installation on an A P Möller container ship in December 2003, where it has been operating successfully for over a year.



SeaSense wave, bending moment, and green-water data from an actual vessel at sea.

A SeaSense diagram, as presented to an officer of the watch, to aid decision-making in seakeeping.

Influence on design

Erik Styhr Petersen, advanced systems manager for Lyngsø Marine, is a naval architect by background, and he sees SeaSense having an influence beyond its prime use in providing data for use onboard in seakeeping decision support. Information obtained in real time, in severe conditions on actual loaded ships will, he says, prove invaluable in future vessel design processes. Although ship designers are well aware of structural strength, the means of achieving such strength tends to be based on class rules and mathematical modelling, with true dynamic and static loading coming down to assumption - sophisticated assumption, which has proved largely adequate, but still assumption.

Fatigue is another area of ship design which Mr Petersen believes is not wholly understood. SeaSense, which records actual events and how the ship structure reacts to those events under real conditions, will provide data which will help designers understand the cause and effects of structural fatigue as well as providing a warning of any actual impending effects of fatigue on ships equipped with SeaSense.

Fatigue has been identified as a contributing factor in accidents involving bulk carriers, but other types of vessel, such as container ships, are also subject to structural fatigue. An overload, or unbalanced loading, at any time can occur without immediate danger, but this can set in motion a train of events which will contribute to fatigue damage in the future. Green water on deck is a good example of something which

may be overlooked, or compensated for based on assumptions, during ship design, for which SeaSense will provide actual data for future reference.

The modular concept, described by Mr Petersen as being based on typically Danish 'Lego-style' building blocks, means that the same basic platform can be applied to all ships, from tugs and research vessels to large container vessels or cruise ships.

Mr Petersen identifies a number of future directions for ship automation and his company. First is an increasing focus on integration of all onboard systems, enabling any function, including navigation, cargo monitoring and machinery, to be controlled from a single workstation, thus replacing several operators by a single person whose function is mainly to supervise automated processes. This involves a high level of software integration with a standard baseline solution for many different functions.

The decision support approach typified by SeaSense will, says Mr Petersen, be extended to areas such as real time damage assessment and management, with additional functionality being given to damage stability software to add dynamic analysis, eg, sloshing, filling, and dynamic relations between stability and ship motion. Further integration will take in things like smoke propagation in case of fire - all of this will provide a tool for designers as well as assisting onboard operation. Finally, asset condition and tracking will be incorporated into ship automation and control systems.

Efficient drainage solutions from Blucher

ALL Blücher drainage products are manufactured in Denmark using modern production methods and according to internationally recognised quality standard ISO 9001, and class society approval. They are made in stainless steel, grade AISI 316L, or optionally grade AISI 304.

Blücher's EuroPipe is a complete stainless steel sanitary pipework system approved for installation in ships. It is said to be light in weight and easy to install. The push-fit joint has been developed in such a way that EuroPipe is completely interchangeable between either gravity or vacuum discharge systems. In addition to sanitary discharge, the pipework is also suitable for central vacuum cleaning and refuse disposal systems. The benefits of being able to use the same pipework throughout a vessel, regardless of the type of system employed, can offer significant installation savings.

The system is available in outside diameters of 50mm, 75mm, 110mm, 125mm, 160mm, and 200 mm in standard lengths from 0.15m to 6m, and can, if required, be easily cut to length on site. It is fast and simple to install due to push-fit socket-and-spigot end jointing, and can be combined with other pipe materials. Material weight is low, with 1mm-1.25mm wall thickness.

To date, EuroPipe has been installed in more than 800 vessels worldwide. Recent contracts include the cruise liner *Costa Magica* (Fincantieri), and the cruise-ferry *Color Fantasy* (Kvaerner Masa-Yards), several product tankers at 3 Maj Shipyard, as well as naval vessels and offshore installations.

A typical arrangement of Blücher push-fit drainage piping being installed. All piping is fabricated from stainless steel.

Drains and channels

Blücher Marine drains have been developed in conjunction with shipyards worldwide. As a result, the products meet the specific demands of each individual installation, regardless of the deck construction. All drains are suitable for welding in the deck, can be fitted with a removable water trap (providing full rodding access from above) and are available to suit any deck finish. These all stainless-steel drains have a modular system allowing numerous possible combinations, and they are multi-adjustable.

New multi water trap

A new 'multi water trap' - a removable water trap with the added functions of odour stop and flooding safeguard, which is particularly suitable for improving hygiene and comfort on cruise liners and ferries - has recently been launched by Blücher. The trap has self-cleansing properties, it is said to be easy to install in deck drains, and it is easily removed for access to the drainage pipework system.

A special sealing ring closes the water trap when it is not in use, preventing bad odours from penetrating into cabins in case the water trap dries out, or if the water trap is emptied when the ship is rolling. The same ring closes the water trap if water rises from sewage piping, preventing water rising through the grating onto the deck (however, it is not approved for use as a backflow valve).Like all the company's drainage products, the multi water trap is entirely in stainless steel.

Mary Arctica: a heavily ice-strengthened container ship for Greenland service

ALMOST interesting ship that was delivered last month (although originally scheduled for completion at the turn of the year) was the 8870dwt container vessel *Mary Arctica*. This heavily ice-strengthened design, created by the Danish consultancy Carl Bro, was built in Poland by Gdansk Shiprepair Yard Remontowa, which in recent years has been involved in several innovative newbuilding projects alongside its repair activities. Detail design work and workshop drawings of this, the largest ship built there, were handled by Remontowa itself.

Mary Arctica, like her earlier cousin, *Irena Arctica*, and the larger and different container ship *Sea Arctica* (presented in *Significant Ships of 1995* and *1994* respectively), is specially conceived for trading with her owner, Royal Arctic Line (a joint Danish/Greenland operation), to and around Greenland, hence the high level of ice strengthening employed. Strengthening on the newest ship is based on Royal Arctic's experience with its existing vessels, which has resulted in an extension to the ice belt, and with ice frames and strength of the structure specified to be above the requirements of Det Norske Veritas.

The length of the hull was limited to a maximum of 113.00m to ensure best possible manoeuvrability in Greenland harbours. This fact, compared with the required container intake and the need for a complete double hull everywhere (2.40m at the sides and 1.60m at the bottom) - including in the machinery room, enabled the other dimensions to be fixed.

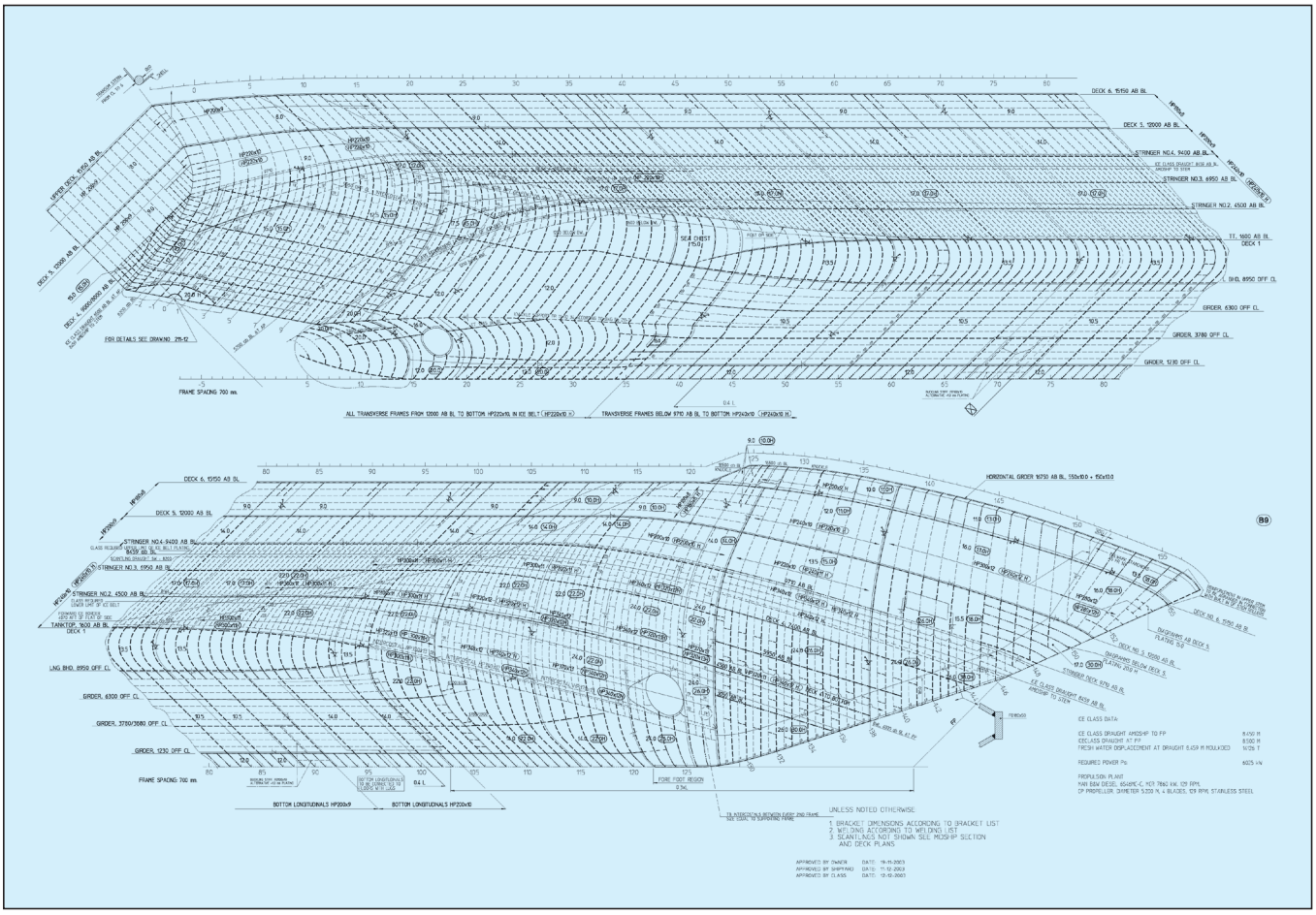
At the same time, an unusual length/breadth ratio of 4.51 (block coefficient is 0.704) is beyond the normal limits, so a manoeuvring test was carried out at Force Technology (formerly the Danish Maritime Institute). To aid manoeuvring, a Becker Marine Schilling rudder and steering gear with a high rate of turn are fitted, also an 800kW Rolls-Royce Kamewa tunnel thruster at both the bow and stern. These features are reported by Carl Bro to have given excellent sea trials results.

A spoon-shaped bow is designed to enable *Mary Arctica* to rise up on ice and crush it, while a pram-shaped stern with centre skeg is included, with ice fins forward of the propeller and a knife above the rudder for protection. Shell plating in the bow area is up to 30mm thick, and the stem is 50mm thick (approximately 30% high-tensile steel is included in the construction). All these features enables the ship to secure a Det Norske Veritas 1A* ice classification.

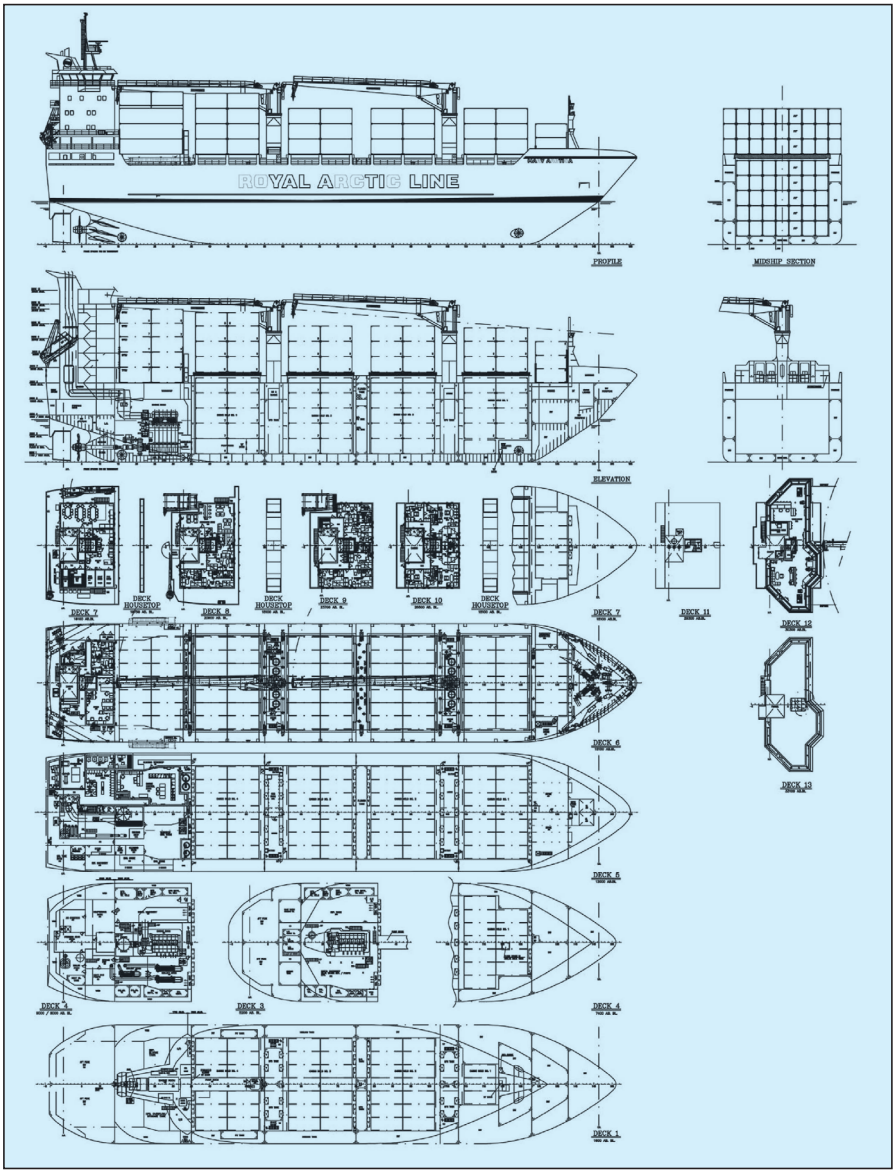
TECHNICAL PARTICULARS
MARY ARCTICA

Length, oa	113.00m
Length, bp	102.45m
Breadth, moulded	22.70m
Depth, moulded, to main deck	15.15m
Depth, moulded, to tweendeck	12.00m
Draught, design	7.00m
Draught, scantling	8.20m
Gross	10,300gt
Lightweight	5100tonnes
Displacement	11,465tonnes
Deadweight, design	6365dwt
Deadweight, scantling	8870dwt
Container capacity	572TEU
Main engine	Cegielski-MAN B&W 6S46MC-C
Output	7860kW at 129rev/min
Speed, service, 90% MCR, shaft alternator engaged	15.30knots
Complement	15
Classification	Det Norske Veritas +1A1, Ice 1A*, General Cargo/ Container Carrier,EO, ICS, DG-P, In Water Survey

Shell expansion drawings for the new ice-strengthened container ship *Mary Arctica*.



A fine model view of the new container ship *Mary Arctica*, built for service to Greenland.



The cargo area is divided into four box-shaped holds, all fitted with cell guides and enabling the ship to load a maximum of 259TEU in the holds, with a further 313TEU on deck. Electrical plugs are provided for 220 refrigerated containers, and all fuel is carried in deeptanks between the holds. To be self-sustaining in small Greenland harbours, *Mary Arctica* carries her own cranes - two Liebherr 45tonne jib units of the CBW45/298 type. Protection for the forward mooring gear in the difficult trading area is afforded by a whaleback over the forecastle.

Despite the compact stern hull form, the Carl Bro design team was able to create space for a low-speed two-stroke main engine from the MAN B&W stable: a six-cylinder S46MC-C model built in Poland by H Cegielski and developing 7860kW at 129rev/min; this is fitted with an Aalborg exhaust-gas scrubbing system. The engine drives an MAN B&W Alpha CP propeller of 5100mm diameter and with stainless steel blades - as they often are for ships navigating in ice conditions.

A Renk tunnel gear is fitted on the propeller shaft to enable a 1600kW Leroy Somer alternator to be driven by the main engine. Further electrical supplies come from three diesel-alternators, comprising MAN B&W Holeby 16/24 engines (two with eight cylinders and one with five cylinders) driving Leroy Somer alternators (2 x 760kW and 1 x 475kW).

General arrangement plans of the 8870dwt ice-strengthened container ship *Mary Arctica*, design by Carl Bro and built by Remontowa for service to Greenland with Royal Arctic Line.

XFlow - a Danish water-mist firefighting system

A RELATIVELY new water-mist firefighting system, XFlow, from York Fire Fighting (a member of the York group), provides both full (accommodation) and local (machinery space) firefighting protection, in one and the same system. Designed for spaces of unlimited size, XFlow aims to soak an affected area with a penetrating mist that should extinguish a fire speedily.

Early response is one of the key claimed advantages of XFlow. Unlike gas- or foam-based protection systems, it can be activated instantly, minimising any damage that might be caused. While CO_2 and foam demand extra equipment and space for tanks or bottles, XFlow uses water from a normal freshwater tank. No special rooms are needed to install or use the system, and less maintenance is required.

The York XFlow low-pressure water-mist fire extinguishing system is designed both for accommodation and machinery areas. As a result of extensive R&D, the company has succeeded in designing the nozzle head opening far larger than in high-pressure sprinkler layouts, and in this way, the risk of the nozzle being clogged by impurities is largely eliminated. A useful feature is that the accommodation sprinkler head, as seen here, is designed to be concealed in a ceiling and only to pop-out when the system is activated; this could help avoid malicious damage or unintentional release.

XFlow is designed for full protection in machinery spaces of Category A, Class 3. The system has been tested in accordance with MSC/Circ, 668/728 for unlimited room volume and is suitable for use in enginerooms, turbine enclosures, paint booths, cable tunnels, switchboard installations, and other enclosed spaces with limited draught conditions. Features include low power consumption, low pressure rating for piping, use of standard components, and low filtration requirements.

XFlow's low-pressure nozzles are suitable for installation in dry pipe systems. Minimum working pressure is 10bar, and a plastic cap protects the nozzle during installation; this is blown off when the system is tested with pressurised air, even if covered by paint. XFlow is a deluge system with open nozzles utilising fresh water plus 1% AFFF foam additive for the first 10 minutes of release. Water application rate is low, with only IP 22 necessary to protect electrical equipment. Water is pumped at a maximum pressure of 16bar from a ship's freshwater tanks without need for filtration. Seawater can be used for emergency water supply if freshwater storage tanks are depleted.

The pump unit consists of two pumps (one a standby); a foam additive injector; a small, foam additive storage tank; and an electronically controlled quick-opening valve for each section. The unit is located outside protected areas (eg, in the steering-gear room).

XFlow is designed to mimic the way a fire spreads across a room, by splitting the space into sections. Only those areas actually on fire are targeted (unlike CO_2 or foam systems, which fill an entire space), so that other areas are not affected by the mist.

The system is activated manually from a control panel in the engine control room or fire-control station. When the release button for a specific section is activated, the water mist pump is started and the relevant section valve opened. Activation of the system gives a visual and audible alarm in the protected space as well as at a continuously manned central control station.

Numerous vessel projects for consultancy

A MARINE consultant company based in Copenhagen, Alpha Ship Design, is currently engaged in the design of multipurpose cargo vessels and a medium-size ro-ro vessel, as well as a number of other projects.

Alpha Ship design is also working on the total refurbishment of *Logos Hope* for OM Ships International (OMS). OMS is a subsidiary of the international organisation Educational Book Exhibits Ltd. Alpha's scope of involvement includes fully developing the project, preparing all the necessary project/tender documentation, and arranging the tender phase with several shipyards in Europe, and elsewhere. During the conversion of the vessel, Alpha will assist OMS with inspection and supervision at the shipyard.

The conversion includes modification and refurbishment of the entire accommodation area as well as extra cabin accommodation in the old car deck space. The existing accommodation area has been converted with cabins for 500 people (crew, some with childen) and visitors. Also added is a large book exhibition area and a book store; an auditorium, hospital, and dental clinic; installation of greater generator capacity, adding a new airconditioning system and a sprinkler system, as well as several other changes. A new school and kindergarten have been arranged as part of the expanded superstructure.

In the future the vessel will be operating as a floating book store and will carry more than 250tonnes of educational books. The vessel will call ports all over the world, mainly in underdeveloped countries. When *Logos Hope* is in service, some 600,000 people are expected to visit the vessel every year.

Alpha is also working on a ro-pax newbuilding project for Strandfaraskib Landsins, from the Faroe Islands, and has been appointed project manager for the inspection team. The vessel is currently under construction at IZAR, San Fernando Shipyard, in Cadiz, Spain. The vessel has been designed for domestic trade between Thorshavn and Suduroy, and has a capacity of 200 cars and 980 passengers.

A strategic alliance with Harland & Wolff, Belfast, has recently brought an unusual task to Alpha, that is, taking on the task of owner's representative/project manager for the conversion of a Danish ferry into a hospital ship for Mercy Ships, of Texas. The conversion had in fact been underway some years ago, but due to the unfortunate closing of Cammell Laird, the owner did not receive the finished vessel.

A&P, at Hebburn, Newcastle upon Tyne, signed a new contract with the owner and the work is now scheduled to be finished by the end of August. It is the intention to take the vessel to the Far East after completion, to assist in tsunami relief operations.

Other recent work includes consultancy services for Smyril Line, ranging from technical to organisation matters onboard the new ro-pax vessel *Norröna*, which serves the Faroe Islands, the Shetlands, Norway, Iceland, and Denmark. Supervision and project management during construction of *Norröna*, delivered by Flender Werft in 2003, was also carried out by Alpha Ship Design.

In other news, Alpha has formed a consortium, which includes: Harland & Wolff, Lloyd's Register, Royal Caribbean Cruise Lines (UK), and Safety At Sea (Glasgow), and which has been selected, together with other consortia, to participate in the research and development project SAFEDOR, under the European Union 6th Framework Programme. The project started in February this year, and will run over the next four years.

Alpha's consortium will be responsible for designing a large cruise vessel using risk-based design as a formalised design methodology. This will integrate systematically risk analysis in the design process with prevention/reduction of risk (to life, property and the environment) embedded as a design objective.

Alaskan shiphandling pod simulator from EMRI

ALONGSIDE its established product-the design of remote control systems for large propulsion pod and conventional propeller installations, the Danish specialist in such systems, EMRI A/S, has very recently designed and built a new shiphandling simulator for the Ketchikan headquarters in Alaska of the Southeast Alaska Pilots Association. This unit has been specially engineered for training pilots in the use of azimuthing propulsion units; these are becoming increasingly popular on cruise liners, and the latter are, of course, regular visitors to the environmentally-sensitive coast of Alaska. This is believed to be the first such trainer in the USA.

The simulator features two display screens, one showing the vessel in a specific Transas electronic chart display area, and the other showing the ship's own data. The electronic chart will be capable of displaying other vessels through an automatic identification system (AIS) and will present real-time traffic situations for the operator. The simulator is interfaced with an instructor's PC and LCD, which forms the system's 'control room'. Vessel selection, wind, current, and location can be fed in, together with details of alternators on- or off-line (important for pods with their integral electric motors), alarms, and other initial data related to an exercise.

The new Alaskan pilots' shiphandling simulator, specially designed by EMRI for use with ships featuring azimuthing propulsion pods. It features two display screens, and the controls include a dynamic positioning joystick. To the right is the instructor's console, with keyboard.

Semco success with firefighting systems on ro-ro vehicle carriers

A TREMENDOUS boom in new contracts for ro-ro export vehicle carriers, especially in Korea, Poland, and Japan, has given a boost to the workload at Semco Maritime, the Danish firefighting specialist, whose gas division is based in Copenhagen. As typical examples, both Leif Hoegh and Wallenius are continuing their series of 6000-unit pure car carriers (PCC) at Korea's DSME. Parallel to this, Wallenius is also building a series of 8000-unit ships - the latest generation in DSME's programme of super car carriers. Recently, Danish owner A P Möller joined the race for new vessels by ordering three ships.

Meanwhile, in Poland, Stocznia Gdynia is continuing to construct vessels for the Israeli owner Ray Car Carriers, which seems to have a huge demand for new tonnage and is believed to have prolonged its 6400-unit car series to 20 vessels. Furthermore, Ray is building a series of smaller 'feeder' ships, also at Gdynia.

For decades, Semco Maritime has enjoyed a close co-operation with both DSME and Stocznia Gdynia and is delivering single- and double-tank CO_2 low-pressure firefighting systems for both cargo deck and engineroom protection. The advantages of such plants are the very compact dimensions and low weight (50% weight and space savings over high-pressure systems) compared with the huge volumes to be protected. The largest plant built by Semco with a single tank was a 54,000kg CO_2 installation for the 67,000m^3 deck space of a pure car carrier built at Minami Nippon for Mitsui OSK Lines. Another up-and-coming market is China, where Semco CO_2 systems were fitted to the new Airbus ro-ro ship *Ville de Bordeaux* from Jinling Shipyard (presented in *Significant Ships of 2004*).

Each Semco plant is delivered as a complete unit, pre-wired, pre-piped, and factory- and full-scale tested for a minimum five days under real conditions, ie, charged with CO_2. During these tests, all functions are monitored and adjusted. Installation and commissioning onboard is therefore reduced to a minimum, eg, compared with a CO_2 high-pressure cylinder system with 800-1000 cylinders.

Low-pressure CO_2 tanks for marine firefighting systems being loaded at the Semco factory. This company has enjoyed particular success recently with orders for new-generation car and truck carriers, mainly at DSME in Korea and Stocznia Gdynia in Poland.

At the other end of the scale, Semco Maritime has secured a remarkable order for CO_2 high-pressure systems for 12 patrol vessels for the Australian Navy, being built at Austal Ships in Henderson, Western Australia. These systems are electrically monitored and activated from a compact control panel built into the bridge control desk. Being vessels built to the HSC code, there is a 100% extra manually-released cylinder battery.

In April 2003, we reported that Semco was examining new types of non-lethal gas for fire extinguishing, including Novec 1230, which appeared to show some promise. Two small systems with this agent have recently been delivered to the Danish Navy, and more orders are expected this year; however, the company believes that at present the chemical is too expensive for cargo ships.

New mini-chute and mini-slide installations from Viking

FOR smaller vessels with evacuation heights between 1.5m and 20m, Viking Life-Saving Equipment has designed two rapid escape systems. These are the Viking evacuation mini-chute (VEMC) and the Viking mini-slide evacuation system (VEMS). A VEMC installation is claimed to be able to evacuate 354 people within 30 minutes and is SOLAS approved according to IMO resolution MSC 81 (70). The basic system consists of a chute and a 101-person liferaft, which are suitable for evacuation heights between 5m and 20m. A recent installation featured in this journal was that on the Spanish ferry *Volcan de Tindaya* (*The Naval Architect* October 2003, page 9).

The Viking mini-slide is said to be capable of handling 303 people within 17min, 40sec. It is designed for vessels with embarkation heights of 1.5m to 3.3m above the waterline. A recent installation of this minislide, as part of a Viking package, is on the 63m catamaran ferry *Nixe*, completed by Singapore's Marinteknik Shipbuilders (S) Pte Ltd for Spanish owner Balearia. This combined passenger/vehicle/cargo ferry, with a crew of 10 and up to 536 passengers, is fitted with four 5m slides.

The package is completed by a further three 51-person liferafts, one 101-person liferaft, and two 470-type GRP rescue boats. The slide itself is claimed to be ready for operation within 2.5 minutes, and the system is based on the company's experience with manufacturing many full-scale systems.

A mini-slide and liferaft are packed in a GRP container taking up no more space than a standard liferaft container, and can be stowed on steel or aluminium racks; the package can be purpose built for individual vessels. It is quickly launched by pulling a release pump. In trials and in practice, the VEMS has demonstrated its ability to provide a safe means of evacuation in wind forces of 13m/sec -15 m/sec and in significant waves of more than 3m.

Mini-chute system to be installed on new Italian vessels

Viking has recently been awarded an order for lifesaving systems onboard two new ferries being built at the Visentini shipyard in Italy for an undisclosed owner. Both are to be fitted with mini-chute systems with 101-person capacity associated liferafts and eight 100-person drop liferafts. The orders are due for delivery in 2006.

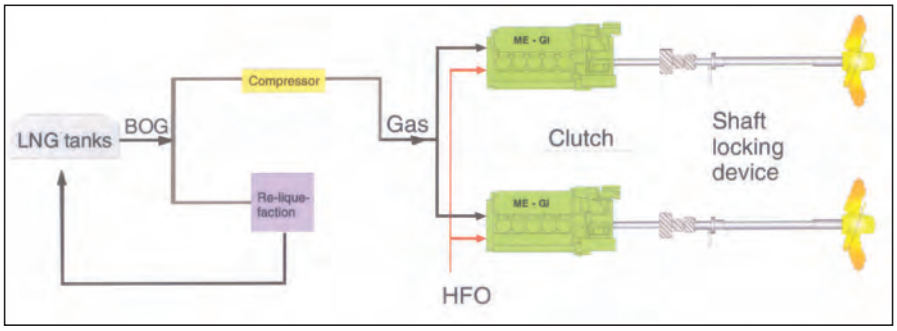
The self-contained and compact nature of a VEMC system allows for installation anywhere onboard, either on open deck or between decks. Passengers and crew are evacuated through the reinforced Kevlar chute into self-righting liferafts. All systems have been subjected to extensive sea trials under extreme climates and heavy seas.

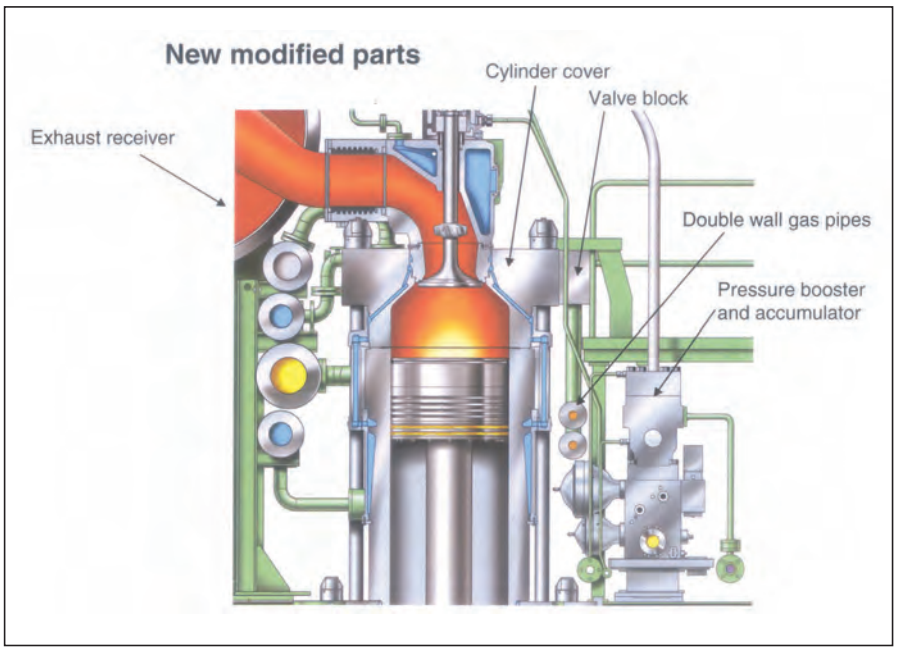
A recent delivery of a full-scale large system is on the new Color Line cruise-ferry *Color Fantasy* (illustrated in *The Naval Architect* February 2005, page 24). For this large ship, Viking delivered six evacuation chute systems, including 100 DKS self-righting liferafts. Other recent orders have come from Rodriquez Shipyard, in Italy, Scandlines, in Denmark, and Lloyd Werft, in Germany (the latter for the cruise liner *Pride of America*). Other packages are being delivered to Fincantieri (for Carnival and Costa cruise liners), and to the Barreras yard in Spain, for two new ferries.

Gas-fired low-speed engine alternatives

THOSE owners interested in following the rising new star of slow-speed diesel propulsion for their next-generation LNG carriers might possibly consider an alternative to the heavy-fuel-burning-plus-reliquefaction concept. This is a gas-burning (boil-off gas) version, as epitomised by the MC-GI model from the Copenhagen headquarters of MAN B&W Diesel. This can burn any ratio of liquid or gas fuel desired, depending on the natural or forced boil-off available.

Although no marine experience has yet been accumulated, a 12K80MC-GI engine has been running for 20,000hours driving an alternator at Mitsui's Chiba shipyard in Japan. Today, owners would probably opt for a camshaftless version with electronic controls (ME-GI type). A typical shipboard propulsion plant using twin screws could employ two 6S70ME-GI low-speed engines (2 x 18,660kW) driving twin FP propellers, with a clutch and brake on each shaft so that one propeller could continue operating in the event of failure of the other.





Arrangement of a typical low-speed diesel engine plant on a large twin-screw LNG carrier employing ME-GI gas-burning engines (top) and the modified components of an engine fuel system and combustion chamber to enable gas to be burned (bottom).

THE SECOND

HIGH PERFORMANCE YACHT DESIGN

CONFERENCE

www.hpyd.org.nz

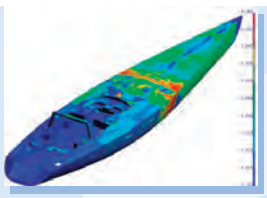
14 to 16 February 2006 Auckland, New Zealand

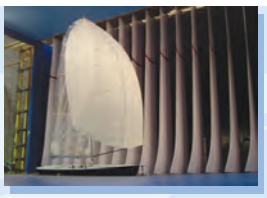
First Notice and Call for Papers

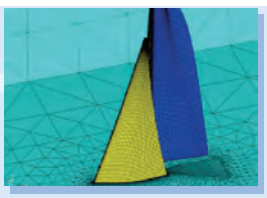
ABSTRACTS DUE 30 APRIL 2005

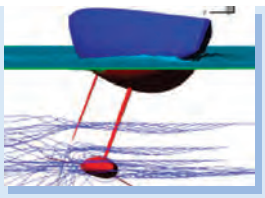
Timed to coincide with the arrival of the Volvo Ocean Race fleet in New Zealand, the second international conference on high performance yacht design will be held in February 2006, and will showcase the latest developments in yacht research from around the globe. This conference will be a venue where naval architects, engineers, designers and researchers can present and hear papers on the current state of high performance yacht and power craft technology.

Advances in high performance yacht design are being driven by a range of factors, including development of new racing classes and demand for increased size and performance of racing and cruising craft. Radical design concepts such as innovative new hullforms, moving keels and masts and new approaches to sails and propulsion systems require innovative approaches to analysis, design and experimental verification.









Papers are invited on all topics relating to the design of high performance power and sailing yachts including:

- Performance prediction and measurement
- Wind tunnel and towing tank technology
- Regulations and rating rules
- Computational methods
- Materials and construction
- Hull and Appendage Design

Feedback from HPYD1:

"The most informative technical conference I've been to as well as an exceptional opportunity to meet old friends and be educated at the same time" *Merfyn Owen, Owen Clarke Design, England*

"You managed to attract the most prominent researchers in the field from all parts of the world. This must be one of the best conferences in yacht design ever held" *Professor Lars Larsson, Chalmers University, Sweden*

THE UNIVERSITY OF AUCKLAND
NEW ZEALAND

The Royal Institution of Naval Architects

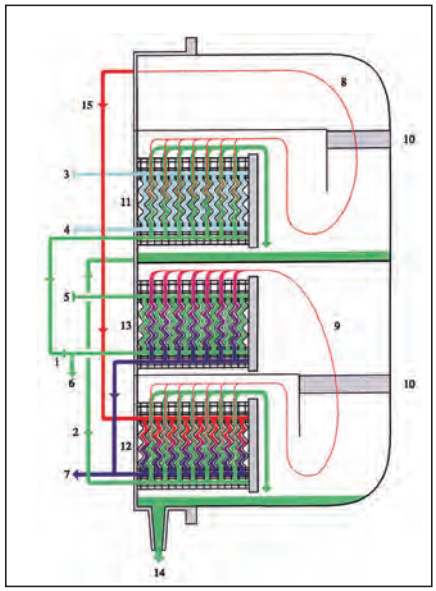
Massey University

Desalination range gears up for increased demand

ALFA Laval's Danish factory at Söborg, near Copenhagen, concentrates on freshwater generators and water purification products, for which the marine industry provides substantial business. In fact, the company claims a 60% share of the marine freshwater generation market, based on 2004 sales, and says that its products on ships currently produce some 146 million tonnes of water annually. The facility, with 450 employees, received orders for more than 900 additional units during 2004.

Demand, says the company, shows little sign of slowing down. With bunker water prices steadily rising - Alfa Laval foresees a three-fold increase between 2000 and 2015 - and quality deteriorating, exacerbating problems of scale formation and increasing onboard maintenance costs, more ships are expected to use desalination equipment to produce their own fresh water supplies. Other factors are likely to increase onboard demand for high-quality fresh water - Alfa Laval cites future, more stringent, exhaust emissions limitations, which will encourage water injection or fuel oil emulsification to reduce levels of nitrogen oxides.

All current production centres on plate-type systems, which are said to offer several advantages over the older tube-type concepts. Although Alfa Laval has not made any tube systems since 1992, it still supports older equipment from Atlas and Nirex, companies acquired by Alfa Laval.



Cross-section through an Alfa Laval two-stage freshwater distiller.

Alfa Laval claims more than 60 years of experience in desalination of seawater. The company has built up a range of vacuum distillation equipment consisting of freshwater generators and seawater desalination units, which convert seawater into freshwater by vacuum distillation. Made of corrosion-resistant materials, the generators are claimed to deliver freshwater with a salinity of less than 2ppm, both for human use and for various onboard processes.

The current merchant ship range offers four types of generator, producing between 0.5m^3 and 100m^3 daily. Higher output requirements are met by the cruise ship range of multi-effect freshwater generators, which are capable of producing between 100m^3 and 1000m^3 daily. As an example, three such generators are onboard *Queen Mary 2*, to produce up to 1890tonnes daily. For LNG carriers, a bleed steam plate-type generator has been specially developed. Heating is normally supplied by engine coolant water; a hot-water-loop module is available to secure maximum freshwater production and ensure constant temperature and flow when engine are not running.

Other types of water purification equipment produced at Söberg include decanter centrifuges, normally used in the brewing and similar industries, but Alfa Laval has supplied one to a P&O cruise liner for treatment of waste water, allowing the ship to operate in particularly environmentally sensitive regions. The company sees further maritime applications for equipment of this type in treatment of used tank-cleaning water onboard tankers.

New upgrades ensure accuracy and automatic straking

SINCE releasing the 2005 version of ShipConstructor, the AutoCAD-based 3D product modelling software for shipyards and designers, Albacore Research Ltd (ARL) has been working closely together with customers worldwide to introduce even more time- and cost-saving features. In close collaboration with Japanese and Australian shipbuilders, two new features have been introduced, namely, accuracy control marks and automatic straking.

Small inaccuracies easily add up to significant deviations during multiple steps of assembly. Precise fabrication is a means of reducing rework, delays, and waste. In Japan, accuracy control marks are used for two tasks: aligning stiffeners with high accuracy on plates, as well as the accurate joining of plates for welding. This feature is now available worldwide through ShipConstructor2005, update 1.16.

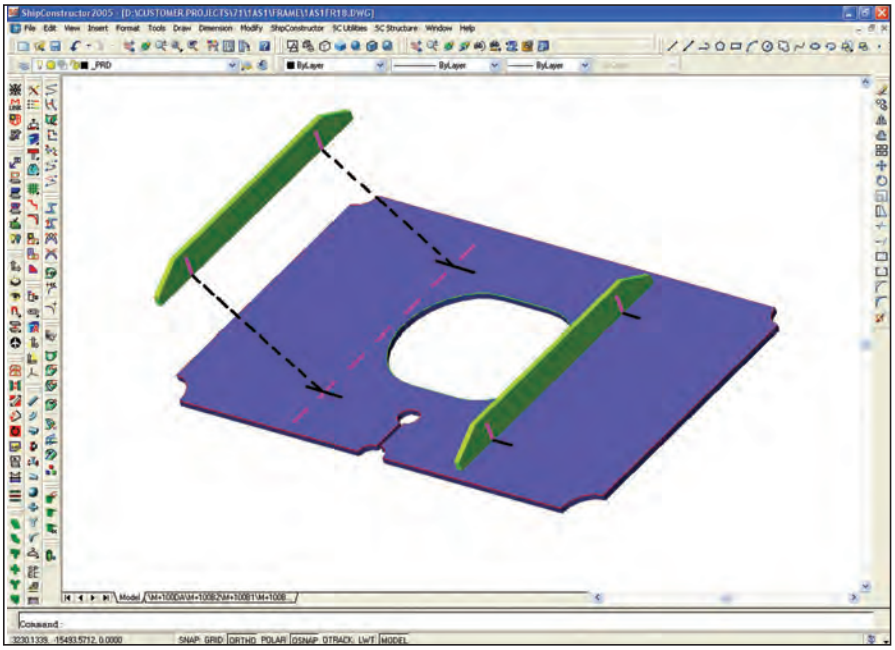
For aligning stiffeners, a mark is made on the plate and on the stiffener so they can be easily aligned during assembly. ShipConstructor scribes accuracy control marks onto plates during NC-cutting. For stiffeners, ShipConstructor automatically generates stiffener plots with dimensioned locations of the accuracy control marks, or the data can be fed directly to an automated stiffener cutting system.

For joining plates, a line is made on each of two plates to be welded together such that the line runs parallel to the plate's edge and is offset a certain distance from the edge. Before welding, yard workers measure the distance between these lines at various points to ensure perfect alignment. Without these lines it can be difficult to maintain the correct spacing between plates, especially for plates with bevelled edges and weld gaps.

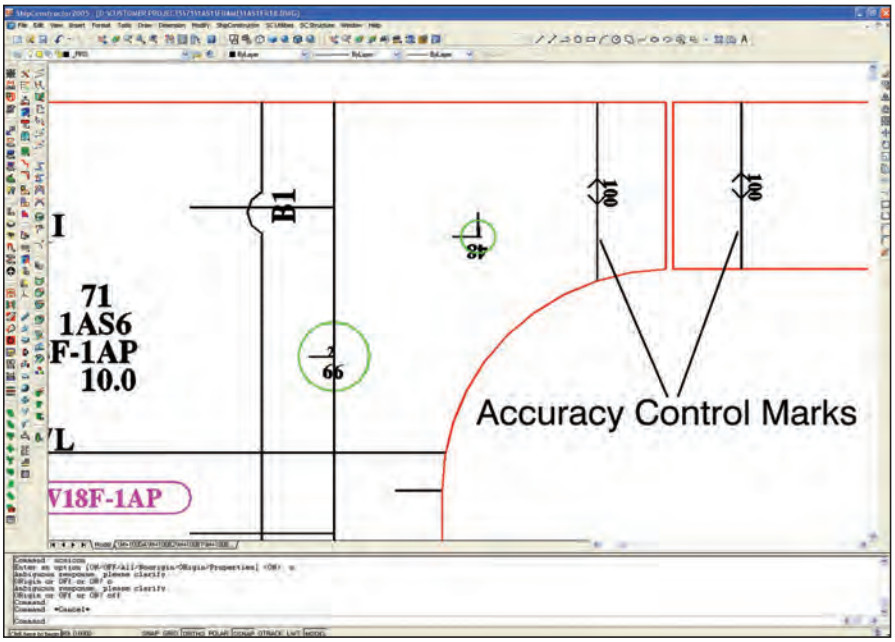
As in previous releases, ShipConstructor's product-model database automatically provides a list of shipyard standards based on plate thickness and weld type to ensure that the project standard is followed by all designers. These standards, loaded into the project database by production managers, are an effective way of transferring knowledge to less-experienced users.

Previously, Japanese shipyards created the accuracy control marks manually within AutoCAD, a time-consuming process. Now, they can easily create these marks in a few seconds. Not only does this feature accelerate Japanese customers' existing workflow, it also makes these Japanese best practices available to ShipConstructor customers worldwide.

ShipConstructor users in Australia, who rely heavily on aluminium construction, have brought forward the issue of automatic straking. Automatic straking is used for automatically dividing predefined areas, such as decks and bulkheads, into planks based on the parameters of available stock, then generating a bill of materials automatically. Previously, straking had to be done manually, so an automatic method of straking represents a significant saving of time. Automatic straking also works with state-of-the-art prefabricated aluminium extrusions and sandwich panels, which are increasingly being used outside of Australia as well.



Japanese best practices implemented into ShipConstructor: accuracy control marks ensure proper alignment of stiffeners on plates.



Accuracy control marks also ensure accurate joining of plates for welding.

ShipConstructor2005 Update 1.16 with accuracy control marks is available for customers with current upgrades, maintenance, and support contracts to download from www.ShipConstructor.com. Automatic straking will be available in a subsequent update of ShipConstructor.

More funding for design project

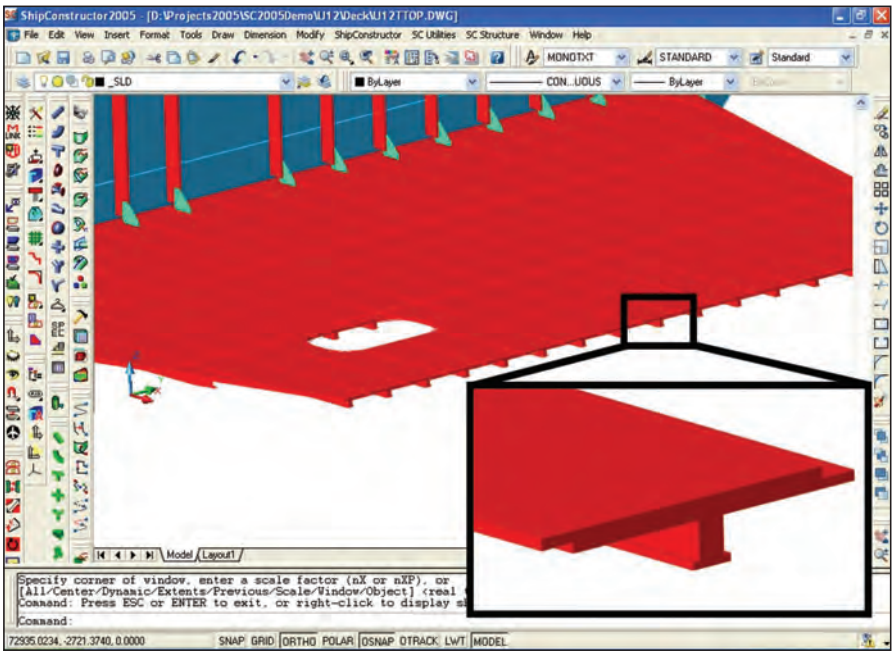
In other news, the development of key features in ShipConstructor will be funded by the Second-Tier Shipyard Design Enhancement Project II, which recently received significant

funding from the National Shipbuilding Research Program (NSRP) Advanced Shipbuilding Enterprise. The project, headed by Bender Shipbuilding & Repair Co, Inc, includes seven shipyards and four naval architect firms, representing the core of second-tier shipbuilding and ship design in the USA (*The Naval Architect* April 2004, page 42).

The overall goal of the project is to provide US second-tier shipyards with a state-of-the-art design system that will enhance their global competitiveness. Albacore Research Ltd (ARL) will extend ShipConstructor's capabilities to fully meet the design requirements of the US second-tier shipyard industry. Specific features to be developed include integration with the common parts catalogue and the ability to split and merge projects.

The common parts catalogue, developed by the US first-tier yards, standardises the definition of purchased part data and related support documents. Provisions for equivalency allow yards to exchange data efficiently, and facilitate the ability to communicate and even utilise parts in stock at other yards. Integrating ShipConstructor with the common parts catalogue streamlines the material control system from definition to delivery of the finished product, and even during product lifecycle management.

The ability to split and merge ShipConstructor projects will enable collaboration among shipyards and design agents working on a single project in multiple locations, simplifying outsourcing and subcontracting. Even in mid-project a yard can subcontract part of the work and still remain in full control, should its own resources not be sufficient.



With automatic straking of a predefined area within the ship, ShipConstructor provides another time-saving tool.

Enhancements made to shipbuilding solution

FROM mid-February the Tribon M3, Service Pack 3 has been available, and it includes a number of significant new functions such as clash detection and management, analysis tools in basic design, and linkage between Tribon M3 and AVEVA's Review visualisation solution.

In addition to the existing clash detection function in the Tribon M3 shipbuilding system, a detection and management function has been developed. It is based on a new interference detection algorithm that analyses large 3D models for clashes within seconds including, if desired, any objects that are within a certain capture distance from a specific object. This feature can be used for analysis of shock-mounted objects which may vibrate or move in operation. It can also be used to determine service space and access to equipment items.

Information about clashes (proximity and physical space violation) is stored with the data model and there is a set of management tools for presentation, approval, and reporting of clashes. The calculation speed, ease of use, and efficient reporting tools represent an important, practical step towards totally clash-free 3D models.

In addition, the Basic Design application of Tribon M3 has gained two new major features for early estimations in planning, assembly, transport, and lifting. Weld lengths for blocks or assemblies can now be easily calculated based on a preliminary steel model, and all individual weld lengths can be reported. Preliminary block weights and centres of gravity can also be quickly obtained for any selected part of the model. This allows alternative block divisions to be analysed quickly, thereby determining optimal final block divisions.

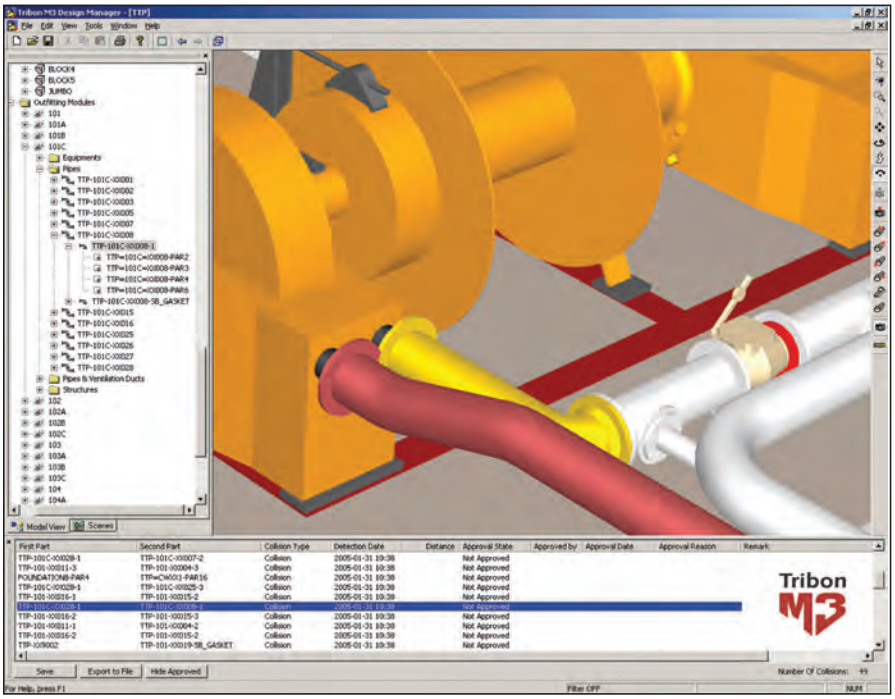
Together with the existing capabilities of Tribon M3 Basic Design, these new functions extend the solutions capabilities for integrated basic structural design, analysis, and development of classification drawings.

Hull panels being symmetrical or unsymmetrical with respect to the centreline of the ship are now handled more efficiently than before. This is of particular importance in the transition phase between basic and detailed design, when many panels are becoming specialised with changes and additions unique to one side of a ship. Another significant new feature in Hull is a new dialogue for selection of end cuts. The new graphical selection window is said to be more clear and easier to use than the previous one.

The Project Copy function released with Tribon M3 can now be used to transfer data between ship product models directly without the use of an intermediate data transfer set. Project Copy plays an important role in the efficient re-use of product model data between ship projects.

Included in Service Pack 3 is a new version of the program for transfer of model geometry data between Tribon M3 and AVEVA's Review solution. Review is used for design inspections and reviews, model 'walk-throughs', checking of access routes and creation of photo-realistic images.

The two-way link capability also means that Tribon M3 users now can import pipe arrangements from PDMS (Plant Design Management System) which is a popular solution for marine outfitting. PDMS users can also import hull steel structures from Tribon M3. In both cases, information can be used for clash detection and creation of drawings.



The new collision detection and management system in Tribon M3 Service Pack 3. The two pipe flanges connecting to the mooring winch collide and this is reported in the list window in the lower part of the screen.

New contracts

In December 2004 (as reported in *The Naval Architect* January 2005, page 37), Hyundai Heavy Industries (HHI) selected AVEVA's marine products for the design and production of ships and offshore products at its shipyard in Ulsan, Korea. This followed a very detailed and wide-ranging CAE/CAD/CAM evaluation of all products on the market.

The contract, worth in excess of US$12.5 million, includes implementation of the current AVEVA marine products with licences for more than 1000 designers. HHI will initially use Tribon M3 and PDMS and take up the new VANTAGE Marine products as they are released. HHI will also, together with other major shipbuilding companies worldwide, be a part of the VANTAGE Marine reference groups - consultative bodies of major shipbuilding companies that will provide industrial knowledge to the ongoing VANTAGE Marine programme.

The first release of VANTAGE Marine will be in mid-2005, combining the technology of PDMS, which is a popular outfitting solution, with that of Tribon M3. This first release will meet immediate customer demand for the best of both solutions, will include new marine functionality and will demonstrate the compatibility of the two technologies.

The very thorough evaluation to find a modern and efficient shipbuilding system for design, engineering, and production of ships was carried out by the 35-strong CAE/CAD/CAM development department at HHI. This department has many years of experience in the use and development of CAD for shipbuilding. During this process, a large delegation from HHI visited Malmö in Sweden for a four-week benchmark test. In addition, a 12-week pilot project was conducted in Ulsan supported by 15 technical experts from AVEVA on site every day. The evaluation process was completed with two weeks' review of current AVEVA technology in Ulsan and one week detailed presentations of the development plans for the VANTAGE Marine system at AVEVA's head office in Cambridge, UK. An important issue for HHI was that AVEVA had a solid future 'roadmap' as well as products that could be used for shipbuilding immediately.

In other news, Volkswerft has also signed a four-year agreement with AVEVA to continue its use of the Tribon Shipbuilding System at its shipyard in Stralsund, Germany. Volkswerft will use the Tribon System for design and production of all types of merchant ships.

Volkswerft has used shipbuilding systems from KCS/Tribon Solutions successfully since 1993. The Steerbear system was implemented in 1992 and later substituted by the Tribon system. In total, Volkswerft has designed and built 1598 ships such as container vessels, reefer vessels, dredgers, car carriers, ferries/passenger vessels and other special ships, using this software.

The Royal Institution of Naval Architects

WARSHIP 2005
NAVAL SUBMARINES 8

22 - 23 June 2005

Second Notice

The changing face of naval warfare means that the role of the submarine has altered in recent years. Their use is increasingly moving away from the open ocean into shallower waters and the littoral.

Most navies are currently facing a reduction in resources, which will also affect the design of future submarines and size of complement. Lower complements are becoming more attractive with advances such as total integration of combat systems, machinery controls and data presentation. However, lower complements mean improved support infrastructures are required. Much can be done in making the submarine more 'support friendly' with more efficient supply chains both in production and for support.

The issue of safety aboard submarines is becoming increasingly important. Effective evacuation and fire fighting are complicated by the enclosed atmosphere and deep operation. A further issue is the resolution of minor incidents, such as onboard fires, while still retaining covert operations.

This will be the twenty-fifth in the Institution's successful WARSHIP symposia. The symposium will cover developments since 'Naval Submarines 7' in 2002. The Institution invites papers on the following subjects:

- **Propulsion**: nuclear power, air independent propulsion (AIP), hotel & combat system energy requirements, fuel processing, hull resistance, propulsors.
- **Design & Construction**: developments in design and analysis methods, advanced materials, more efficient structural configurations, ease of construction, inspection techniques, quality assurance.
- **Combat Systems**: sensor and data integration and presentation, non penetrating masts and periscopes; command, control and communication systems, weapon stowage and launch solutions, shore bombardment weapons.
- **Signature control**: passive & active anti-ASW.
- **Life Support**: atmosphere control and monitoring, acceptable concentrations of contaminants, food, water, accommodation standards.
- **Upkeep & Support**: equipment re-supply, refit support, maintenance, through life support, access to the submarine, disposal.
- **Emergency Situations**: escape & rescue, fire fighting, policy, equipment, life support.
- **Submersibles**: ROVs & AUVs in ASW and other roles.

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Type approval for loading instrument software

LOADING instrument software from Autoship Systems Corp, of Vancouver, Canada, Autoload 6.0, has recently received Lloyd's Register type approval as a strength and stability calculation program. The approval is valid until November 2009. Autoload 6.0 is a loading instrument software for new ships.

Philippine yard purchases Autoship CAD/CAM software

Herma Shipbuilding located in Quezon City, the Philippines, recently purchased Autoship Systems Corp's CAD/CAM software. The yard has installed Autoship Pro, Autopower, Autohydro Pro, Autoplate, and Autostructure plus Production Manager for two dedicated users across a network platform. AutoPlant, a 3D Piping program from ASC partner firm, Bentley Systems Inc, was also installed with direct integration into Autostructure.

Herma Shipyard carries out shipbuilding, shiprepair, and conversions. It is a member of the Herma Group, which provides petroleum, maritime and environmental services. Herma Shipyard is said to have chosen Autoship for three reasons. The software has integrated functionality of all CAD/CAM operations for shipbuilding and engineering processes, the company provides technical support and training, and prices are competitive.

Ship stability software improved

A NEW version of General HydroStatics (GHS), a software program that deals primarily with ship stability and strength, has been released by Creative Systems Inc. The version 9.50 includes new commands, and features new style options for printed reports, either colour or black and white, and has a selection of fonts. In total, Over 70 additional enhancements and over 80 'bug fixes' and performance improvements have been added to this upgraded software.

The new THRUST command is typically used for modelling the effect of bow/stern thrusters but also applies to any force perpendicular to a ship's vertical axis. Several points of thrust can be established in various directions and applied at several points simultaneously.

The new PULL command is useful in salvage operations where a cable attached to a vessel is contributing to the heeling and/or trimming moments and also to the vertical force if the pull is not in a purely horizontal direction. Several of these pull forces can be in effect simultaneously.

A condition graphics window can now be set to automatically update whenever a change takes place that affects draught, tank loading or attitude of the vessel. This is particularly useful in the Load Editor.

Three new LIMIT types have also been added. That is the minimum flood point height at a given angle, the maximum inclination angle (in the steepest direction considering both heel and trim), and the maximum roll angle.

With the new Tank-Smart downflooding point, each critical (downflooding) point can now have one tank assigned, to it, which causes the point to be ignored in stability criterion evaluation when the tank is already flooded. Fourteen new system variables also give increased direct access to tank properties and other parameters.

Propeller seminars accredited

THE Society of Naval Architects and Marine Engineers (SNAME) has accredited HydroComp seminars for the continuing education requirements of professional engineer licence renewal. Designed to suit the needs of a specific audience, HydroComp's propeller seminars dissect both theory and practical application. For example, previous seminars have focussed on a range of issues including the fundamentals of propeller sizing, engine performance, speed prediction, and cavitation.

Seminar participants enjoy an open dialogue with the instructor, and have an opportunity to discuss current projects and participate in round-table discussions. They are suitable for everyone with an interest in inboard propeller propulsion, including naval architects, ship operators, propeller dealers and manufacturers, engine and gear companies, and port agents and surveyors.

More information can be found on the HydroComp training web page at http://www.hydrocompinc.com/support/training.htm.

Second upgrade allows structure definition in basic designs

THE V50R3.0 is the second major release of the FORAN system in a year (as noted in our January 2005 article). Many important features have been added, and substantial improvements have been made. In addition to the major improvements obtained in the V50R2.0, launched at the end of May 2004, migration to ORACLE 9i has also been included in the newest release.

A major new feature is the ability to define internal structure for basic design (in the FHULL module). This involves:

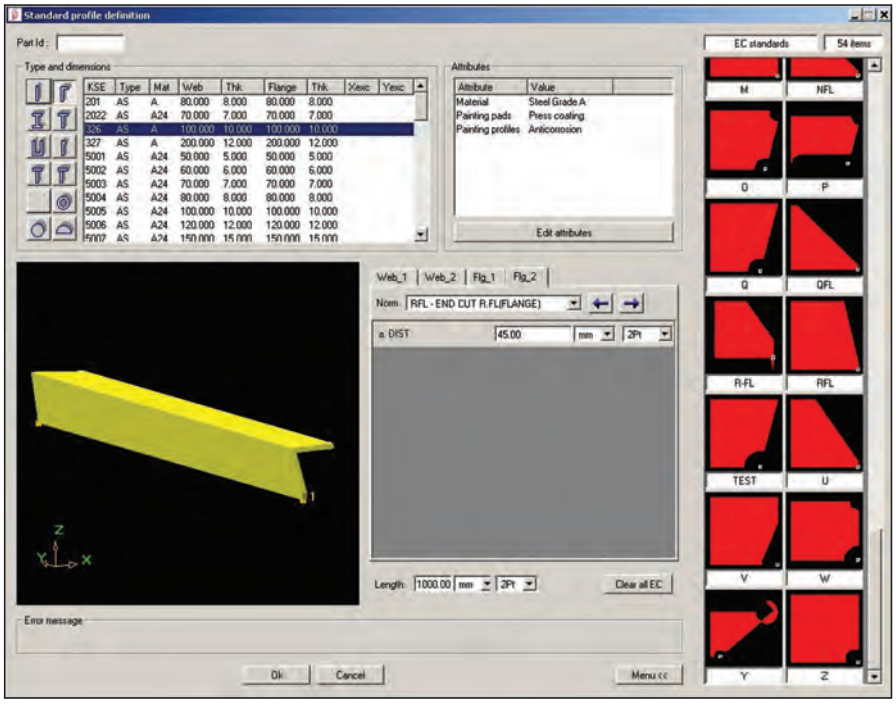
- definition of 2D geometry (2D Sketcher)
- handling of non-standard holes
- handling of topological brackets
- handling of face bars
- penetrations handling
- visualisation of outfitting elements.

Other distinctive features include advanced tools for the definition of outfitting structures (in the FPIPE module), namely:

- high-performance modelling and visualisation environment
- hierarchical organisation of libraries
- user-configurable list of other materials (bolts, nuts)
- generation of pattern-based solutions based on FDE macros
- gratings, platforms, ladders
- user configurable reports and drawings (FDE).

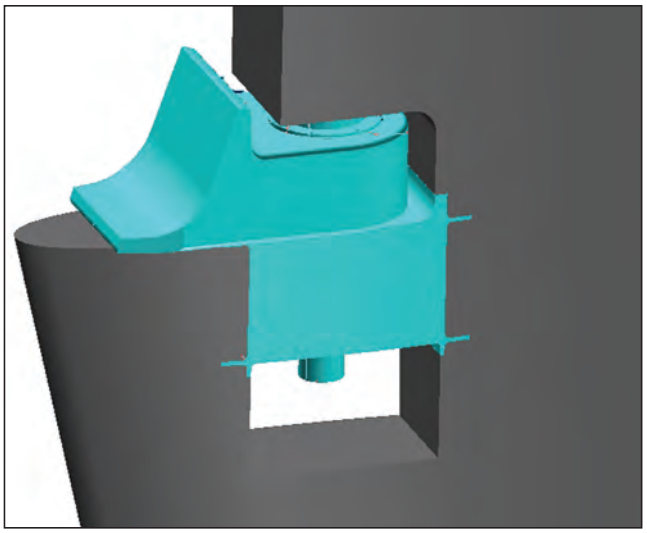
Considerable advances have been made in improving the capabilities of design for piping, HVAC, and cable tray supports. This includes the use of standard libraries and geometric macros, support positioning and configuration, modelling dependent on piping and hull structure, and user-configurable reports and drawings (FDE).

With respect to the previous release - generated only six months ago - there have been important advances in the FORAN drawing Generation (FDESIGN). The new development environment is aimed at both system developers and advanced users. Designers may take advantage of the new environment with little or no programming experience to automate repetitive tasks by recording macros, and by writing macros which may perform calculations and execute existing application commands. The integrated development environment (IDE) contains tools for writing code, handling projects and libraries, giving access to reference manuals and testing. The programming language is based on the same standard as JavaScript, which makes the environment familiar to most programmers.



An example screen from the most recent FORAN upgrade.

A 3D rudder designed using V50R3.0.



More licences for Sevmash

In other Sener news, Sevmash Predpriatye, one of the largest shipyards in Russia, has extended its use of Foran by acquiring more licences on all packages. At one time, Sevmash was deeply involved in nuclear submarine construction but from 1995 has diversified into the commercial field, especially offshore work. Recently, it has almost doubled its construction capacity.

This shipyard first installed Foran at the beginning of 2001 after a thorough evaluation of CAD/CAM systems available. The new agreement covers upgrading of the system to the latest version and the granting of new licences. This will particularly enable Sevmash to deal its bold new project - the design of a series of IMO II chemical tankers. The leading Norwegian owner Odfjell recently placed orders here for eight 45,000dwt vessels, with options on four more.

Strengthening university links

Sener has also strengthened its bonds with the naval architecture and marine engineering department of the Polytechnic University of Madrid. For some years, the department has used the Foran CAD tools; now students are receiving tuition in outfitting subsystems. In addition to the Foran Outfitting programs, the University is going to select - from the many packages compatible with Foran - a piping flexibility analysis software package. Once the pipes are routed in Foran, students can analyse piping strengths and deformations and design supports, specify expansion joints, and carry out other tasks.

Ship Dynamics for Mariners

By J C Clark. Published by The Nautical Institute, 202 Lambeth Road, London SE1 7LQ. UK. Hardback, 300 pages. ISBN: 1 870077 68 7. £50.00 (£35.00 members of The Nautical Institute) plus postage.

The author began his career as a cadet with the Ocean Steamship group. Later he gained his BSc in Nautical Studies from Liverpool Polytechnic, and later again he became a physics teacher and studied for his MSc in Marine Geotechnics. He returned to the Merchant Navy in 1990 and gained his Master's Certificate.

Most of his interesting book deals with the behaviour of sea-going merchant ships but it also includes, where appropriate, application of the principles to other ship types. Throughout, the author offers physical explanations of what is 'going on' and keeps any mathematics simple and to a minimum. The explanations are such that most people will be able to follow and understand the physical phenomena involved without difficulty.

At the same time the phenomena are covered in enough depth to explain what happens in practice. For instance, in considering waves, the author moves from their formation in deep water to what happens in shallow water; he then discusses the effect of refraction on waves encountering shelving beaches. The interactions of waves with currents are covered, explaining the importance of the Agulhas current in creating large waves. Methods of defining waves, including energy spectra and the concept of energy spread in three-dimensional waves, are discussed.

His discussion on transverse stability begins with a conventional monohull then goes on to consider multi-hull configurations, planing and hydrofoil craft, and air-cushion vehicles. The components of resistance are discussed, also the calculation of power required to drive a ship through the water. Froude and Reynold's numbers are defined and the development, and use, of model testing is covered. Different types of machinery are described, setting out their main characteristics as affecting ship design and the need to match machinery to propeller.

The sections on ship handling will be very useful to seafarers. Turning ability and directional stability are dealt with, as are steering astern, the Williamson turn (a manoeuvre for man-overboard situations), dynamic positioning, and automated controls. Stopping distances in deep and shallow water are discussed together with the optimum use of propellers to reduce ahead speed. Going full astern as quickly as possible is not the answer. Rudders of various types, azimuthing pods, and thrusters are covered, together with associated control and actuating systems also bridge displays. In dynamic positioning systems, the effects of winds and waves, and the filtering of sensor signals are all recounted.

Ship handlers will find the discussions of shallow-water effects (on resistance and manoeuvring) and interactions between passing ships and between a ship and a shoal of particular interest. As the author points out, squat is not a matter of the ship's draught decreasing but a lowering of the local water surface. Various formulae for assessing squat are introduced (readers might also like to consider the formulae of Brian Barrass, *The Naval Architect* June 2004, page 6 - Ed).

In dealing with a ship's response to waves, the usual six degrees of freedom are covered. Then the author goes on to consider synchronous rolling and parametric rolling. For parametric rolling, combinations of ship speed and wave length are calculated for seas from different directions. Passive and active means of stabilising ships are outlined.

This single volume contains a wealth of information. It is difficult to convey a feel for the comprehensive treatment that the author has achieved whilst retaining a clear, easily followed description of the subject matter. It is thought-provoking as well as being very informative. The book is intended as a 'bridge' between the theoretical naval architect and the practising mariner.

Even experienced naval architects and mariners will find much to interest them. Some of it will be challenging in making them look at certain aspects of ship dynamics in a novel way. The author is to be congratulated on putting across some quite complex physical phenomena in a way which is so easy to follow. The imaginative, and in many cases novel, diagrams contribute significantly to this success.

E C Tupper

P&O's new *Arcadia*: an imaginative public-room project for The Design Team consultancy

BRITISH and proud of it! That is the clear message that passengers who board P&O's newest cruise ship *Arcadia* are destined to receive as they marvel at the changing face of its interior design. From *Arcadia's* Atrium, spanning three decks and modelled on the central lobby of a modern international hotel, through a full spectrum of colours and lighting in the decor of the ship's series of elegant lounges, bars and restaurants, to its selected works of art, the passenger should appreciate this truly 'British' creation.

That is the intention of the owner and of The Design Team Ltd, the young London-based marine, hospitality, leisure, and retail design company contracted to create more than 90% of the public areas onboard *Arcadia*. The consultancy set out to design a ship that will 'develop and enhance the P&O brand, both aesthetically and operationally'. The results of the project were unveiled with the liner's official launch last month at the Marghera shipyard of the Italian Fincantieri group.

Although The Design Team, headed by directors Eric Mouzourides and Frank Symeou, was only formed in 1998, it won the role of lead architect on this project, largely based on its innovative work on a range of cruise vessels including Cunard's 150,000gt *Queen Mary 2*. The company's work on the latter ship was reported in *The Naval Architect's* special supplement *Queen Mary 2: Genesis of a Queen*, published in January 2004.

With *Arcadia*, the interior architect has set out to provide its complete service, from developing attractive concepts in line with function, brand, and budget to liaising with the whole construction team to ensure those concepts are fully realized; however, the firm has gone one step further by making certain that *Arcadia* showcases British design expertise and related fields such as lighting, graphics and signage.

The Intermezzo, on Deck 2 of the Atrium, is an open-plan lounge bar, ideal for pre-dinner drinks. Features include marble flooring with a circular inlaid stone design around a sweeping staircase.

A tour of some of the public areas aboard *Arcadia* reveals something of the designers' progressive approach. On Deck 1 of the Atrium are situated the reception foyer and shore excursion desk. Here, the colours of a diaphanous curtain are used as signature tones throughout the Atrium's three decks, with the colour palette becoming stronger as one ascends. On Deck 1, they can be seen in the bespoke oval inset rug encompassing the seating area and sweeping staircase. A circular fused coloured ceiling feature, back-illuminated to allow flexibility in the strength and tone of the lighting for the space, creates a variety of lighting effects during the course of the day.

Intermezzo: an elegant lounge bar

On Deck 2 is the open-plan Intermezzo lounge bar, an ideal venue for pre-dinner drinks. Here, the sweeping staircase leads onto pale marble flooring with a circular inlaid stone design, beyond which is the blue-and-grape-colour carpeted bar area. These colours are used extensively in the upholstery and soft furnishings, combining with warm veneers to create and inviting and comfortable ambience. Particular features here include columns dressed in ruched sheer curtains. The interplay of different light was also behind the insertion of blue convex glass lenses in the decorative balustrading around the seating area, creating interesting refractive effects.

Part of the artwork feature in the Intermezzo are contemporary glass panels featuring dye-suffused crackled glass, created by exhibited artist George Papadopoulos. Each pair of panels is internally lit to enhance the artistic result.

At Deck 3 level, the entire Atrium space is given over to *Arcadia's* sophisticated Piano Bar, a large space planned around a deck opening where care has been taken to introduce an element of warmth and intimacy. The bar itself is positioned centrally but screened with the full

***Arcadia's* Rising Sun pub is designed on the Victorian style and is arranged in four areas, each with its distinct features. Much attention has been given to decorative detail, including vintage posters and Punch prints.**

height curtain. Also in the Piano Bar is P&O's signature flower stall, Celebrations, offering a range of bouquets, baskets, and corsages for every occasion.

The Spinnaker Bar, ideally placed for pre- and after dinner drinks between the Atrium and the main dining room on Deck 2, has a relaxed contemporary feel designed around a yachting theme. That is evident in the porthole-style mirrors in the bulkheads.

Another venue on Deck 2 with tradition, in contrast to the vessel's contemporary design, is *Arcadia's* own Victorian-style pub, The Rising Sun. This is arranged in four traditional areas: the entrance lobby, saloon bar, public bar and lounge, each one with its own distinct and recognisable design features.

For the *Arcadia* passenger in search of an ideal venue for a light breakfast or quiet afternoon tea, there is The Retreat area on Deck 10. A dedicated wellbeing and lifestyle centre, it has evolved from the 'Easy-like-a-Sunday' concept devised by The Design Team for P&O's *Adonia*. The Retreat will also host lifestyle demonstrations including yoga, pilates, and relaxation classes.

The Orchid Restaurant on Deck 11 is designed to complement the Asian fusion cuisine on offer. Accordingly, the colour palette uses accents of warm cinnamon balanced with lighter neutral tones to create an elegant relaxed setting.

Orchid restaurant: a touch of the Orient

On Deck 11 is the Orchid Restaurant, offering the passenger a touch of the Orient. The Orchid is entered through double doors onto a sweeping pebbled pathway, flanked by stone plinths bearing four oriental vases. Of contemporary design with hints of eastern imagery, the restaurant offers Asian fusion cuisine including Indian, Chinese, Indonesian, Thai and Japanese dishes.

In keeping with this, the colour scheme draws on warm cinnamon balanced with lighter neutral tones to create an elegant, relaxed setting. Although relatively large, with 144 covers, the room has been planned in three connected sections to generate a more intimate dining experience. A degree of privacy is provided by the eight semi-circular banquette seating areas around the restaurant, punctuated by sheer decorative curtains marking out each area, and oriental folding screens positioned throughout the restaurant.

Despite the company's short life, The Design Team has a positive track record in many developments for all major cruise operators such as Royal Caribbean International, Cunard Line, Carnival, and P&O. The firm has completed contracts including Royal Caribbean's *Voyager*-class ships and is currently involved in designs for that group's Ultra Voyager project.

Designing complete lifetime cabin packages

WHEN Piikkiö Works Oy supplies cabins for cruise ships or ferries, the company is not just providing a simple living space, but creating a design to suit the many changes that cabins will probably experience through the 25-30 years of a vessel's operating life. During that time, living quarters can expect to be repaired, refurbished, and upgraded several times, so today the company aims to offer the customer 'whole cabin lifecycle management'.

Piikkiö Works (a member of the Aker Finnyards group) specialises in the manufacture and erection of ready-to-install modular cabin and bathroom units, for all types of passenger vessel. It claims to be the world's biggest manufacturer of prefabricated cabins, delivering up to 6000 units annually.

Piikkiö Works' believes in the concept of 'lifecycle design'. Easy maintenance, upgrading, and revitalisation of designed cabins will reduce the overall lifetime cost. Special attention is paid to the use of waterproofing detail and corrosion-resistant materials in bathrooms to extend their life in the marine environment.

Renewable furniture, easy assembly and dismantling of components, energy-saving solutions, new technological opportunities, also advanced materials and manufacturing technologies are all employed, not only in new ships, but in repair solutions as well, according to the Finnish company.

Lifetime revitalisation of a cabin and bathroom should be planned in advance. The target for bathroom life is 15 years, the company says. Piikkiö Works' modular concept introduces a solution where the bathroom is built 'inside' the cabin, not simply integrated as part of it. The old bathroom unit can then easily be replaced with a new one.

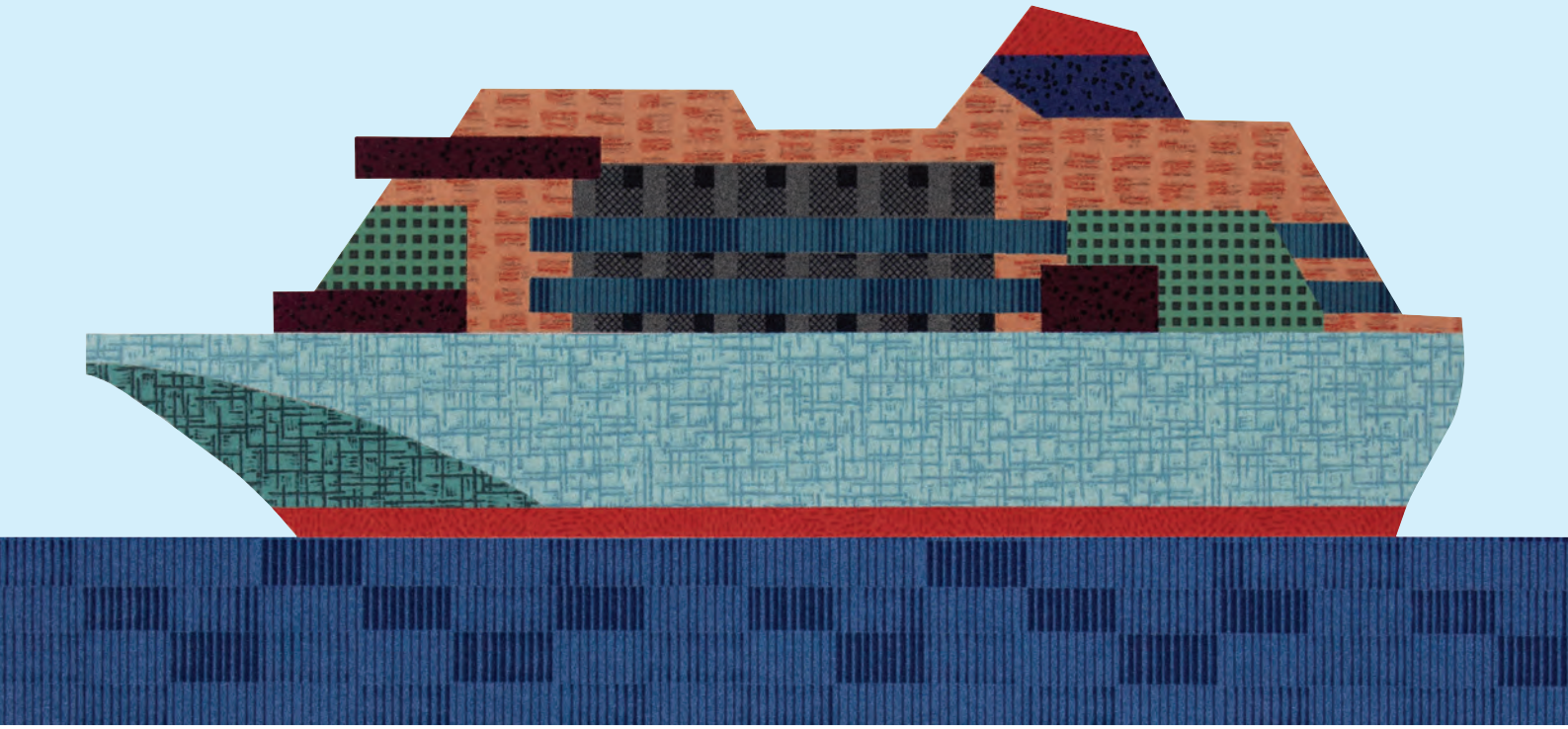
Where repairs are required, Piikkiö Works' own experienced personnel can move in to assess the extent of damage and prepare cabin and bathroom condition surveys. Then, a prefabricated solution is proposed with mock-up manufacturing and installation onboard the vessel, before serial production of selected replacement products begins. With repair products, prefabrication means the work does not need to take place onboard ship, but can be carried out in the factory, so increasing work efficiency and lowering cost.

More recently, Piikkiö Works has placed greater emphasis on research and development work, to meet the ever more demanding worldwide market. Development covers design and function of a cabin, and studies are made of alternative layouts for cabin, bathroom, balcony and corridor. New lighting possibilities and HVAC technology, and particularly passenger comfort, are high on the list of aspects taken into account.

The latest design, material and production technologies are utilised, together with feedback from operations, to create innovative and intelligent solutions. The company's R&D department works closely with its newly established customer service section to come up with answers to meet customers' increasingly demanding expectations. Solutions, from concept design to cabin revitalisation projects, are based on active feedback from clients.

One example of growing demand for modularisation of onboard accommodation is a current Piikkiö Works turnkey contract. This is for 1058 modular cabins and the construction of the whole cabin area on the third Tallink cruise-ferry, to be delivered by Aker Finnyards' Rauma shipyard in April 2006.

Floorcovering designed for the sea



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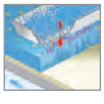
Construction



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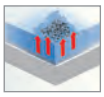

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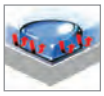

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BONAR FLOORS

Innovative modelling software for generating accommodation designs

SHIPS' architectural outfitter Hertel Marine Services has developed innovative computer software to radically simplify the task of designing modular accommodation areas on board ship. A specially developed 3D modelling tool is used to create quickly alternatives which can be evaluated easily by just 'walking' through the accommodation model in real time.

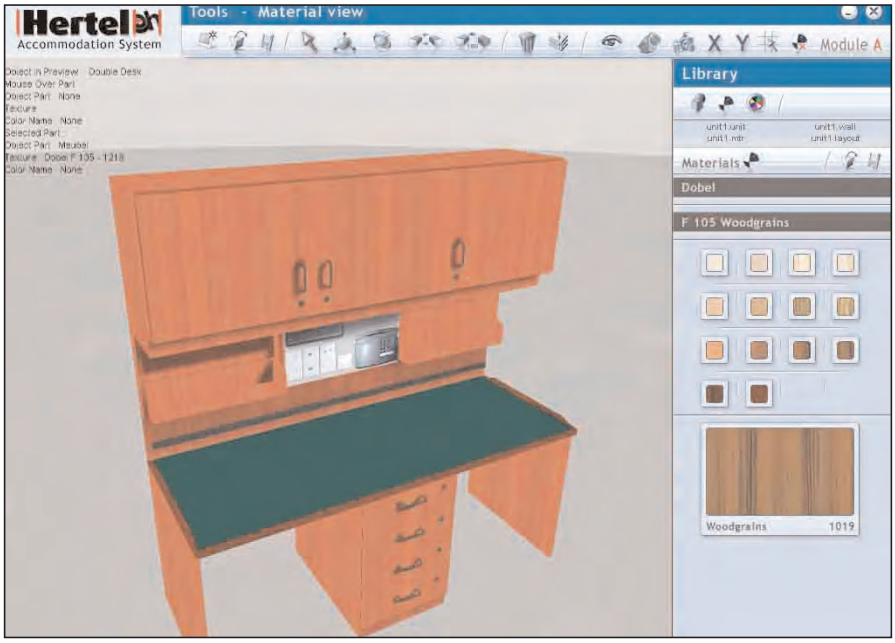
To date, the Dutch company's 3D software has been used mainly with designs for naval vessels around the world, but it can and will be applied equally in commercial cases, according to the Rotterdam-based company, which is part of the group Hertel Beheer BV.

The Modular Accommodation System (MASH) was developed during the design of a new vessel for the Royal Netherlands Navy, the landing platform dock ship *Johan de Witt*. Hertel won the contract for outfitting the LPD-2 last year.

The design team was faced with a number of areas on various decks, which had to be optimised in layout and safety terms, so as to fit in accommodation required for the vessel's capacity of 700 men. In addition, the Navy decided to modernise its accommodation outfitting standard and, after consulting Hertel, it opted for wood-based furniture, consisting of water-resistant multiplex with a fire-retardant hard plastic finish to replace traditional steel furniture.

Hertel decided to develop a 3D design tool, tailor-made for use in its core business area of architectural outfitting of ships and offshore structures. Key features of the application include quick and easy modelling, realistic and sufficient details to avoid the fabrication of mock-ups, the capacity to include a large number of cabins in a single model, and real-time virtual reality.

Hertel chose a computer program called Quest (graphic software used regularly for personal computer games), as the basis of the MASH application. Existing 3D modelling tools used in shipbuilding were all based on CAD programmes and are quite demanding on computer hardware, especially when larger files are created. Furthermore, they cannot generate real time-virtual reality, the company believes.

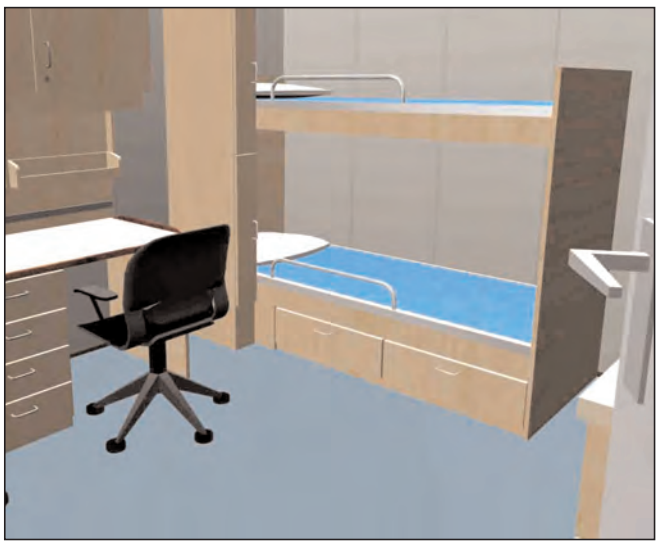


A menu display for detailing of finishing textures and colours.

Designing accommodation with the MASH system comprises three separate stages: Stage 1 sees the design of single cabins and accommodation spaces. In stage 2, complete accommodation areas are formed by joining the various cabins and spaces into a single model, complete with stairs and corridors. The third stage involves material take-off of wall panels, ceiling panels, furniture, flooring, and other components, including details of such aspects as materials, finishing, and colours.

Staging the work allows feedback from the client to be incorporated in a structured way. At the end of Stage 1, the client can evaluate each cabin and accommodation space in terms of layout, sight lines, furniture, colours, and materials. Every space can be looked at from all angles by means of a movable orbit camera or 'visited' by entering the space and moving around in the model as if it were a mock-up. Alternatives are easily generated by picking up components and moving them around. Finishes and materials are simply changed by double-clicking on the item and selecting the required finish from a menu.

Comparison of a 3D computer-generated model (right) showing a two-berth officers' cabin for an Indonesian corvette, with the end-result (left) on a different ship, a Dutch hydrographic vessel.



Cabins and accommodation spaces are approved before moving on to Stage 2. At this point, various cabin types and spaces such as mess rooms, medical rooms, the galley, or laundry are placed on a virtual grid so that the complete accommodation is generated. Each type of cabin or space can be used as many times as required, can be rotated, mirrored, and moved around. The program recognises when one cabin is placed adjacent to another cabin, or a corridor, and single lining panels are automatically replaced by partitioning panels. When the cabins are in place, corridors are generated, including handrails, doors, and stairs.

When Stage 2 is complete, it is possible to see the accommodation from a bird's eye view or in real time, moving through the virtual reality model. The layout can be evaluated with respect to escape routes, the positioning of safety signs, and view angles. Cabins can simply be relocated or altered. Colouring of the corridors and outer doors can be selected individually, by deck or by area. Furniture can be selected by group for change of finish materials.

The model emerging from Stage 2 of the system can provide analysis of different safety situations. The company makes use of the University of Greenwich' Exodus program, through which the effects of a fire on board can be simulated (Exodus was discussed in *The Naval Architect* October 2001, page 26 and January 2002, page 41). Hertel's 3D software has been used in a number of projects since it was applied to the design of *Johan de Witt*. The company won an order to engineer, supply and, install the complete insulation and architectural outfitting aboard two corvettes to be built for the Indonesian Navy at the Schelde Naval Shipbuilding yard, Vlissingen. In the tender phase, the 3D modelling tool was successfully employed to present the Indonesian Navy with a realistic impression of the interiors, and again during detailed design to generate alternatives and optimise layout.

Not only is the modelling tool used for new projects but is also employed in refurbishment of older vessels. Here the tool is particularly useful in optimising the use of limited space available for accommodation aboard the ship. Hertel was awarded the refitting of cabins and some general areas on the Belgian Navy command ship *Godetia*. The engineering and work preparation will continue until July 2005, after which the actual removals and installation of the new outfitting on board will begin.

Engineering is an important activity in the process of building a ship and is used by Hertel to optimise construction and minimise the overall costs. Standardising the MASH system has proved to be cost-effective. It enables the company to purchase components from wherever is most economical for the project, without concessions to quality and specifications. At first, Hertel Marine Services had local and foreign fabricators manufacture wall panelling, ceiling panelling, and furniture for its own projects only. Recently, a trading company has been set up to provide owners, shipyards and other accommodation contractors with complete material packages. The delivery of these packages is worldwide, with Panama and Turkey examples of two recent destinations.

Top view of the commanding officer's cabin and officer's single-berth cabins on an Indonesian corvette.

Independent tests for Solar Solve sunblinds

MARINE window-blind specialist Solar Solve Ltd is putting its Rolasolv fabric roller sunblind range through new independent testing to confirm it meets the IMO flame spread requirements. All fabrics used in the roller blind range, which was launched in 2003, are flame-retardant according to Solar Solve, of South Shields, UK, but the company is determined to reassure customers of the safety of its finished products with a second test.

Rolasolv roller blinds are already installed in cabins, lounges, restaurants, and other public areas aboard a variety of ships. Suitable for most types of window, they are said to be durable, easy to operate, and stylish.

'Our customers wanted us to carry out our own tests and obtain our own certificates, which we have started to do', explained Solar Solve's chairman John Lightfoot. Already, all three fabric ranges: Polyester, Blackout and Lyverscreen, have passed the BS 5438 flame spread standard, and Blackout fabric also passed the IMO FTPC part 7 A.563 (14) test, he added. The company expected the other fabrics to reach the same standard in a matter weeks, he said in February.

Solar Solve also claims to be the world leader in the manufacture of anti-glare roller screens for navigation and control room windows. Its laminated polyester-film Solasolv sunscreens are claimed to reject 87% of the sun's heat and to reduce glare by up to 93%, so greatly improving visibility, while leaving bridge crew more comfortable and cutting down air conditioning requirements.

PVC-free alternatives from SSAB

TWO PVC-free alternatives to its Dobel film-laminated steel range have been introduced by SSAB Laminated Steel AB. This company, based at Ronneby, Sweden now offers Dobel 2000 and Dobel 2005 as alternatives to its established scratch-resistant, repairable PVC-based Dobel F105 film-laminated steel surface.

Dobel 2000 is steel sheet, covered with a thin layer of polyester paint, laminated with a printed polyester film. Said to be twice as thick as comparable coatings, it is designed for large areas, but comes in a limited range of designs.

Dobel 2005, similar in appearance to the F105 product, is made of hot-dip galvanised steel, laminated with a new 130micron-thick type of PVC-free flame-retardant highly modified polyester (HMP). The surface is repairable and scratch-resistant and comes in a wide range of substrate choice and colours. Both new coverings fulfil the requirements of the SOLAS 74 Convention and IMO resolutions (IMO FTP Codes) and follow the European Marine Equipment Directive 96/98 EC (EU-MED).

TNF Magic: a safe and versatile wall finish

SAFETY and environmental pressures have led shipowners increasingly to demand PVC-free onboard interior decoration products. In line with this philosophy, a stylish new breed of non-PVC fire-retardant marine wall finish, offering for the first time large-scale pattern opportunities, was unveiled last year by Danish company Inexa Panel A/S (*The Naval Architect* April 2004, page 44). Its fresh approach to the design of fire-retardant wall coverings, made possible through a major breakthrough in technology and production systems, has resulted in the TNF Magic Designer Collection.

This non-toxic, halogen-free wall finish for cabins, corridors, and public rooms in ships, yachts, and offshore accommodation units, is safe and offers the marine interior designer almost unlimited creativity, according to the Hedehusene-based company. TNF Magic also offers other advantages including its exceptionally light weight; it is also claimed to offer low maintenance, to be easier to clean and repair, and to have a long life-cycle.

The new wall panels have already been specified by NCL America for its cruise ship *Pride of America*, which is being outfitted in Bremerhaven, Germany at Lloyd Werft, following initial construction in the USA. For decades, says Inexa, cabin and corridor finishes were invariably of PVC material in small-scale patterns 'in the most unappealing colours', while PVC has been widely exposed for the serious health dangers for passengers and crew from poisonous fumes which the material gives off in case of a fire.

'For too long, shipowners and their designers have had little or no choice when it comes to fire-retardant wall finishes for cabins and corridors. Now, both owners and designers can have virtually any design and in any colour in a safe format', says Lars Munkso, Inexa Panel's sales and marketing director. The first finish in the TNF Magic range features subtle colours such as silver greys and earth tones, but the full range offers an extensive colour palette for use in any location. Inexa, with production facilities in Denmark and Estonia, has supplied, over the past 30 years, surface materials accommodation onboard 50 cruise ships, 6000 cargo vessels, and 200 offshore platforms.

A typical example of the new TNF Magic PVC-free panel finish. A wide range of designs is available.

LETTER TO THE EDITOR

Faulty definitions of limit states?

Sir - I refer to the article 'ISO 18072: limit-state assessment of ship structures' on page 84 of the February 2005 issue of *The Naval Architect*.

I am in full agreement with the aims of the ISO Technical Committee presented in this paper, indeed I with many others have been pressing for much wider use of limit state design for ship structures for more than 20 years.

However, the definitions of limit states given in the paper are misleading and potentially dangerous. There are in fact only two limit states in the safety analysis process - The Ultimate (ULS) and the Serviceability (SLS) - although there may be other levels of hazard and consequence acceptability. ULS is the condition where there is an unacceptable risk of loss of the vessel or of a significant number of lives (either on or adjacent to the vessel); SLS is the condition where the risk of loss of fitness for purpose is unacceptable. Both *Fatigue* and *Accident* are subsidiary to these conditions.

Fatigue is not a limit state in itself but a *Failure Mode*, which may lead to either SLS or ULS, depending the survey and repair regime in place. There is no reason to separate out fatigue from other failure modes such as fast fracture, corrosion, or buckling, all of which may result in a limit state being reached. To do so in fact can lead to the interaction between failure modes - so-called mixed mode failure - being missed or ignored.

To treat *Accident* as a limit state is even more confusing. An *Accident* is a *Hazard* which has happened. To investigate the effect of accidents properly, a formal hazard identification and analysis process must be undertaken. Only then can the likelihood and consequences of an accident be established and it is the consequences of this happening that can result in a limit state being reached, which may be SLS or sadly ULS. To draw out accident as purely a structural design issue can lead to the broader aspects of the accident being ignored, or indeed unnecessary structural precautions being taken if the probability of the accident is very low or the consequences minor.

I am also uneasy about the concept of reversible or irreversible limit states. Strictly all limit states are reversible by human intervention, ultimately by raising a wreck and repairing it. If recovery from the limit state does not need human action, then it is not a limit state, otherwise it seems to be more an matter of proper safety management. I cannot see what is achieved by the this artificial distinction.

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Surveyor - Structures Section

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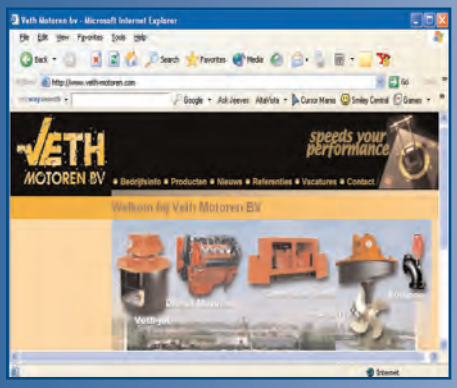

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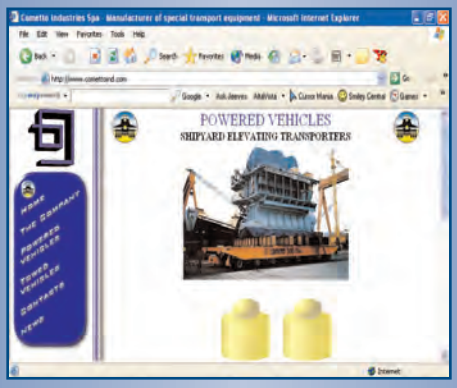

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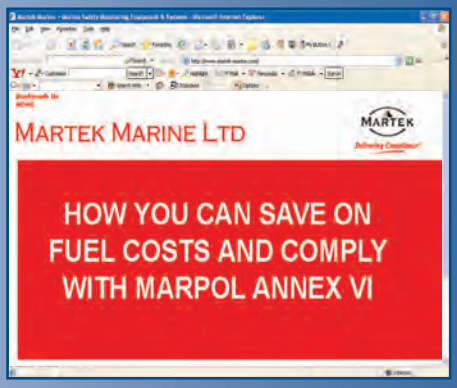

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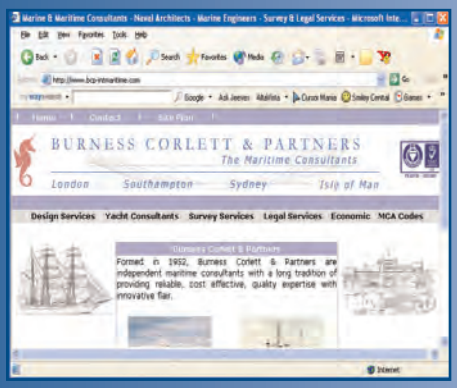

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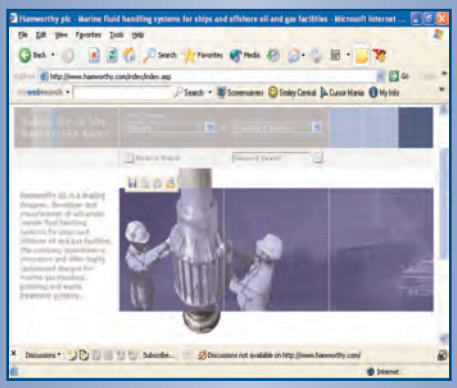

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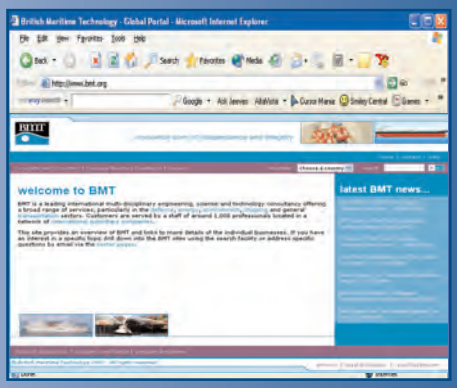

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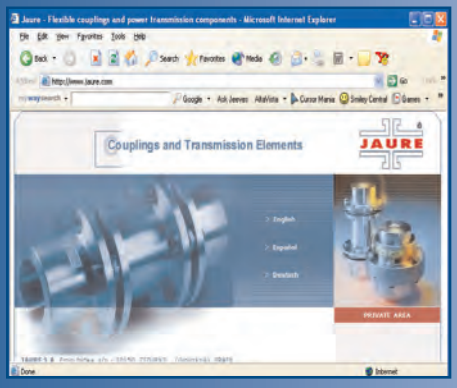

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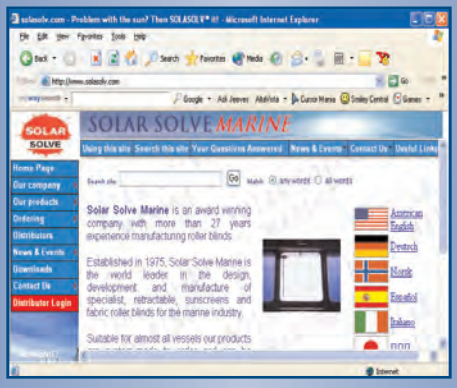

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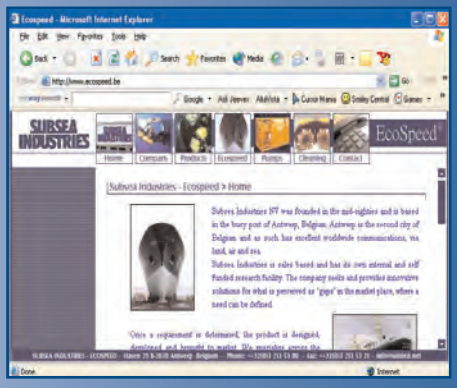

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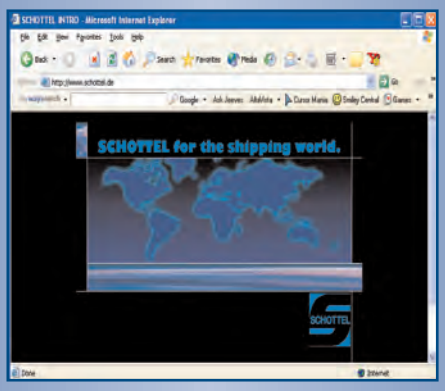

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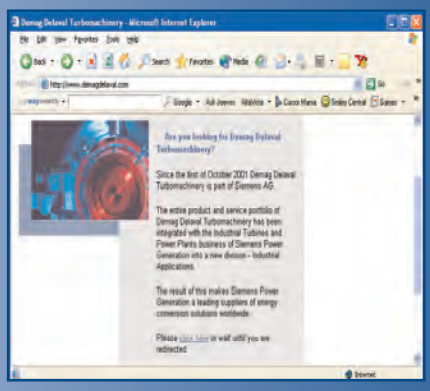

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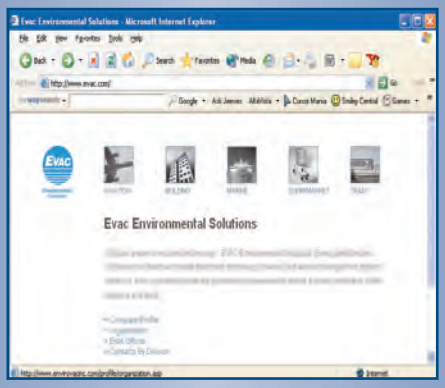

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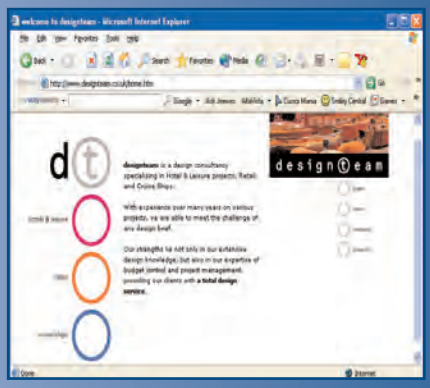

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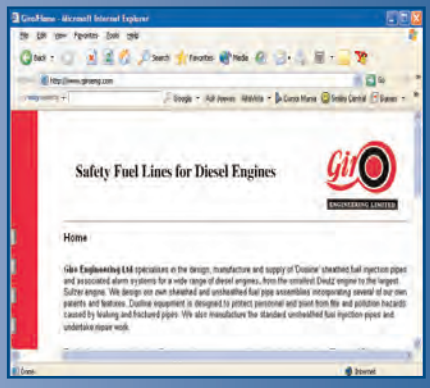

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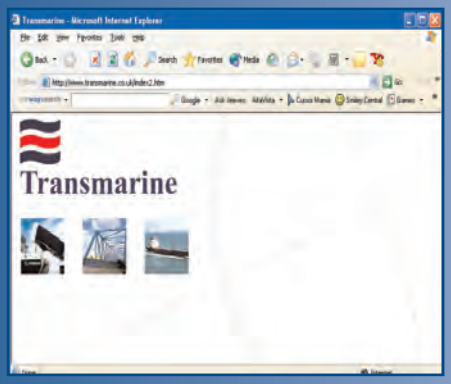

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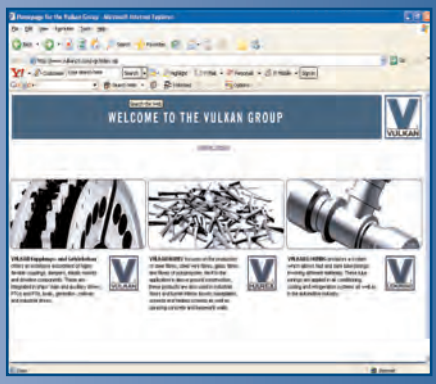

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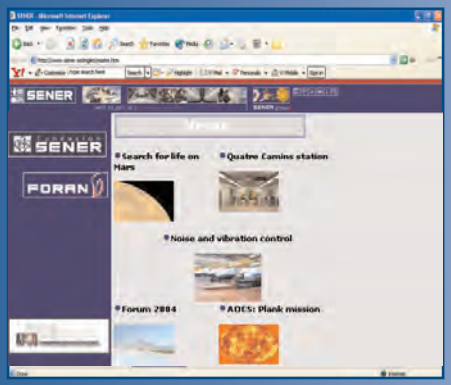

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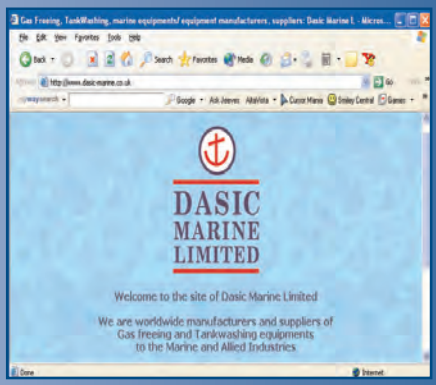

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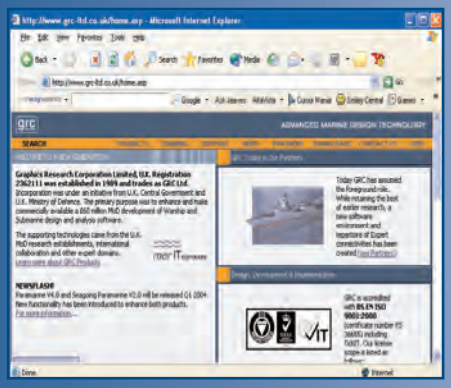

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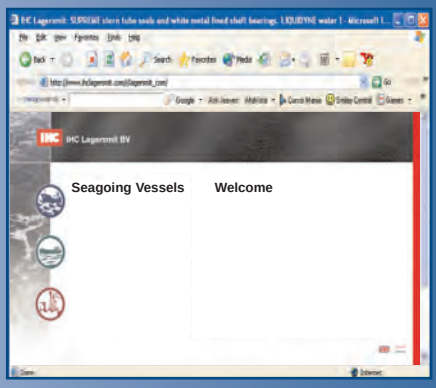

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