THE NAVAL ARCHITECT

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Cruise ship technology / Finland's marine industries

Cranes & cargo handling / **February 2010**

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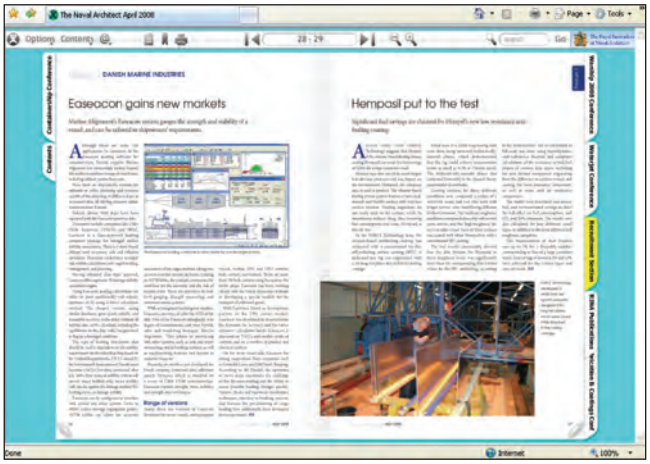
Printed in Wales by Stephens & George Magazines.

A one-year subscription in 2010 to *The Naval Architect* costs £125 (UK), £130 (Europe), and £140 (Rest of the world).

Audited Circulation 11,650
JAN–DEC 2009
ISSN 0306 0209

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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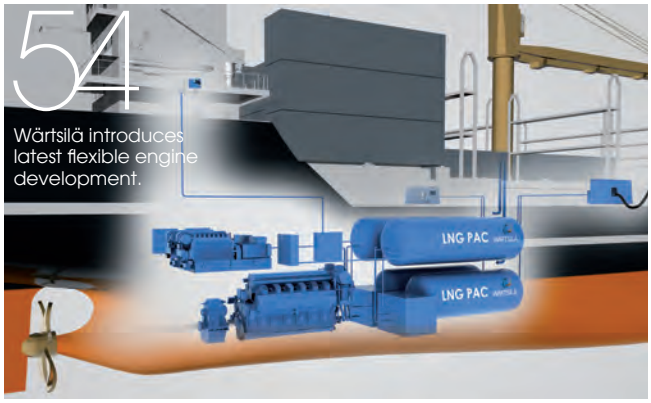
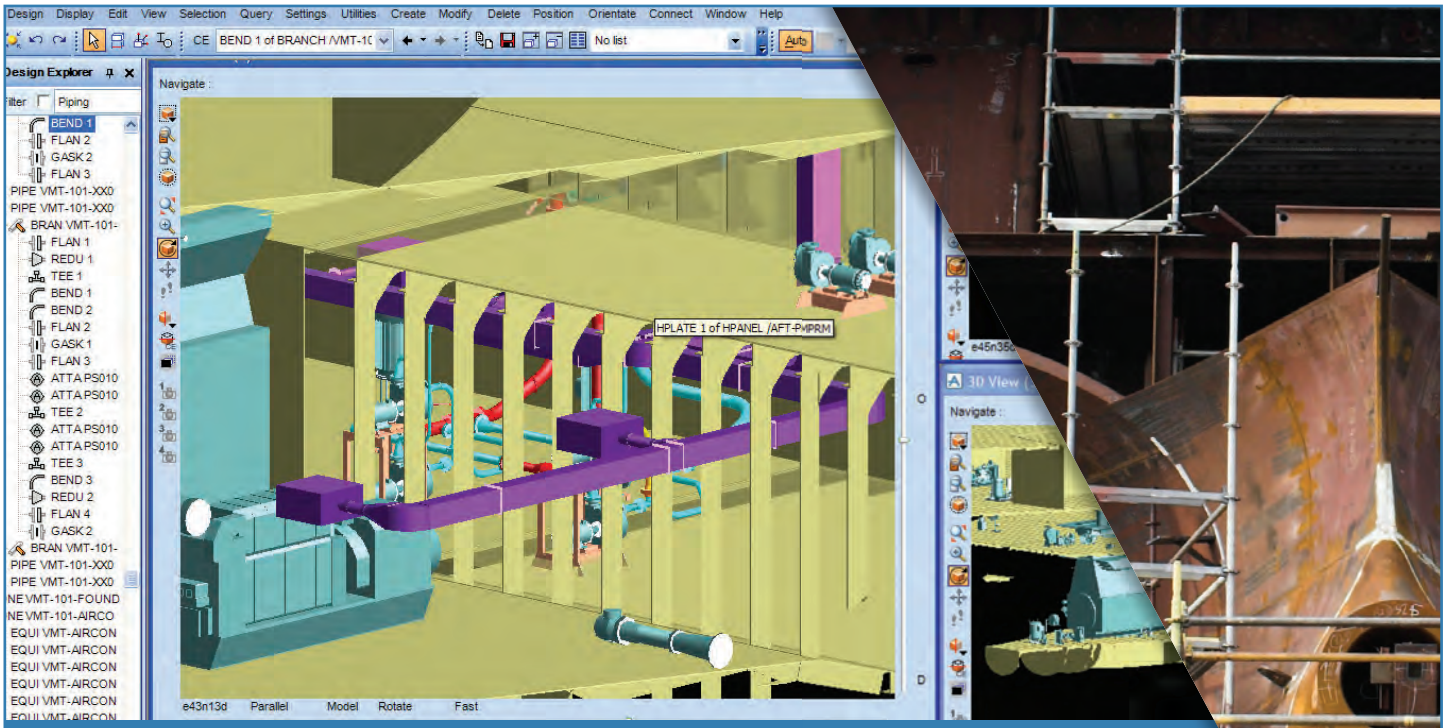
27-68 Features





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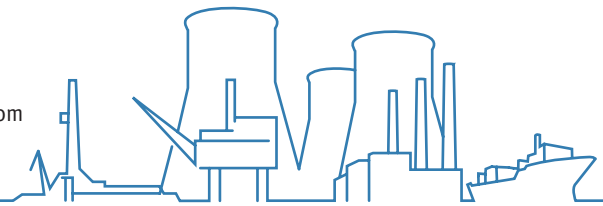

Economics and regulation, a permanent struggle.

The chemical tanker *Ece* floundering in the English Channel following a collision with another freight vessel in January 2006. The ship sank as it leaked its cargo of phosphoric acid.

Regulation defines the way we build and use ships and that is the way it should be though in the cruise sector, one could be forgiven for thinking that economics is the key factor.

Delivery of the *Oasis of the Seas* and the impending delivery of its sistership the *Allure of the Seas* has taken the cruise industry by storm. The vessel is a landmark in terms of size and design. At 225,000gt the vessels are the largest cruise ships ever built and they sport many new features, the Aquatheater, the division of the vessels into two "neighbourhoods" and the computer systems that are built on wi-fi and fibre optics are state of the art.

Redefining the cruise experience the *Oasis* has raised the bar, but is bigger necessarily better? Luring passengers to large ships may be more difficult in the future, even as the global economies slowly revive. Costa Crociere have also taken delivery of the *Costa Luminosa*, but this is a far smaller, 92,000gt, more flexible vessel. Costa *Luminosa* and its sistership *Costa Deliziosa* are small enough to traverse the locks of the Panama Canal, but large enough to sport the world's largest "wellness centre" on a cruise ship and Formula 1 and golf simulators and a Joseph Farcus designed interior. From the fjords of Norway to Dubai and the Americas Costa Crociere's new vessels will be capable of operating in most markets.

Both vessel types have had rigorous safety assessments and lay claim to being more efficient and environmentally friendly as required by regulation and an increasingly climate aware clientele.

Perhaps the most significant change in the cruise industry has passed comparatively un-noticed beneath the radar with the South Korean yard Samsung Heavy Industries becoming the first Far Eastern yard to enter the cruise shipbuilding market. In building *Utopia*, a 900 passenger 296m long vessel that will cater for a more select clientele. *Utopia*, which will be delivered in 2013, is a new concept in cruising and it is a bold project that will offer the long-term lease, 75 year, of cabin apartments onboard the vessel. The ship will then travel to regions where major events are taking place, such as the football World Cup or other world events and passengers will be able to attend these events from, effectively the comfort of their own home. Apartments will range in price from US$3.7 million to US$25million and will go on sale this year. It remains to be seen how well the apartments sell and how successful this new type of cruising will be.

Many of these cruise ships have been designed using the International Maritime Organization's (IMO) probabilistic rules and are considered to be amongst the safest ships around. In fact the *Oasis* had more than 9000 damage scenarios tested under these new regulations.

Smaller passenger ships with long low holds, such as ro-ro ferries may turn out to be less safe as the UK authorities at the IMO's SLF52 committee meeting pointed out at the end of January.

The UK group will now lead the re-established Correspondence Group of the IMO and will report back on its findings at the next meeting in January 2011.

Meanwhile, SLF52's major discussions were on the damage stability of chemical tankers and the feeling from the UK authorities here was that there had been some progress. The IMO sub-committee agreed that there was ambiguity in the regulations and that guidelines for were necessary for owners and masters so that they could comply with, what were considered to be adequate, regulations.

Guidelines will be separated into two sections, the design and application of stability information that will make certain that a vessel design complies with regulations; and secondly the operational aspects of loading a tanker that will help masters, surveyors and inspectors to be certain that a vessel complies with regulations.

Agreement on the need for guidelines was reached despite the concerns of some parties, notably the delegation from the Cook Islands and the non-government organisation International Parcel Tanker Association which acts as an advisor, as do other organisations, to the sub-committee.

According to source's at the IMO the major concern from the Cook Islands delegation was that the UK and its co-sponsors had not demonstrated a compelling need for guidelines. The delegation said that the conclusions reached were based on research that used a sample that was too small to be conclusive. *NA*

Business

Wärtsilä global job cuts

Wärtsilä has announced that it will sack 1400 staff from its global workforce as it expects the contracting orderbook to impact negatively on sales by between 10% and 20% during the course of this year.

An increase of 14% in net sales last year and increased profitability was not enough to secure Wärtsilä workers their jobs as the company forecasts a severe downturn in net sales this year compared to 2009.

The company said following the analysis of its "manufacturing footprint" late last year it will cut its manufacturing capacity and move the bulk of its propeller and auxiliary engine production to China, "close to the main marine markets".

The propeller and component shops in The Netherlands will both be closed with the loss of 570 jobs and the Vaasa, Finland factory making generating sets will also swap production to the Far East.

"The world has dramatically changed in a short period of time. China has become a strong maritime centre and its growth will continue," said Ole Johansson, Wärtsilä's president and CEO, he added: "By developing our manufacturing footprint and our businesses for the future key markets Wärtsilä will further improve its competitiveness and service to our customers in the tightening markets. It is our responsibility to ensure Wärtsilä's leading position now and in the future."

The company estimates that the restructuring will cost €140million and that it will eventually realise savings of between €80 and €90million.

Business

More Finnish job cuts at STX Europe

European shipbuilder STX Europe has announced the loss 430 jobs from its Turku yard to be implemented in full by the end of this year following discussions with workers' representatives.

The yard, owned by Korean shipbuilding group STX Corporation, said in a statement: "The need to significantly improve the competitiveness and cost-effectiveness has increased; this is accentuated by a drop of the market prices of up to tens of per cents. Improving the cost-effectiveness and streamlining the operations are prerequisites for the future of the shipyard."

The company added that no new orders had been taken and the situation in the shipbuilding industry globally had not improved and this was having an impact on the employment situation.

"The need to significantly improve the competitiveness and cost-effectiveness has increased and this is accentuated by a drop of the market prices of up to tens of per cents. Improving the cost-effectiveness and streamlining the operations are prerequisites for the future of the shipyard," a company statement said.

Propulsion

Scandlines Propeller efficiency gain

VScandlines said that by fitting a modern propeller to its ferry, *Scandlines Sassnitz*, which operates between Trelleborg, Sweden, and Sassnitz, Germany, has made 12% efficiency savings.

Rasmus Nielsen, Scandlines' project engineer said that originally MAN Diesel had targeted an 8-10% reduction in fuel consumption, however, he added "Our tests document that this has realised an increased efficiency of no less than 12%... it's very pleasing that our measurements show an even better result."

Brian Grusgaard, manager of Upgrading Retrofit Support at MAN Diesel Propulsion After-Sales said: "Scandlines was a front runner within retrofit propeller optimisation and the 21,154gt *Sassnitz's* fuel consumption has now been reduced, which is also an environmentally friendly solution. We expect many such retrofits in the future, and are currently in contact with a good number of other ship owners who are very interested in propeller optimisation."

Mr Grusgaard said that MAN Diesel had been in contact with many shipowners that were interested in the company's propeller optimisation programme and that the company expects to undertake a significant number of retrofits in the future.

Engineers fitting *Sassnitz's* new propeller blades.

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Software

Autoship next generation

Autoship Systems Corporation (ASC) has announced that it has released its next generation of Autoship marine design software.

ASC said the latest development in its flagship surface modelling programme Autoship has improved usability due to a re-write of the surface-to-surface intersection functionality, removing the need for users to worry about the tolerances plus a host of additions to what the Navigator can do. Many user-inputs will also be streamlined. The Pro version of the programme will allow import of Initial Graphics Exchange Specification (IGES) entities 141 and 143, further broadening the designer's capabilities, ASC said.

The stability and strength calculation programme, Autohydro has been increased in scope to include the latest regulations. These will include the new probablisitic damage assessment rules and enhanced handling of free surface effect. A new configurable report tool has been added that will shorten the time needed to produce customised reports. Also, a new model-maker for model creation and an editing tool will be released as part of the package, which has been designed from the latest developments in user-interface controls.

Planning is also underway for the closer integration of modelling for Autohydro from within Autoship. ASC, in realising the need for developing more integrated software due to vessels becoming more complex, has shifted into developing the capabilities of its Autoship software.

Classification

ClassNK publishes welding guidelines

ClassNK has published new guidelines aimed at shipbuilders and owners outlining the possible advantages of using a welding method that could protect the integrity of welding joints on vessel hulls.

The class society expects that laser beam arc hybrid welding will be widely used in the future. A ClassNK statement said: "Laser beam arc hybrid welding, a high performance welding process, for the shipbuilding field is being studied. Laser beam arc hybrid welding is a high quality welding process notable for realising high efficiency in welding work that can inhibit thermal deformation."

The publication, Guidelines for laser beam arc hybrid welding will provide a "unified approval" of the welding procedure, "and related welding procedure specifications applicable to hull structural members".

Currently shipyards use CO_2 semi-automatic welding and submerged arc welding methods and these joints come under immense pressure during the working life time of the vessel.

The vessel structure will operate in a corrosive environment and will endure massive impact loads, fatigue and wave loads. "To ensure the safety of the ship and to prevent marine pollution, it is vitally important to establish the quality of welded joints," said ClassNK.

Newbuilding

Mitsui's 56 delivered

Mitsui Engineering & Shipbuilding Co., Ltd. (MES) has completed and delivered a 56,000dwt bulk carrier *Ocean Leader* (MES Hull No.1792) at its Chiba Works on 20 January, 2010.

Owners Mingtai Navigation Co., Ltd., Taiwan took delivery of the handy-max bulk carrier which has a large cargo hold capacity of over 70,000m^3. This bulk carrier series, known as Mitsui's 56, is popular in the market with more than 150 units ordered from MES.

TECHNICAL PARTICULARS

Ocean Leader

Length oa	189.99m
Length bp	182.00m
Breadth (moulded)	32.25m
Depth (moulded)	18.10m
Draft (moulded)	12.69m
Gross	31,753gt
Deadweight	56,136dwt
Main Engine	MITSUI-MAN B&W 6S50MC-C x1set
Ouput (MCR)	9480kW x 127min^{-1}
Service Speed abt	14.5knots
Complement	24 persons
Classification Society	NK
Flag	Panama
Date of Delivery	January 20, 2010

Lifesaving

MES developed for specialist ships

Brude Safety and Ulstein Design have developed the Marine Evacuation Systems (MES) used on passenger vessels, where passengers evacuate a ship through a chute directly into waiting life raft, for use on specialist ships such as offshore support vessels.

The system can be used in international waters from a height of three metres up to a maximum of 20m. Crew will evacuate into life raft waiting below.

Already installed on the 6570gt *Polarcus Nadia* a seismic vessel which was delivered late last year, and the system will also be installed on the second vessel *Polarcus Naila* that was delivered from Dubai Drydocks World last month. The remaining four vessels in the

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Lloyd's Register

LIFE MATTERS

six-ship series will all be equipped with the MES.

The system is manually operated by two crew meaning there is no need for hydraulics or electrical supply. When the chute deploys crew will evacuate into 65 and 10 person life rafts directly.

"All components are made of marine aluminium. The system container is bolted to the deck of the vessel and designed to hold the launching ramp and chute in a deployed position. The container door is opened by means of two gas cylinders. When the container door is in the open position, the launching ramp and chute are ejected and lowered into the deployed position in a controlled manner," said Brude.

Ulstein SX124 design *Polarcus Nadai* seismic vessel.

Newbuilding

DSME secures first 2010 orders

In one of the first contracts for the New Year Daewoo Shipbuilding and Marine Engineering (DSME) has received orders for two VLCC, including one option, and two bulk carriers from the Thessaloniki-based Greek owner Angelocoussis Shipping Group.

The oil tankers will be 320,000dwt and the bulk carriers will be 180,000dwt each and will be the standard DSME designs. All the ships are expected to be delivered by the end of 2012.

Newbuilding

Samsung order for two suezmaxes

Stena Bulk has ordered two 158,700dwt suezmax tankers with an option on two similar vessels from the Samsung Shipyard in South Korea. The two options must be declared by the spring of this year.

The ships will be 274m in length with a 48m beam and will be delivered in 2011. Stena said that it will invest US$7million in state-of-the-art technology that will mean the tankers consume 10% less fuel than comparable suezmax tankers of today.

The ships will be named *Stena Superior* and *Stena Supreme* and they will both be deployed in the Stena Sonangol Suezmax Pool. The tanker pool, which has operated for the past five years, currently has 15 vessels within its remit and this will be expanded to 25 ships over the next three years.

Business

Dutch and Qataris in Ras Lafan deal

IQatar Gas Transport Co (Nakilat) and Dutch firm Damen Shipyards Group are to jointly operate a shipbuilding facility at the Qatari port of Ras Laffan, the companies said.

Nakilat, the world's largest shipper of liquefied natural gas (LNG), and Damen have agreed to establish a joint venture 70% of which will be owned by the Qatar Gas and 30% by Damen to run the shipyard, a statement said.

Nakilat Damen Shipyards Qatar, the 15-hectare (37.1 acre) shipyard built on reclaimed land in the expanded port of Ras Laffan, will begin operations in the first quarter of 2010. Neither company gave the value of the deal.

The shipyards will produce commercial vessels, naval and coastguard ships and luxury yachts of up to 120m long.

Environment

Samsung to go green

Samsung Heavy Industries (SHI) has announced that it will build only environmentally friendly vessels from 2015, that is vessels that achieve a 30% reduction on greenhouse gas emissions.

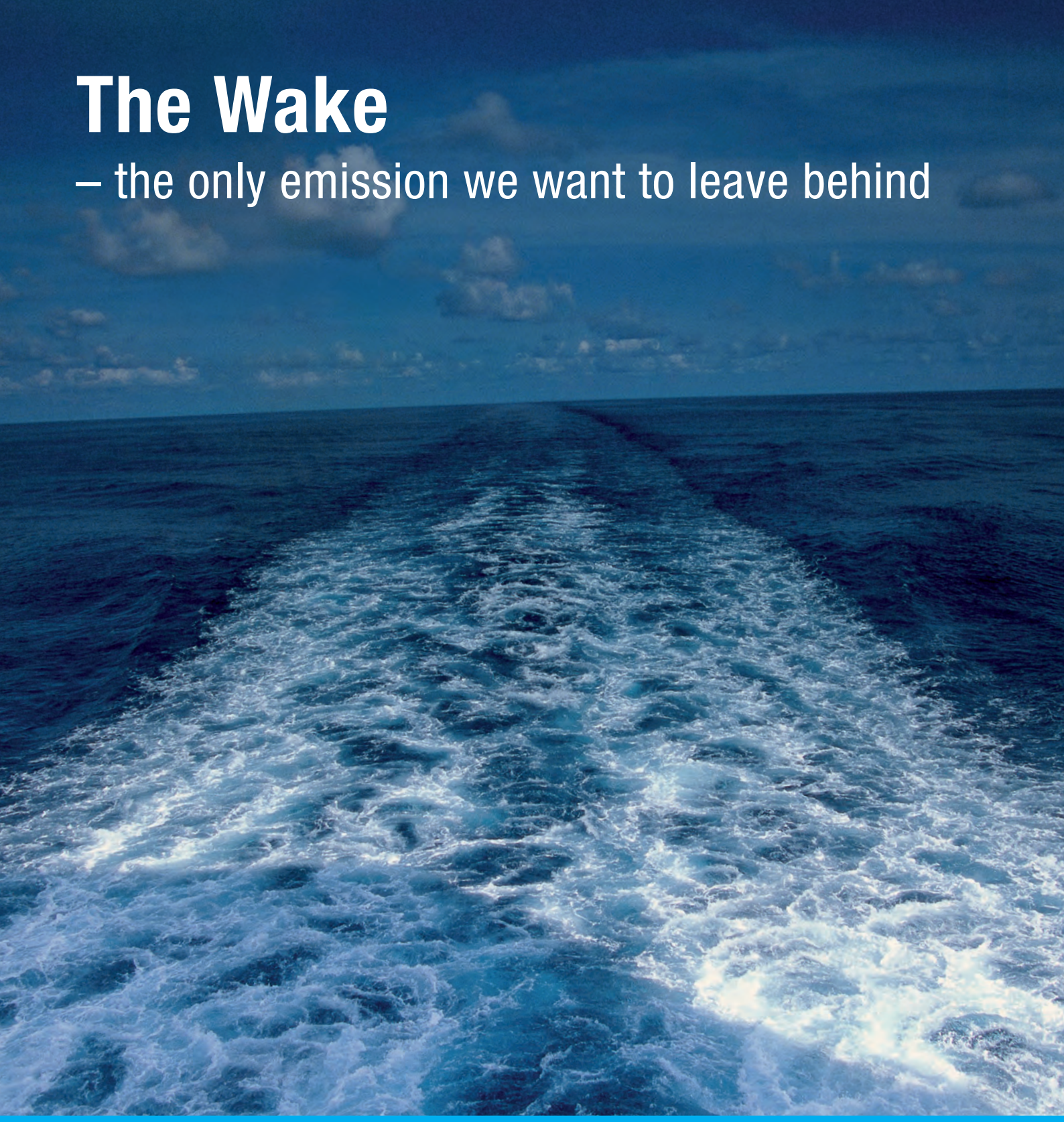
The company said: "As the first step of its journey, the Company aims by 2015 to design the optimal shape of ships that will maximize fuel efficiency, and to develop diverse technologies to improve energy efficiency, including heat recovery devices and low-temperature combustion devices, in order to reduce the greenhouse emissions of its ships.

In particular, the Company has set a goal of building the world's first eco-friendly ship by developing LNG and hydrogen fuel cells, super-conduction electricity-powered motors and cables, and CO_2 collection technology, jointly with universities and private research centres."

SHI has, in addition, designed a 13,000TEU container-ship and the company has run simulations of the vessel that show a 30% reduction in greenhouse gas emissions.

"Experts predict that companies that enter the green technology shipbuilding market early will lead the shipbuilding and marine transportation industries in the future," said SHI.

Samsung pointed to its experience of leading the field in its development of double-hulled oil tankers in 1992 and electricity-powered LNG carriers in 2001, both of which were world firsts." *NA*



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Ancillary equipment

Cygnus launches hatch sure

Cygnus Instruments has announced the launch of it latest product Cygnus Hatch Sure a system for ultrasonic testing of hatch covers. Cygnus Hatch Sure is the next step in the evolution of hatch cover testers. It is the result of feedback from marine surveyors around the world and is now the benchmark for the marine survey industry.

Sea water ingress is one of the major sources of damage to cargo resulting in expensive insurance claims. The system provides a quick and effective method of evaluating hatch seals. Leaks can be detected accurately and reliably. Cygnus Hatch Sure is ABS type approved and is accepted for use by P&I clubs. It can be used in place of hose testing and has the advantage of use in sub zero temperatures and no pollution risks.

The Key benefits of this new instrument are digital calibration controls, open hatch value and sound level in dB are simultaneously displayed, powerful and robust transmitter, lightweight & easily transportable, three year warranty.

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Cygnus launches hatch cover leak detector.

CAD/CAM

Just add ICE

CD-Adapco has announced that its STAR-CD V4.12 and es-ice V2.16, CD-Adapco's toolkit for engine simulation are now available to download. The principle ICE related features of STAR-CD V4.12 include: Extension of liquid property database for fuels and liquids. Introduction of Continuous Multi-Component (CMC) approach for modelling multi-component fuel sprays. A new sub-grid-scale spray induced turbulence model for LES simulations. The ability to use pure oxygenated fuels such as Ethanol with ECFM and ECFM-3Z; AKTIM ignition model for ECFM-CLEH for ECFM and ECFM-3Z; Improved G-equation combustion model; Consolidated TIF combustion model.
Enhancements to es-ice V2.16 include: Improvements to the meshing engine - including better cell trimming and prism layer definition for the ports of mapped models. Added ability to graph the input all 1D input parameters including: initialisation, boundary conditions, rpm, piston motion, etc. Introduction of apparent heat release (AHR) to es-ice post processing. The new versions of STAR-CD and es-ice are available for download from CD-Apaco's user service site.

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Paints & coatings

Universal primer meets requirements

A new range of universal primers for the newbuilding market is being introduced to address the productivity, regulatory, performance and commercial needs of shipyards and ship owners alike from International Paint.

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For the ship owner the range provides long term asset protection with controlled through life maintenance costs, high performance corrosion and abrasion resistance and PSPC compliance.

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Lubricant Technology

Castrol invests in Shanghai

Castrol Marine has announced it will be developing a dedicated lubricant technology centre in China. Located in the Jinqiao Science Park in Shanghai, the technology centre will focus on the development of lubricant technology for the marine industry. It will also support Chinese businesses that operate overseas.

The technology centre will feature state of the art analytical and lubricant development laboratory areas, a training facility and high-tech conference centre. It follows on from Castrol's recent launch of a tote tank offer at Guangzhou, China

Luigi Tedesco, sales director for Castrol Marine, said: "This investment reinforces Castrol's commitment to its Chinese customers and consumers and is a key part of our strategic plan to expand our business in China. Together with our research and development centres in the United Kingdom and Germany, the new technology centre will give us a world class capability to meet the unique and exciting challenges of the Chinese market and the wider ASPAC region, both now and in the future. Shanghai was chosen because it is easily accessible for our customers and partners and we believe we can recruit talented scientists and engineers locally."

The new technology centre will be fully operational by the end of 2010 and will initially employ up to 20 Chinese and international scientists and engineers. This team will work collaboratively with vehicle manufacturers, distributors and other partners focusing on leading edge lubricant technology support, development and training.

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SeaSafe Systems Ltd has invested a in new machinery for making lifejacket lungs. By bringing this specialist technology in-house it means they can make and assemble all parts of a lifejacket at their large factory on the outskirts of Cowes. SeaSafe are best known for their range of coats and jackets with concealed lifejackets, worn by professional mariners the world over, with a coat range called Voyager featuring a hidden lifejacket now available to recreational and racing sailors.

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Safety

Two in one safety solution from ESAB

ESAB has announced it will now stock a type of hat adaptor that will save the wearer the time and bother of changing safety wear for different working situations.

The Hard Hat Adaptor has been developed for sites where welders need to use both a hard hat on health and safety grounds as well as a welding helmet. The equipment is ideal for use in areas such as shipyards and construction sites, where fear of falling objects requires a hard hat, simultaneously with welding equipment, becomes an issue.

The hard hat adaptor is simply attached to a New-Tech Helmet, after the removal of the internal head harness, in a matter of seconds.

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provide maximum comfort, but additionally, they offer a wide viewing area and provide protection to the ears and neck, as well as just the face.
The area in front of the mouth is larger for a good flow of fresh air, this feature will also ensure there is no build up of carbon monoxide. The hard hats are available in a choice of colours, these being yellow, white, blue, green and red.

Contact ESAB, Hanover House, Queensgate, Britannia Road, Waltham Cross, Hertfordshire, EN8 7TF, UK.
Tel +44 800 3893152
Fax +44 1992 788053
E-mail info@esab.co.uk
www.esab.com

Propulsion

Veth for new passenger vessels

German-based Premicon has ordered six new passenger vessels at the Volkswerft in Stralsund, Germany. For the last five of the six ships they decided to use Veth Z-Drives and Veth Compact-Jets.

The order concerns the development of passenger vessels for the shipping company Premicon in München. The intention exists of three orders as well as three options for identical cross liners. Five of these six ships will be equipped with each a contra rotating Veth Z-Drive type VZ-800A-CR and a Veth Compact-Jet type CJ-1000.

The Veth-Z-Drives are also exceptionally quiet. By using the best spiral tooted gear wheels with a minimum of resistance the units are very quiet. The sound can be reduced even more with flexible suspension and/or contra rotating propellers which is the case with the ships for Premicon. Main navigation area for the 135m long ships will be the Rijn, the Donau and the Main-Donau-Channel. The four deck-ships with up until 110 double huts will be ready for delivery between 2010 and 2012.

Contact Veth Propulsion, P.O. Box 53, 3350 AB Papendrecht, The Netherlands.
Tel +3178 615 22 66
Fax +3178 641 11 69
E-mail info@veth.net
www.veth.net

CAD/CAM

Sener upgrades FORAN

The Spanish company Sener has recently launched the new CAD/CAM marine System FORAN release V60R3.0, with new developments in all disciplines that considerably improve the performance during the ship design process.

Sener has launched the new FORAN release V60R3.0, with important developments which allow the complete ship design in a collaborative and integrated environment. As a consequence, Sener with a clearly defined strategy, focused on innovation and customer requirements, is always looking ahead to situate FORAN as the reference in the marine CAD/CAM sector, both in naval and commercial areas using state-of-the-art technologies.

Contact Sener, Severo Ochoa 4, Parque Tecnológico de Madrid, 28760 Tres Cantos, Madrid, Spain.
Tel +34 918 077 000
www.sener.es

CAD/CAM

Aveva launches FEM interface

Aveva has announced the release of its Aveva Hull Finite Element Modeller (FEM), a new addition to the Aveva Marine portfolio which accelerates and simplifies the stress analysis of ship structures.

Aveva Hull Finite Element Modeller has been developed in collaboration with leading shipbuilders to overcome analysis problems. It applies sophisticated, rule-based methods to ensure the rapid idealisation of structures created in Aveva Hull Structural Design, to faithfully represent the essential characteristics of the physical design while ensuring accurate and computationally-efficient analysis in third-party FEA programs.

Commenting on this important new release, Stéphane Neuvéglise, Aveva's product marketing manager for Aveva Marine said: "This product meets a widespread demand in the shipbuilding industry, which must meet stringent international regulations while faced with severe competitive pressure to achieve ever lower costs and shorter delivery times.

"Aveva engineers have worked closely with our collaboration partners to develop an extremely powerful and easy-to-use application which is already meeting or exceeding expectations on a number of different projects. Users have consistently reported achieving 30-50% reduction in direct man-hours for FEA, as well as valuable gains in design quality, timescale and avoidance of construction rework."

Aveva Hull Finite Element Modeller is available for immediate deployment in an Aveva Marine environment and may be used effectively on all types of commercial or naval vessel designs, or other floating structures.

Contact AVEVA Solutions Ltd, High Cross, Madingley Rd, Cambridge, CB3 0HB, UK.
Tel +44 1223 556655
Fax +44 1223 556666
E-mail name@domain.com
www.aveva.com

The shipyard's aid to risk aversion

Cost planning requires estimations which are combined with uncertainties. These uncertainties can be handled efficiently by special methods and systems. Report by Dr. Jan O. Fischer, of costfact*, and Professor Dr. Ing. Gerd Holbach, of TU Berlin**.

Cost planning in shipbuilding always requires estimations. Especially in the early project phases those estimations are combined with uncertainties. The software system 'costfact', which supports the planning, analysis and control of the product's costs throughout all of the building phases, offers special functions to handle those risk estimations. costfact gives an overview of the distribution of different risk classes and calculates how much the expected cost will probably differ from the planned cost.

Cost management in shipbuilding

Cost pressure in shipbuilding has intensified over the past few years substantially. Many shipyards have already gone bankrupt through worldwide competition and the inability to keep to their original budget that the offer was based on. In the naval sector it is not unusual to double the originally estimated costs when building the vessel.

As up to 90% of the total costs are fixed at the start of production (Figure 1) it is obvious that approaches to optimise costs have to be considered in design and engineering. However, this is complicated by the fact that there is only insufficient cost information in these early phases.

Therefore, estimating and planning the ship's costs is a protracted process. Simultaneously the pressure of time limits leads to difficulties with determining exact and robust cost information. Last but not least, the existing data base, generated in past projects, is far from complete, caused by the lack of an integrated system for managing and providing the cost information. Hence, it can be said that there is a big gap between existing cost optimisation systems and of controlling the allowable costs.

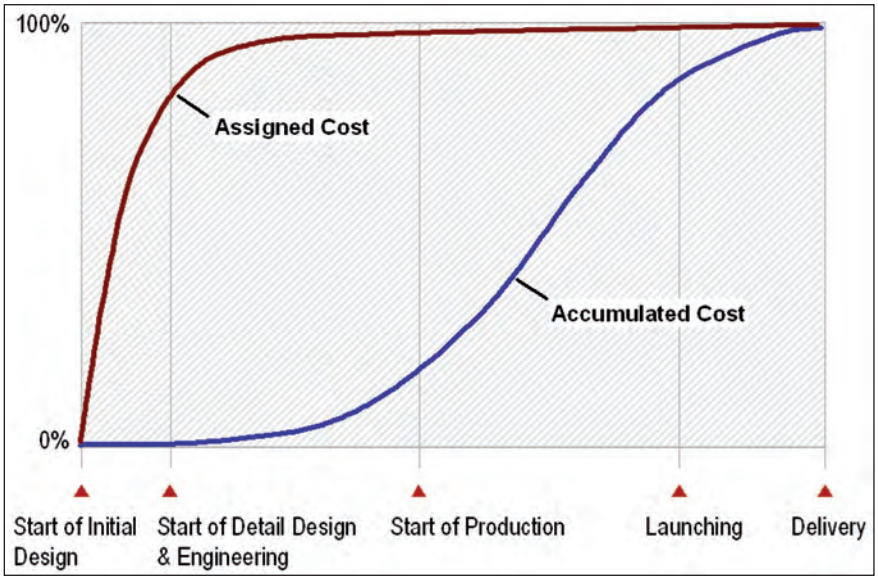

Figure 1. The greatest part of the costs is fixed after the initial design.

Against this background a software solution ('costfact') was designed by the company of the same name, of Cologne, and the department of design and service of maritime systems of the University of Berlin (EBMS). costfact is based on an existing tool that has already been applied in plant engineering. The modification of costfact for the maritime industry is based on experience, which the head of EBMS gained by more then 10 years experience at Flensburger Schiffbau-Gesellschaft shipyard in leading positions and with responsibility for cost estimation and budgetary control.

Cost planning in shipbuilding with costfact

The main value of costfact is its ability to enable the user to determine and describe the cost of projects and new ships easily and precisely. In addition costfact can analyse the cost of complex projects with a high degree of transparency. To achieve these targets the programme offers the following functions:

Figure 2. Cost calculation according to the ship's building structure.

Display of the costs according to the ship's building structure defined by the user: With costfact the planning of costs, both top down and bottom up, is done within the vessel's parts list, differentiated by cost types (e.g. material costs or manufacturing costs) and objects (e.g. stock material or additional costs). costfact contains complete building structures of ships like

Footnote: * costfact; www.costfact.de

** Department 'Design and Operation of Maritime System' Technische Universität Berlin; www.naoe.tu-berlin.de

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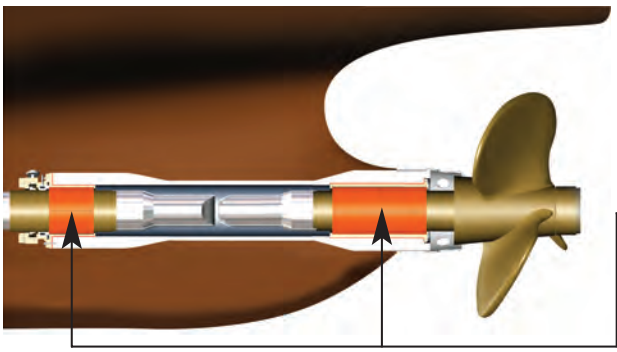

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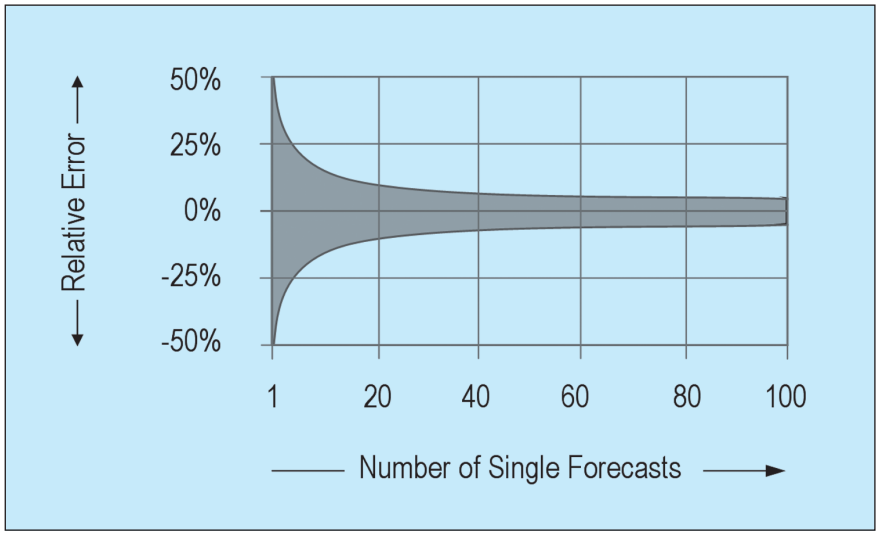

Figure 3. Decrease of the relative error as a function of the number of single forecasts.

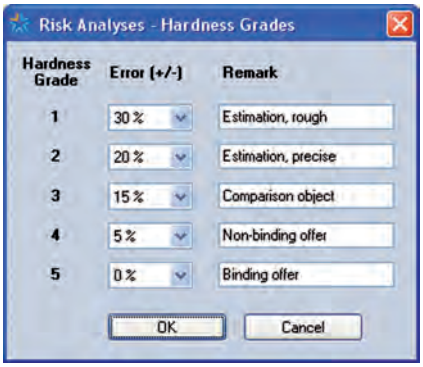

Figure 4. Specifying of forecast inaccuracies by 'hardness grades'.

NATO's Expanded Ship Work Breakdown Structure (ESWBS).

These structures can be modified and expanded, according to the demands of the shipyard and the project concerned. It will also allow for completely new structures to be imported. The hierarchical structure enables the user to navigate quickly between the different levels and allows cost planning at each of these levels, beginning with the whole vessel and working down to single parts (Figure 2).

Cost estimations for new projects based on existing calculations: In addition to the beginning of new cost planning with an 'empty' cost structure, the user can derive the costs of new objects from those of existing components and assemblies, and consolidating this information into the calculation for the new vessel. For this purpose whole calculations from complete projects or parts of them can be imported and taken over for the cost planning of new ships. The imported values can be modified subsequently, if necessary.

Parametric cost estimation: costfact is able to determine cost functions, based on a statistical examination and validation of the technical and economical characteristics of existing objects. These functions can be used to derive the costs of similar objects.

Mapping of project calculations between different building structures: Project calculations must often be transferred from the internal system in an alternative structure, for example at customer's request. In support of this function the programme allocations between different structures can be defined. Then on this basis project calculations can be automatically taken from a structure in one of the other structures.

Uniform system base for calculation projects: The organisation of projects and project information is controlled by a project management module that enables an exchange of information between different projects and several users and ensures a company wide integration of cost controlling. In addition it allows the linking to external systems, e.g. for importing actual costs from the ERP system.

Different performance features for cost analysis: costfact supports the cost analysis both of projects which are already concluded as well as the calculation of new ships. A cost driver analysis based on Pareto's law is applied to functions within the cost driver analysis and this determines the cost drivers that have the biggest influence on these costs. In addition cost filters enable the user to deduce the different cost components separately, so that he can get an overview of the cost structure at different structural levels very quickly and the analysis will have a high relevance to the problem at hand. In addition, this information can be used to determine key figures. Last but not least the user has different possibilities to analyse the cost caused by a change in the customer demands.

Life cycle costing for including all expenses in the ship's life cycle: With life cycle costing, a change of view is made from the producer to the owner, and not only the price of the ship, but also the costs of the whole in-service phase are included. Using costfact, life cycle costs can be calculated up to an examination period of 35 years in-service phase. Moreover, the effects by uncertainties of the in-service phase parameters can be considered.

A particular advantage for costfact is its continuous support of the cost management in all project phases, from the early design to the in-service phase of the ship. Here the cost planning and cost control takes place at different consideration levels, according to the information which is available in each case. According to these different levels several sources can be used for cost information, for example a calculated plan values or registered actual costs by preceding projects.

This supports, in particular, the calculation for quotations which are required quickly and must be precise at the very earliest stage of a new project.

In this context it poses a problem that the information available at that time is associated with uncertainties. Hence, besides the prospective costs of the project, information is necessary in which range the actual costs can deviate from the forecast costs. This information can be estimated with the help of risk analysis.

Consideration of uncertainties

In particular in early project phases, cost forecasts for ships are always afflicted with significant uncertainties. The magnitude of these uncertainties depends on different parameters such as whether


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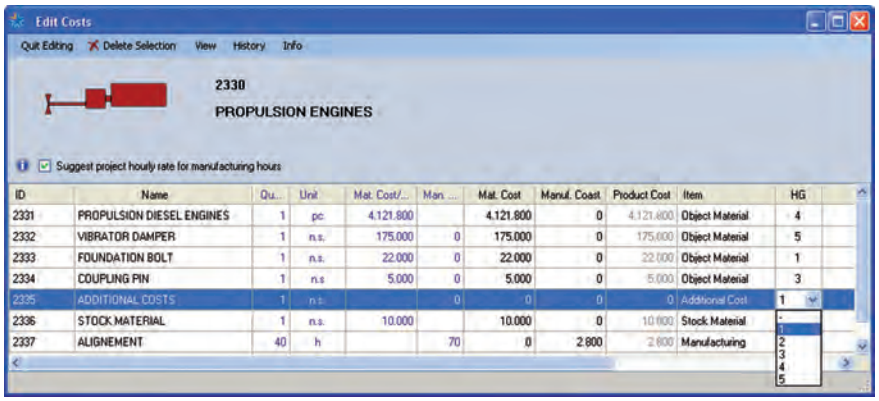


Figure 5. Differentiated allocation of hardness grades.

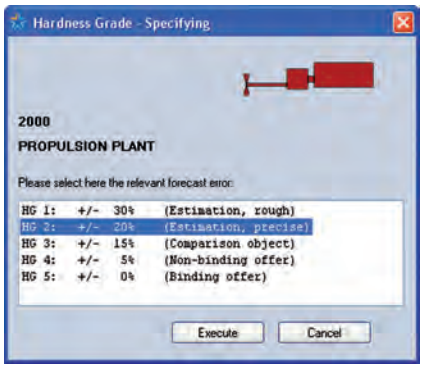


Figure 6. Assembly-related allocation of hardness grades.

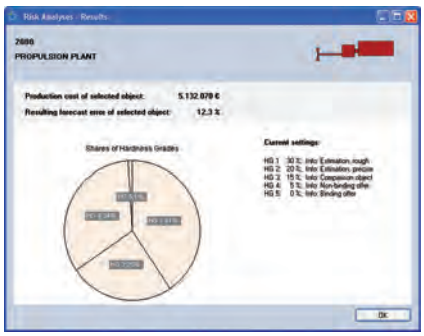


Figure 7. Risk analysis – forecast error at project or assembly level.

a binding offer of a supplier is already given for the considered object or whether the cost can be estimated by referring to a comparative object. To quantify this uncertainty, costfact offers a risk analysis function. This function calculates the prospective forecast error for a calculation object, e.g. a subordinated or higher assembly, as well as the complete project. The calculation is made on the basis of evaluations with regard to the forecast errors of the single components of this object and the statistical compensation of any divergence. This compensation effect is briefly described in the following.

Statistical error compensation: The exactness of an estimate can be improved substantially by determining the value to be forecast as a sum of its single components. If only accidental and no systematic errors appear with the determination of the single components, the positive and negative distributed divergences will compensate themselves partly.

If the Gaussian normal distribution can be assumed, the relative error of the complete forecast value can be calculated as:

$$f_{sum} = \sqrt{\frac{\sum_{i=1}^{n} (f_i \cdot y_i)^2}{y_{sum}^2}}$$

with

f_{sum} = relative error of the complete forecast value

f_i = relative error of the single forecast values

y_{sum} = complete forecast value (sum of single forecast values)

y_i = single forecast values

Figure 3 shows exemplary the decrease of the relative error of the complete forecast value depending on the number of the single forecast values. Here it is assumed that all single forecast values are estimated with a divergence of ± 50% and have the same share of the total sum.

Beside the advantage of the statistical error compensation the splitting of an estimate improves its quality because it is more simple to forecast single cost components, than a whole cost block. In such a manner it will be always easier to estimate the production costs of an object if this takes place divided into material costs and production costs or valued manufacturing hours. Also the costs of an assembly can be easier predicted if the single components are considered individually.

'Hardness grades' to describe the uncertainty: In costfact the evaluation of the prospective exactness of the cost forecast of single components is expressed by so-called 'hardness grades'. These grades can assume values between 1 and 5. A hardness grade of 1 shows a forecast with high uncertainty, while the hardness grade 5 represents an especially low uncertainty. The quantitative meanings of these hardness grades are specified centrally in the system (Figure 4). In the shown example a forecast divergence of +/- 30% is assigned to the hardness grade 1. This means that the actual costs of a calculation object with this hardness grade will vary probably in the area between 70% and 130% of the forecast value. Beside the percentage value also a comment can be given in another column. This comment is later indicated to the user as information in which case the respective hardness grade should be chosen.

The reason for not assigning a percentage value of the prospective forecast error to a component directly is that the allocation of a hardness grade of one of maximum five different classes is much more practicable than to estimate a percentage value with every input.

Within the project calculation there are two different ways to fix the hardness grades for the cost forecast of a component. On the one hand, it can be differentiated for every single cost component. This is carried out in the dialogue mask for the input and editing of the calculation objects (Figure 5). The applicable hardness grade is selected from the dropdown list in column 'HG'. On the other hand a hardness grade can be also specified for complete building groups. Therefore, the user selects the respective building group in the project view which is shown in Figure 2. This building group may be both a final assembly as well as a group on another structure level (e.g. 2000 – Propulsion plant). Afterwards the user chooses the hardness grade that shall be given for the single components of the selected object (Figure 6). After the selection of the suitable hardness grade in the list, the user associates this grade to

all components of the selected building group, including subordinated assemblies if necessary. Here it is to be noted that the prospective forecast error applies not for the complete selected assembly (in this example propulsion plant), but for every single component of this group. Depending of the number of the components the divergence of the complete assembly will be clearly lower as a result of the statistical error compensation.

Display of the risk distribution and calculation of the resultant forecast error: After the hardness grades and with them the prospective forecast errors have been specified for the different calculation objects, the resulting uncertainty can be calculated and displayed for the complete project or also a single building group (Figure 7). The top range of this display form indicates the complete prospective forecast error for the considered object which arises from the forecast divergences of the single components and the statistical error compensation. With this information about possible worst and best case scenarios of the project can be won in addition to the planned costs. Furthermore, the shares of the calculation objects with the different hardness grades are displayed as a pie chart. With it the evaluation gives an overview, like many components with a higher divergence between the planned and actual values has to be expected. Depending on the settings made by the user, this partitioning either refers to the cost portion of the components or to their portion according to the number of all components. While the statement referring on the cost portion gives a clue to the resultant forecast inaccuracy, the analysis which refers to the number gives an overview, of how many objects the estimation quality must be improved if the accuracy of the complete cost forecast is to be increased.

Conclusion

By using costfact, cost planning in shipbuilding becomes quicker, clearer and more reliable when compared to conventional procedures. The improvement of cost planning contributes to the economic success of projects and consequently to the success of the shipyard. A special strength of costfact is the consideration of uncertainties with which cost forecasts are always combined. These uncertainties can be handled by suitable methods. The systematic procedure, provided by the described feature of costfact, leads to quantified evaluations of the prospective divergences. These evaluations support the decision-making with the quotation costing and show if necessary the need to improve the quality of available cost forecasts by procuring additional information. Figure 8 shows a benefit-cost-analysis of costfact and answers some questions around its implementation. *NA*

How to integrate costfact into the development process?

Due to costfact's flexible concept, the installation of costfact including linking it to external systems is done easily. costfact is documented in detail and can be handled very simply and mainly intuitively. Therefore, besides a short instruction, no special training is required.

What's the fare of costfact?

costfact is modularly structured and its application starts at 11.449 Euro.

How about the return on investment?

The license expenses of costfact will usually be offset by reduced effort for cost calculation within the first project. Nevertheless, the main advantage of costfact is the prevention of a cost overrun by improved cost planning and controlling.

What's the first step to implement costfact?

The implementation of costfact can start with a test installation. Within this installation a complete pilot project can be calculated.

Figure 8. Implementation of costfact.

Oasis is fulfilling the dream

Delivery of the world's largest cruiseship has been a major event in the cruise calendar this year, writes Sandra Speares, and Royal Caribbean's 225,000gt *Oasis of the Seas* has already completed several cruises.

There has been little time off for naval architect, Harri Kulovaara, executive vice president, maritime at Royal Caribbean during the period it has taken to get *Oasis of the Seas* operational. "We are very proud of the result and the reception has been very good".

The ship, he says, has functioned exceptionally well operationally. "We are very pleased that she has fulfilled our dream".

Mr Kulovaara and RCCL can perhaps have time to take a break before the delivery of the next ship in the Oasis class, *Allure of the Seas*, which is due from STX Europe later this year.

Oasis' maiden crossing across the Atlantic was not without incident, with hurricane force winds providing a testing time for the vessel. "The highest wave heights were 24m – really exceptional weather in the beginning," Mr Kulovaara said. Such conditions allowed the company to evaluate the ship's performance. "Of course the captain was taking it very carefully," Mr Kulovaara said. "We delayed the arrival into Port Everglades by two days. That kind of test is good because it gives you a really good shake down. She really behaved very well."

The workforce for this kind of project is of very large magnitude, as a prototype the project was very challenging and it was "wonderful how she came together in a timely manner and fulfilled all our expectations," Mr Kulovaara added.

Technically, he says, the ship is working very well.

In a ship with this number of passengers – 5400 in total, passenger flow is very important. Royal Caribbean has always paid considerable attention to this element, notably how the passengers divide themselves between the various different attractions onboard.

The ship is not that much longer of any of the other new generation RCCL ships, although she is wider across the beam. Easy navigation of the ship is essential, not only for passenger comfort, but to handle any emergency.

Mr Kulovaara said that the thing that he found most surprising, was that when one considered the open area at the centre of the ship, the amount of daylight that enters how it changes the ambiance overall.

One of the most innovative parts of the ship is her split superstructure which leaves two 'neighbourhoods' - Central Park and Boardwalk - open to the sky.

Oasis has an extensive number of new computer applications on the ship, Mr Kulovaara explained. "Everything is built on fibre-optics; everything is built on wi-fi".

There is an independent computer room onboard the ship. "There are a lot of new applications that we have not had in the past." The photo gallery he cites as being one example of cutting edge technology.

Photos are a big part of the cruise experience, from security not just from leisure points of view. A photo of the passenger is taken at the outset. The phone system, the 'Wow Phone', is an iphone which essentially can be used

A size comparison, *Oasis of the Seas* alongside the Statue of Liberty, a Boeing 747, a London bus and a Mercedes saloon.

to locate family members onboard the ship.

It is possible to supply small children with a micro watch-size transponder which can track the child's location. "We know exactly where the family members are".

Another innovation is interactive TV screens located next to the lifts which enable passengers to see entertainment and dining options. This inter-active way finding system is also used as part of the security and safety system onboard.

Royal Caribbean's ships are known for their range of activities including surfing machines, climbing walls and in the case of *Oasis of the Seas*, a zip wire above the deck. Passengers indulging in these pursuits are required to sign a waiver as far as the vessel's insurance is concerned.

The waiver agreement can be done via a handheld device, Mr Kulovaara explains. The ship also has system which traces any technical deficiencies in the hotel side of operations, like for example if a light bulb blows. This property management system is also based on handheld devices.

Even the phone system that the ship's officers use is wi-fi based. "We don't have traditional deck phones any more, we have wi-fi phones for the officers."

The ship is very different, designed from a blank sheet of paper, unlike the Freedom class ships, which were based on the previous Voyager class.

Oasis was built from scratch, taking into account the latest International Maritime Organization regulations, Mr Kulovaara says, and using the latest technology.

On the safety and regulatory side, the ship goes beyond the regulatory requirement because, for example, the ship's fire zones have to be bigger than the regulations specify.

"We needed to do reviews based on that, making sure that the ship's safety standards were not compromised. We wanted to use the latest regulatory framework and elected from the beginning to work with the probabilistic design.

"We feel that gives us the opportunity to build a ship that is safer and more fit for purpose. From the design point of view she has several features which are extraordinary."

Central Park, one of two open areas on the *Oasis of the Seas*

Considering that the entire centre of the ship is open to the skies, including the Boardwalk and Central Park areas, the fire safety has been reviewed with alternative design processes, he says.

The alternative design, which is allowed under SOLAS requirements needed to be used in quite a few areas, he says. Simulation methods have been used for safety calculations, demonstrating that the solutions onboard are of an equal or higher level than what is required under the regulations.

"I believe this is the largest technical naval architect design undertaken in the world for a commercial ship," Mr Kulovaara says. Work on the project took three years with the participation of the "greatest minds in shipbuilding."

These included the shipyard STX, Delta Marine, Det Norske Veritas and Germanischer Lloyd. The Maritime Safety Board for the ship included former chairman of the International Marine Organization (IMO) Maritime Safety Committee, Dr Tom Allan, Professor Dracos Vassalos of the University of Strathclyde, Dr Tor Svensen of DNV and Vice Admiral James Card , former vice commandant of the US Coast Guard. Safety assessments for the lifeboats were completed by Germanchisher Lloyd.

The most modern calculation methods have been used for safety assessments, within the framework of SOLAS, Mr Kulovaara stresses. He says that it is not only a question of working with experts, but the company has been very transparent with regulatory authorities as well. "I am very proud of the positive endorsements we have got from IMO and the Secretary-General".

The bridge configuration is similar to that on the Celebrity ships – a lot of the same thinking has gone into both ships where the navigation of the vessel is separated from the safety operations – with each having their own discrete part of the bridge. "We have a safety centre which is separated and manned 24/7 behind the wheel house," he explains. We want to make sure that there are no distractions for the navigation team. A similar methodology is employed for the control room.

"I am very proud of the technical design and the competence behind the process," he says. "I feel *Oasis* is a historic design effort and reflects the best that technology can do and builds on SOLAS and all the naval architectural competence in the world.

"I have seen a few first of class ships in my life and have been involved in building 50 at least. She has functioned exceptionally well." The safety advisory board, he says "have been difficult people to please". Technology and expertise aside, the important thing has been the team effort. ***NA***

Theatre of dreams

Oasis of the Seas sports a big water feature that's not the sea, the Crystal Fountains and Fluidity designed Aquatheater on the Royal Caribbean liner is a first time a water show will be performed regularly on a cruise ship.

Two dynamite blasts, 16 arching jets 40 fan jet nozzles, 96 vertical jets, 1500 nozzles for a rain curtain, more than 250 LED lights, 25 water pumps and a 518.6m^3 pool together comprises the 700-seat Aquatheater on the *Oasis of the Seas*.

The feature is claimed to be the only one of its kind on a cruise ship that will offer several water shows on every cruise for passengers on the massive liner.

In building the feature STX Europe, the shipbuilder effectively project managed the coordination of the theatre, while the Los Angeles-based water feature designers, Fluidity, drew up the plans and the Ontario, Canada, based Crystal Fountains provided the equipment for the theatre which was designed by Wilson Butler of Boston.

Theatre consultants Fisher Dachs helped with theatrical support and lighting and Handling Specialty designed the lifts for the stages that rise and fall within the pool.

The team has put together a pool that was specifically designed for use on a ship, including a motorised system of sails that are raised in order to protect the theatre from the wind as the ship sails at between 18 and 24knots. An ultrasonic wind sensor measures wind speeds and indicates when the sails need to be deployed, said Crystal Fountain's product support manager Dave Justus.

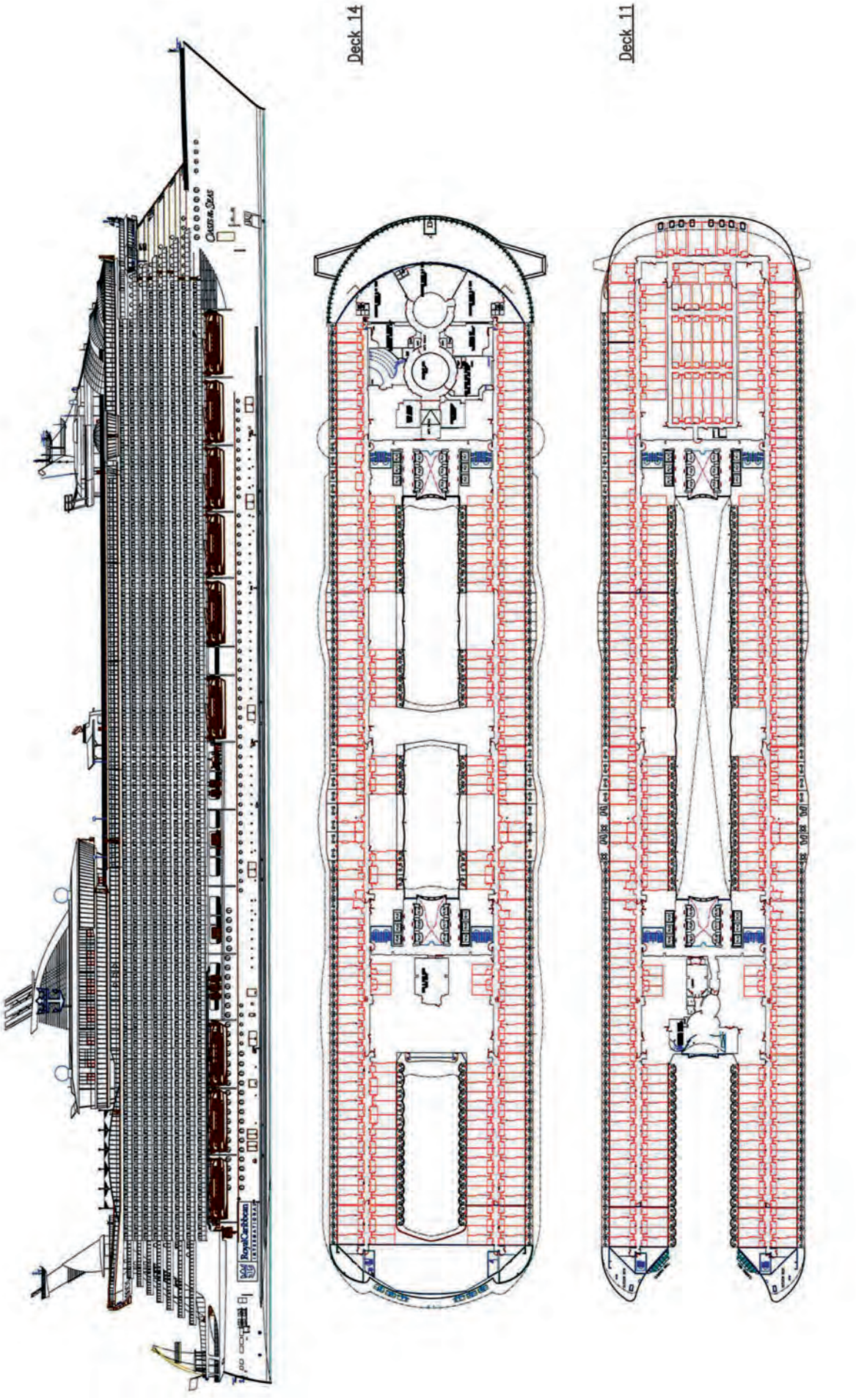
Crystal Fountains also redesigned the nozzles for the fountains especially for use in the pool. "We designed custom nozzles, specific to the *Oasis of the Seas*, made from stainless steel," explained Mr Justus. The company also needed to design a nozzle and pump system that would shoot water 15.24m into the air, which two fountains, the Dynamite Blasts as they are known can spectacularly do and they are situated either side of a stage that can be raised and lowered into the water.

The Dynamite Blasts each has its own 11.3kW pump producing 44.2m of head (the water pressure) with a flow of 15.77litres/sec. The nozzles for the Dynamite Blasts have a wider pipe that then squeezes the water through smaller holes, increasing the pressure and helping to keep the water together after it is shot into the air.

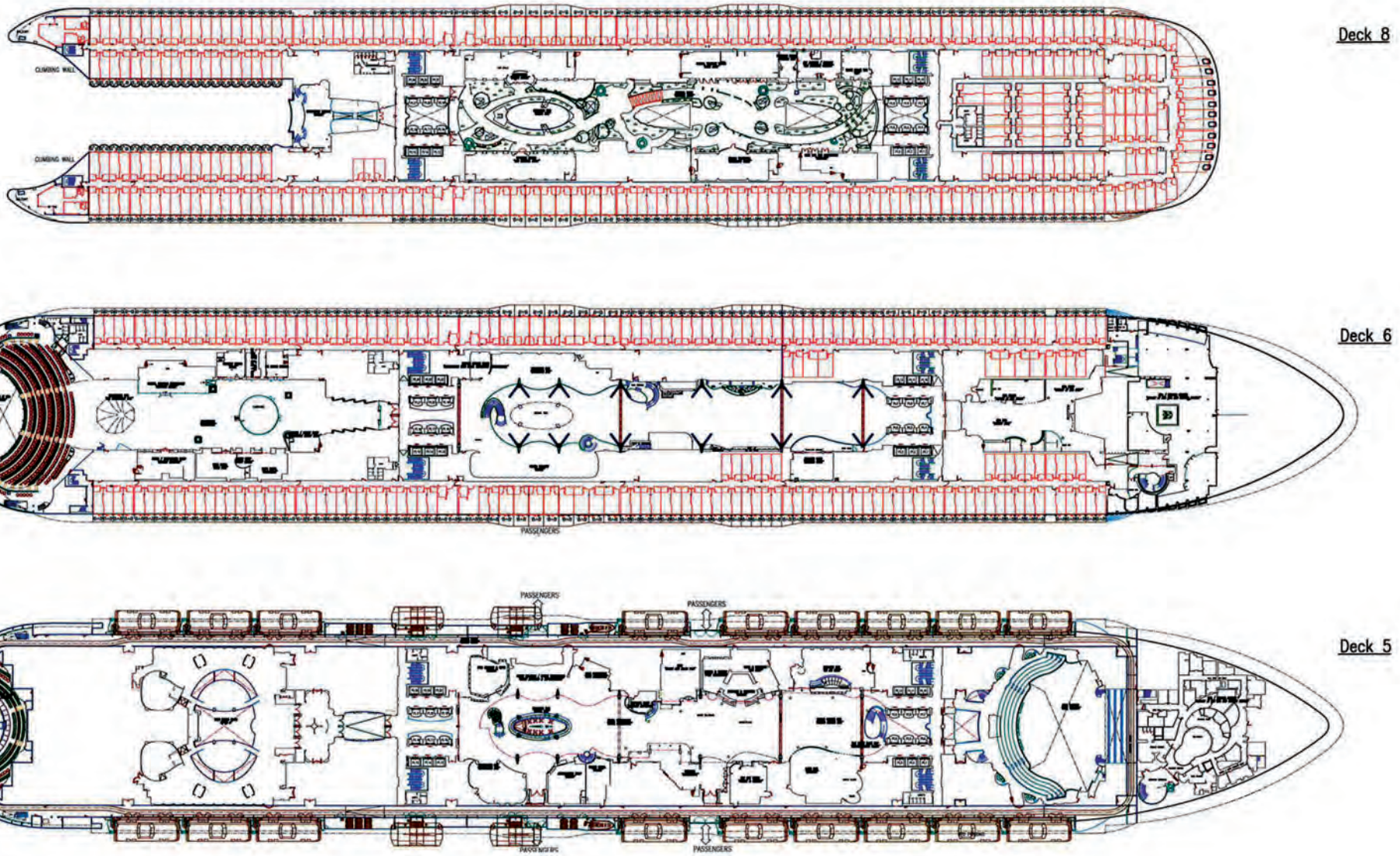
The rain bar at the back of the pool consists of 1500 nozzles served by two 11.3kW pumps at 21.34m of head at the rate of 23.34litres/sec. Images and lighting can be projected onto the rainbar even when a show is not in progress and this can be accompanied by music allowing passengers to enjoy the Aquatheater even when there is no show, said Tom Yankelitis, design director at Fluidity.

Lifts raise the stage at certain times of the show and additionally if there is a swell the vessel is causes the water in the pool to slosh the centre stage can be raised and that acts as a breakwater preventing too much water movement. ***NA***

The Aquatheater from the side showing the Dynamite Blasts.



Oasis of the Sea General Arrangement Plan



Oasis of the Sea General Arrangement Plan

It just became safer to go back to sea

Safety, security and environmental considerations make the *Oasis of the Seas* a more relaxing vessel for passengers to cruise on. Sandra Speares outlines the vessel's special features.

Oasis of the Seas "demonstrates that larger cruise ships offer a better platform to achieve higher safety standards," according to Royal Caribbean.

Whether one believes this claim or not - and salvors have repeatedly raised concerns about handling large cruise ships in casualty situations - it is clear that the world's second largest cruise line has pulled out all the stops on the safety front.

The ship, which was delivered from STX Europe's Turku yard last November, was built according to the International Maritime Organization's probabilistic rules contained in SOLAS II-1.

Royal Caribbean said that tests suggest that the ship exceeds the required index of 0.88 by at least three points. Computer simulations and model tank tests suggest that the ship has a survival probability of 0.99.

Over 9000 damage cases were analysed using the probabilistic approach. The ship contains 18 watertight compartments and 720 watertight spaces.

Machinery spaces are protected by a double-hull.

The alternative design methodology was used to demonstrate equivalent safety as far as fire is concerned. This is contained in SOLAS II-2.

Openings in the five main bulkheads ensure the safety of the horizontal atrium concept, protected by A60 rated double shutters.

In special open areas, including the Boardwalk and Central Park, geographical fire breaks have also been made.

The equivalent safety methodology has been used to ensure the right level of safety for the ship's non-traditional arrangements.

Third party risk assessments have been made for the ship's special features, including the carousel, the zipline and the Aquatheater.

The 225,000gt *Oasis of the Seas* is flagged in the Bahamas. The vessel is 361.8m long, 63.4m across the beam and 64.92m high from the water line. She has a 9.14m draught and a 22.6knot cruising speed.

Oasis of the Seas **displaying its catamaran lifeboats fixed onto the LS45 davits that allow the craft to be lowered directly into the water.**

Oasis of the Seas has 16 passenger decks and 24 passenger lifts, her four bow thrusters with 7500 horsepower each and three steerable 20MW pod propulsors each of which has its own dedicated switchboard. The ship is equipped with an integrated navigation and dynamic positioning system.

Oasis of the Seas can carry 5400 passengers (double occupancy) up to a total of 6296 including the 2165 crew. Cabins total 2706, including 1956 with balconies and 46 with wheelchair access.

Three dimensional topographic simulation was used to verify configurations as far as safe return to port compliance under the new SOLAS requirements is concerned.

Machinery is housed in two compartments, with three propulsion units which are all steerable. This ensures that if one engine compartment is flooded or lost due to fire or other damage, the other can sustain the vessel.

In order to allow for optimal energy use, the ship is equipped with several engine sizes based on common rail diesel engine technology to supply the ship's power needs whether in port or at sea.

An advanced energy management system conserves energy thanks to optimal routeing and power usage. Royal Caribbean estimates that it has reduced electrical use 30 to 40% compared to its previous classes of ship.

The ship is able to carry the new low sulphur fuel and the company says that the carbon footprint of the ship is 15% to 25% better than previous classes.

As far as the environment is concerned, the ship has the Det Norske Veritas Green Passport designation. A full time environmental officer is on the ship to ensure that crew training in environmental matters is carried out.

The ship was awarded the first Clean Sea Award by Nor-Shipping for its Advanced Wastewater Purification System, which was designed to be twice as stringent as US

Federal standards for in-port wastewater discharge. Royal Caribbean's own policies restrict the discharge of even bilge water to outside 12 nautical miles off shore.

The ship recycles everything it can on the ship, with shredders, bailers and compactors, as well as crushers for glass, light bulbs, tin and aluminium. Cold storage facilities on the ship can be used to store hazardous waste, among other substances.

Lifeboats capable of carrying 370 passengers each are just one of the innovations the ship has in terms of safety.

Built by lifeboat designer Schat-Harding, *Oasis of the Seas* is equipped with 18 CRV55 lifeboats and LS45 davit systems. According to the lifeboat manufacturer the CRV55 "is the only pure lifeboat with a catamaran hull, which provides excellent sea-keeping capability and manoeuvrability".

The LS45 davit is a newcomer in the cruise market. The lifeboats are lowered directly from the stowed position, so that the lifeboat does not need to be swung out. The boat is positioned outside the hull of the ship. The CRV55 is of reinforced construction and has a special 'green sea' lashing system, making it secure in high waves.

According to Ole Meijer, executive vice-president of Schat-Harding's equipment division: "These new boats will be safer and quicker to board for large numbers of people. They will also be easier to get away from the ship, because the davit does not have to move, and they will be safer once in the sea as they have twin engines and full built-in buoyancy."

Given the thousands of passengers and crew that might need to be evacuated from the ship if a safe return to port scenario proved impossible, getting passengers to the muster stations quickly and safety is a priority.

The ship's TraffGo simulation is based on the MSC circular 1033, with representative passenger demographics being used. There are 11 assembly stations on the ship, of which 10 are inside. All life jackets are located at the assembly stations.

"These new boats will be safer and quicker to board for large numbers of people. They will also be easier to get away from the ship, because the davit does not have to move"

Royal Caribbean estimates that assembly times at night would be 44.51 minutes, against a limit of 60 minutes. During the day, assembly times were put at 33.38 minutes, against the same 60 minute maximum.

Video broadcasting is another element of the process. Video screens are placed at all the assembly stations which, if necessary gives the captain the chance to communicate directly with passengers. Assembly stations are also equipped with technology to ensure a reliable passenger count.

The PA system extends to the lifeboats and there is a digital surveillance system for enhanced evacuation monitoring. Aside from the PA system, the lifeboats are equipped with GPS, stretcher locations, windows and toilet facilities.

While the bridge remains dedicated to navigation, there is a safety centre adjacent to it to handle safety management. The same principle has been adopted for the engine control centre.

According to Royal Caribbean: "Safety by design led to *Oasis* exceeding requirements on fire protection, stability, survivability and manoeuvrability", as well as in evacuation and life-saving systems.

The next ship in the series, *Allure of the Seas*, is due to be delivered late this year. Royal Caribbean recently announced that it had secured funding for the project. Finance worth US$1.1billion, an estimated 80% of the contract price, has been secured from four banks, including BNP Paribas, Citi, Nordea and SEB, so all is in place for the second delivery in the series.

Meanwhile Royal Caribbean Cruises and Rolls-Royce have just announced that they have reached a suitable and amicable resolution to the lawsuit regarding the Mermaid pod propulsion system on Celebrity Cruises' Millennium-class ships. *NA*

Costa design a beacon in European cruising

Costa Luminosa's eclectic design has broadened the line's business scope, writes David Tinsley.

Delivered by prolific passenger vessel builder Fincantieri, Costa Crociere's 92,600gt *Costa Luminosa* represents a milestone in the development of Carnival's Italian brand, and provides a model example of design platform usage and adaptation for different companies encompassed by a major shipowning group.

In keeping with recent years' expansion of Costa's operating remit, within and beyond its fountainhead Mediterranean business, *Costa Luminosa* offers a high level of operational flexibility and a more upmarket product by virtue of innovative new features and combination of design elements from several different classes of ship deployed by various Carnival-owned lines.

She and newbuild sister *Costa Deliziosa* have accordingly been described as of hybrid design, wherein a circumspect project approach has imbued the Costa marque with a new reference point for onboard quality and for technical attributes bearing on efficiency and environmental protection.

Costa Luminosa owes its main derivation to the Vista class, originally conceived for Holland America Line but also built in other variants for Cunard Line and P&O Cruises. However, she also embraces aspects of the *Costa Atlantica/Costa Mediterranea/ Carnival Spirit* series from Finland, as well as Costa's own larger, post-Panamax Concordia type. The resulting *Costa Luminosa* class, optimised for Panama Canal transits at 294m length overall and 32.2m moulded breadth, is the first of its type in the Costa Crociere operation, and provides 1130 cabins for a double-occupancy passenger complement of 2260, up to a maximum of 2826.

With 772 cabins having private balconies, *Costa Luminosa* has the highest proportion of balconied cabins in the Costa fleet exceeding that of the larger, Concordia vessels. The nature and standard of the accommodation befits the vessel's target market at the 'high end' of the business, and in longer cruises, such as summer deployments from Amsterdam to the Norwegian fjords, and on itineraries along the Arabian Peninsula out of Dubai during the winter period.

Fincantieri's *Costa Luminosa* at sea shortly after its delivery.

Advances with regard to public facilities include the Samsara Spa, arranged over two decks and ranking as one of the largest 'wellness centres' in the cruiseship market, an 18-hole championship golf course simulator, a Grand Prix Formula One race car driving simulator, a 4-D cinema, and a pool area amidships over two decks encompassing a movie screen and a retractable roof of the Skydome type.

Constructed on the Venetian industrial mainland at the Marghera shipyard, *Costa Luminosa* has provided a new vehicle for the interior design and architectural skills of Joseph Farcus, whose name is synonymous with the Carnival fleet and who has been retained for all Costa projects since the 2000-built *Costa Atlantica*. Light has been a main theme in the creation of the passenger spaces, to the extent that this has influenced the choice of ship name. Mr Farcus' stamp on the design is also evident from the expansive atrium, extending for 12 decks.

Iridescent interiors decorated with high-grade materials such as fine marble, ebony, and mother-of-pearl, are complemented by the use of state-of-the-art technology to provide spectacular lighting and colour effects. In line with the tradition in the Costa fleet, *Costa Luminosa* houses an extensive art collection, including nearly 300 original works as well as a multiplicity of copies. The focal point of the central atrium at its lowest level is a huge bronze sculpture, Reclining Woman 2004, by Fernando Botero.

Mobility throughout the vessel, of which a total 12 decks are used by the public, is provided by 27 elevators and also escalators from the Swiss firm Schindler Management's marine unit. Lifts in such applications have to meet stringent engineering, installation and performance criteria, ensuring 24-hour operation regardless of ship motions. The elevator cabins in *Costa Luminosa*, for instance, are vibration-free and protected

against water, dust and corrosion, and have been designed so that the doors will still open smoothly at a 30 degree angle of heel.

Moreover, the ambient qualities are important from the passengers' standpoint, given high expectations as to onboard standards. The interiors and aesthetics of the elevator cabins were conceived by Joseph Farcus. The ship's decor plays on light and art, and rose crystal and other sculpted glass have been used for the panoramic elevators.

The vessel is fitted with special service elevators and escalators used primarily to transfer food from the galley to restaurants. These installations must conform to strict hygiene standards, such that the service elevator cabins are of stainless steel, while the escalators are fitted with a special rinsing system. The latter employs powerful water jets to clean each step while it is moving along the underside of the truss. Schindler was in the vanguard of the move to offer preventative maintenance for lifts and associated access equipment on cruiseships and has been contracted to service the installations in *Costa Luminosa*.

Navalimpianti Tecnimpianti designed, fabricated and supplied the retractable roof, the Skydome, providing weather protection for the swimming pool on deck 10. The sliding glass cover is made of five tempered sliding panels and one fixed panel. Both sides of the driving panels are mechanically synchronised by two electrical gear motors. The Italian subcontractor's involvement in the project also included delivery of the vessel's side doors and platforms, and the davit systems for the lifeboats, tenders, rescue craft and liferafts.

The lifesaving equipment features two fully-enclosed, 70-person lifeboats of Umoe Schat-Harding's KISS type, along with 12 partially-enclosed lifeboats of 150 person-capacity apiece, and six combined cruise tender/survival craft from the same company. The latter have capacities of 120/150 in respective tender/lifesaving roles. The outfit otherwise comprises 60 davit-launchable Viking liferafts, each designed for 35 persons.

Costa Luminosa's diesel-electric power and propulsion system employs MaK medium-speed, long-stroke engines from Caterpillar's German stable, driving ABB alternators, and employing two azimuthing Azipod units regulated by cycloconverter technology. The same engine and propulsion configuration had been adopted in the Fincantieri-built *Eurodam*, which was phased into service under the Holland America Line brand in 2008. The installations are testament not only to the 'power station' principle as the system of choice for large cruise vessels, but also to the growing penetration of the luxury passenger ship sector by Caterpillar's MaK marque.

The plant is based on four 12-cylinder, V-form models and two eight-cylinder, in-line versions of MaK's M43C design, engendering a total power concentration of 64,000kW. As may be gauged from the sum of 64 cylinders, the installation has a per-cylinder output of 1000kW at its maximum continuous speed of 514rev/min. Each diesel is connected to an ABB alternator, the four larger sets being of 16.6MVA output, and the two smaller aggregates being of 11.1MVA. Each of the two Azipod electric propulsors has a maximum effect of 17.6MW, and the level of redundancy conferred is implicit in the two cycloconverter units and double windings of the pod motors.

ABB's scope of supply also included two redundant main switchboards of 11kV 2500A, a total of 13 transformers, comprising four of 16,000kVA, four of 1800kVA, three of 1250kVA and two of 400kVA, plus the 2200kW motors for the three Fincantieri bow thrusters, and the remote control and dynamic positioning systems.

The engines apply Caterpillar MaK's Flexible Camshaft Technology (FCT), guaranteeing an absence of visible smoke at all loads and facilitating compliance with upcoming, tougher International maritime organization (IMO) limits on NOx (oxides of nitrogen) emissions, as well as local controls such as the Alaska Marine Vessel Visible Emission Standards.

Costa's focus on energy-saving initiatives, highlighted by the company's receipt of the ABB Energy Efficiency Award 2009, is reflected in *Costa Luminosa* in a number of technical and operational aspects, including air conditioning, ventilation and lighting, as well as power management and scheduling. The efficiency drive, which has been given added impetus by global events of the past 15 months or more, is understood to have been pursued even more vigorously in *Costa Deliziosa*, due for handover in January 2010.

Costa Cruises' qualification for the ABB award was largely determined by its policy of installing inverters on its ships. An inverter provides the controlled electrical power in a variable-frequency drive, and these devices enable operating performance with equipment such as engine room fans and blowers to be optimised, leading to energy savings and a commensurate reduction in environmental impact. Intelligent inverter speed control, which was designed into *Costa Luminos*a and *Costa Deliziosa* from the outset, was first introduced in the *Costa Fortuna* and *Costa Serena*, and has been specified for a number of other vessels of the fleet.

Costa Luminosa is said to be the first cruiseship in Italy, and one of the first in the world, to incorporate a 'cold ironing' capability, by which a connection is made to the shoreside electrical grid when alongside, obviating the need for diesel gensets to be run during port stays. The design of the main ABB switchboard provided for the requisite high voltage connection to the dockside electrical supply. These arrangements raise the ship's environmental credentials and 'future-proof' her against the spread of tougher emission controls governing vessels in harbour. *Costa Deliziosa* has been specified with the same system.

All vessels in the Costa fleet have been assigned Registro Italiano Navale's (RINa) Green Star notation, certifying that they are operated in compliance with the highest environmental standards, and encompassing all shipboard systems and procedures that potentially impact on the sea and air environment. The company's culture of responsibility in this respect is also demonstrated by its BEST4 (Business Excellence Sustainable Task) accreditation from RINa. BEST4 is an integrated system of voluntary certification of corporate compliance with the most demanding standards governing social accountability (SA 8000), the environment (UNI EN ISO 14001), safety (OHSAS 18001), and quality (UNI ENI ISO 9001).

Costa Luminosa is testament not only to Costa Crociere's leading position in Europe's cruise shipping sector and to its business expansion strategy, but also to the strength of Italy's maritime industrial cluster in the field of luxury passenger vessel construction and outfitting. ***NA***

Vista class shines on the queens

Cunard's second ship to be delivered from a Fincantieri yard is due in October this year, and the float out for the *Queen Elizabeth* took place on 5 January, writes Sandra Speares.

Unlike the *Queen Victoria*, delivered in 2007 from Fincantieri's Marghera yard near Venice, the 90,000gt *Queen Elizabeth* is under construction at the Monfalcone yard near Trieste for an estimated €500million.

Technically speaking, it closely resembles the *Queen Victoria*, although certain modifications have been made, notably to the hull design aft, to create a more vertical superstructure, in order to increase the number of cabins.

On the passenger side, a number of modifications have been made to accommodate a single seating dining area which is linked to pricing certain accommodation.

Other changes compared to the *Queen Victoria* include a skylight for the garden lounge compared to a sliding roof cover on the *Queen Victoria* which has presented technical difficulties in terms of weight.

Because the keel was laid well in advance of the new SOLAS requirements, the ship does not need to comply with either the safe return to port requirements or probabilistic design methods.

Britannia Restaurant on the Queen Victoria

Queen Elizabeth at the Monfalcone Shipyard in November 2009, the vessel was floated out in January 2010.

That said, according to The Royal Institution of Naval Architects president and chief naval architect for Cunard, Stephen Payne, the Vista class vessels, on which *Queen Victoria* and *Queen Elizabeth* are based, have been run through procedures used to test compliance with probabilistic standards and would have complied, although *Queen Victoria* and *Queen Elizabeth* are slightly longer than the original platform.

If from the environmental perspective the two ships are perhaps more basic than some other cruise newbuildings on the environmental front, every effort is being made to ensure zero discharge policies are followed.

If the normal building time for a cruise ship is between two and a half and three years, *Queen Elizabeth* is now structurally complete and the team are racing to complete the outfitting ahead of the ship's delivery in October this year. All has been going very smoothly to date, Mr Payne says.

There are clearly certain advantages in using a tried and tested platform, and although the *Queen Elizabeth* is not a Vista class vessel per se, she is a "close cousin", Mr Payne explains.

The replication of the product is the proof of the pudding. The Vista prototype has been used not only for the Holland America ships but the ex- *Queen Victoria* hull, transferred to P&O and renamed Arcadia, as well as two ships in the Costa fleet.

Constantly refining the structural side of the design process is an important aspect, according to Mr Payne. Discussions with the yards have been on-going in terms of improvements, with increased scantlings in the *Queen Elizabeth* to reduce flexing being one example.

The 90,400tonne *Queen Elizabeth* will be 293.97m long, 32m across the beam, and will draw 9.11m. It will have a lower berth capacity of 2014 with a crew of 1001. Passenger decks total 12 out of 16. ***NA***

T.Mariotti delivers an epic to Seabourn

Seabourn Odyssey has now been delivered to its owner Seabourn Cruise Line with a further two vessels to be delivered in 2010 and 2011.

The expansion of the Seabourn fleet will see it increase its capacity by 200% with addition of the three new vessels *Seabourn Odyssey*, *Seabourn Sojourn* and *Seabourn Quest*. *Seabourn Odyssey* made her debut in 2009 as the new flagship for Seabourn Cruise Line. Although the vessels are currently the smallest cruise ships under construction on the market at this time, they will be an ultra luxurious, all-suit vessel and will be able to access uncommon and interesting places.

Seabourn Cruise Line still has confidence in the cruise industry with *Seabourn Odyssey* being its first luxury cruise ship for six years and first newbuild for 15 years. The vessel and her sisterships are all 'green ships'. All the vessels will have advanced wastewater treatment technology to minimise pollution and be powered by two independent propulsion systems. The Odyssey-Class vessels will all comply with the latest International Maritime Organization (IMO) safety standards for damage stability that come in to force in 2009, even though the construction began before the new rule came in to effect.

"Building *Seabourn Odyssey* required us at T.Mariotti to be creative and to seek out new ways to build a new kind of vessel", says Marco Bisagno, chairman, T.Mariotti shipyard. "I think *Seabourn Odyssey* is a further step ahead in the cruise shipbuilding field; she is listed as a yacht of Seabourn, in fact this ship features the same allure and comfort required to a yacht, and a technical complexity expected by a ship", he adds.

All vessels will be similar in design and will each carry a maximum of 450 passengers. Each vessel will also offer all-suite accommodations, menus by renowned chef Charlie Palmer, and an open-bar policy throughout. *Seabourn Odyssey* is 198m in length overall with a Breadth of 26m and is 32,000gt, will also have a service speed 19knots.

Seabourn Odyssey **is the first to be launched of the Odyssey-Class vessels.**

Yran & Storbraaten Architects were commissioned for the design of the vessel blending luxury and elegance with technology and materials, say Seabourn Cruise Line. Although not common in vessels of this design, Seabourn has added the feature of a marina on the stern of the vessel that can be lowered in to the sea for swimming and water sports.

Seabourn Odyssey held the Seabourn's first world cruise a 108 day voyage that departed in January and will visit 42 ports from Fort Lauderdale to Athens. Highlights of the voyage will include five exclusive complimentary events for full world Odyssey guests ranging from whale watching in the sea or Cortez to a Chinese bazaar in Hong Kong, in addition to seven complimentary experiences for all guests onboard such as an exhilarating Maori cultural discovery experience in New Zealand and a visit to the carved wooden Sanctuary of Truth in Pattaya, Thailand.

The second vessel *Seabourn Sojourn* is currently under construction and will begin her journey from CI.MAR. out of the Adriatic and up the Italian coast to Genova to be completed at the T.Mariotti shipyard, where in mid-July she will be delivered to Seabourn Cruise Lines. *NA*

TECHNICAL PARTICULARS

Seabourn Odyssey

Shipyard	T. Mariotti, Genoa, Italy
Registry	Bahamas
Length o,a	195.15m
Length b.p	169.20m
Breadth moulded	26.00m
Draught	6.6m
Gross tonnage	abt 31.350tonnes
Deadweight	3000dwt
Service speed	19knots
Main engines	2 x VEM 7,5MW 15,000kW
Propellers	2 x Wartsila Propulsion
Alternators	4 x Wartsila VEM DRKSX 1032 4 x 12V32, 5.60kW
Passengers	452
Crew	348
Contract date	October 2006
Launch/Float-out date	June 2007
Delivery date	June 2009

Silversea Cruises increases its fleet with *Silver Spirit*

At 195m *Silver Spirit* is the largest vessel in the Silversea fleet and is the fifth vessel in the Silver series to be delivered from Fincantieri to the Italian owner.

Silver Spirit will join *Silver Cloud*, *Silver Wind*, *Silver Shadow* and *Silver Whisper*, with *Prince Albert II* making six vessels overall in the Silversea's cruise ship fleet. *Silver Spirit* will offer passengers the same standards of luxury as the other ships in the fleet, an intimate atmosphere, sophisticated elegance and top five star service.

Guiseppe Bono, chief executive officer, Fincantieri said: "This is our first ship for the prestige brand Silversea and the first luxury vessel of this type that Fincantieri has built, thus making its debut in the super-luxury segment. It is also a first for Ancona shipyard which has succeeded in this type of production as it can draw on a wealth of highly qualified human resources."

Silver Spirit **the latest vessel to join the Silversea Cruise fleet.**

Responsible for the interior design of *Silver Spirit* was Italian naval architect Giacomo Mortola who made a balance between modern functional requirements and Art Decò. The general public rooms have been designed to suit the needs of the European/ Mediterranean cruise market. The ship's suites all have a private view of the ocean while the dinning guests may choose from six restaurants, one of which is called the Seishin will specialise in Eastern food.

Adding to the features of *Silver Spirit* is the Stars Supper Club a restaurant inspired by Art Decò where the exclusive, sophisticated atmosphere of British clubs of the 1930s has been re-created. The main feature of the vessel is the 770m^2 new wellness centre "The Spa".

Silver Spirit is 36,000gt and 195m long with a length between perpendiculars of 167.5m. The breadth moulded is 26.50m, with the design draft at 6.40m. The vessel features eight decks and has a cruising speed of 20.3knots. The vessel has two bow thrusters with controllable pitch propellers, each driven by a 1000kW motor along with two electro-hydro rotary vane type steering gears operating two spade rudders. Assisted by a crew of 378, over 540 passengers can be accommodated onboard *Silver Spirit*.

Manfredi Lefebvre d'Ovidio, Chairman, Silversea Cruises commented: "The *Silver Spirit* is a further achievement for the company which now has a total of six vessels and has confirmed its position as leader in the luxury sector. The hallmarks of the *Silver Spirit* are innovation, her distinctive, elegant Art Decò style and greater space available for passengers. Despite the economic slowdown in 2008, we have continued to invest in the product and in human resources; in July we reached a record number of bookings and for the end of December we expect to achieve approximately 70% of the revenue plan for 2010. The company's best result since it was founded."

Silver Spirit set out on its grand inaugural voyage around South America at the end of January after its Christening at Fort Lauderdale. The voyage is due to take 91 days and will arrive at Rio de Janerio for Carnival, round Cape Horn, explore the Mexican Riveria and sail up to the Panama Canal calling at 45 ports in over 20 nations calling at Chile, Peru, Ecuador, Guatemala and Cost Rica. ***NA***

TECHNICAL PARTICULARS	
Silver Spirit	
Length o,a	195.8m
Length b,p	167.5m
Breadth moulded (at w.l.)	26.50m
Design draft mld	6,40m
Deadweight (at 6,40m)	3500tonnes
Scantling draft	6,60m
Maximum air draft	40.0m
Propeller (max. continous output)	2 x 8,50MW
Contractual speed	20,3knots
Sea range at 19,5knots	14 days
Maximum number of persons onboard	918

Meyer Werft packs more fun into *Disney Dream*

There is a gloomy economic outllook and a subdued shipbuilding industry as a whole, but for Meyer Werft things are still looking up with the construction of two more cruise vessels; *Disney Dream* due to be delivered in 2011 and *Disney Fantasy* due for delivery in 2012.

Disney Cruise Lines (DSL) entered operation in 1998 with the launch of *Disney Magic* that drew on the idea of a classic cruise ship bought to life onboard with Disney's 'magic' of fairy tale fantasies. Since the success of *Disney Magic* and *Disney Wonder*, DSL has signed another contract with Meyer Werft shipyard in 2007 for the construction of two further vessels *Disney Dream* and *Disney Fantasy*.

The latest two 122,000tonne cruise ships will be two decks taller than the existing 83,000tonne *Disney Magic* and *Disney Wonder*. Karl K Holz, president of Disney Cruise Line said: "This is an exciting time for Disney Cruise Line, and we are looking forward to working with Meyer Werft to blend our innovation and creativity with their fine craftsmanship. Meyer Werft has a strong tradition of building magnificent ships. We are confident that the results will be ships that take the immersive family-focused cruise experience to an entirely new level."

Disney Dream and *Disney Fantasy* will be similar in design to the first two vessels, but will have a more modern interpretation of classic ocean liners on the 1930s. Disney say that its imagineers, as it describes them, drew their inspiration from the original trans-Atlantic ships that featured a dramatic black hull with two funnels and portholes for windows. Enhancing the Disney 'theme' of the vessel the colours used for the exterior of the ship are the same colour palette as Mickey Mouse with black, white, red and yellow.

Fitted onboard *Disney Dream* will be its main feature a water coaster called Aquaduck that will send guests racing above the upper decks, say DCL. Aquaduck will be 233m in length and spans four decks in height. Guests will also have the experience of sliding out 3.9m over the side of the ship in a translucent 'swing-out' loop, allowing them to look down at the ocean 45m below them. Aquaduck also has a 102m stretch of river rapids, with the splash down on deck 12.

Disney Dream is currently under construction with the first block being laid in August last year at Meyer Werft's Papenburg shipyard. The vessel will be 339m in length overall, with a breadth of 36.88m, a draft of 7.9m and speed of 22knots. ***NA***

TECHNICAL PARTICULARS

Disney Dream

Length o,a	339m
Beam	36.88m
Draft	7.9m
Height	56.99m
Speed	22 knots cruising speed (maximum 23.5 knots)
Shipyard	Meyer Werft shipyard Papenburg, Germany
Home Port	Port Canaveral, Florida
Ship's Registry	Bahamas
Tonnage	128,000gt
Crew	1453
Passenger Decks	14
Capacity	4000 passengers
Staterooms	1250
Maiden voyage date	26 Jan 2011

Samsung breaks into luxury cruise ship market

US-based cruise owner and operator Utopia Residencies has commissioned Samsung Heavy Industries (SHI) for the construction of it latest cruise ship *Utopia*, the next generation of cruise ship

Utopia is a new concept apartment type cruise ship, which will combine leading edge shipbuilding and architectural technologies, say Samsung Heavy Industries. Differing from conventional cruise ships, which are operated for short-term travellers that travel for up to 10 days, the new concept vessel is an apartment type cruise ship that is characterised by the sale of cabins to individuals who then can enjoy cultural experiences in a leisurely manner.

The aim of the ship will be that it will drop anchor in countries hosting large global events such as the World Cup, the Olympic Games and Cannes Festival for periods of two weeks to a month. The vessel will offer the opportunity for guests visiting these events a base from which they can entertain and also provide set places Utopia Residences say.

"*Utopia* will offer more time at these locations for people to take in the cultural experience and will offer more by to the business customers in facilities. For instance *Utopia* will have two large cinema screens, which will be beneficial at Cannes Festival as that is something they actually lack in," said John Latham of Utopia Residences.

Expected for delivery in 2013, Utopia Residencies will start taking booking for the apartments this year, with the cost of the apartments to range from US$3.7 million to US$25 million. Utopia will have 200 apartments onboard with each apartment ranging in size from 1400ft^2 to 6600ft^2. The owners who buy these apartments will have a 75 year contract on the apartment, allowing effectively three generations of a family to use the apartment in that time.

The US$1.1 billion cruise vessel will be 296m in length overall, with a breadth of 36m and a gross tonnage of 105,000gt. The vessel will be able to accommodate 900 passengers onboard, with 606 crew and will have 212 residencies onboard.

"The decision to construct the vessel at SHI was an investor's decision," said Mr Latham. "The Institutional investor's have ties with Korean Businesses which helped make the decision, but also for practical reasons. Anyone wanting to build a cruise ship in a European shipyard will look at paying a higher cost, where as constructing at a yard in Korea will obviously have a better cost due to prices of materials, etc.," he added.

Vice chairman of Samsung Heavy Industries Kim Jing-wan commented: "As the Korean shipbuilding industry needs to advance into the cruise ship market if it is going to maintain its number one position in the global shipbuilding market, Samsung Heavy Industries aims to surprise the world with the exceptional quality of this apartment-type cruise ship, and lay a foundation for new growth of the Korean shipbuilding industry."

With the recession biting into the shipbuilding market, *Utopia* signifies the confidence that both the investors and Utopia Residencies have in the market. Mr Latham comments: "The yards are taking a long term view, and address projects that come in this way. The recession has given a price point advantage to the buyer and Utopia has been able to take advantage of the lower prices." At current Utopia is running to plan, which Mr Latham has attributed to the investors and their timing of the project. *NA*

TECHNICAL PARTICULARS

Utopia

Length	296m
Breadth	36m
Draught	8.3m
Gross tonnage	105,000gt
Passengers	900
Crew	600
Residences	212
Hotel Suites	218

***Utopia* to be constructed at Samsung Heavy Industries.**

The man behind the design at Carnival

Design architect Joseph Farcus has been working with Carnival designing the interiors of its cruise ships for the past 30 years. He tells *The Naval Architect* how it all began and the future of interior ship design.

Mr Farcus started out in design 30 years ago where he initially studied land based architecture at Florida University and now is a recognised name in the maritime industry. Drawing on his knowledge from land based architecture and focusing on what the passenger wants onboard a cruise ship has enabled him to explore and create impressive designs onboard vessels under the Carnival Corporation cruise brand.

Even though Mr Farcus has not been involved in any land based designs for the past 20 years, he has been involved in over 40 ship projects from the beginning to the end of the design process in that time.

Mr Farcus comments on his experience: "The knowledge that I have from being a land based architect merged with the necessity of design with a ship and getting in on the 'ground floor' of a project is important."

When Mr Farcus first started out in cruise ship design after meeting the owner of Carnival, he notes that that there were no purpose built cruise ships at the time and it was usual for a freighter ship that wasn't being used through certain points of the year to be painted white and with this the cruising tradition started.

The first vessel that Mr Farcus worked on for Carnival was *SS Festivale*, originally *SA Vaal* of Safmarine Lines running between Southampton and Durban. In 1977 the vessel was sold to Carnival where it was refitted in Japan to a modern cruise vessel and re-entered service in 1978.

Believing in the principle that 'the ship itself is the desitination' Mr Farcus has worked closely with naval architects and says that his experience in land based architecture has given insight to naval architects who did not have the experience in that field. He highlights projects that he has worked on with Maurizio Cergol, senior naval architect at Fincantieri who he has worked closely with in recent years. "When we've talked about ideas they've lead to some further interesting ideas and it's been quite an experience", comments Mr Farcus.

After completing the biggest vessel in Costa's fleet, *Costa Luminosa*, and seeing the launch of *Oasis of the Seas*, Mr Farcus believes that ships in the future will not be as big as Royal Caribbean Cruise Line's (RCCL) *Oasis of the Seas*, mentioning that the important variable in the decision of cruise lines building bigger ships is the economic environment, which these vessels are being constructed in. "Just to build a huge ship is not worth it, I don't know about whether the RCCL's vessel is feasible, but there is no profit to build really big," he adds.

Mr Farcus comments on the large vessels that are in service at the moment: "Bigger ships will get built which will be good for new passengers and will help people who may never have thought of going on a cruise ship cross that line, but at the moment it's too costly for people to go on them. The cost of going on the ship [*Oasis of the Seas*] is the same as going on a luxury ship."

"How they [RCCL] resolve this will be the interesting point. If they are successful in resolving this then yes it will push people further in the design of cruise ships."

He carries on to say that if the

Joseph Farcus

Joseph Farcus received his Architectural degree from the University of Florida in 1967. He became licensed as a registered architect in 1969 and at that time was the youngest corporate member of the American Institute of Architects in the U.S.A. He received national certification in 1970. In 1977 Mr Farcus opened his Architectural office; one of the first projects he worked on was the refit of Carnival's third ship TSS Festival. Specialising in cruise ship Mr Farcus has designed all interiors for the entire Carnival fleet. In 1998 Mr Farcus feature in the Guinness book of Records as the interior designer for *Carnival Destiny* which was the first passenger ship to exceed 100,000tonnes. He has designed 28 delivered ships for Carnival Cruise Lines and six delivered ships for Costa Crociere. He is currently working on two Carnival Dream class ships and four mega-cruisers for Costa Crociere.

He is a member of the board of Trustees for the Miami Art Museum and is on the Board of Governors of the American Jewish Committee. He is married to Jeanne Farcus and has three Children.

industry is going to build bigger ships even though they may not be profitable, companies must stay focused on keeping the features on the vessel in cruise ship style and for the features that all passengers would want onboard.

Mr Farcus also warns that when coming up with ideas for designs there is a need for the utmost care, as designers are faced by two options in which they can spend all of the budget, or spend it wisely, he says. "I would rather devote space and functionality to a passenger ship," says Mr Farcus. "Concentrating on the details and not the gimics and more family orientation," he adds.

Giving an example of the *Costa Luminosa* Mr Farcus highlights the points that make that vessel a cruise ship that all the family can enjoy: "It has the biggest area for young children in the fleet, it still has its traditional cruising function, there are more choices of how you want to relax and enhance the cruise. Two people can experience the ship in two different ways.

When it comes to designing a vessel the size of the recently launched *Costa Luminosa*, Costa's largest vessel to date it is not without its challenges. The 294.00m Length overall cruise ship has a breadth of 32.25m and a depth (to main deck) of 13.69m. She has a service speed of 21.6knots and the capacity for 2800 passengers. Not only is she the largest of the fleet so far, but also has the facility for cold ironing, allowing her to shut down her engines in port and draw power from a shore based supply.

Costa Luminosa, a recent Joseph Farcus project.

Mr Farcus said that for him when designing *Costa Luminos*a he was aiming to create the dream cruise ship, practising the philosophy that the ship is the destination. What he wanted was for guests boarding *Costa Luminosa* to feel that it enhanced their dreams of a cruise experience. The realisation of the idea is now launched and will be joined by *Costa Deliziosa* which was delivered in January this year and with *Costa Pacifica* delivered in May last year, making the total of three vessels delivered to the Costa fleet in under a year. *NA*

Almaco to supply *AIDAblu*

Almaco has recently announced that it has completed a contract to supply galleys, pantry and provision stores onboard *AIDAblu*.

AIDAblu will be the fourth newbuilding for German-based shipyard Meyer Werft that Almaco Group has supplied food handling equipment. Almaco has also delivered food handling systems to the previous three ships *AIDAdiva*, *AIDAbella* and *AIDAluna* and is contracted to work on the following two.

The recent order encompasses the supply and installation of galleys, pantries and provisions stores. This delivery of the equipment supports Meyer Werft's confidence in Almaco's food handling systems fully, which satisfying AIDA's stringent requirements and high quality standards, as well as all USPH, say Almaco.

Almaco will supply and install all the equipment on the AIDAblu's galley's and pantries, which will occupy an area of 2000m^2. The area comprises of three big galley areas and 24 pantries for bars and cabin service for passengers and crew. Almaco's scope will also included the supply and installation of foundations and stainless steel ceiling and wall panels on a complete system basis, in accordance with USPH policies.

In addition Almaco has also supplied 34 provisions stores including walk-ins and dry stores onboard of each ship, occupying a floor area of 950m^2. Where necessary A-60 rated fire hinged and sliding doors have been installed in the stores. The doors fully comply with both fire and instulation requirements in a single unit, eliminating the need to fit two adjacent doors to provide fire protection and temperature insulation.*NA*

IMO takes action on damage stability

Damage stability in chemical tankers came under scrutiny again at the International Maritime Organization (IMO) during the last week of January 2010, the UK authorities were at the forefront of the debate.

Following discussions at the International Maritime Organization's (IMO) sub-committee SLF 52 (Stability, Load Line and on Fishing Vessels) agreement was reached by the delegates that guidelines should be produced to help owners, operators and inspectors to ensure that chemical tankers can survive an accident, should it occur, when they leave port.

A working group was established to determine what will be contained in these guidelines which will be divided into the design and application of damage stability information as defined by naval architects, and operational guidelines will help masters, owners, surveyors and inspectors ensure that a vessel meets damage stability regulations before the vessel leaves a port and after loading.

"It will essentially tell a master what is expected of him," explained Paul Coley, assistant director seafarers and ships at the UK's Maritime and Coastguard Agency.

The guidelines will supplement the regulations that are already in place, but are not necessarily enforced, because many in the industry are unaware that the damage stability of chemical tankers can vary significantly depending on the number of tanks that have cargo, how full those tanks are and the specific gravity of those cargoes.

One source said: "there is no need to change the regulations, SOLAS and MARPOL are fully understood, the main difficulty is that the loading book is produced at the design stage and owners think that covers all operations, but it doesn't cover every permutation that a ship could load during its lifetime."

This is particularly difficult for chemical tankers, as opposed to crude carriers and gas tankers which were also considered at the January meeting, because of the wide variation in specific gravity for the cargoes that a chemical tanker might carry.

"The UK delegation will lead the correspondence group established to develop the guidelines and we hope that we can reach a consensus before the SLF53 meeting [the next sub-committee meeting due to take place in January2011], which will then decide on the final form of the guidelines," said Mr Coley.

> "The UK delegation will lead the correspondence group established to develop the guidelines and we hope that we can reach a consensus before the SLF53 "

In addition an inspection campaign is planned for later this year and states and administrations will be asked to "consider this year's meeting when their officers carry out inspections," said Mr Coley.

Backed by co-sponsors from Germany, Denmark, Sweden and Norway the UK delegation took research evidence collated by the MCA to the IMO sub-committee to reinforce its view that many chemical tanker operators were failing to meet damage stability regulations. The MCA surveyed tankers calling at UK ports and found that around 50% of chemical and product tankers were either not in compliance or were unaware whether the vessel had met the damage stability rules or not before leaving port.

Additionally the MCA's research found that many operators believed that if the tanker loaded using in tact stability guidelines would automatically meet the damage stability rules as well. The MCA rejected this view and has sought to enforce regulations more rigorously.

However, some of the parties present were not fully behind this decision at the sub-committee meeting with some owners concerned that ships could be delayed in port and that these delays would mean they incur extra expenses. The International Parcel Tankers Association (IPTA) believes that the MCA's survey sample, of 70 ships, was far too small to make an informed judgement. Even so IPTA confirmed in a written statement that: "IPTA will participate in the ongoing discussions on this issue, and welcomes the fact that the Sub-Committee agreed that in order to be able to develop Guidelines for onboard verification of damage stability where the ship is in a non-approved condition, it is important, firstly, to establish what constitutes an approved condition, as well as clarifying what can be considered a significant deviation from an approved condition."

The last point was also picked as a key issue, before the meeting, by ClassNK which told *The Naval Architect* that the situation regarding older chemical tankers may not be the same as for more modern ships and this could mean that different calculations could be made for the same vessels.

ClassNK explained: "One of the reasons for this is the difficulty in obtaining the necessary information to calculate damage stability and operate onboard computers for aged vessels. Such information might include, for example, lines and offset (hull form data) including inner-hull information, due to the intellectual property rights of the shipyard or bankruptcy of the shipyard. Even when such information is available, the original damage stability booklet has usually been prepared using an older programme and the calculation results would likely differ from results

obtained with an onboard computer using an updated programme. Therefore, discussions of acceptable deviations would be a key issue within the IMO."

Mr Coley also recognised that there would need to be a tolerance in the system: "We will have to work out what kind of tolerance would be acceptable if a ship is not in accordance with the damage stability regulations, that is if you load 5000tonnes into tank 1 and you have one tonne too much, that's not much variation, but if it's 10 or 20tonnes maybe that is too much."

In November IPTA had voiced its apprehension about the MCA's position: "We are concerned that to insist on port state control requiring vessels to demonstrate compliance with damage stability requirements before leaving port will inevitably lead to vessel delays. Why? Because, as the MCA has conceded all along, the only practical way to do this is by use of a damage stability computer.

"If the vessel does not have such a computer (which is the case with a large number of vessels) then the administration would have to be called in. This would naturally take time and lead to delays for vessels, and not necessarily because the vessel is not in compliance with damage stability requirements, but simply because it does not have onboard a piece of equipment which is not mandatory," wrote IPTA general manager Janet Strode.

However, Mr Coley said after the January meeting: "It is not needed to stop ships from sailing, owners will need to be warned first, but ultimately it will be for the Paris MoU (Memorandum of Understanding) to decide."

IPTA explained on its website that it had concerns about the content of the MCA's paper and submitted, jointly with ICS and OCIMF (International Chamber of Shipping and the Oil Companies International Marine Forum), a paper outlining these concerns. After further lengthy debate, the sub-committee report noted: "The majority of delegations considered that no justification or compelling [evidence] had been demonstrated and strongly supported the view of IPTA, OCIMF & ICS that more information on the alleged non-compliance (e.g., type, size, age , and the number of vessels involved) is needed to decide on the course of action on the matter."

A view from the bridge, how will new damage stability guidelines affect chemical tanker operators and owners?

ClassNK offered another reason as to why some owners maybe opposed to installing damage stability computers onboard their vessels. It said: "One of the reasons that shipowners may oppose the proposed requirement to have damage stability computers installed onboard ship is because most are already provided with shore-based damage stability analysis support which many shipowners may feel is more effective."

ClassNK does not, however, believe that there would be any problems providing verification of a chemical tanker's damage stability status in a modern vessel. It argues that: "Nowadays, intact/damage stability programmes can be used both in the design stage to prepare the stability booklet and in the operation stage to operate the onboard computer. In such cases, the calculations for either would result in zero deviations. Even if different programmes are used in the design stage and to operate the onboard computer, such software will usually be quite similar and consist of updated programmes, and any differences in the calculation results would usually be within acceptable or allowable tolerances."

Although IPTA is a non-government organisation and as such has only observer status at the IMO it is supported in its concern over the UK's proposals by the Cook Island's registry, which has full representative status, including voting rights, at the SLF meetings. The Cook Island's representative at the IMO, Captain Ian Finley, said: "The Cook Islands registry felt that the MCA did not submit enough documentary evidence to make a compelling case. However, the sub-committee agreed that there were certain ambiguities in the regulations and those ambiguities needed addressing."

Capt Finley denied, however, that there had been any discussions between IPTA and the Cook Islands on this issue: "The Cook Islands and IPTA have never co-sponsored any paper on this issue," he said.

Meanwhile, the debate that took place appears to have allayed any fears that the ICS may have had and it has now fallen into line with the UK delegation in supporting the development of new guidelines.

In the final analysis, Mr Coley said: "The Paris MoU will have to decide whether it wants to enforce these regulations now, they can do that, they could take that decision." *NA*

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LNG power, your flexible friend

As the price of crude oil rises and new regulations impose harsher penalties on polluters the cost of alternative fuels becomes ever more attractive. However, the main aim for owners must be flexibility, said the Finland based Wärtsilä.

Liquefied Natural Gas (LNG) is becoming an increasingly viable alternative to diesel, said Wärtsilä's director of sales - ship power Rolf Stiefel, and the company expects to sign contracts within the next six months that will see merchant ships, other than gas carriers, use the technology.

Wärtsilä believes that the years of development that it has put into LNG power has given the company a competitive edge in the market for dual fuel engines. Wärtsilä's experience in the field dates back to the latter part of the twentieth century with dual fuel engines for land based applications before the marine versions were fitted to gas carriers built by Chantier de l'Atlantique, said Mr Stiefel.

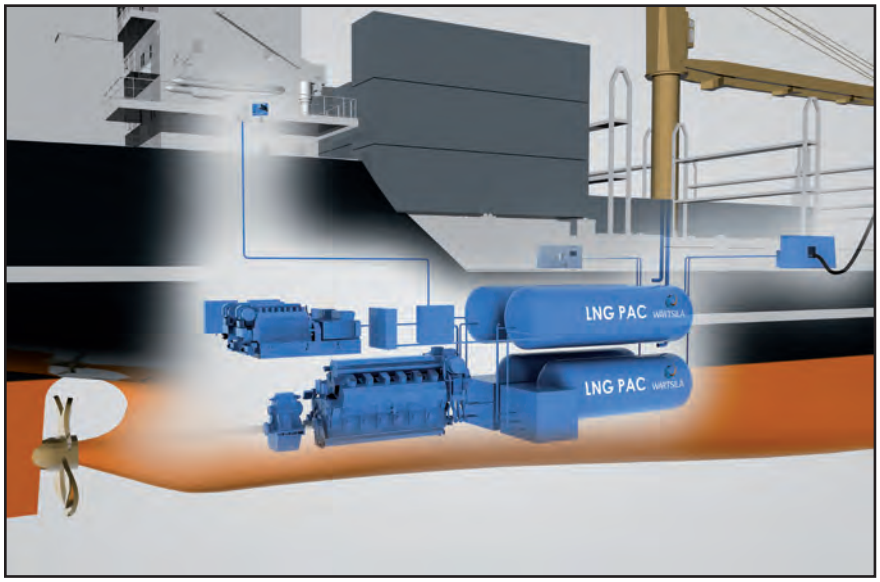
"We have several hundred engines, around 300, on order and we have the greatest experience and the biggest variety of dual fuel engines to offer," said Mr Stiefel.

The latest version of Wärtsilä's dual fuel series of engines, the 20DF the smallest of the dual fuel units, was first presented to the market during December's Marintec exhibition in Shanghai. It joins the medium range 34DF, 34SG and 32GD engines or the largest in the series the 50DF engine.

All the dual or tri-fuel series of engines can operate on LNG, marine diesel or heavy fuel oil and this gives ship operators the flexibility to use the most cost-effective fuel in the region in which the vessel is operating.

"Fuel flexibility is the innovation in these engines," explains Mr Stiefel, "the connection to the ship [of the dual fuel engine] is similar to diesel – through a gearbox and a controllable pitch propeller – or they can generate electricity for auxiliary power or main engine power."

Multi fuel engines are not new said Mr Stiefel, they have been utilised in the



LNG system intergration showing stoage tanks, evapourators, dual fuel main engine and dual fuel auxilary engines.

TECHNICAL PARTICULARS

WÄRTSILÄ GENSET W20DF

Cylinder bore 200mm
Piston stroke 280mm
Cylinder output ..... 146/176 kW/cyl
Engine speed .....1000/1200 rpm
Mean effective pressure .....20.0 bar
Piston speed 9.3/11.2m/s
Generator voltage .....0.4-13.8 kV
Generator efficiency 0.95-0.96
Fuel oil specification:.....ISO-F-DMX, DMA and DMB ISO 8217:2005(E)

Rated power				
Engine type	60 Hz		50 Hz	
	176, kW/cyl, 1 200 rpm		146 kW/cyl, 1 000 rpm	
	Engine kW	Alternator kW*	Engine kW	Alternator kW*
6L20DF	1 056	1 014	876	841
8L20DF	1 408	1 352	1 168	1 121
9L20DF	1 584	1 521	1 314	1 261

* Assumed alternator efficiency 96%

Dimensions (mm), Weights (tonnes)						
Engine type	A*	E	I*	K	L*	Weight*
6L20DF	5 325	2 070	900/980/1 030	1 800	2 688	17
8L20DF	6 030	2 070	1 030/1 080	1 800	2 824	20,9
9L20DF	6 535	2 300	1 080/1 130	1 800	2 874	24

Technical details of Wärtsilä's latest dual fuel engine the W20DF.

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shore-based industries for more than 10 years, particularly the energy generation market. "Shipping has been slow to adopt the technology, but the availability of the fuel [LNG] is the key to the development of dual fuel engines."

In addition there is the changing regulatory environment means that not only has diesel increased in price, but the cost of using diesel will increase as a result, making alternative fuel options a more attractive proposition.

More owners are looking into the LNG or dual fuel option, claims Mr Stiefel, who says that they are now getting many enquiries from owners that operate merchant vessels other than gas carriers, which already employ the technology.

In general Mr Stiefel estimates that the capital costs for installing LNG power on a vessel are 30% higher than for a standard design. In the current financial climate that may cause difficulties for the initial funding of a newbuilding, however, the operational costs are significantly lower. "We estimate that the extra capital costs can be recovered within five years," said Mr Stiefel, though he points out that each project would have to be looked at individually.

As such the company will do the comparisons for prospective clients. "We do the feasibility studies that compare the operational costs with standard designs and compare the capital costs also and then calculate the payback time for a particular investment, we find it pays off very well," he said.

Furthermore, with new regulations coming vessels will need to fit SOx scrubbers and NOx catalysts which increase the cost and complexity of operating a conventionally powered ship. The introduction of Sulphur Emission Control Areas along with NOx control zones and the North American proposals to curb pollution within 200nm of the USA's coast will mean that some vessels will incur further costs.

"Of course there is also a cost that conventional vessels will incur to fit all of the machinery that will deal with the new regulations," points out Mr Stiefel. And not to mention the probability that the special low-pollution zones will be further extended.

As a result the main obstacle that is currently seen by Wärtsilä to the introduction of LNG powered ships is the availability of the fuel itself. "The technology is a done deal, it is accepted," said Mr Stiefel, "we now need to solve the issue of sourcing fuel".

Availability in Norway remains small scale, trucks that load offshore vessels, said Mr Stiefel, but other areas of the Baltic, Lubeck, Gothenburg and Stockholm are looking at projects that are large enough o refuel ro-ro ferries, he said.

It is in this maritime sector, ferries, which operate from point to point that the first non-gas carrier dual fuel orders are likely to come from, Mr Stiefel believes. However, the regulations on how the fuelling will work still need to be worked out and he admits that the discussions around this are ongoing. *NA*

WÄRTSILÄ 34DF — IMO Tier II

Main data

Cylinder bore ..... 340 mm
Piston stroke..... 400 mm
Cylinder output..... 435, 450 kW/cyl
Speed ..... 720, 750 rpm
Mean effective pressure ..... 20.0, 19.8 bar
Piston speed..... 9.6, 10.0 m/s

Fuel specification:
Fuel oil ..... 730 cSt/50 °C
7200 sR1/100 °F
ISO 8217, category ISO-F-DMX, DMA and DMB
Natural gas
MethaneNumber: 80
LHV: min. 28 MJ/Nm³, 4.5 bar
BSEC 7700 kJ/kWh

Rated power

Engine type	60 Hz		50 Hz	
	435 kW/cyl, 720 rpm		450 kW/cyl, 750 rpm	
	Engine kW	Gen. kW	Engine kW	Gen. kW
6L34DF	2 610	2 510	2 700	2 600
9L34DF	3 915	3 760	4 050	3 890
12V34DF	5 220	5 010	5 400	5 190
16V34DF	6 960	6 680	7 200	6 920

Generator output based on a generator efficiency of 96%.

Engine dimensions (mm) and weights (tonnes)

Engine type	A	B	C	D	F	Weight
6L34DF	5 280	2 550	2 305	2 345	1 155	34
9L34DF	6 750	2 550	2 305	2 345	1 155	47
12V34DF	6 615	2 665	3 020	2 120	1 475	59
16V34DF	7 735	2 430	3 020	2 120	1 475	75

WÄRTSILÄ 50DF — IMO Tier II

Main data

Cylinder bore ..... 500 mm
Piston stroke..... 580 mm
Cylinder output..... 950 kW/cyl
Speed ..... 500, 514 rpm
Mean effective pressure ..... 20.0, 19.5 bar
Piston speed..... 9.7, 9.9 m/s

Fuel specification:
Fuel oil ..... 730 cSt/50 °C
7200 sR1/100 °F
ISO 8217, category ISO-F-DMX, DMA and DMB
Natural gas
MethaneNumber: 80
LHV: min. 28 MJ/nm³, 5.5 bar
BSEC 7410 kJ/kWh

Rated power

Engine type	50 Hz, 60 Hz	
	Engine kW	Gen. kW
6L50DF	5 700	5 500
8L50DF	7 600	7 330
9L50DF	8 550	8 250
12V50DF	11 400	11 000
16V50DF	15 200	14 670
18V50DF	17 100	16 500

Generator output based on a generator efficiency of 96.5%.

Engine dimensions (mm) and weights (tonnes)

Engine type	A	B	C	D	F	Weight
6L50DF	8 115	3 580	2 850	3 820	1 455	96
8L50DF	9 950	3 600	3 100	3 820	1 455	128
9L50DF	10 800	3 600	3 100	3 820	1 455	148
12V50DF	10 465	4 055	3 810	3 600	1 500	175
16V50DF	12 665	4 055	4 530	3 600	1 500	220
18V50DF	13 725	4 280	4 530	3 600	1 500	240

Wärtsilä and partners develop methanol fuel cell.

Finnish engine maker Wärtsilä and its partners are developing fuel cell technology as an alternative means of power for coastal and deepsea vessels. Fuel cells are cleaner and cheaper to operate than conventionally fuelled ships. Is this a fuel of the future?

In Finland the expectation is that coastal or inland vessels will be powered through the use of fuel cell technology within the next 10 years. According to Wärtsilä's director of fuel cells Erkko Fontell environmental issues and the debate over cleaner, emission free or low emission, shipping is driving the development of the technology.

Effectively the use of fossil fuels will decrease over the long term due to the increased cost of mining the fuels and changes in regulations that will see penalties imposed for NOx, SOx and carbon dioxide emissions.

Research into possible substitute energy sources is now under way and the lead technology currently appears to be liquefied natural gas (LNG) burnt in engines connected to a gearbox and propeller. Other forms of energy production such as sail and electrical energy through fuel cells are considered experimental at this stage.

However, Wärtsilä is involved in two research projects that are developing fuel cell technology for use on ships, the Fellowship project in partnership with Det Norske Veritas (DNV) and Eidesvik funded by the Norwegian Research Council has produced the *Viking Lady* which has a 320KW fuel cell with a molten carbonate electrolyte that offers auxiliary power to the vessel. (See *The Naval Architect* January 2010 pages 54-56).

Fellowship's *Viking Lady* project is further advanced than the €2.02million Methapu project which is supported by the EU with €1million in funding. Methapu, the Methanol Auxiliary Power Unit, is a 20KW fuel cell that uses solid oxide as the electrolyte.

Wärtsilä's partners in Methapu, Wallenius Marine, Lloyd's Register, The University of Genoa and DNV, have all contributed to the development of the methanol based fuel cell.

Wärtsilä FC20 unit, 20kW solid oxide, methanol powered, fuel cell.

According to the EU the aims of the project are to "validate" the use of methanol as a fuel in cargo ships involved in international trade and each partner must develop its own element of the project.

Though Mr Fontell points out that the fuel used could just as easily be LNG, biogas or methane or, "Anything that can be easily converted into hydrogen, carbon monoxide or methane," he said.

Wärtsilä is developing the power unit; Wallenius will integrate the unit onto one of its vessels; Lloyd's Register is taking care of the safety assessment, quality and reliability and classification; The University of Genoa is conducting a life cycle assessment and DNV is assessing the operational safety and evaluating the fuel cell emissions.

According to the EU: "The work on regulatory issues would facilitate the birth of new regulations aimed at enabling the use of methanol as a fuel onboard ship." In addition the EU said: "This work would facilitate the work of other fuel-cell system integrators and provide a technical basis for the growth of a new industry around methanol."

The EU concludes that, "This project would generate a tremendous base of knowledge for further research activities on greener ships, larger fuel cells and a sustainable society based on renewable fuels."

With new regulations controlling emissions this work will make a contribution towards cleaner shipping and it will in the long term save money for owners and operators who will face penalties for pollution.

The imposition in some regions of Sulphur Emission Control Areas (SECAs) and NOx free zones has already been imposed in the Baltic and North Sea with the USA looking to reduce pollution within 200nm of its coastline and a further SECA zone being discussed for the Mediterranean region the feeling is that these areas will become the norm over time.

Driven by these new controls inland and coastal shipping will seek cleaner fuels with which to power vessels and one solution could be electric powered ships using fuel cell technology to produce the energy.

"It's not impossible to develop a 2MW fuel cell," believes Mr Fontell, the largest fuel cell today is 2.5MW, but these take a lot of space, it would take up a lot of engine room space and the weight is heavier than a diesel," he added. Mr Fontell went on to say that the company will "improve the power density and the system will become more robust in the future".

Even so that aim appears to be some way off as Wärtsilä is about to launch its latest range of fuel cells, some two and a half times more powerful than the original cell, which was rated at 20KW. "Our long term target is to increase the power output to 250KW and beyond," said Mr Fontel. *NA*

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The environment must be considered in every aspect of the design and operation of all shipping, from construction all the way through to decommissioning. The earlier these issues are addressed in the design stage, the more cost effective and successful they are likely to be at reducing the environmental impact of shipping industry. However, much can also be undertaken on existing vessels to reduce the impact of the remainder of their lives. The IMO is systematically introducing regulations on a number of topics to reduce the impact of the marine industry on both the sea and atmosphere, including exhaust emissions, anti-fouling, and ballast water amongst others.

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V.Delta draws on design and operations

With the newbuilding market stalled, a one of a kind combination of ship design and operational know-how is generating an ever-widening portfolio of services in the ship conversion market for the partners in the joint venture V.Delta.

V.Delta, the 50-50 joint venture between Finnish naval architecture and marine engineering group Deltamarin and V.Ships Leisure, continues to extend the range of services it is offering to facilitate ship conversions.

Concentrating on managing conversion projects for owners of cruise ships, ferries and mega-yachts since its formation in 2007, the company draws on experience that extends from first principle engineering to day to day operations to manage major conversion work on existing tonnage. V.Delta also manages around 20 drydockings a year and concentrates on interior design refurbishment and noise and vibration troubleshooting.

The company has high expectations that significantly more conversion business will be generated from 2011 onwards.

Live projects include the proposed conversion of *Artemis*, the 1196 passenger, 1984-vintage cruise ship sold by P&O Cruises in October 2009 to Artania Shipping. *Artemis* will continue to sail for P&O through to mid-April 2011, but *Artania* Shipping is set to charter the ship, renamed as Artania, to the German tour operator Phoenix Reisen.

Discussions are continuing as to whether the new owners will take forward a P&O plan to add up to 100 new balconies. V.Delta has already undertaken some work towards this end. Balconies have already been added to this ship in the past. As a result, class determined that past additions had brought the ship to the limits of its longitudinal strength, given the new insertions in the shell. V.Delta was, therefore, asked to perform finite element modelling to establish how much strengthening would be required for up to 100 more balconies to be added in the upper decks five and six.

Phoenix Reisen said it was studying whether to take the plan forward, or whether a smaller scale refurbishment would be more appropriate. Either way, the ship will likely enter a yard for work in April 2011, after handover. V.Delta's project brief will include developing a design for the addition of balconies, as well as establishing a yard for the conversion to take place.

Rather than simply offering project management for conversions, however, V.Delta offers anything from feasibility to turn-key management, taking in basic design to construction drawings, engineering, procurement, construction supervision, logistics, interior designing, bidding specification, contract negotiation and award to yard and subcontractors. Additionally, the company can offer training for ship and shore based staff, energy balance consultation for machinery and accommodation spaces and engineering for hydrodynamic upgrades.

V.Delta managing director, Matteo Di Maio said that the dearth of orders in the cruise and ferry markets would see owners of existing ships more prepared to invest in assets already at sea from 2011 on, in order to prolong their lives and adapt them to changing market demands.

Typical was the US$25million refurbishment of the 296 passenger capacity Silversea Cruises vessel *Silver Wind* at the end of 2008. Here, work at the San Giorgio del Porto yard in Genoa over a 25 day period saw a new deck added, with significant upgrading of cabins and public areas entailing the creation of a new block for the Spa and Observation Lounge. Last year, V.Delta also served as project manager on a similar refit for sister vessel *Silver Cloud*.

V.Delta's responsibilities on *Silver Wind* extended to the design and installation of a new aluminium structure on the top deck to create the observation lounge, ocean-view spa and fitness centre, and eight new superior-class suites. Some 50 tonnes of steelwork were also replaced in the ballast tanks, and a new panoramic lift was installed. V.Delta prepared all technical specifications and handled the bidding process with competing yards and suppliers, supervised work, controlled the budget and planning, and assisted GEM, the interior design contractor.

The depth of design and engineering knowledge available to the partnership has been further demonstrated in an ongoing project covering the renewal of an engine room onboard a mega yacht at Blom + Voss, whose ownership has not been disclosed. However, what is disclosed is the fact that the stripping out and replacement of the existing installation exploited 3D modelling software based on the automotive industry product CATIA, where 2D construction drawings are extracted from the 3D model.

Crosshead: Fuel specifics

Another area where V.Delta has been carving out a niche based on its broad engineering and operational experience is in energy conservation. Given the fact that fuel consumption contributes up to 50% of a ship's operating costs, the company has developed a targeted 'Energy Conservation Program' to offer a systematic approach to evaluating and improving average fuel consumption. The approach includes an analysis of historical fuel performance, culminating in a report highlighting weaknesses, systems deficiencies and areas that require improvements, the development on an action plan and follow up analysis.

This analysis takes in the performance of individual crew members. Depending

on the historical fuel data base analysed, it is possible to compare how the same ship behaves with different senior officers. It is, for example, possible to see if one master consistently arrives in port more than one hour in advance, or if the power plant always has a lower than average efficiency with the same chief engineer. After fuel saving training has been given, crew sit an exam.

From the more technical point of view, in establishing a ship's 'fuel history', V.Delta takes abstracts from the engine log covering speed, propulsive power and fuel consumption at sea in different sea states, and while in port. As some of the suggested actions require an investment, V.Delta first identifies the potential savings through the analysis of fuel consumption trends over a two to three year period, and then suggests the possible actions to reduce the annual fuel consumption.

Technical recommendations have included application of foul release paints instead of traditional antifouling paints, in order to reduce friction, updating autopilot systems, inserting interceptor plates and ducktails, minor modifications on ship hull appendixes, grinding of weld seams in the bow area, propeller optimisation, the installation of frequency converters to various pumps and fans, the improvement of waste heat recovery efficiency through modifications to automation, and control improvements on AC system and air handling units and a chiller control system.

Each vessel requires special attention, of course. In the case of the Corsica Ferries vessel *Mega Express III*, for example, operated by Corsica Ferries between Italy and Sardinia, V.Delta recommended the installation a dynamic trim assistant on board.

Over 212m in length, this roll-on, roll-off ferry can transport 650 vehicles and 2100 people and travel at speeds of up to 35knots. However, while built to high specifications, *Mega Express III* had one drawback: it was expensive to run. Compared to other vessels in Corsica Ferries' fleet, *Mega Express III* had the highest fuel consumption per mile travelled.

Like all ship operators, Corsica Ferries knew that the trim and drag affected fuel consumption. However, the organisation had no way of monitoring actual trim during sailings and altering the trim accordingly.

"The trim adjustments were based on a table of optimum trims derived from sea trials of *Mega Express III*, which had been conducted before she was put into active service," said Giuseppe Parenti, technical manager at Corsica Ferries. "We wanted to find a way to better monitor the optimum trim during sailings and thereby reduce the vessel's fuel consumption."

Following the deployment of Eniram's Dynamic Trimming Assistant, the annual fuel consumption of *Mega Express III* ferry dropped significantly. Designed specifically for the shipping industry, this technical solution calculates the current trim of a vessel and displays it onboard, on a very clear and self-explanatory user interface. Crew members can instantly see if the vessel is sailing at the optimum trim and make adjustments, if necessary.

After installation, the shipowner reports that masters and crew members found the system easy to use and were soon able to manage the trim of the ferry in a much more proactive and effective way. "DTA helped to focus the crew on the importance of trim management to reduce fuel consumption," said Mr Parenti. "We have had good feedback about DTA from those who use it."

The *Mega Express III* crew can now also ensure that the ferry sails at its optimum trim for each and every journey. As a result, the ferry is operating with far greater fuel efficiency.

"We have reduced fuel consumption on the *Mega Express III* by three percent in the high speed range of over 25knots per hour," said Mr Parenti. "This corresponds to an annual reduction in fuel requirement of 980tonnes."

At an operational level, the company has recommended water hull cleaning once before drydocking, or each six months (depending on the type of hull coating), water propeller brushing each four to six months and itinerary modifications, speed profile optimisation, guidance for operation in shallow water, guidance in use of fin stabilisers, maintenance of the engine fuel system, and the maintenance of turbocharger and charge air cooler.

V.Delta reckons to have achieved average reductions in fuel costs of 3-5%, which it guarantees through a no-cure-no-pay proposal. The 3-5% range depends on the ship's initial performance, age and its employment. *NA*

MacGregor lifts crane technology to new heights

New developments in the cargo lifting community are seldom as radical as MacGregor's all electric crane development. The freethinking craneiologists at Cargotec have launched the company's new MacGregor GLBE electric cranes.

Polish shipowner, Polsteam's, award of the contract for the supply of 24 cranes to its eight newbuildings, currently under construction in China's Taizhou Sanfu Ship Engineering yard, is a shift from the standard order. The 16,900dwt bulk carriers will be fitted with 30tonne SWL MacGregor GLBE all electric cranes.

The cranes, which are tested both mechanically and electrically before delivery as complete units, will be installed on the the newbuildings between the end of 2010 and 2012.

In confirming this new order late last year Polsteam brought to a successful conclusion seven years of debate and development by Cargotec. A pre-study into an all-electric solution was first conducted back in 2003 and that lead to a design that was both environmentally cleaner and operationally more efficient and this lead to the prototype being built and tested in 2006.

The prototype crane was then fitted to a China Navigation vessel, the *Indotransflores*, in 2007 which traded on a route that took the vessel from Singapore to India, the USA and Canada. The ship presented Cargotec with an opportunity to test the cranes in a wide range of climates and environments, from very humid in Singapore and Indonesia to very cold in Canada.

Fitted with 50W heaters to maintain the temperature within the machinery spaces at a level that was 1-2°C above the ambient temperature, thereby preventing the machinery from condensation damage, the crane's performance exceeded the expectations of its designers.

Per-Erik Nilsson, director marketing and sales for MacGregor cranes, said: "Electric cranes have fewer moving parts, they have no pumps and no oil, they have a 20% better efficiency and they do not lose heat energy."

In fact the Cargotec crane was designed with a "backpower" feature that turns the electric motor in the jib into a power generator through the weight of the cargo.

"We have calculated that the backpower system will mean savings of power generation of around 30%. We have not yet confirmed those savings, though, we will validate the energy savings next year after more tests," said Mr Nilsson.

In looking to provide a radical new solution for cargo handling cargotec

A close up of MacGregor's electric crane.

has developed a crane with, said Mr Nilsson, many advantages. The price of electric cranes is now the same as an electro-hydraulic crane; the electric crane sports a variable frequency drive that allows it to alter the lifting speed and a CC3000 control system that calculates the weight of the load and then uses the maximum speed for that weight.

In addition hydraulic cranes are can leak fluid if they are badly designed, use poor quality components or they are poorly maintained, there is no such risk with the electric cranes which do not use hydraulic fluid. In addition the installation for the cranes is far simpler as a technician must fit hydraulic piping to carry the fluid to the crane. Wiring must be installed for the electric cranes, but this can be carried out by a comparatively unskilled worker as most of the electrical system is provided by the manufacturer.

In fact, said Mr Nilsson: "If maintenance is carried out properly and regularly the [electric] crane will work for the lifetime of the ship.".

He added that, "On the test ship the crane has been operating for two years and all the crew want to use the electric crane, because it is smooth in its operation and there is no oil and no cleaning."

"It is," said Mr Nilsson, "the crane of the future for every size for all ships." *NA*

MacGregor's electric crane mounted alogside a conventional hydraulic crane aboard the *Indotransflores*.

MacGregor supplies cargo handling to Japan

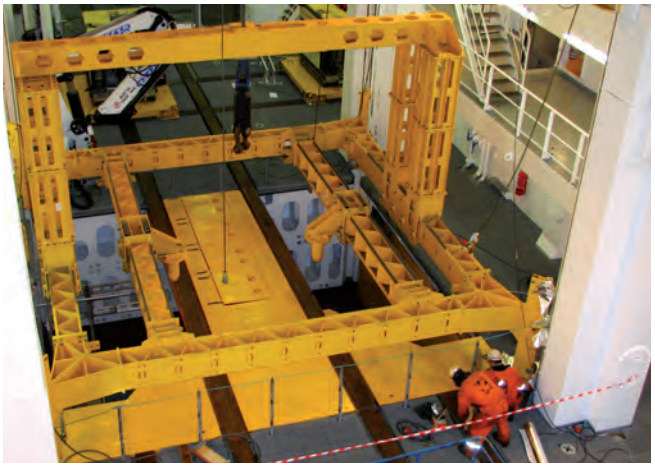
Cargotec has recently announced that it has signed a contract to deliver a range of advanced MacGregor offshore and subsea load handling systems to a deepsea research vessel.

The vessel will be built at Mitsubishi Heavy Industries Shimonoseki shipyard in Japan and was booked in the fourth quarter 2009. "This contract serves as recognition of Cargotec's capacity and technological expertise in the offshore load-handling segment," says Øystein Bondevik, sales director for offshore load handling at Cargotec.

The contract covers some of the major MacGregor products for ultra deepwater operations and deck handling machinery and will be manufactured at Cargotec's production hub in Kristiansand, Norway. The contractual agreement includes an extensive engineering package and customisation of solutions for special operations and the distinctive design of the vessel.

Systems ordered include a large knuckle-jib crane; an advanced moonpool-based module handling system, deck-skid system and several deepsea AHC winches with a capacity down to 10,000m. All winches in this series are fitted with a proven MacGregor electric drive system introduced three years ago. "The winch performance, compact design, power efficiency and low noise level of this system makes it a superior solution to any alternative," Mr Bondevik says.

"This order further strengthens our presence in Asia, and by working together with our global team enables us to serve our customers in the best possible way." *NA*



MacGregor has received orders from Japan for its cargo handling equipment.

Huisman adds to *Borealis* design

Acergy has recently purchased Nordic Heavy Lift's vessel *Borealis*, which was originally ordered in 2007 with the special feature of a Huisman 5000tonne mast crane as part of that design

Acergy has said that it has set aside US$240 million for further equipment upgrades to the vessel, but is like not to spend the full amount. The extra work the vessel will include the installation of a 1000tonne J-Lay tower and 600tonne S-Lay equipment.

The vessel is also due to be also be fitted with support systems and construction equipment for deepwater and harsh environment operations. Provisions will be made for the offshore construction unit to include one of Acergy's heavy duty flexible pipelay systems.

Borealis was constructed at a budgeted cost of US$221 million and was due to enter service in March 2010. Last September Nordic Heavy Lift said it was facingcost overrun of up to US$460 million on the vessel construction, attributed to increased project management and changes in the ship structure; which will now see *Borealis* delivered in the first half of 2012.

Borealis is 181m in length overall, with a beam of 46.2m and a moulded depth of 16m. The draft of the vessel ranges between 7-11m and has a speed of 14knots. The vessel has a 5500m^2 deck area that has a maximum load capacity of 350tonnes and average capacity of 10t/m^2. The high load capacity of the vessel will allow it to transport large modules over long distances.

The *Borealis* is fitted with a 5000tonne revolving single mast deck crane, developed by Huisman Special Equipment. *NA*

MacRack side-rolling hatch covers are a greener solution

Cargotec has developed a second generation of fully electrically-operated MacGregor side-rolling hatch covers following its success with the E-Roll system. Torbjörn Dahl and T. Laakso of Cargotec Marine, Finland describe the system.

Development of the electric-drive side-rolling hatch cover started in 2001 in response to the Japanese car industry's ambition to make its supply chain as 'green' as possible. The answer to this challenge was to launch the 'E-Roll' side-rolling hatch cover system.

E-Roll's components and control system were essentially developed from scratch because similar systems for the marine and bulk carrier environments did not exist. After extensive tests and a lengthy component selection process, the first orders were signed in 2006. Ten ships using E-Roll systems are in service but this number is growing rapidly: another 21 shipsets of equipment are on order and about 20 more are in the pipeline.

As with all first-generation technology, improvements were needed. A development project focusing on the safety, technical limitations and cost of electric drives has now resulted in the launch of 'MacRack' that employs an enhanced control system and just one electric motor per hatch cover panel.

Advantages of an electric drive compared to hydraulic systems

For the shipowner:
- fast and easy to operate
- no pollution from hydraulic oil
- maintenance friendly with simplified inspections
- operation position is not limited
- cost savings, initially and during ship's lifetime
- energy saving as no continuous running
- no cold climate sensitivity
- high reliability
- easy to monitor

For the shipyard:
- installation friendly (plug and play)
- no pump and hydraulic pipes to fit
- no system to flush
- no hydraulic control stand installation required
- cost benefits

Introduction

Ship operators and shipyards increasingly appreciate that environmentally-friendly ships are competitive. Electric drives offer them many advantages compared with hydraulic versions, such as: hydraulic oil leakages are eliminated; there is no need to fit hydraulic pipework onboard; electric drives are easy to monitor and maintain; and electric drives offer energy savings.

Having identified a need in the market for cargo systems that use environmentally-friendly electric drives several years ago, Cargotec's development policy for electrically operated MacGregor systems had three main aims. Compared with hydraulic drives the electric-drive versions had to be more environmentally-friendly, have equal or better performance and cost the same or less

For some years, many shipowners have tried to minimise the use of hydraulic oil onboard. One reason for this is that certification (ISO 14001 for example) requires them to minimise the environmental impact of their operations.

Oil should not leak from hydraulic-drive equipment that is properly designed, maintained and uses quality components. However, simply not using hydraulics removes the pollution risk entirely, as well as the possible risk of hydraulic oil damaging cargo which could be an issue for some ship types.

A major difference when adopting electric drives is eliminating the need for hydraulic power packs and valve stacks, and replacing hydraulic pipework with electric cables. Cables can be installed by less-skilled personnel than the mechanics needed for hydraulic pipework. More electrical cabinets with motor control functions will be required, but most of the skilled electrical work is inside these cabinets and is done by the supplier in a workshop ashore. The net effect is to, therefore, minimise work onboard by moving it ashore – giving slightly higher equipment costs, but lower installation costs.

Comparing the costs for electric and hydraulic drives shows that these are basically the same overall. However for individual items or systems the cost of an electric drive should not be higher than its hydraulic counterpart.

Hydraulic drives need power packs using electrically-driven pumps. These pumps are not 100% efficient, and systems with the variable-displacement pumps used for most cargo systems also consume power in idle. This could result in a higher electrical consumption compared with direct electric drives.

General Design

The electric-drive design work covered three areas: mechanical design, electric design, and electronic control design.

Hydraulically operated mechanisms can be replaced with electrically operated versions. Such a device can be divided into two main parts: the mechanical part and the actuator part.

The mechanical part is in most cases the same whether hydraulically or electrically operated. However, if design changes are required for some sizes/types, the new mechanical parts will be designed according to the same criteria and safety factors applied to all other similar

mechanical parts used in MacGregor equipment. Therefore, any new mechanical parts will be proven designs with the same reliability as existing components.

In operating cylinders there is basically only one part – the actuator part connected to the cargo equipment structure or hull structure. If the cylinder is replaced by electric screwjacks, such a mechanical interface will be the same, so parts reliability remains the same.

Electric design involved replacing hydraulic valves with electrical contactors and Variable Frequency Drives (VFD) for speed control. Each item has a local electrical contactor cabinet for the start and control of the electric motors. This cabinet replaces all operational valves found in the hydraulic system. The contactors can be manually operated, offering the same first line of redundancy operation provided by the hydraulic valves with manual opening/closing.

The electric motors are either controlled by inverters or by variable frequency converters, when speed adjustment is needed. A further advantage of VFD is that at a low speed the torque can be higher.

Electronic control design addressed overload protection and other control functions that are carried out by security valves and control valves in the hydraulic system, replacing them with similar functions in the electrically operated system.

Drive and lifter

Large bulk carriers are in most cases equipped with side-rolling hatch covers and there are two types of drive for opening or closing them: chain drive or rack-and-pinion drive.

For both drive options there are two ways of lifting the panels before side-rolling: pot lifts (which can also be described as hydraulic jacks, or wheel lifters), or 'Roll-up-Roll' lifters.

With the pot lifts, cleating is performed by manual quick-acting cleats or by hydraulic cleats. The Roll-up-Roll system enables automatic cleating to be adopted.

The new MacGregor solution, the MacRack, is at the same time a rack-and-pinion drive and a lifter system. When opening hatch covers the lifting force needed is achieved by the MacRack lever mechanism. The mechanism converts the rotation (torque) into a vertical movement. When closing, the mechanism lowers the covers and pushes them together to achieve the correct amount of rubber compression and tightness.

The MacRack, therefore, makes separate hatch cover lifters obsolete. This reduces maintenance work for the shipowner, and the shipyard's installation work is also simpler because fewer components need to be installed on the coaming. A significant feature of this side-rolling system is that the actuators are installed on the hatch sides only. There the drive unit is well protected from cargo spills during loading and discharging. Detailed technical checks as well as prototype tests have been carried out, and a patent is pending.

The panels are kept in the closed position by an automatic lock (with a manual release). For intermediate stops the panels are held by the built-in brake on the motors. With the opening/closing movement, auto-cleats are activated in the same way as for the Roll-up-Roll system.

This new system incorporates a number of mechanical as well as electrical innovations:

- the drive and lifting systems are combined
- automatic cleating (as in Roll-up-Roll) is foreseen
- initial lifting is practically straight up enabling the use of a standard seal all around the hatch cover panel
- the motor and its mounting are disconnected from the panel when the hatch covers are closed at sea, allowing free relative movements between ship's hull and hatch covers
- the modular configuration means that installation and repairs can be done independently and replacements are easy
- automatic locking when closed, but with a manual release
- for shipyards the standard interface's big benefit is speeding up the ship design process.

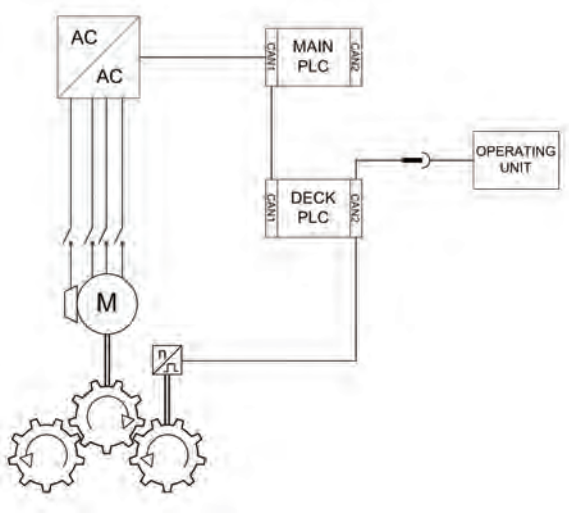
The control system

The electric control system enables automatic speed control; allows independent panel control – meaning that panels can be driven separately; improves feedback to the operator; and has automatic operation and safety features. Redundancy is also to some extent achieved with the control system design.

The control system uses bus communication (e.g. CANopen, Profibus, Profinet, DeviceNet) between system components, thus reducing cabling work on board and as an option allows information to be shared with external systems as well.

Automatic speed control

Panel position is monitored by continuous measuring principle (absolute encoder). In specific panel positions the control system automatically allows high speed panel travel. Low speed movement is used near the end positions and in high torque



A schematic of the MacRack control system.

areas. For one-side operation, a reduced travel speed is used – lower than normal high speed, but higher than low speed. The operator can also use low speed in a high speed area, but never high speed in low speed area. Motor rpm, and therefore panel speed, is controlled by VFD. In heeled conditions the VFD brake resistor keeps the speed at the correct level.

Because of the VFD, the initial slow speed gives a much higher driving force (i.e. torque) compared with the normal speed mode needed during one-side operation (in heeled condition).

Panel position monitoring improves hatch opening/closing operations: the operator does not need to see the actual position of a panel when positioning is required (e.g. for one-side operation) and different automatic stop features are used.

In two-panel arrangements both panels have their own actuator. Both actuators are controlled by separate VFDs. This enables separate speed control for each panel. It is possible to operate just one side. This separate speed control feature is also used for one side operation.

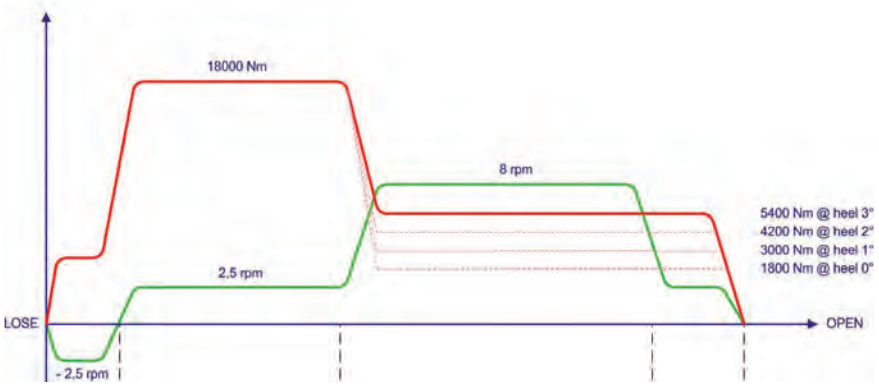
Improved feedback to operator

A four-digit display and four indicating LEDs are included in the Portable Operating Unit (POU) for operator feedback. LEDs indicate with two colours (red and green) and different blinking of VFD and encoder status to operator. This also improves diagnostics for maintenance. The four-digit display shows simple text messages about operations to the operator. Confirmations of certain operation sequences are also required, and are shown on the POU display. These confirmation texts are used to improve equipment safety, especially in one side operation.

In the main control cabinet traditional lamps are used for feedback and system status.

Redundancy features

Some redundancy has been enabled in the control system design. For instance if one of the deck PLCs is broken, the panel can be driven directly from VFD operating panel. It is also possible to manually cross-connect motors between VFDs.



A schematic of speed and torque (opening)

Position control is based on absolute encoders. Whenever there is a problem in position control, the system goes into 'safety mode'. This operating mode allows panel to be driven, but only at low speed. If electrical power cannot be used, panels can be operated with the same emergency equipment usually used in all MacGregor hatch cover systems.

Remote diagnostics

Remote diagnostics technology has advanced to a stage where it is now practical to relay parameters of equipment operation to a central point for analysis, monitoring equipment condition wherever the ship happens to be. Electric drives are ideal for this. By using all-electric components it is possible to provide continual diagnostic data for analysis round the clock.

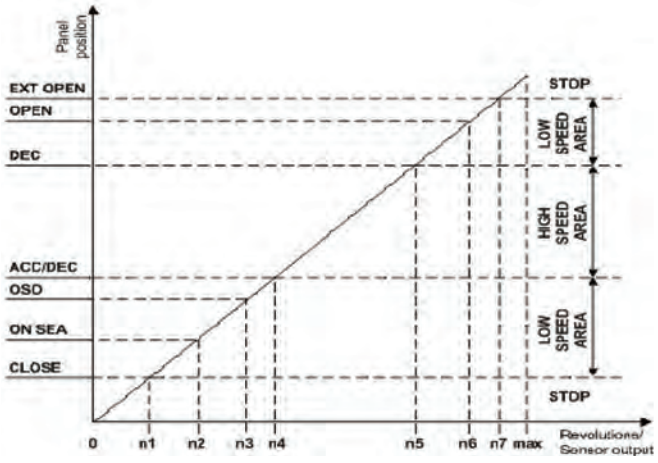
Using the latest diagnostics tools it is now possible to offer real-time equipment condition analysis and reporting via telephone or satellite communication media. In combining the equipment condition analysis with planned maintenance based upon equipment maintenance protocols, Cargotec can now offer seamless service solutions.

Conclusions

It is clear that the future will bring stricter measures to protect the environment, which the shipping and shipbuilding industries will have to comply with. But, 'green' solutions are not just ways of conforming with legislation or improving a company's image – they make economic sense.

The shipbuilding process also needs to be made more effective, and one way of achieving this is to move work from the building dock to a workshop – such as a supplier's own factory – where there is a better environment and a concentration of skills.

Finally, shipowners today need to be more effective than ever. Remote diagnostics technology makes this possible. *NA*



A schematic of number of revolutions (i.e. positions) and travel speed areas.

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