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Cruise ship update / Shipboard water treatment
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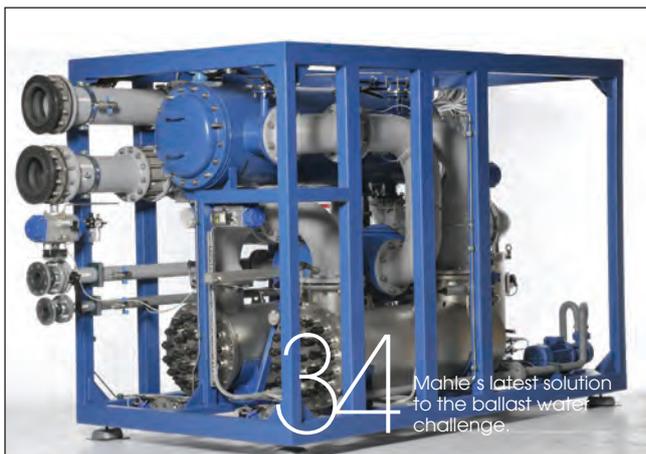
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On-line Edition

The Royal Institution of Naval Architects is proud to announce that as of January 2008, *The Naval Architect* journal has gone digital. We are very pleased to inform the maritime industry that each issue will be published online, on the RINA website. Visit www.rina.org.uk/tna and click on the issue cover you wish to view. This means that the entire publication, including all editorials and advertisements in the printed edition, can be seen in digital format and viewed by members, subscribers, and (for a limited time) any other interested individuals worldwide.



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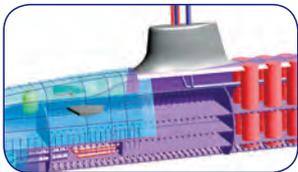
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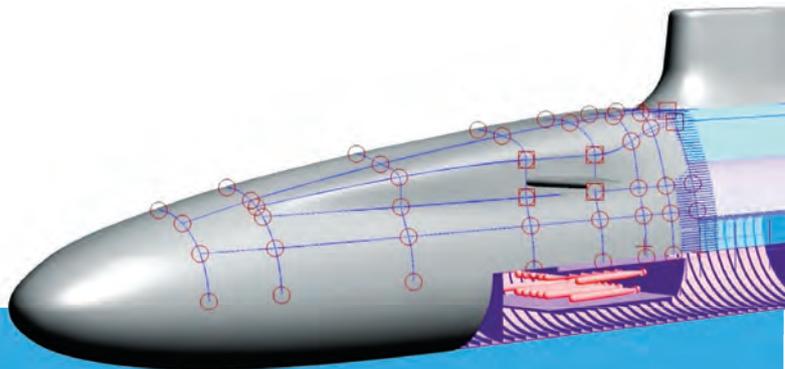
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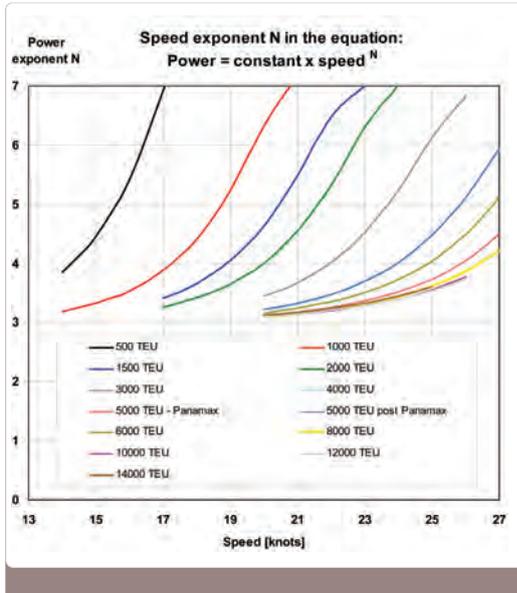
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EEDI is the right formula to clean up shipping

The relationship between speed and power is complex, making the speed exponent a variable rather than a constant which increases as the speed increases. That exponent also depends on the ship size.

If ships had to sail more slowly there would be a net gain to the world and the industry would also be a beneficiary in the long run. This should be remembered when considering the Energy Efficiency Design Index (EEDI). Criticisms that EEDI is merely a speed limit for the seas do not stack up.

According to the Technical University of Denmark (DTU), a false assumption is often made by people in the maritime industry and that is that power output needed is speed cubed. However, according to Hans Otto Kristensen, senior researcher at DTU, this is a common error and the speed exponent of three only works at the lower end of the scale.

In fact the power needed to increase speed from 10 to 15 knots is significantly less than the power needed to increase speed from 20 to 25 knots explains Mr Kristensen. "When we reach higher speeds in any aspect of nature the power output needed increases," he said.

"Effectively if you worked a four hour day for a set salary and you doubled the number of hours worked you would expect double the pay, but speed does not work like this, if you looked at speed you would multiply it as 2x2x2x2 and the last two multiplications would increase the power required significantly," said Mr Kristensen.

In effect then the savings in fuel consumption and, therefore, costs and pollution are far higher at the high speed end of the scale than at the lower speeds, so shipping could achieve significant savings by simply reducing vessels speeds.

That is why slow steaming is already a reality in many sectors, notably the container shipping sector, as increasing in fuel costs and the increasing number of container-ships delivered has seen the number of ships outstrip demand. Too many ships for the level of cargo meant operating at a much higher cost per box just as the income per box was falling dramatically.

In addition operators are now faced with a further increase in their costs as environmental regulations aimed at cutting the pollution from ships is introduced. So slowing vessels down on a permanent basis may become a more attractive solution for owners.

Containership operators slowed their vessels as a result and added ships to their vessel schedules so that they could maintain their weekly services out of China. In doing so the container lines saved money on fuel and polluted less and they found employment for vessels that would otherwise have been idle. Adding extra ships to schedules also incurs a cost, monetary and ecological, and these must be included in the calculation of the net gain for slow steaming.

Criticisms of the International Maritime Organization (IMO) and its EEDI have centred around the speed limitations that the index would impose on ships and clearly some scheduling would need to be adjusted, particularly for ferries operating on fixed timetables. Or other environmentally acceptable methods for cutting emissions will need to be found.

However, environmentally and economically the cost of making up the top knots is

hardly worth the bother, and some in the industry are finding this out for themselves. And they may be right. A glance at the graph from a project operated by AP Møller - Maersk and MAN Diesel illustrated the point.

Operating the 8000TEU *Maersk Salalah* while cutting out of one of its turbo-chargers and the closing of the throttle offered the operator significant cost benefits. MAN Diesel and AP Møller - Maersk said: "Turbocharger cut out is already implemented within the current certification on the 8000TEU container ship *Maersk Salalah* with a MAN B&W 12K98ME main engine. Tests on the ship show that by lowering the ship speed from 24knots to 22knots, the main engine power will decrease approximately from 77% to 56% load. The lower ship speed will cut emissions by 25% per sailed nautical mile. The additional decrease of CO₂ emissions due to the optimised engine operation with turbocharger cut out will reduce CO₂ emissions by another 3%."

Owners that are more open to the possibilities may find that the green revolution is not as painful as they had first thought. Of course the benefits to container shipping are substantially higher than for other sectors, such as bulk carriers and tankers which generally move at slower speeds, but even these ships could see significant savings by making comparatively small adjustments. The way for improving the maritime sector's carbon footprint is there. The industry must also grasp the nettle and show it has the will to achieve those changes. *NA*

Newbuilds

L'Austral takes Ancona bow

French cruiseship owner Compagnie du Ponant will take delivery of the first of two new ships from Fincantieri's Ancona yard in the autumn. The 10,700gt *L'Austral* was launched early last month with its sistership, *Le Boreal* expected to be launched in the coming months.

The new ships are 142m long with a 20m beam and a passenger capacity of more than 260 people who can be accommodated in 132 cabins, all with a sea view and 94% have a private balcony.

The company claim that the vessels are equipped with cutting edge technologies that will reduce environmental impact and the ships will be able to dock at ports and destinations which are inaccessible to larger vessels.

Compagnie du Ponant currently has a fleet of three cruise ships serving a super-luxury customer target. Founded in 1988, the company is a member of CMA-CGM Group.



L'Austral at the Ancona yard before its launch.

Classification

Owners go back to class

Classification society, ABS, is offering free seminars to shipowners led by experts in differing areas of environmental regulation. ABS said that to help owners "keep pace with the steady flow

of new environmentally-oriented regulations", it is scheduling free seminars around the globe starting within the next few months.

Kirsi Tikka, ABS VP, global technology and business development, said new environmental regulations are expected from deliberations at the International Maritime Organization (IMO) and in regional and local regulatory initiatives, particularly relating to emissions.

"It can be daunting for an owner to keep pace with these requirements and with the equipment that is being developed to assist with compliance," she added.

In addition, ABS has published a guide for owners looking to obtain its optional class notations ENVIRO and ENVIRO+ denoting adherence to enhanced standards for environmental protection.

The standards are contained in the recently released ABS Guide for the Environmental Protection Notation for Vessels. They include procedures and requirements for ballast water and sewage management, anti-fouling applications, airborne pollutant discharges, fuel oil and the use of exhaust gas cleaning systems, refrigerants and the Green Passport for ship recycling.

The new ABS standards and notations replace those contained in the earlier ABS Guide for the Class Notation Environmental Safety (ES), first issued in 2001.

Ancillary equipment

Bright future for Colfax

Bunker ship operator Brightoil Shipping Group Co. Ltd, based in China, has ordered 180 two-screw rotary positive displacement pumps that will be fitted to 40 newbuilds that it has on order.

The deal, worth €5.7million, will be supplied by Colfax Corporation of the USA and will see the pumps installed during next year. Colfax said: "The pumps – manufactured by Colfax's Houttuin business in Utrecht, Netherlands – will be used for transferring fuel oil and gas oil, as well as stripping (removal of waste or contaminants, such as water)."

"We had originally considered other pump suppliers but ultimately decided on Colfax's rotary positive displacement pumps because of their low maintenance needs – an especially important consideration for vessels that need to operate away from port in potentially adverse weather conditions," said Sit Kwong Lam, CEO of Brightoil.



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Trimming

Level Seas

In an effort to improve the efficiency of its fleet Royal Caribbean Cruises Ltd (RCCL) has agreed to install Eniram's Dynamic Trimming Assistant (DTA) on six of its vessels, including the newly delivered *Oasis of the Seas*.

The DTA system allows the crew to make certain that the ship is operating at the optimum trim at all times thereby minimising fuel consumption and reducing harmful emissions. (See *The Naval Architect* April 2010 pg 16-18).

"The deployment of Eniram's technology is part of our continued commitment to utilise next generation technologies to increase energy efficiency and decrease carbon footprint," said Capt. William Wright, Senior VP, Marine Operations at Royal Caribbean International.

The agreement between RCCL, which is listed on the New York and Oslo stock exchanges, and the Finland-based Eniram has an option inserted that will allow it to be extended to other ships in the RCCL fleet at a later date.

New Design

Cushion supports *Stena AirMax*

Stena has named its 15m prototype of a bulk carrier that rides on an air cushion, which is designed to reduce water resistance thereby reducing fuel consumption and pollution. *Stena AirMax* was named in Gothenburg at the end of March and is part of Stena's SEK50 million project, which has so far spanned five years, for reducing fuel consumption in ships.

The 25tonne model was developed by Stena Teknik in cooperation with Chalmers University of Technology and SSPA in Gothenburg. The *Stena AirMax* will be tested in the Gullmars Fjord on the Swedish West Coast, during spring 2010 when an extensive - test programme will be run. The model will be powered by electric motors during these simulations.

Reduced friction is achieved through a cavity

The *Stena AirMax* consists of a steel box, containing equipment, surrounded by a hull made of fibreglass reinforced plastic. The flat bottom has a cavity for an air cushion, which is almost as wide and half as long as the ship. The model will be manned by 1-2 persons. Test data is transmitted via a link to a tender boat.

TECHNICAL PARTICULARS

Demonstrator model
***Stena Airmax* on a 1:12 scale**

Length	15m
Breadth	3.3m
Draft "fully loaded"	0.9m
Weight fully loaded	35tonnes
Speed5knots
Propulsion	2 x 10kW

Full scale:

Length	182m
Breadth	40m
Draft "fully loaded"	11.3m
Weight "fully loaded"	65,000tonnes
Speed	14knots
Propulsion	2 x 8000kW

filled with air in the bottom of the hull bringing the water into contact with air instead of steel plate and reducing friction. However, there a number of complications that can reduce the effectiveness of the system including internal wave formations within the cavity and a balance must also be struck between optimising the air pressure to achieve the greatest possible reduction in resistance and, at the same time, minimising air leakage, said the company. Stena has applied for a patent for the wide and flat bulbous bow, which facilitates a favourable water flow below the hull.



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LIFE MATTERS

Navigation

BW-800 keeps watch

UK-based Uni-Safe Electronics has launched its latest Bridge Navigational Watch Alarm System (BNWAS) BW-800 that complies with International Maritime Organization (IMO) MSC. 128(75) and the new IEC 62616 performance standard. DNV has carried out the performance test on the BNWAS system with success and now the company are waiting for the environmental test to be completed. The BW-800 system will be ready for sale until April 2010.

The BW-800 system is designed for easy installation on both new vessels as well as the retrofit market. The BW-800 Bridge Watch Alarm System will be environmentally tested according to specifications from classification societies.



Uni-Safe launches latest bridge navigational watch alarm system.

New regulations from IMO's Maritime Safety Committee (MSC) will require carriage of a Bridge Navigational Watch Alarm System complying with IMO performance standards. For existing ships, the equipment should be installed in connection with the first survey after the following deadlines: Existing passenger ships and ships over 3000gt by 1 July 2012. Existing ships over 500gt by 1 July 2013. Existing ships over 150gt by 1 July 2014. New ships over 150gt and all new passenger ships constructed after 1 July 2011 shall be equipped with a Bridge Navigational Watch Alarm System.

Contact Uni-Safe Electronics a/s, Amager Strandvej 124, DK-2300 Copenhagen S., Denmark.

Tel +45 3286 0525

Fax +45 3258 1330

E-mail info@unielec.dk

www.unielec.dk/Page-1.htm

Ancillary equipment

NEXT Door gets approved

Newthex has recently announced that it has received Type Approval for its NEXT Door product from Lloyds Register. NEXT Doors come with a new and patented NEXT Door Closing System.

Newthex say that its NEXT Doors offer Simplicity, Safety, Efficiency and Reliability.

Newthex NEXT doors are suitable for mega yachts, naval ships, merchant ships, offshore vessels and platforms.

Newthex NEXT Doors can be seen at www.newthex.com. Documentation can be obtained from Newthex Ned B.V. in Sappemeer, the Netherlands.

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Software

Beele adds up

Beele Engineering has announced that its calculation software now supports even more sealing solutions.

Beele Engineering's calculation software, designed to support users when calculating the materials requirements for sealed cable or pipe penetrations, now includes even more sealing solutions. The current version now calculates the RISE or RISWAT insert sleeves, the RISE, RISWAT or NOFIRNO filler sleeves, ACTIFOAM spare filling sheets, the RISE or RISE/ULTRA crushers and the DRIFIL, FIWA or NOFIRNO sealant.

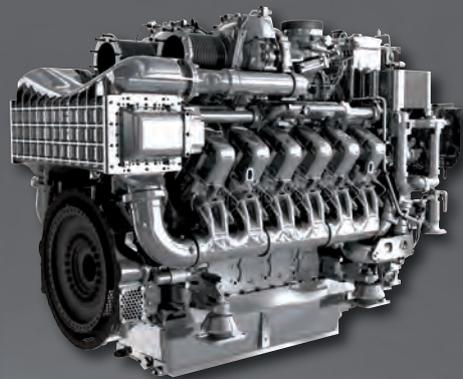
After entering the dimensions of the conduit opening and the amount and outer diameters of the ducted cables or pipes, the software calculates the amount of material. It is easy to switch between the several systems and also between A-class, H-class, EMC and watertight penetrations. Based on the entered data, a drawing appears on the computer screen showing also the remaining free space in the conduit opening. Furthermore, the filling rate of the cable penetrations is shown. Warnings appear for deviations of the certified configurations and for overfilling the transits or exceeding filling rates.

All calculated transits for a created project can be stored in a database. Order and calculation forms can be shown on screen for project totals and single transits. The material lists can be printed and/or exported to MS Word. The list displays the selected

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system, cable (or pipe) specifications, and the sealing material requirements. All transits in a project can be selected to create a similar list for all materials for the whole project.

The user-friendly software runs in Windows and automatically checks for updates at regular intervals, thus ensuring that the user has the latest version available at all times.

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Navigation

Wärtsilä and Raytheon integrate

Wärtsilä has signed a new agreement with Raytheon Anschütz, a division of Raytheon Co., USA. The agreement extends the scope of Wärtsilä's offering of integrated system solutions to include navigation systems, which can now be offered by Wärtsilä on a global basis.

"The cooperation between Wärtsilä and Raytheon is in line with our strategy of staying at the forefront of systems integration within the marine sector," commented Mr Jaakko Eskola, group vice president, Wärtsilä Ship Power. "This close association with Raytheon Anschütz is something that delivers benefits to the global operations of both parties. It gives us the ability to combine our engine and propulsion controls, our alarm and monitoring systems, and the Raytheon Anschütz navigation systems into a seamless integrated package."

Wärtsilä intends to make these integrated packages, combining navigation and automation systems, available for all types of vessels. Wärtsilä Services will also, as a result of this agreement, be offering global retrofit possibilities. Raytheon Anschütz will provide their entire range of Integrated Bridge Systems, including Multifunction Displays, Radars, Chart Systems, Conning Display, Gyro Compasses, Autopilots and Steering Controls, Speed Logs, Echosounders, and Communication Systems, which provide maximum flexibility for navigation data access at any location on the bridge, and delivers the information needed for safe and precise ship navigation.

Contact Wärtsilä Corporation, John Stenbergin rantaa 2, P.O. Box 196, FI-00531, Helsinki, Finland.

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Ancillary equipment

TMEC expands territory

Thermal & Mechanical Equipment Company (TMEC) has expanded its representative and distributor relationship with API Heat Transfer, Buffalo, New York. TMEC has expanded its exclusive territory for the API – Basco product line of shell and tube heat exchangers, and has added API's Schmidt-Bretten line of plate and frame exchangers to TMEC's portfolio of heat transfer and filtration products.

TMEC now represents both the Basco and Schmidt-Bretten product lines in Texas, Oklahoma, Louisiana, Colorado and New Mexico.



A Schmidt-Bretten plate and frame heat exchanger.

TMEC president, Russ Braden, characterises these changes as "a great way to expand on our successful relationship with API Heat Transfer, and an opportunity to offer both the Basco and Schmidt-Bretten families of high quality products to our customers in these important geographical areas."

According to Bob Platt, president of API Heat Transfer: "We are looking forward to consolidating representation of our shell and tube and plate and frame products with TMEC, which has been one of our premier sales distributors over the past 13 years. We are confident in TMEC's ability to grow both the Basco and Schmidt-Bretten product lines in all of these territories."

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IMO's EEDI is making waves

Criticised by a European Maritime Safety Agency (EMSA) report for, among other things, its “questionable” approach regarding short sea shipping the International Maritime Organization (IMO) with its Energy Efficiency Design Index (EEDI) is facing up to its critics.

As a cornerstone of the IMO's efforts to reduce the levels of CO₂ and other environmentally damaging emissions the EEDI has come under fire from a number of quarters, but most recently from an EMSA report which

says that EEDI is not suitable for use with ro-ro vessels.

The EMSA report, which was produced by Finnish consultancy Deltamarin and is entitled EEDI Tests and Trials for EMSA, said: “Generally speaking, the current

EEDI approach is very questionable for short sea shipping.” However, on its front page the report is clear that it does not necessarily reflect the views of EMSA or the European Commission, but is the work of Deltamarin. Nonetheless it was commissioned by EMSA.

According to Deltamarin vessels operating short sea routes are often designed for particular routes or operations on scheduled services. “Within each ship type the actual design criteria can be very diverse and ships are difficult to categorise for good correlation of EEDI value. This means that in many cases the individual ships are not comparable with each other in index point of view. Therefore, limitation of the index value should not be made as it could finally lead to undesired sub-optimisation of bigger transportation chains.”

As a result Deltamarin writes: “It has been concluded that the current EEDI methodology is not suitable for short sea shipping in general, including: all small ships, RoRo-, RoPax- and passenger ships as well as other special ships.”

This is a view that is not shared among some in the industry, notably the Technical University of Denmark (DTU). According to DTU the latest Marine Environment Protection Committee (MEPC) meeting in March has agreed to develop baselines, that is emission limits for each vessel type. Included in this will be a separation of ro-ro ships into three categories, vehicle carriers, volume and weight carriers. Weight carriers will be defined as such if they carry more than four tonnes/lane metre and a volume carrier will be defined as transporting less than four tonnes/lane metre.

Hans Otto Holmegaard Kristensen, senior researcher at DTU, said: “The headache for political people, owners and operators will be where to place the baseline for these ships and we must solve this problem.”

A comparison of emissions and costs for transporting cargo between Gothenburg and Rotterdam - moving the cargo by either ro-ro, load on-load off ship or truck.

Gothenburg - Rotterdam		
Sailing distance (km)	km	930
Container feeder ship		
Container Capacity	TEU	750
Speed	knots	16.4
Payload per TEU	t/TEU	8.2
CO ₂ emissions per TEU per km	g/TEU/km	170
Total CO₂ emissions for the whole trip	kg	118464
External costs to society per TEU per 1000 km	EURO/TEU/1000 km	28
Total external costs for the whole trip	EURO	19584
Ro-Ro cargo ship		
Number of ships	-	2
Length of cargo lanes	m	3000
Speed	knots	20.7
CO ₂ emissions per lanemeter per km	g/m/km	81
Total CO₂ emissions for the whole trip	kg	453023
External costs per lanemeter per 1000 km	EURO/m/1000 km	13
Total external costs for the whole trip	EURO	74894
Driving distance		
	km	1090
Trucks		
TEU per truck	TEU/truck	2
Length of truck	m	16
CO ₂ emissions per TEU per km	g//TEU/km	485
Total CO₂ emissions for the whole trip	kg	396382
External costs to society per TEU per 1000 km	EURO/TEU/1000 km	218
Total external costs for the whole trip	EURO	177985
Transport mode	CO₂ emissions	Total external costs to society
750 TEU container feeder ship	118464	19584
Two 3000 lanemeter Ro-Ro cargo ships	453023	74894
375 trucks (16 m long)	396382	177985
Transport time	Hours	
Feeder ship	31	
Ro-Ro cargo ship	24	
Lorries	15	

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Emissions comparisons for ro-ro's, container feeder vessels and trucks between Gothenburg and Rotterdam.

An intercessional meeting has been timetabled for June that will attempt to resolve some of these issues ahead of MEPC 61 in October this year. Mr Kristensen emphasised that ships will need to reduce speed in the future, but that containerships have plenty of excess power which can easily be curbed, with bulkers and tankers speed is more of an issue with a speed of around 12knots cited as a possible lower limit.

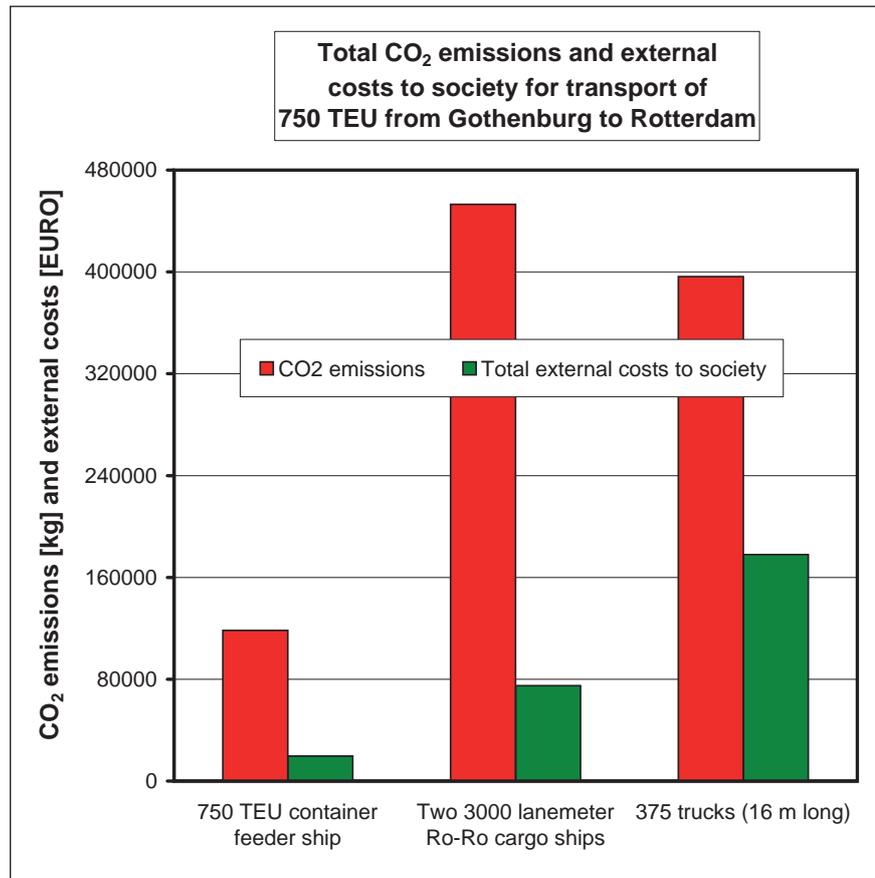
Taking into account the different needs for each ship type "IMO has already decided that the EEDI will have a separate index for each ship type," explained Mr Kristensen. Japan's delegation has submitted plans that will see the EEDI implemented in three steps, starting from a baseline and becoming more stringent in three, three yearly steps.

According to a Lloyd's Register circular a two-year timeline has been agreed for determining the EEDI baselines with the EEDI and Ship Energy Efficiency Management Plan amendments to MARPOL VI likely to enter force around January 2013.

Greece, however, has voiced concerns over the lower speed limits as has the Confederation of European Shipyards Association with both claiming that under-powered or vessels with low power could become casualties in heavy weather. Other MEPC sources, however, have claimed that these safety concerns are over-stated and are mere politicking by the countries and organisations involved.

"We need to check which ships have the highest potential for power reductions and this will be the basis for the next discussions," said Mr Kristensen. He believes that the de-rating of engines will materialise in the near future, but that the "costs [of modifying engines] compared to the benefits in fuel savings is not a lot of money".

Deltamarin in its study for EMSA evaluated the applicability of EEDI by major ship type with tankers and bulk carriers Deltamarin concludes that "there



is in general a quite good correlation of index values. Similarly as for tankers, different size-classes such as handymaxes and panamax can be separated from the data as they form clear data-clouds around certain deadweight ranges."

Effectively, "The basic philosophy would limit installed power of ships and should be applicable for ships bigger than about 25,000dwt with certain limitations. Special ships should be fairly treated and baseline definition could be made separately for different size classes of ships in order to avoid non-conformity of regulatory requirements", said Deltamarin.

Similar conclusions were reached for container ships, with size again the defining feature, feeder ships will require a different baseline for the deepsea vessels. However, the application of EEDI to general cargo ships is difficult given that the speed of these vessels can range from 7knots to 20knots depending on the purpose for which they were designed.

Deltamarin, therefore concludes: "Applying EEDI on general cargo ships

is very questionable since the design criteria of the ships varies way too much. Only ships bigger than 50000dwt seem to be similar enough for comparing them with each other. Further categorisation of general cargo ships is possible, but probably a very challenging task."

Gas carriers are also split into two major groups by Deltamarin, LNG and LPG carriers, with size again determining the subgroups. "The current methodology of calculating baselines is not very suitable for LNG carriers. Many LNG ships use cargo as their fuel which would drop CFME factor from 3.13 to 2.75. Also, the traditional solution in LNG carrier machinery is steam propulsion which, has SFC (Specific Fuel oil Consumption of engines) of around 280g compared to 190g/kWh used in the baseline formula. Today the machineries and utilisation of cargo varies and therefore attention should be paid in fair definition of the baseline for different sizes of LNG carriers," explain Deltamarin.

However, for Deltamarin, perhaps the most problematic of ship types as far as

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the EEDI applicability is concerned are ro-ro ships. Within the three categories of ro-ro the vehicle carriers present the least difficulty as the vast majority are, “quite similar ships”. Safety margins could be a concern for these vessels due to their large superstructure, which can mean that maintaining the ship’s course in heavy winds can be problematic.

Weight carrying ro-ro’s cannot apply the EEDI formula because these ships are often designed to operate at speeds that allow them to meet schedules. Deltamarin cites the example of the Finland to UK services where ship sizes are determined by the cargo, usually paper on these routes and a seven day round trip is the standard time for a vessel operating on this route.

Deltamarin believes that “The current EEDI philosophy is not applicable for schedule defined transport systems. In these kinds of ships, application of EEDI could easily lead to sub optimisation, and probably also use of oversized vessels. A strict EEDI approach would concentrate the cargo to big hubs thus increasing the size of vessels used.”

Nor do the volume carriers fair any better. “A strict EEDI approach for RoRo volume carriers is a bit questionable since it would reduce operation speeds on certain routes and thus make short sea shipping schedule wise less attractive compared with road transportation,” said the report.

The view is that this could see cargo shift from ships to roads and would as a result increase the level of emissions for cargo that would otherwise move on ships. Deltamarin, therefore concludes: “Instead of comparing RoRo ships with each other they should actually be compared against other means of transportation in their actual route.” However, Deltamarin claims that “setting a regulatory framework for comparisons between different means of transportation makes no sense,” though it does not explain why.

Given that a cargo owner would compare the costs of the different transport modes and weigh the advantages such as time and overall cost of each means of transport this would appear to be an entirely reasonable comparison to make.

Ro-pax ships are defined as passenger vessels that have the car carrying ro-ro capacity and these ships, mainly operating in Europe, are specifically designed to meet the demands of certain routes. Deltamarin identifies the definition of the capacity of these vessels as a problem, though trailer capacity can be measured by deadweight, car capacity is volume related and the volume needed for passenger capacity is different for day and night ferries.

Gross tonnage as a measure can be discounted as this would include machinery spaces. “A more sophisticated approach would be to develop a capacity index, taking into account deadweight, RoRo deck volume, max passenger capacity and cabin number,” said Deltamarin.

Other difficulties in applying the EEDI to ro-pax vessels are variables such as speed and engine power which can be used for ice class, safety or redundancy issues. The EEDI approach under these circumstances is “very questionable since the ships are not practically comparable with each other”, said the Deltamarin report.

It concludes: “The current EEDI approach would limit the design speed of new vessels. That again could make newbuildings on some routes, where high speed vessels are practical, less feasible. The end result would then be either use of older vessels or a shift to road or air transportation since in many cases RoPax ships are actually competing against other means of transportation.”

A rigid EEDI approach could then lead cargo to other methods of transportation. “The cargo could be shifted to container vessels or general cargo vessels and the passengers to airplanes. This is of course possible, but not certainly desirable from the industry point of view,” said the report.

Certainly Mr Kristensen does not consider the possibility of cargo and possibly passengers migrating to other forms of transport as beyond the realms of possibility. At DTU he has developed a programme, a Ship Design Model, that can evaluate the costs of transporting goods and people by various transport modes and has developed a method for calculating the cost to society in terms of pollution, noise, congestion and

accidents as part of the overall calculation for the value of a particular method of transportation.

Shipping scores highly in some circumstances compared to trucks because it alleviates congestion and is less likely to cause congestion on the roads for example. Mr Kristensen adds that ship operators believe that ro-ro vessels will always score highly over trucks because of the volume of cargo they can carry. “They forget that a ro-ro vessel carrying a truck must also include the weight of the truck and the wasted space around the vehicle, this can mean that ro-ro ships do not score as highly as we imagined.” (See Panel)

According to Mr Kristensen “cargo can be just 30% of the deadweight of a ro-ro ship whereas for a bulk carrier the cargo is up to 95% of its deadweight.”

“IMO discussions concentrate on technology, but there must be a way of including the benefits to society of non-technical wins, eg safety, noise, congestion and infrastructure costs,” claimed Mr Kristensen.

He went on to say: “By using the the costs of each transport mode to society you can get a better balanced view of the overall costs.” However, he conceded that “quantifying safety or noise costs is difficult”.

Mr Kristensen disagreed with Deltamarin’s view of ro-ro vessels and said he was “astonished” by the Deltamarin report because having a variety of values for the different ship types and a variety of sub-divisions within each vessel type “has been fundamental to the IMO’s work from the very beginning”. He said that EEDI “can be developed to refer to each ship types individually.”

Composing the various baselines for the substantial number of ship types that have already been identified is the work now being conducted by industry representatives who will report back in October to MEPC 61.

However, Mr Kristensen said: “The industry now realises that it is acting at least a year too late, it must now work hard to catch up. In Copenhagen [the COP15 conference] there was no decision taken that meant there is more time for the IMO to adopt rules, so this is a godsend.” **NA**

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Miami cruise hits the high notes

Cruise lines had were providing an air of cautious optimism in Miami last month, writes Sandra Speares, as the main event of the year, Seatrade's Cruise Shipping Miami, looked to build further on an improving outlook.

Over 10,800 people attended this year's Cruise Shipping Miami event, which provides a showcase for everything from marine engines to Australian opals.

Cruise line operators gathered to outline plans for 2010, and hopes that yields will start to shift upwards.

Last year was a grim time for the industry. It was described as one of the worst in the last 40 years. Yields were down and fuel costs were high, coupled with a slump in orders for new cruise ships.

There was heavy discounting to ensure that cruise operators could keep their ships full and new demands on the environmental and regulatory front.

Faced with a falling orderbook, yards have indicated that they need to diversify into the refurbishment side of the business as cruise operators decide to go down this route rather than order new tonnage.

In the boom years yards were in a commanding position when negotiating newbuilding contracts, and when negotiating repair work, orders had all but dried up in the cruise ship sector. Since the turn of the year, however, contracts have been signed by the Carnival and MSC groups.

Fincantieri chairman Corrado Antonini, told the Cruise Shipping Miami conference that the outlook offered both good news and bad.

Many economic indicators, he suggested showed that the economic crisis was beginning to soften, as stimulus packages were put in place and recovery looked to be underway. The cruise industry he said remained "resilient" in the face of price discounting to maximise ship occupancy.

Figures produced by the Cruise Lines International Association (CLIA) and Cruise Europe have pointed to the number of people taking cruises continuing to rise.

CLIA statistics suggest that passenger growth among their membership will be up 6.4% this year compared to 3.4% in 2009.

Statistics produced in Miami by the

European Council of Cruise Lines (ECCL) show that almost 4.95 million Europeans took a cruise in 2009, up 12% on 2008. Growth of about 10% is predicted for this year.

That said, ECCL chairman David Dingle warned about tax issues and environmental regulations in the future.

"The cruise industry wants to be part of the solution not the problem, but we need to make sure that the environmental agenda develops in a sensible way unfettered by unnecessary regulations."

Gas turbines, common rail systems and solar panels are just some of the approaches used for the cruise industry to be more energy efficient and to meet new environmental requirements.

While the introduction of a new emission control area (ECA) around North America is set to go ahead in 2012, issues remain for cruise line operators based in the USA concerning the supplies of low sulphur fuels needed for use in ECAs.

The USA authorities have said, however, that they are prepared to consider abatement technology solutions including the use of scrubbers.

However, as the summer season approaches in the Mediterranean, there are more questions than answers as to how the new European Union (EU) directive of maximum 0.1% sulphur in fuels used in member state ports will be applied.

Guidance for operators revolves around checking before their ship enters a port as to what attitude to the directive is likely to be taken.

Questions remain over whether documents showing that modifications to meet the new low sulphur requirements have been made will be sufficient to avoid a fine in Italy, for example, which has been vocal in its support for the sulphur cap.

Most modern cruise ships can handle two to three different grades of fuels in order to meet the requirements of ECAs but this is not true of older tonnage.

Cruise lines have understandable concerns

about making investments in abatement technologies without being sure that they will be able to deliver the 0.1% maximum sulphur content required for the new North American ECA from 2015 and for ships entering EU ports.

Although technologically most cruise companies seem to be comfortable with the current 1.5% maximum, which reduces to 1% in July in the North Sea and Baltic ECAs and in North America in 2012, they are less sanguine about a 0.1% figure.

So far, Holland America is the only cruise line to have put in place a scrubber system for testing - the Krystallon seawater scrubber. The project is now in suspension, after its first stage, subject to negotiations in progress with Hamworthy, which now owns Krystallon.

Other lines says they have been considering options like Ecospec's CSNox product, which makes seawater more alkaline, thus getting over the problem of discharges of acidic wash water resulting from the scrubbing process.

Cruise lines have also been looking at new energy savings using solar power, for example on Celebrity's Solstice class ships, to feed into the central electrical grid as a means of powering lifts.

Taxes put in place in environmentally sensitive areas like Alaska have been of major concern to the cruise industry, particularly in view of the importance of the Alaskan cruise market.

There seems, however, to have been a willingness on the part of the authorities to consider abatement technology as a solution.

Availability aside, low sulphur fuels present issues for engine manufacturers in terms of dealing with the dangers of catalytic fines.

In a recent presentation to the Insurance Institute of London, Captain John David of consultants Marine Professionals issued a warning that this may be a major issue for all those using low sulphur fuels in the future.

"The more demand for low sulphur, the more potential for cat fines," he told an audience primarily made up of insurers and underwriters. *NA*



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Cruise blues starting to lift

“Inflexibility” and “fragility” define the state of the European yards’ in the cruiseship market, but the optimists at Fincantieri believe the industry is turning a corner. Sandra Speares reports.

Italian shipyard Fincantieri’s chairman Corrado Antonini believes there is room for “cautious optimism” as, unlike other shipping sectors, the cruise industry has not over-ordered and has followed a balanced approach to growing the fleet.

The bad news, as far as the Fincantieri chairman is concerned was that cruise lines’ investment programmes would take longer to recover.

Only three cruise ships of over 10,000gt were ordered in 2008, one in 2009 and, while Fincantieri has an order from the Carnival group and STX a ship order from MSC Cruises, these are clearly insufficient to satisfy employment demands in the highly specialised cruise sector.

“The shipbuilding industry has an intrinsic inflexibility deriving from plant assets and specialised skilled resources which cannot be simply frozen, moved or fired.”

He also has concerns over the “fragility” of cruise yards’ networks of small and medium sized suppliers. Those suppliers could move to other markets if there was no continuity in production.

The European cruiseship building industry has always argued that its supply networks give it the edge against the potential threat from Far Eastern yards.

Diversification into the ferry sector might present one potential area for growth, according to Mr Antonini.

He added that the “elimination from European waters of aged tonnage and its replacement facilitated by a scrap-and-build scheme could both help to preserve the passenger ship production network and to set up a ‘green’ transport system”.

European shipyards had the tough proposition of having to deliver ships that not only met requirements for environmental and energy saving, but also international rules on safety. At the same time they need to be customised to meet the needs of individual cruise lines as well as be cost effective.

The “supply of prototypes at very attractive financial conditions and prices, without the



Celebrity Solstice at the fitting out stage of its construction at the Meyer Werft Shipyard in Germany.

guarantee of an adequate volume of orders, is a hard challenge,” the Fincantieri chairman warned.

Now, while refurbishments might be on the increase, the cruise lines are looking for fewer ships, but those that provide more innovations at a better price.

Martin Landtman, president of STX Finland said that European specialist yards for cruise ships had capacity for 10-12 major cruise ship projects per year, but if European yards were to continue to deliver cost-effective vessels a “near stable” workload would be needed.

“Without continuity in the workload the building capabilities will deteriorate and construction costs will inevitably increase,” he told delegates at Cruise Shipping Miami.

He believed that in order to enhance profitability, yards would need to enhance cost efficiency and competitiveness across the board, improve fuel efficiency and operating costs, develop new products in association with their clients, and diversify, including into providing life-cycle services.

Aside from financing issues, a close relationship would need to be maintained between the cruise companies and specialist cruise shipyards.

Cruiseship construction has become increasingly demanding, and

development of prototype vessels can only be achieved with a good working relationship between the two parties, he said.

In considering the cruise shipbuilding market, Jean- Bernard Raoust, president of Paris-based shipbrokers Barry Rogliano Salles told the conference that today’s market for cruise ships was a narrow one “operating in favour of shipowners”.

The European shipbuilding industry, he suggested, had become overly dependent on cruise shipbuilding because of Far East competition in other sectors.

He echoed Mr Antonini’s concerns about losing the sub-contractor network during a downturn in the market.

On one side of the coin, from the point of shipowners, there were few prospects of new entrants because the industry was too capital intensive. On the other, good profit margins for newcomers to the shipbuilding market were also questionable.

Recent market movements as far as the euro was concerned, could reactivate projects on hold at the moment, he suggested. The vast majority of cruise ships currently being built are in the euro zone.

According to Mike Kaczmarek, vice president of corporate shipbuilding at



Cruise Max software was installed on *Seabourn Odyssey* first. The programme aids load management, emergency response and shipyard stability systems.

Carnival, demand was for “fewer but better ships, at less cost”.

He identified a need for better newbuild prices, designs that take in regulatory requirements and are also innovative and ahead of the market as well as being energy efficient to operate. Energy efficient hull designs and technical systems, he considered to be critical.

New regulations entering into force this year, including the amendments to SOLAS, will place greater demands on shipbuilders who will be designing ships that meet the new probabilistic rules outlined in the regulations, as well as meeting damage stability and ‘safe return to port’ requirements that mean a new approach to shipbuilding.

Some cruise companies have already implemented these requirements as far as newbuildings are concerned, others have yet to tackle the challenge.

Amendments include criteria on the amount of damage a ship can withstand, according to its design and still return safely to port. The amendments include a certain degree of flexibility so that designers are not restricted to prescriptive rules.

Other amendments to come into force this year include provisions for safe areas for passengers following a casualty and maximum propulsion redundancy.

Onboard safety centres will be required that operate independently from the navigation of the ship, and newbuildings like Royal Caribbean’s *Oasis of the Seas*, or *Celebrity Solstice* already have the new bridge configuration on their vessels.

Fixed fire detection and alarm systems are needed, including ensuring alarm calls can be individually and remotely monitored. There are also amendments to enhance safety procedures for atriums, a feature on most of the recent cruise newbuildings.

Consideration is also given to which essential systems should still be operational in the event of one vertical zone is put out of action due to fire.

Legislation and regulatory changes have sparked many developments in safety software.

For example Herbert Software Solutions CruiseMax product was showcased at this year’s trade show in Miami offering shipboard stability, load management and emergency response software. The first installation was on *Seabourn Odyssey*.

Another example is class society Lloyd’s Register’s emergency response service, which aims to minimise the risk to passengers, crew and to the environment in the event of an accident. **NA**

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Eco-cruisers are future of cruiseconomy

New pragmatism to replace the razzmatazz of the old cruise industry as designers respond to economic and regulatory changes say Deltamarin.

Notwithstanding a continuing contrary financial situation and a backlog of new large cruise liners yet to be delivered, the potential benefits offered by designing and constructing better ships for the future – sharply defined and highly optimised – remain very attractive, believes the Finnish consultancy, Deltamarin.

Vastly improved tonnage has already been conceived over the past 40 years since the arrival of Royal Caribbean Cruise Line's (RCCL) *Song of Norway* in the early 1970s – considered by many to be the first modern purpose built cruise vessel. Yet tremendous scope remains for far-sighted designers working with imaginative builders and owners. The industry's latest arrival offers a hint of what is already being achieved in the first decade of the 21st century: *Oasis of the Seas*, built at STX Europe's Turku yard and newly delivered to RCCL, can carry up to 6300 passengers and 2160 crew. Such figures would have been unbelievable a few years ago.

For the following generation of cruise tonnage cost pressures will almost certainly play a dominant role; these will apply not only to construction, but to operating and service expenses. Functional efficiency and maximum revenue will be important themes for all new projects; here, Deltamarin has the necessary tools – including 3D modelling, experience and a statistical data bank – to achieve positive results.

Oasis of the Seas, which complies with the new SOLAS 2009 probabilistic stability rules, is also the first built to the new Safe Return to Port (SRTP) rules, which come into force on 1 July 2010. The SRTP regulations require, amongst other things, a split of the main propulsion and generating plant into two watertight compartments for redundancy.

Deltamarin participated in the process of verifying the SRTP together with RCCL and the shipyard with a 3D modelling tool having all required spaces, systems with equipment, piping, ducting and cabling included in the model. Intelligence was built into every system showing the availability and

redundancy of the system in case of a loss of any single watertight or fire insulated space.

Encouraged by the good results in verifying the system availability in case of an incident, the Finnish company further developed the modelling from a verification method into a design system, which shows great potential for savings in the process itself, especially in the layout and system design complexity.

It is essential that SRTP is considered as part of the design from the first concept development phase with proper modelling, as through that the cost for fulfilling the rule is only a relatively modest sum in extra features and there are other savings available with the 3D modelling technique. Layout optimisation with a 3D model including piping, ducting and cables has shown remarkable saving potential.

In the current economic climate, revenue generation will be paramount for new ships. Efficient use of space will be an essential priority for owners, and here attractive opportunities still exist to shrink the gross tonnage-to-passenger ratio, while retaining passenger comfort, believes Deltamarin.

A figure of 40gt/passenger lower berth is often quoted as a good target value for the most common contemporary class ships and most of the modern ships are between 40 to 45gt/passenger. But the consultancy has successfully demonstrated that a realistic figure below 40gt/passenger can be secured with the same passenger service level. Volume is a primary cost factor in shipbuilding so anything that can be done to compress this should be attempted. It is believed that better efficiencies in this field still can be achieved – not just by studying major aspects, but minor ones too.

The layout development needs to be carried out in 3D instead of the typical 2D approach, as all space reservations can then easily be checked. Having major piping and ducting included already in the concept model true space means that material amount optimisation can be carried out more efficiently. First studies carried out show

interesting saving potentials in void volumes, amount of piping and ducting along with an improved build process.

Optimisation and simulation techniques are likewise of immense value. Most aspects of ship operation can be optimised and simulated, and one that could still yield useful economies is an examination of service flows and proximity of spaces, such as luggage handling and catering layouts, but also major innovation is possible, in the arrangement of a typical main service corridor, for example. Simpler and more efficient routes should be a prime aim.

Finally, there is yet another important aspect to which enough attention is not always paid: design condition. Most ships are planned for a certain design condition; yet measurements taken during service have revealed large deviations, meaning that systems are run under off design conditions far from their optimum efficiencies. With crew training and adjustments to vessel operations up to 7% fuel savings have been achieved.

Deltamarin believes that careful design for an optimised service profile is a worthwhile exercise. The consultancy re-asserts that – even today with all the advances made – remarkable energy savings in the order of 10 to 20% can be achieved.

Refined hull forms and propulsion techniques can play a leading role here. Nevertheless, fundamental preliminary work well before the contract signing stage will be mandatory, including the use of computational fluid dynamics (CFD) techniques, which are seen as offering great potential. However, there are two essential subjects for achieving efficiencies, team work and best practice. There are a lot of good ideas circulated within the industry, but a fluent team work with mutual respect of all parties is required to reach coordinated results. A best practice approach is required to reach optimum results, this means that the best knowledge of all parties is combined efficiently. **NA**

Sulphur limits testing cruise operators

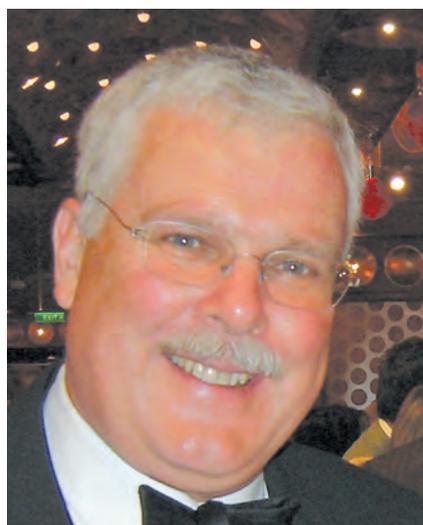
Meeting new environmental regulations will test the cruise industry more than most because the coastal areas, where they operate largely, will change to environmental control areas (ECAs) in both the USA and Europe. Sandra Speares tracks the industry's response.

Compliance with the next stage of environmental regulation will be a tough challenge for the cruise industry.

Cruise operators put their message across at the Miami conference about regulation in Alaska, including a US\$50 per passenger tax introduced in 2006, and they lobbied Alaskan governor Sean Purnell intensively about the effects of the tax, and undertook to explore the matter on his return to the state.

According to Tom Strang, vice president of policy and regulation at Carnival, the introduction of a North American emission control area, set to go ahead in 2012 after agreement at the International Maritime Organization (IMO) will present challenges for the cruise industry.

While the North American ECA will initially introduce a sulphur cap of 1%, in line with the Baltic and North Sea ECAs, the sulphur percentage will drop to 0.1% in 2015.



"That is the challenge going forward," Mr Strang said. The cruise industry will be cooperating closely with the ferry industry in its approach to operating in ECAs and low sulphur environments.

Ferry industry concerns have centred on the potential for modal shift away from the sea and onto land as a result of the new rules. Practical problems remain due to the fact of having to store different grades of fuel when transiting the ECA.

Costs arising from shifting from heavy fuel oils to low sulphur products are significant and the cruise lines are looking at mitigation strategies including the use of scrubbing technology.

Newbuildings in the cruise industry can generally accommodate two or three grades of fuel although in some cases modifications have needed to be made in boiler technology for auxiliary engines, Mr Strang says.

These modifications having been made, the cruise industry is well prepared for the forthcoming cruise season in the Mediterranean, given that Italy has indicated it will be taking a tough line over the recently-introduced 0.1% sulphur cap in European Union ports.

One advantage the cruise industry has, according to Mr Strang, is that it has had experience of tough environmental legislation introduced in states like California, and is therefore ahead of the game.

While there are always going to be risks, not least where fuel quality is concerned, Carnival employs Det Norske Veritas to

Tom Strang, vice president of policy and regulation at Carnival says new sulphur limits are a "challenge" to the industry.



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Fuel quality remains a challenge for the whole industry going forward with the potential for legal action should poor quality bunkers result in an engine failure.

Fuel availability of the low sulphur products is just one of the questions going forward, not least for the cruise industry, which has so many ships operating off the USA coastline, and therefore needs a substantial source of supply locally.

Costs are obviously going to be a problem, one reason why the cruise companies have been monitoring closely European ferries' experiences.

"We will continue to play our part and do that effectively," Mr Strang says.

Scrubbing technology, LNG and nuclear fuels are just some of the alternatives available. While excessive regulation is counter-productive, "regulation does drive innovation," Mr Strang believes.

Although initially critical of the new Ecospec scrubbing technology CSNoX, Mr Strang says he has become more positive about its application, as the company has taken on board many of the initial concerns of potential users. "It seems to do what it says on the tin," he says.

The debate about the use of distillate fuels or abatement technology has been going on for some time, with very entrenched views on both sides.



Tom Strang, vice president of policy and regulation at Carnival says new sulphur limits are a "challenge" to the industry.

MEPC meeting in October.

Shipyards need to diversify and cruise ship yards are looking to extend their refurbishment work.

As Mike Kaczmarek, vice president of corporate shipbuilding for Carnival says, the industry trend for refurbishment is on the upward curve.

Good regional facilities are required that satisfy short transit times and in addition to drydock facilities, services that range from technical design support to project planning and management.

The passenger fleet is maturing, according to Carl-Gustaf Rotkirch, chairman and chief executive of the Grand Bahama Shipyard, with an increasing spend per double occupancy of US\$3000 for maintenance and repair in 2009, compared to US\$1400 in 2004.

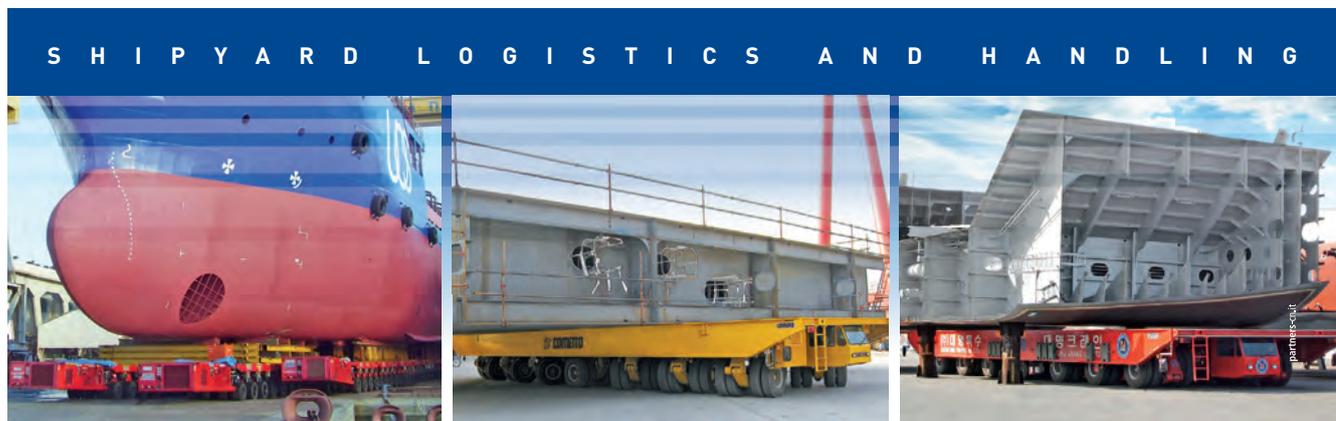
Going forward, Mr Rotkirch said that cost controls, with good forward planning, would be essential.

The economics of cruise shipping suggests that there could be a pause in newbuilding and that owners will look to upgrade vessels to meet new regulations and the yards must also, then, diversify to meet this demand. **NA**

Most maritime companies and trade associations are clear on one thing, that they want the IMO to be in the driving seat as far as providing a roadmap which leads to a solution of the emissions problem.

In deliberations at the IMO during the last in March Marine Environment Protection Committee there was acknowledgement that concepts like the Energy Efficiency Design Index would not necessarily work in the same way for ships more unusual propulsion systems like diesel-electric, which is often used in the cruise industry.

Many of these issues will be taken to working groups in the run-up to the next



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Silverseas is a class apart

Fincantieri's Silverseas project is characterised by RINA's Comfort Class level A notation, the highest level issued by this class society. This implies accurate hydrodynamics and a structural optimisation that avoids resonance through the propeller's entire operating range.

Designing a propeller that is completely free from cavitation is the only way to avoid resonance throughout the propeller's operating range and to study its dynamic behaviour through the schematisation of the entire hull structure with the finite element model (FEM) analysis.

Tank testing and sea trial measurements already carried out have proved that the Fincantieri technical dept has accomplished this very challenging task, obtained by means of a complete in-house design of hull and propeller and a new blade design methodology based on a very extensive use of fully Reynolds-Averaged Navier-Stokes Equations (RANSE) viscous codes.

Hydrodynamic Design

The standard propeller design method consists of considering various input parameters such as power, thrust, speed and wake that develops a blade geometry which fulfils the requirement concerning the efficiency and the pressure pulses. The input wake is normally considered fixed and the propeller designer has to just define the blade geometry characteristics to achieve the required performance.

However, the procedure adopted for this vessel to design a non-cavitating propeller did not consider the wake as fixed input data, but as an integral part of the propeller design loop. The wake optimisation, integrated with the blade design, represents a decisive factor in achieving the goal of completely cancelling the cavitation on the blade surface and the cavitating tip vortex.

Hull and propeller design were, therefore, an integrated activity in which the attention of the designers was concentrated not only on the blade geometry development, but was extended

also to the optimisation of the wake field in which the propeller is rotating.

Before starting the wake and propeller study, the hull optimisation was performed by means of potential flow and fully RANSE free surface calculation in order to get the most reduced wave along the ship length. As a result, the diverging waves and the longitudinal stern wave were kept to a minimum.

In the design of the non cavitating propeller, the fully RANSE code has been extensively used in the design loop through a deep investigation of the influence of the main hull parameters on the wake pattern, such as the longitudinal centre of buoyancy and the propeller disk location. In the end the longitudinal centre of buoyancy has been optimised with consideration to GA plan characteristics and the propeller was fitted in a very stable and undisturbed flow.

The Silversea appendages design consists of a conventional arrangement with propeller driven by a shaft line supported by intermediate and propeller brackets. Special care has been taken during the design stage to minimise every shadow on the propeller disc working on different parameters, such as: cancellation of the hull bossing substituted by the installation of a longer shaft with an intermediate T-support bracket, selection of slender main L-brackets support instead of V-brackets, selection of a low inclination of the shaft line in the longitudinal and horizontal plane, bossing and propeller hub shaped with good hydrodynamic profiles.

It was observed that wake fields with the highest axial peak 1-w higher than 0.75 in all propeller disk with very gentle gradients were possible to be obtained, allowing the propeller to rotate in an optimum environment. At the same time

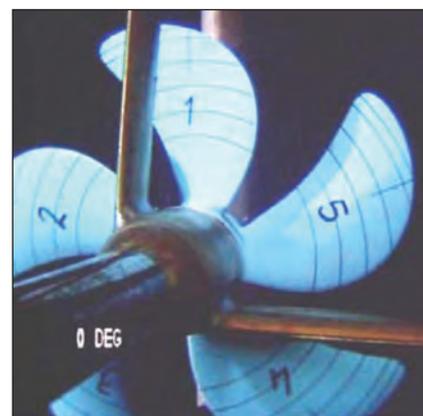


Figure 1. Fully non cavitating propeller at 100% MCR.

the highest tangential components can be less than 0.1.

In the design of a non-cavitating propeller a suitable blade geometry was studied. The target was to cancel the sheet cavitation on the blade leading edge and the cavitating tip vortex at the maximum sailing speed. In this condition the ship was delivering 17,000kW at 100% MCR and in this condition the Comfort class requirements have to be fulfilled.

Three dimensional effects are important in dealing with an unconventional blade form like the adopted spoon tip shape, where the combination of pitch, skew and rake produces a significant curvature to the blade surface. All the information related to the behaviour of the tip vortex was calculated with these new state-of-the-art tools like potential panel codes and the fully viscous RANSE codes.

The skew, rake and pitch distribution was selected and optimised through 3D potential codes and RANSE calculations. By means of these codes it was possible to highlight the three dimensional flow behaviour on the blade and the pressure field around the tip and to apply suitable

skew, rake and pitch adjustments in order to completely avoid the inception of cavitation spots on the blade surface and inside the tip vortex.

In particular, a quite high tip rake was applied and its curvature yields behaved as an energy recovery device like a tip bended propeller. With the most suitable skew, rake and pitch combination, the tip vortex roll up was cancelled as can be seen observing its behaviour predicted through a full RANSE calculation. As seen in Figure 1, a suitable definition of the spoon shape yielded in the end to the complete cancellation of the tip vortex roll up and consequently a full cancellation of cavitation.

As a result the radiated pressure pulses by such a propeller were reduced significantly. Pressure values in the order of 0.8kpa were achieved at 100% MCR. The efficiency at the same time was kept at values higher than 0.71. The total measured integrated Fz vertical force was 8kN. The second third and fourth harmonics were not detected, indicating absence of blade cavitation and tip vortex. To get an indication of the quality of the ship vibration the van de Kooy criteria was used. This criterion, related to the integrated propeller forces, gives a reliable reference level for a good comfort onboard. For Silverseas the attained values was more than eight times less than those suggested by the van de Kooy rule.

Hull efficiency

An important factor in the reduction of propeller load was designing an efficient hull. As for the propeller the wide use of RANSE tools yield to a hull geometry with a strong reduction of wave generation. In addition the application of a suitable interceptor selected with the support of Marin experience for a further smoothing of the stern wave proved to be a good tool for a significant energy saving (See Figure 2). The whole hydrodynamic design including an efficient propeller, the low hull radiated waves and the interceptor yield to a total energy saving of 15% compared to contractual commitments.

Dynamic analysis

Low vibration levels requested by regulations may be achieved only in the early stage of design choosing the correct structural parameters in terms of pillar distances and beam stiffness (i.e. section definition



Figure 2. Interceptor application.

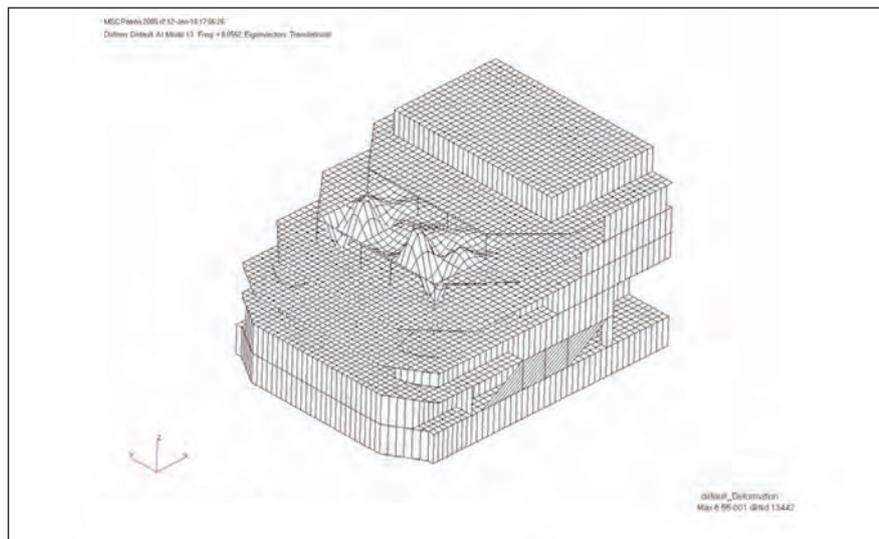


Figure 3. FE model of aft part-relevant mode shape.

and inertia). In particular, resonance with relevant propeller harmonics (blade passing frequency) is to be avoided in the normal operating range (usually 50-100% MCR of propulsion electric motors).

The natural frequency of primary structure has been calculated by FE model representing the typical structures defined by midship section in the aft part.

Generally, a sub-critical design (natural frequency above exciting frequency) has been achieved in order to exclude any resonance also during transient operations.

Analysis of critical areas

The aft structure has been analysed carefully, as it is subject to exciting forces

generated by the propeller and transmitted directly by bearing forces and moments and indirectly by pressure pulses acting on the stern.

Furthermore, in this project an important structural discontinuity is present in the theatre area. Due to the elimination of two rows of pillars for architectural purposes, the decks above the theatre are overhanging and not supported vertically in the middle part.

A dedicated Finite Element (FE) model has been developed in order to study the frequency response of the structure. The goal has been achieved adding structural bulkheads integrated in the interior outfitting, which supply enough stiffness

Figure 4. Predicted max vibration velocity (accommodation decks, absolute scale in mm/s peak).

to the overall structure, distributing the missing support on the connected decks (See figure 3). Frequency response functions in terms of velocity shows no resonances in the normal operating range (in this case blade passing frequency is 10-13Hz).

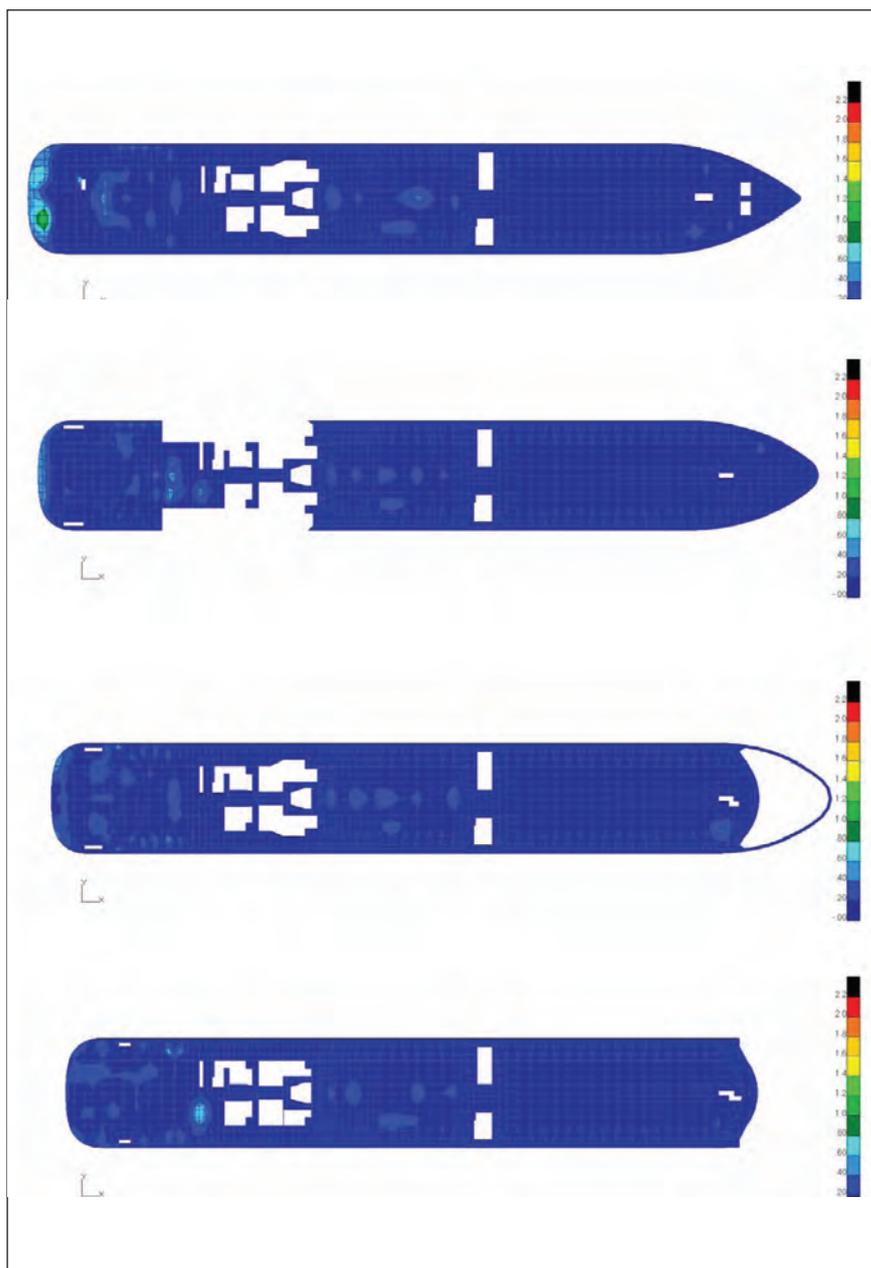
Overall hull vibration calculation

The final predicted levels have been calculated by a global FE model developed in accordance with the final structure verified statically.

The model has been loaded with a typical loading condition and natural frequencies in the exciting forces frequency range has been calculated with an iterative algorithm. Frequency response in term of vibration velocity has been calculated by modal superposition of the response functions, applying as input data the integrated exciting forces calculated and verified during tunnel tests.

The resulting vibration levels have been analysed and compared to Standard limits.

All maximum levels in the middle of the pillar position were significantly below the limits stated by the relevant Standard. In general, all other values were below 1mm/s peak, which represents an excellent value for habitability and comfort in passenger areas. (see figure 5)





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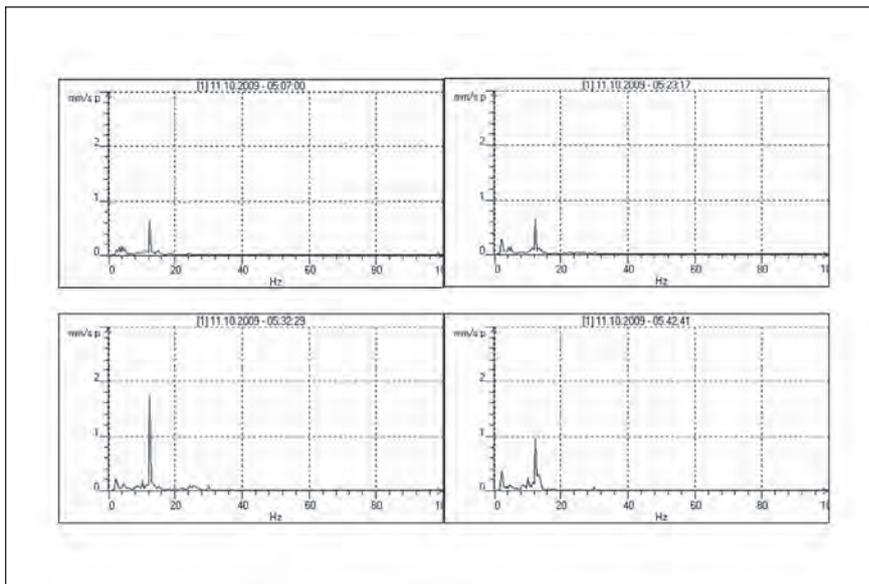


Figure 5. Measured vibration spectra in aft area (vibration velocity, vertical direction).

Sea trial results and correlation with FEM calculation

During sea trials, vibration measurements have been taken at different service conditions, in accordance with the requirements of the Rules.

In all conditions, vibration amplitudes (see figure 5) have shown a good agreement with the calculations.

Also in rough sea conditions, peak values remained in an acceptable range during transient vibrations.

Conclusions

The distinctive hydrodynamic design approach of the Silversea vessel was that hull and propeller have been designed during the optimisation loop in parallel, carried out by means of an extensive use of fully viscous codes. This approach

yielded to significant improvements in the total efficiency and in the quality of the wake pattern. These computational fluid dynamics (CFD) viscous tools were used as well to design a new type of efficient propellers suitable to operate in an optimum wake field without any kind of cavitation on the blades or cavitating tip vortex. As a result, these propellers produced a large improvement of the hydrodynamic load on the hull structure. Validation tests carried out at Marin vacuum model basin showed that very low pressure levels and total integrated forces were achieved for this ship indicating also that no broad band excitation coming from the tip vortex was present.

From a structural point of view, a detailed dynamic analysis has been

carried out, involving basic structure parameters and possible critical areas due to lack of stiffness or structural continuity. This design, carried out at an early stage with Finite Element Technique allowed to easily study and optimise the hull before the detailed definition of structural plans. This approach produced a structural definition integrated with the characteristics of the propeller in terms of matching between frequency response and blade passing frequency.

Final global calculation demonstrated the exactness of preliminary analyses and improvements, showing predicted vibration levels in accordance with the accepted Standards for this class of ships and in compliance with the Rules and the limits stated by the technical specification.

Sea trial measurement proved this statement achieving with large margin all the goals stated by the RINA Comfort Class requirements, making *Silver Spirit* one of the most comfortable vessels ever built. **NA**

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Ballast technology market grows as convention approval drags on

The Ballast Water Management (BWM) convention adopted by the International Maritime Organization (IMO) in 2004 still awaits ratification, but this has not slowed the development of technology in this area.

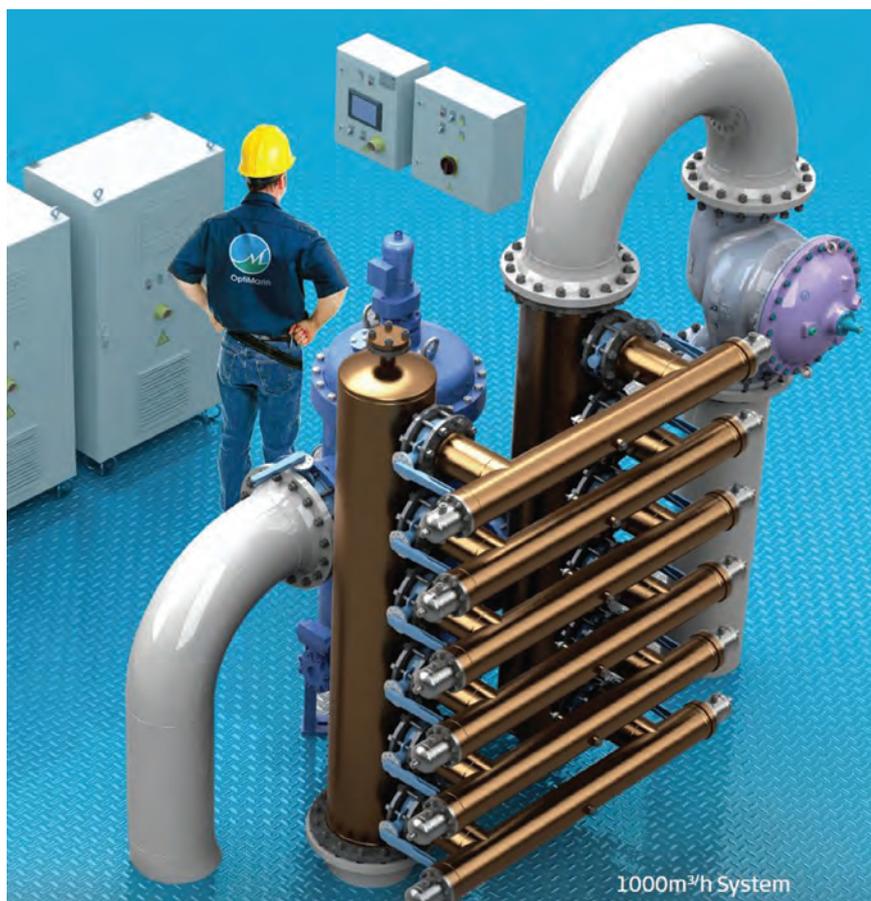
In the shipboard water treatment report in *The Naval Architect* May 2009 issue it said that the convention did not look like it would enter into force until 2010, to date the convention has been ratified by 22 of the 30 countries needed to bring the convention into force.

The IMO has said that they cannot put a date forward as to when the sufficient number of countries will have ratified the convention for it to be enforceable, as it wholly depends on the countries themselves. The countries will have to ratify the convention into their own national law; then deposit the instrument of acceptance with IMO.

The committee at the marine environment protection committee (MEPC) 59 also concluded that there are sufficient type-approved ballast water treatment technologies available for ships, subject to regulation B 3.3, constructed in 2010 and has instructed the secretariat to prepare a draft MEPC resolution for consideration and adoption at this session; and further requesting Administrators to encourage the installation of ballast water management systems on new ships in accordance with the application dates contained in the BMW Convention.

Commenting on the current market for ballast water systems, Per Warg, business manager PureBallast, Alfa Laval has said: "The retrofit market for these solutions has not yet started. The newbuilding market has begun installing ballast water solutions onboard vessels, which is not as costly for the ship owners. Most ship owners think that it will not be that costly for them to install systems onboard existing ships once the convention is ratified."

Following ratification of the convention Mr Warg has warned that there will be a shortage of installation space, equipment and engineering facilities as the rush to meet the deadline will be on. Mr Warg said: "There will be a rush for water ballast systems and there is



Optimarin's ballast water system received Type Approval in 2009 and gets a good start to 2010.

a chance that some owners might end up last and so not be able to meet the time schedule to have these solutions installed onboard for the convention." "More ship owners should start to refit these solutions onboard. In the newbuilding market we have seen owners installing more ballast water systems."

More systems enter the market

Alfa Laval has also said that it will be launching its latest ballast water system, specifically designed for tankers, on to the market later this year. The latest development from Alfa Laval will see the launch of its PureBallast EX

(Explosion). Currently; the system is under development at Swedish-based Alfa Laval's headquarters.

Mr Warg comments: "Alfa Laval has been working with EX approved systems for some time; we have already seen that there are some products [ballast water solutions] on the market in this area. Alfa Laval is looking to have its system installed onboard tankers, but first we need to get the system EX approved and then we will be able to enter the tanker market."

A redesign of the original PureBallast system will be adapted to be able to fit



Mahle joins the ballast water treatment market with its Ocean Protection System (OPS).

into a tanker, and also take in and check that there are no hot surfaces on the system,

which could ignite any explosive gases. The challenge for the system being retrofitted

onboard a vessel will be whether sufficient power can be generated from the power supply, said Mr Warg.

Alfa Laval has already been in talks about the PureBallast EX with some ship owners, who have shown definite demand for systems of this type. PureBallast EX will cost more than the original PureBallast system, but is said to have the same installation costs as PureBallast.

Alfa Laval has also received its first order for PureBallast 2500, the largest version of the system, to be installed onboard the arctic drillship *Stena DrillMAX ICE*. Featuring a flow rate of 2500m³/h, the PureBallast 2500 system will provide more than double the capacity of any previous PureBallast version.

The order has come from Samsung Heavy Industries on behalf of Stena Drilling Ltd. The PureBallast system will be delivered in June 2010 to the Geoje shipyard, where it will be installed onboard the drillship. *Stena DrillMax ICE* combines the successful

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"For Alfa Laval, the order of a PureBallast 2500 for the *Stena DrillMAX ICE* represents a combination of firsts," says Peter Carlberg, general manager of Alfa Laval Marine & Diesel. "As well as being the first order for our largest PureBallast system, it represents our first PureBallast delivery to the Stena fleet. This makes it yet another positive step in Alfa Laval's long-term cooperation with Stena."

Norway-based OptiMarin AS has since the beginning of 2010 received a total of eight orders for its Type Approved ballast water treatment system OptiMarin Ballast System (OBS). The orders have been placed by shipyards on behalf of major ship owners.

The OptiMarin Ballast Systems will be installed in four Platform Supply Vessels that "K" Line Offshore AS is building at STX Norway Offshore AS Brevik. The vessels are of the STX PSV 06 CD design and the technical management of the vessels will be with OSM Shipmanagement AS. Adding to the order is the installation onboard four anchor handling supply vessels, two for Siem Offshore and a further two OSM Shipmanagement AS.

OBS is a mechanical system based on filtration and UV and does not affect the normal operation of the ship, say OptiMarin. The system will not introduce chemicals, electro-chemical generators or biocides in its treatment process. The key benefits of OBS are that it has a simple and reliable design, which makes it flexible for retrofit and is operated

as part of the normal ballast procedures. The system has a low pressure loss, generates no extra noise and has a small foot print.

The OptiMarin Ballast System has been Type Approved and is well suited for any type or size of vessels, add OptiMarin. The Type Approval Certificate was issued by Det Norske Veritas (DNV) on behalf of the Norwegian Maritime Administration in November 2009. In March 2010 Germany through BG Verkehr confirmed acceptance of OptiMarin Ballast System Type Approval.

Mahle Industrial Filtration has also introduced its chemical-free NFV Ballast Water Treatment OPS to the market. The OPS is a three-stage ballast water treatment system; the first and second phases will filter out larger organisms and the third phase will use low-pressure UV radiation to kill or deactivate microorganisms.

The system works as an in-line system during uptake and discharge of ballast water. During uptake the first step of treatment is a prefiltration for separating particles larger than 200µm, followed by a second filtration for separating particles larger than 50µm. This pre-treatment stage will eliminate most parts of sediments from the ballast water. The uptake treatment finishes by disinfection via ultraviolet light. Figure 1 shows the principle operations (flow chart). During discharge only the UV disinfection is in operation, while the other stages are bypassed.

The filter will offer a high level of compliance within the IMO's D-2 standard as well as an efficient solution for filtering sea water containing large quantities of dirt. The filtration process creates differential pressure across the screen that rises as the sediment enlarges, until a predetermined value is reached (normally 0.5bar) to



Alfa Laval install onboard the DrillMAX ICE.

activate the flushing process. In cases of low operating pressures and generated suction forces not reaching the required minimum level, a small suction pump is added to the flush line to assist the cleaning process. This addition to the system is an inexpensive addition to the system, enabling the filter to operate under extremely low pressures of below 0.9bar, say OptiMarin. This low operating pressure is crucial, in particular for retrofit's, because the low operating pressure meets the parameters of existing ballast water pumps and will save costs for ship owners.

The treated ballast water becomes stored in the ballast tanks during the journey. The de-ballasting process bypasses the two filter stages and the medium flows prior to discharge only through the UV reactors to assure absolute accordance to the IMO regulations.

Due to its modular design, the NFV ballast water treatment system OPS will offer customers a wide array of options and configurations: it can be operated as a compact, container-housed unit or it can be flexibly, modularly adapted to the vessel's design and layout.

Mahle has completed official land-based tests at NIOZ (Royal Netherlands Institute for Sea Research) in Texel, Netherlands, successfully and has received the approval to start with the official sea-based tests. The sea-based tests will be finished in Q3 of 2010. **NA**

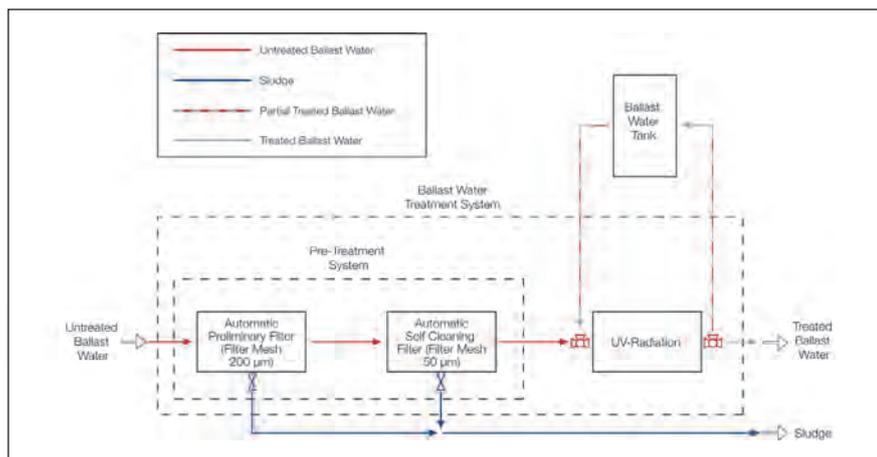


Figure 1. The principle operation of the OPS system.



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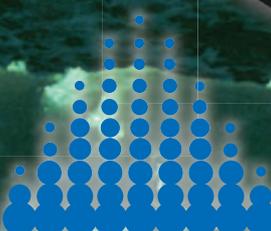
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Unitor gets approval

Wilhelmsen announced that its Unitor Ballast Water Treatment System received Final Approval by the International Maritime Organization (IMO) at its Marine Environmental Protection Committee (MEPC) 60 meeting in London.

The Wilhelmsen unitor system that was launched on to the market in 2008, has received approval. "We are pleased for the system to pass the IMO Final Approval. This is recognition of our efforts to design an environmentally compliant system," says Roger Strevens, business stream manager at Wilhelmsen Ships Equipment. "Our strategy is to be the environmental frontrunner by offering solutions based on the best available environmental technologies to our customers," said Mr Strevens. "The Unitor Ballast Water Treatment System, with technology provided by Resource Ballast Technologies, is a prime example of this."

The Final Approval was awarded to Wilhelmsen at MEPC 57 in 2008.

The system still has to receive Type Approval, which will examine whether it can meet certain pre-defined performance standards for treating ballast water. Central to the Type Approval are a series of three shipboard trials over a six month period; the first two have been completed.

The system has been installed on BW Gas' Very Large Gas Carrier (VLGC) *Berge Danuta* in October 2009. The ship has a ballast capacity of 26,500m³, served by two 800m³/h pumps. The installation onboard the *Berge Danuta* is part of a commercial purchase. The system is also currently undergoing onboard testing on



Wilhelmsen Unitor ballast system aims to get Final Approval by summer this year.

The system can be installed while in normal operation due to its modular, compact, light and robust system components. There is no need for structural modifications to the vessel it is possible to install the components in tight spaces, say Wilhelmsen Ships Equipment.

The power requirements of the system are at the low end of the scale; a system with a 3500m³/h capacity requires only 40kW to operate.

Four to six months planning and installation period is expected for a standard in-service retrofitting. During these months the installation planning, fabricating the connecting pipework and supports and installation itself are carried out.

Last month Wilhelmsen Lines Shipowning Malta Ltd awarded Wilhelmsen Ships Equipment a second contract to supply Unitor Ballast Water Treatment Systems to its two newbuilds at Hyundai Heavy Industries (HHI). Each of the two vessels will be equipped with an onboard ballast water pump capacity of 2 x 500m³/h. The first delivery will be in 2010, while the second system will be delivered in 2011. *NA*

the WWL car carrier *Toronto*, scheduled to be finalised this summer.

"Allowing for time to analyse the results and process the application, we anticipate having the Type Approval Certificate from July onwards", said Mr Strevens. "When this step is completed, the Unitor Ballast Water Treatment System will have all the required approvals."

Installation of the system onboard *Berge Danute* gave BW Gas the opportunity to test the system and gain operating knowledge and experience.



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RWO enhances WWT system

RWO, a subsidiary of Veolia, has enhanced its waste water solution, WWT-LC, to meet the new guidelines for sewage treatment plants for all systems installed on or after 1 January 2010.

The RWO WWT-LC system was launched at the end of 2009 after Type testing by Seeberufsgenossenschaft (SBG) in mid November. The system received Type Approval in February this year and was also enhanced to meet the latest regulations for waste water technology.

The WWT-LC system has been enhanced to bring it into full compliance with the latest IMO resolution MEPC. 159(55), which came into force for ships that had their keels laid from January 2010. Compared to the former guideline MEPC 2 (VI) there are now more stringent limits for biological oxygen demand (BOD5), coliforms and suspended solids as well as an additional limit values for chemical oxygen demand (COD) and chlorine, say RWO.

The 3-chamber system operates with a Mixed Bed Biofilm Reactor (MBBR) providing process stability and excellent effluent results. It is suitable to treat black and grey water or black water only. Vacuum systems as well as grease traps are optionally available.

A special post-treatment prevents pH adjustment challenges, which can occur onboard due to difficult and varying

hardness of the sewage. The WWT-LC is easy to install and maintain, operates fully automatic and has low running costs and is a compact plug & play unit, say RWO.

To date over 20 of the WWT-LC system have been manufactured and left the RWO warehouse in Bremen. *NA*

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It's Crystal clear

With an estimated market of 50,000 ships by 2019 Finnish-based Auramarine adds to the ballast water treatment system (BWTS) market with its UV-C Crystal Ballast water treatment system.

Auramarine has launched its Crystal Ballast system which utilises UV-C radiation. The same technology that is already present in solutions for treating drinking water and wastewater.

The technical solution for Crystal Ballast is a two step process with an automatic filter to remove sediment and larger organisms, followed by an intensive medium pressure UV unit to disinfect smaller plankton, bacteria and pathogens. Ballast water is treated during ballast water intake through the complete process and re-treated during ballast

water discharge through the UV reactor only (filter by-passed). Re-treatment during discharge is necessary to eliminate possible re-growth of bacteria in ballast tanks.

The complete system is installed directly online on to the ballast water piping and integrated into the shipboard ballast water pumping automation system for ease of operation. All ballast water pumping and treatment actions are logged on a system memory for harbour control or flag state surveys.

Crystal Ballast's automatic filter is installed before the UV reactor to remove

organisms and sediment as well as protect the disinfection unit. Sludge and other organisms removed by this filter are then returned to the sea during the ballasting process. The automatic filter is by-passed during the de-ballasting operation.

Additionally, Auramarine's solution does not affect the time required for ballasting or de-ballasting operations, or increase the duration of port calls.

The Crystal Ballast system has entered the Type Approval testing phase, and it is progressing on schedule. Type approvals and Final products are expected to reach the market in the second half of 2010. *NA*

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Tying down the cargo

Jeroen de Haas, MD at BMT De Beer the maritime design, engineering and risk management consultancy, discusses issues associated with container lashing and suggests improvements to stowage systems that will help protect containers and their cargoes.

Containerisation has revolutionised cargo shipping over the last 50 years with approximately 90% of non-bulk cargo worldwide moving by containership. However the flexibility that provides containerisation with one of its greatest strengths can also be an Achilles heel.

A 150,000gt container ship will carry in excess of 11,000TEU, each one of which needs to be individually secured in order to resist loads from environmental factors, ship pitch and roll, and the gross weight of other containers in the stack.

The rapid growth in container traffic, which is expected to reach 177.6million TEU by 2015 from an estimated 77.8million TEU in 2002, has also seen a proportional increase in the number of container related casualties.

BMT De Beer, a BMT Group Ltd subsidiary, has been involved in attending container stowage related casualties for over 20 years and has specific expertise and knowledge in this field (Figure 1).

Uncertainty as to the exact weight of each container is a major cause of container stowage and lashing accidents. Most ship's Masters don't know the exact weight of the containers that have been loaded because they have to rely on a declaration by the shipper.

Unfortunately declarations are not always accurate either due to human error or a desire to gain a commercial advantage. Many shippers do not have the facility to weigh each element of a container cargo and simple clerical or human errors transcribing data from a declaration onto a bill of lading, into a manifest and then onto a stowage plan can lead to errors.

But the stowage onboard the ship is based on the declared weight, with 'heavier' containers at the bottom of the stack and 'lighter' containers towards the top in order to reduce excessive heeling movement. If an over-weight container is placed at the top of the stack, either through error or because of an incorrect declaration, it can generate



Figure 1. The mis-declaration of container weights is a leading cause of container stack collapses like this one.



Figure 2. Compressed container foundations also contribute to stack collapses.

unacceptably high forces in the base of the stack leading to failure and losses if the ship encounters heavy weather. The simple act of negligence by deliberately under-declaring the weight of a container or wrongly stating the type of commodity with the view to reducing shipping costs can have far-reaching consequences.

Some shipping lines have implemented systems for intercepting and checking containers that they suspect to be overweight, but there is no pan-industry solution. However, there is the will to improve and

BMT De Beer was engaged by the World Shipping Council and the International Chamber of Shipping in 2008 to help produce a best practice guide entitled Safe Transport of Containers by Sea.

Some casualties do occur as a result of a mix of totally unforeseen events where even the most fastidious best practice could not have mitigated against the outcome. In 2007, BMT De Beer was instructed to carry out an accident investigation on a casualty that had lost a large number of containers during a storm in the Bay of Biscay. The surveying team noted that the container foundations were heavily compressed in a way that hadn't been seen before (Figure 2). This had led to container lashings going slack as a result of distortion of the deck foundations (Figure 3).

The team also noted that the manufacturer had reduced the dimensions of the twistlocks and deck sockets (Figure 4). There are no widely recognised class requirements on this item other than Germanischer Lloyd (GL), which has a requirement for the size of the flange so there is a wide range of twistlocks available on the market all with different

mechanical and material properties. Without the quality threshold of a broadly recognised class requirement it is perhaps unsurprising that some manufacturers have reduced the amount of material in their product by up to 25%. These items are still being mass produced in enormous volumes in China where the raw material is the largest element of cost. The reduction in material cost allows manufacturers to generate huge overall savings and undercut their competitors. However, the concern remained that these particular twistlocks and deck sockets would not be fit for purpose under certain operational conditions.

In order to investigate further a series of tests on a range of proprietary twistlocks and deck sockets were conducted. BMT De Beer engaged sister company BMT Fleet Technology Ltd to carry out finite element analysis to describe the behaviour of a deck socket and twistlock subject to compressive eccentric loading, which replicates the effect of a ship rolling. The model geometry consisted of two components the socket and the twistlock. These two components interacted through contact elements generated at the mating faces.

Figure 5 illustrates the meshed components. With the two components of the finite element model in the assembled position, several contact surfaces were created. These surfaces joined the model through standard contact (including a component of friction) and transferred loads between the parts, whether through pure compression or due to prying forces

Figure 5. Finite element model components.

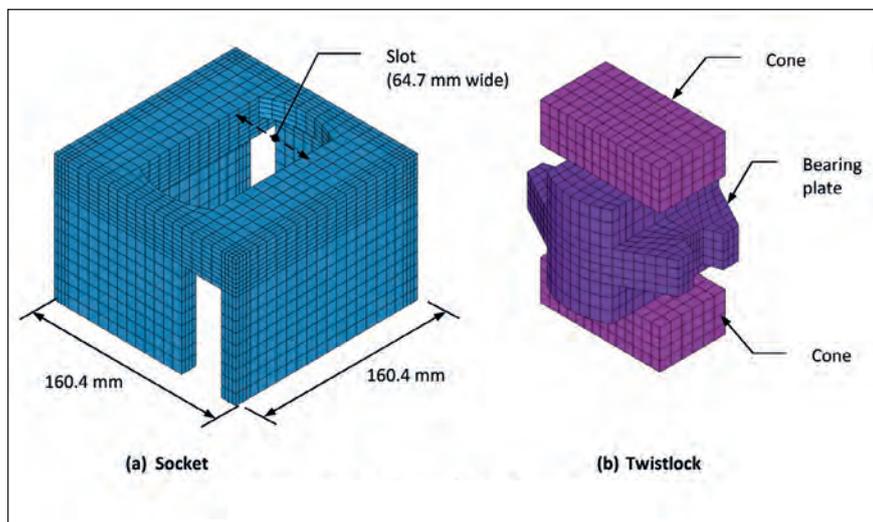


Figure 3. Loose lashing rods resulting from compressed container foundations.

associated with eccentric loading. Figure 6 illustrates the assembled finite element model and identifies the contact surfaces. Initially, some of these surfaces are not in contact due to the relative positions or tolerance gaps, but they later become involved due to eccentric loading.

Figure 6(b) illustrates a plan view of the assembled twistlock and socket. The surface areas associated with the twistlock bearing plate and the top face of the socket are 0.011m^2 and 0.018m^2 , respectively, for a ratio of $A_{\text{lock}}/A_{\text{socket}} = 0.61$. The position of the lock within the socket was adjusted transversely for different load



Figure 4. There are no recognised dimensions for deck sockets.

cases. As shown in Figure 6(c), for the initial analysis the lock is shifted to the left until it comes into contact with the left inside face of the slot.

This analysis indicated that the critical load (P_{cr} , which is defined as the load at which nonlinear behaviour is initiated) at an eccentricity of, for instance 150mm is only 25% of the critical load at an eccentricity of 0mm or pure compression). The vertical displacements and stresses induced by smaller twistlocks indicated values greater than the yield of 350MPa and thereby significantly increasing the risk of a failure and consequential failure of the whole lashing and securing system and ultimately the loss of containers overboard. Figure 7 demonstrates the calculated results with an eccentricity of 150mm. Areas shown in grey correspond to stresses exceeding the yield stress of 350MPa.

The investigation described indicated the need for a change in both hardware and operating procedures. Where appropriate, container vessels should be outfitted with specially designed base twistlocks as shown in Figure 8 and there also needs to be a certain amount of discipline by the stevedores and crew to make sure that these special twistlocks are placed in position.

Another major issue is the need to have a suitability trained and experienced crew as they have to deal with such a wide range of key responsibilities in respect of stowage and lashing. There is also a wide range of legislation relating to cargo that the crew must comply with.

The International Convention for the Safety of Life at Sea (SOLAS), incorporates requirements with regard to all aspects of the operation of a ship including,



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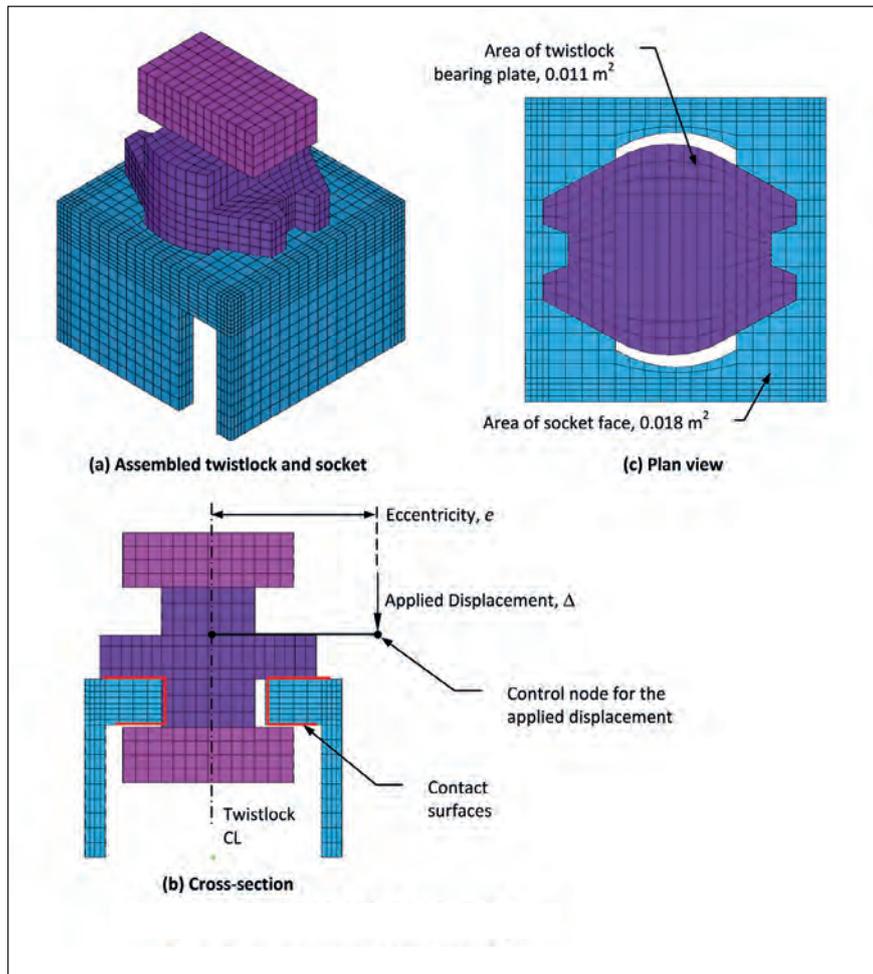


Figure 6. Twistlock and socket assembly.



Figure 8. BMT De Beer's investigation concluded that there was a need for specially designed base twistlock as shown here.

in Chapter VI, the carriage of cargoes. Regulation 5 requires that all cargo be loaded, stowed and secured in accordance with the ship's Cargo Securing Manual.

It is a mandatory requirement under SOLAS that a Cargo Securing Manual, which has been approved by the

Administration, is provided onboard. The purpose of a Cargo Securing Manual is to set out the standards for cargo securing devices used on board bearing in mind the type of cargo, the characteristics of the ship and sea conditions that a ship might encounter.

The manual should be easy to use and must contain information and guidance applicable to the ship for which the manual was drawn up; the idea being that all of the information in the ship's manual should be of use to those onboard. The information given in the manual should follow the layout described in the guidelines and should contain the necessary information specific to the ship. All Cargo Securing Manuals will therefore be in the same format, so that seafarers should become used to that format and will be able to use the manual on any ship efficiently.

Recent container related casualties have demonstrated that crews are not always as

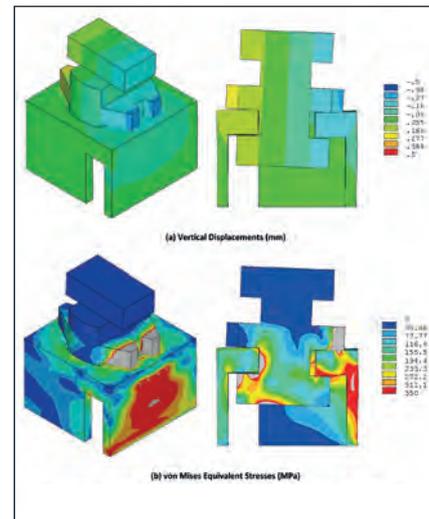


Figure 7. Calculated results with eccentricity, e , of 150mm at $P_{cr}/P_y = 0.15$ (Deflections shown scaled x 10)

well trained as they should be. Considering the scale of the container shipping industry and the risks involved, nautical academies could assist by providing more training relating to container lashing, securing and stowage than there is currently.

While there is certainly a desire for improvement from within the container shipping community, there is a far more vocal lobby from outside the sector demanding change. Container losses at sea can impact stakeholders far removed from the cargo's owner, the shipper and the insurers and the impact on the general public must be considered. The Mayors of many coastal communities on Holland's North Sea coast have regularly expressed their concern and frustration at the number of containers that regularly wash up on their beaches after a period of bad weather.

In addition, while the clearance of inert cargos is a costly and time consuming irritant, the overarching concern is the impact of the loss of a container full of toxic chemicals.

Reducing container lashing and stowage related casualties would certainly be a win-win situation for the whole containerisation value chain. But to achieve the desired result will require buy-in across the sector improve training, provision of equipment, control of container weights and best practice. That is not a revolution, but an evolution of the systems. **NA**

All that glitters

All that glitters may well be gold for the cruise ship builder Fincantieri, as it was the only company to receive an order for a cruise vessel in 2009. Maurizio Cergol, head of design for Fincantieri highlights what the future has in store for such grand vessels.

With modern cruise vessels becoming more technologically advanced in what they have to offer as onboard entertainment, we are starting to see a change in the type of cruising taking place. However, Fincantieri's mantra is that the cruise vessel 'is the destination' and with this in mind; Fincantieri aims to keep designs focus on this for the future.

March saw the delivery of *Azura* the latest cruise ship to be delivered from Fincantieri to P&O cruises. *Azura* is 290m in length, 116,000gt and will be capable of accommodating 4300 passengers. One of the main features of the vessel is the "seascreen", an open air cinema by the side of the main pool.

Although, when launched *Azura* was claimed to be the latest technological jewel from Fincantieri, the vessel is a sistership of *Ventura* and has the same design as its sistership, points out Maurizio Cergol, head of proposal design and new product management, Fincantieri.

Mr Cergol has been with Fincantieri for 27 years, where he started in the basic design department in Trieste, while there he

worked across a broad range of vessel, such as containers, ro-ro, pax ferries, tankers etc. Four years later Mr Cergol was promoted to chief designer.

Although Fincantieri is seeing a lot of action with cruise vessels still under construction at its yards, Mr Cergol says that most of the vessels coming through are sisterships that were ordered when the first order was placed and that the designs for the vessels will be like the original vessel.

One ship that is original is *Oceania*. Mr Cergol notes the *Oceania* which has been a recent project of his: "The *Oceania* is brand new, it has special needs and more luxury has been added to cater for the owners needs. There is no ship like this at the moment."

Today most ship owners are faced with cost challenges, especially with more environmental and safety rules and regulations coming in to effect from



Maurizio Cergol, head of proposal design at Fincantieri.

TECHNICAL PARTICULARS

Oceania

Length overall 238m
 Length between perpendiculars 213m
 Beam 32.2m
 Design draught 7.4m
 Gross tonnage 66,000gt
 Service speed 19.5knots
 Electrical Propulsion 2x12,000kW
 Total passenger cabins 629
 Crew cabins 443
 LSA 2100
 Outside Cabins 98%
 Balcony Cabins 96%
 Class. Society Bureau Veritas
 Flag Marshall Islands

Biography

Maurizio Cergol

Cruise vessel chief designer

Head of proposal design & new product development dept., Merchant ship business unit Fincantieri, Italy

Maurizio Cergol is the Senior Chief Designer responsible for Cruise vessels Basic Design activities and New Products Development in Fincantieri, the major Italian Shipbuilding company.

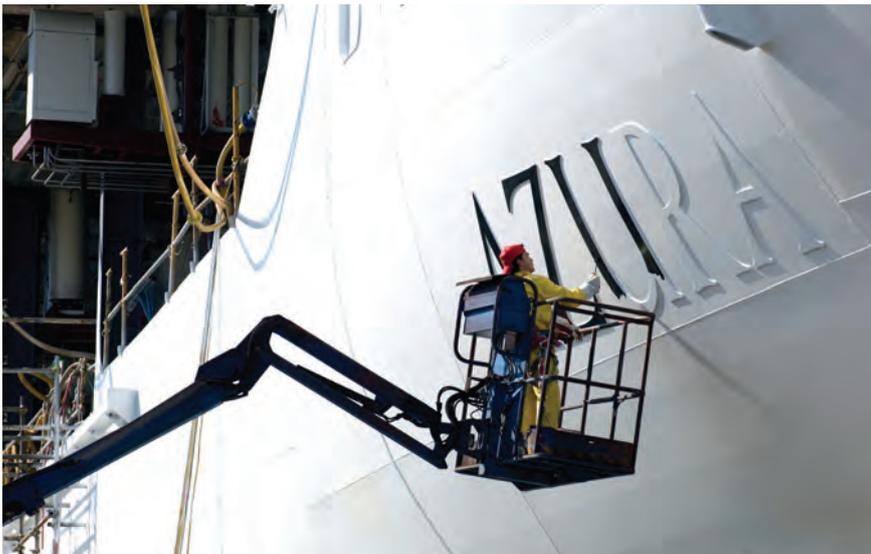
After a working experience in Civil Architecture and Interiors Decoration, he received degrees with honours in Naval Architecture and Marine Engineering from the University of Trieste in 1981 and winning the Costanzi Prize in 1982.

He joined Fincantieri in the same year, starting his career in the Basic Design Dept. of the company's headquarters in Trieste, where he worked with design teams on several ship types like Containers, RoRo, pax ferries, tankers etc.

In 1986 he was promoted to Chief Designer and he started working on cruise vessels, participating in the design of *Costa Classica e Romantica*. Since then, other than countless number of projects, studies and innovative concepts for cruise ships for several Owners, he has been the responsible Senior Naval Architect for developing, designing and contracting numerous Fincantieri Cruise Vessels Projects.



The atrium onboard Azura.



Adding the final touches.



Azura the latest vessel to leave the Fincantieri Shipyard.

Cergol said: “The question of size is always what is more economical and efficient, is it a vessel that can carry 4200 passengers or a vessel that can carry 2000, it maybe the same, but dependant upon the market at the time it may be a risk. The market can not absorb some thing of this size as it is a big jump forward.”

Mr Cergol also believes that we will not see vessels of the size of *Oasis of the Seas* in the future, as he reflects that the average size of a vessel 5-10 years ago was smaller than what we are seeing being built today. He has noted that cruise vessels in the future will average around 12-150,000gt for them to be economical for the owner.

Adding to the to the Italian-based Costa cruise line will be the launch of the *Costa Deliziosa* in 2011. She will be an emblem of the Italian-made cruise fleet and will be the first vessel in recent history to revive the “round-the-world” cruising, say Costa.

Fincantieri expects to keep moving forward in the cruise market and looks to getting more contracts in the future. Currently, Fincantieri is working on the new princess ship, and is also working on a study and development for a new project. Fincantieri has developed its cruise business across all its shipyards, Mr Cergol comments: “With the close economic market, we are waiting for the boom to happen again. The market will rise and the cruise market will see a good result when it does. It is too early though to expect big companies to do big orders, but we can propose new designs.”

He adds: “The economic situation is improving and it will probably take another two years to improve. But, we need to improve, shipbuilding is like a machine and there needs to be orders to fuel that machine, if not that machine will seize up.” **NA**

this year. Ship owners want to keep costs low, but the owner still wants a ship that performs and runs efficiently.

As for new regulation coming in to effect this year, Mr Cergol comments: “There will be a big impact, it will have to have some impact for it to work. Sometimes it is not the direct changes that has more of an effect, such as return to port, damage calculations, etc.” Adding: “Different compartments [return to port] can be more challenging for the design stage.”

Mr Cergol has said that ship design will continue to evolve and not revolutionise, that

even with the constraints of environmental demands on new designs, the ship will continue to look like a ship. However, Mr Cergol did add that the panamax design should now be dropped, as the stability on that type of vessel is limited by the width of the hull. “All new buildings that are wider than the panamax width limits are more stable. The wider a vessel the more stable, also more volume can be placed on top, adding more stability,” adds Mr Cergol.

The future of cruise vessel design looks to be expanding in size with the delivery of *Oasis of the Seas*, but contrary to this Mr

Elements of Modern Ship Construction

By E. C. Tupper

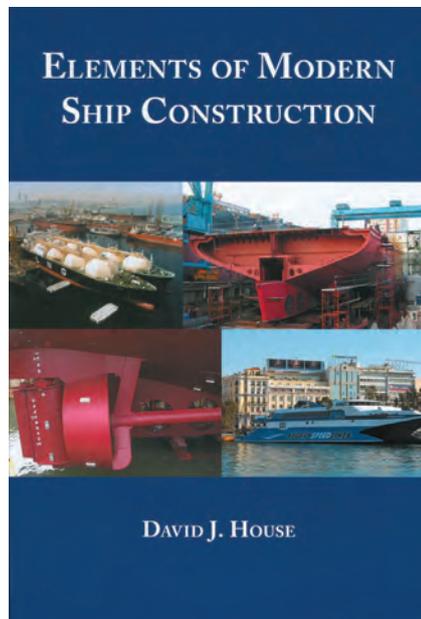
Written by David House

published in 2010 by Brown, Son & Ferguson of Glasgow as a hard back in A4 format, 370pp, ISBN 978-0-85174-814-6, £50.

The author, who currently lectures in Nautical Studies, has published fourteen books on maritime topics. He has a seagoing background in a variety of ships and has taught for thirty years. His main disciplines have been seamanship and navigation. This book is written with aspiring deck officers in mind, to give them an overview of ship design elements and shipyard practice.

The book begins with a list of abbreviations which is useful as new ones appear regularly with changing technology and specialised ship types. This is followed by a section on shipyard and construction terminology. Any specialist engineering subject has "its own language" and the maritime sector is no exception. It is important that the correct terms are used and understood. The first main chapter is devoted to Marine Measurement. Included are Imperial/metric conversions; the classing of ships; length and tonnage definitions; load lines and watertight integrity; freeboard and so on. The next chapter deals with the after end structures and equipments. It covers propellers and podded propulsion; rudders of various types and their bearings; stern tubes and thrust blocks and the general aft end shape.

The next three chapters deal with other areas of the ship – bottom structure and engine room spaces; upper and lower deck structures and hatch design; the fore end, including anchoring arrangements. These design elements are discussed with some comments on assembly. The book is fully illustrated throughout. There are over 330 diagrams and photographs, some in



colour. Whilst these show what the various features look like it would have been useful to have had dimensions, weights and scantlings quoted for typical ship types and sizes. Some idea of scale is provided

“this approach is acceptable in a book which is essentially aimed at sea going officers for whom it provides very useful background knowledge of the ships in which they serve.”

by the deck heights when shown, but it would have helped to know the thickness of plating which can be very significant in large ships. That can influence construction and repair methods, often making

them more difficult.

The next three chapters are devoted to the features of different ship types – passenger and ferry; oil, gas and chemical carriers; dry cargo carriers. The final chapter deals with miscellaneous features such as helipads and life saving appliances including lifeboats and their davits. Finally there are two annexes, of some 70 pages in total, which discuss various shipbuilding operations – prefabrication, welding, docking (although the author concentrates on the hydrolift docking system), launching and shipbuilding materials. Also discussed are the stresses to which a ship, and its structural elements, are subject. These include the bending moments and shear forces on the hull and more localised loads due to docking. There is a fair amount on aluminium as a building material. I would have liked to have seen more on dry docking of ships as ships' officers are more likely to be involved with this than with the launching of a ship. Also, although they are mentioned, I would have liked more on the impact of computers in the design and construction of ships and, in turn, on their operation.

As one would expect, the book draws heavily on regulations and classification rules as these often have a major influence on the final design of a ship. References to further reading and to relevant web sites would have been useful, enabling the reader to follow up in more depth, points of particular interest.

Books on ship construction are relatively few and far between although the sixth edition of D. J. Eyres' Ship Construction was published in 2007. This current book covers a wide range of topics which means that most are not dealt with in real depth. That is why references to further reading would have helped. However, this approach is acceptable in a book, which is essentially aimed at sea going officers for whom it provides very useful background knowledge of the ships in which they serve. As the author also discusses some areas of a ship which are particularly susceptible to corrosion, or damage in service, surveyors will also find it of some interest. **NA**

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Uncompromising ro-ro's

Dear Sir,

With reference to your leading editorial article "Are ro-ro's compromised" (*The Naval Architect*, April 2010, pg 7), even though modern 'First World' ro-ro's are much safer than the Herald, these vessels are still compromised! In the case of the Herald, because her bow doors were open, she took onboard sea water, at an estimated rate of 600tonnes per minute. The ship only needed about 1000tonnes of water on her car deck to capsize her, which took about 90 seconds.

At the University of Portsmouth, where we used 1/100th scale models of the Herald, we found similar numbers to apply in capsizing the ship. We recommended that such vessels should have built some 2ft (0.61m) above their existing watertight car decks, a perforated car deck, sandwiched between the two car decks, with several dwarf longitudinal watertight bulkheads, to prevent the resulting water ingress from sloshing side to side and capsizing the vessel.

We found that for the passive case (without hydraulic pumps), a modified *Herald* model needed five times more water to cause the vessel to capsize than the unmodified model. Moreover, when we introduced four pumps to our modified model, to expel the water, we could not capsize her, despite pouring water on the car deck at some equivalent rate of over 3000tonnes per minute.

Our invention works and this can be seen on our video link: <http://www.youtube.com/watch?v=0D7ztCzaOAE>

As for *Estonia*, I have my doubts that her demise was principally due to the ingress of water on her car deck, because, although her visor was ripped-off, she had a watertight ramp door behind this and videos of the sunken vessel show that her ramp door was intact immediately after her sinking. Moreover, she had some 18,000m³ of air space below her watertight car deck. Thus, she should have capsized but floated and not sunk in about 40 minutes.

The loss of life due to capsizing ro-ro's in UK waters has been in single figures since 1945. This is put into context when we realise that, in 2006 the UK alone, some 99 people died when they fell out of their 'domestic' beds! A video of my views on the sinking of the *Estonia* can be seen at: http://www.dailymotion.com/video/xa8x66_the-sinking-of-the-estoniaanother-v

Yours sincerely,

Professor Carl T.F. Ross, B.Sc., Ph.D, D.Sc, C.Eng, FRINA, MSNAME,

Department of Mechanical & Design Engineering,
University of Portsmouth, UK.

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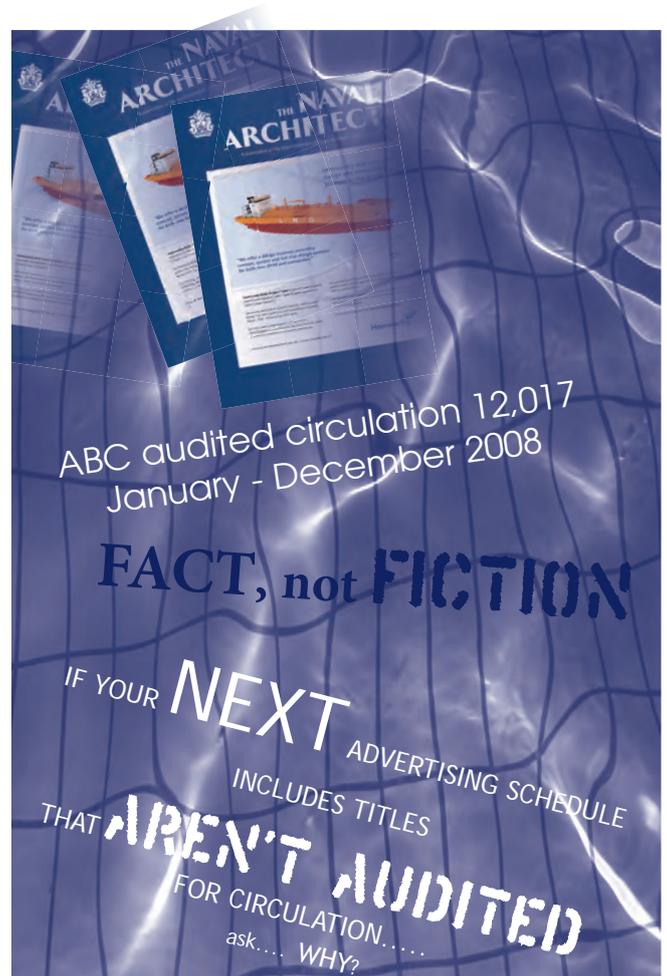
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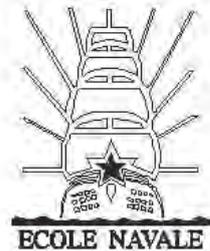
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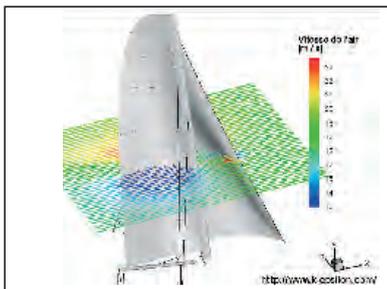
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The conference will be held in the auditorium of the Cité de la Voile Eric Tabarly in Lorient/Brittany, which opened in the beginning of 2008 and is dedicated to the adventure which is modern sailing, of which Eric Tabarly is an emblem. The Cité is situated in the heart of the old submarine base which, after its closure in 1997, is being converted into a big nautical project centre called 'Le Nautic de Keroman'. Already, an important builder of multihull sailboats, a manufacturer of carbon masts, the logistical centre of the biggest European boat fittings supplier, and nine offshore racing teams are installed here, next to the Cité de la Voile Eric Tabarly. The language for the papers and presentation at the conference is English.



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