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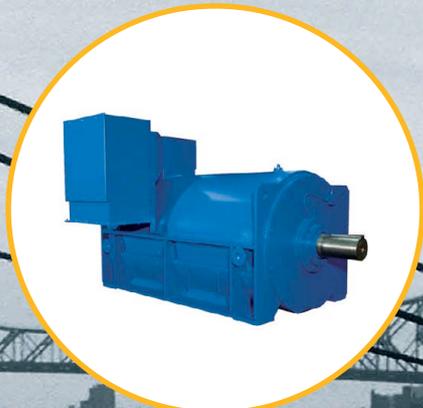
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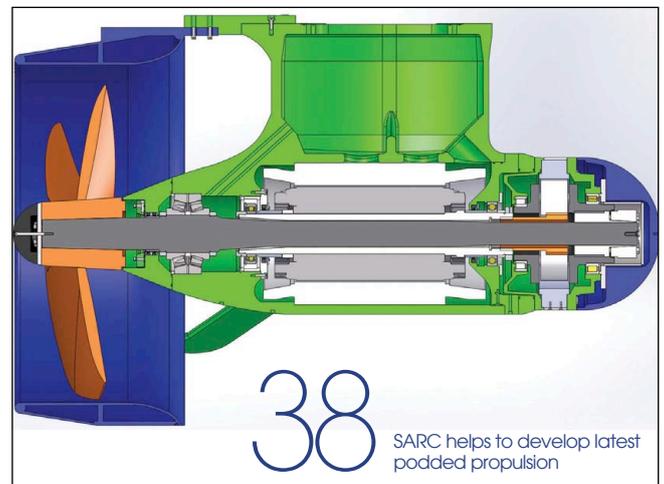
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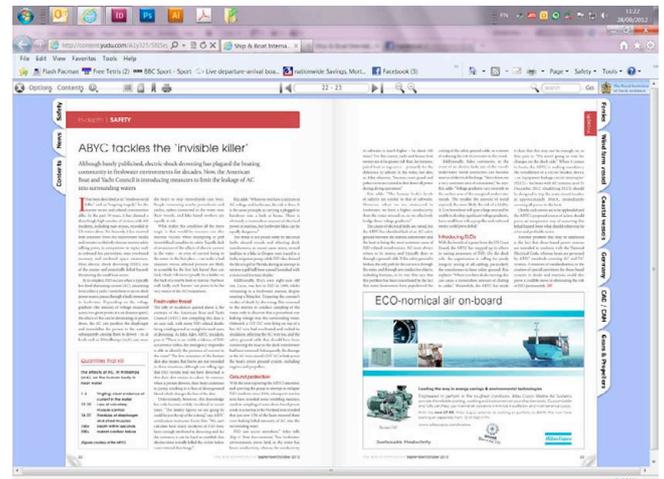
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Revolution key to new boxship designs

Maersk Mc-Kinney Møller was the first 18,000TEU vessel to be launched, more will follow, but a revolution in design is necessary for boxships to take the next step

Development of boxship designs has reached a crunch point. Port and logistics capacities have an influence on the design of container ships, even the largest vessels, of 18,000TEU, have similar draughts to ships less than half of their capacity.

Politics and economics may also play a role in vessel design as global trading patterns shift with the emergence of new regions of growth, perhaps Africa and parts of Latin America and Eastern Europe. Already there has been some localisation where factory owners who had relocated European factories to China to take advantage of cheaper costs are now returning to their European roots. This could mean less demand for vessel space.

In addition some experts believe that the cost savings from economies of scale have become less significant as the vessels have become larger, so the economies of scale of *Emma Maersk* over the previous generation of ships was greater than the economies of scale offered by *Maersk Mc-Kinney Møller*.

It has been in chasing these economies of scale that the development of container ships over the last three decades or so has seen vessels become longer as the ships were required to carry more cargo. According to one vessel design expert from a leading class society, one of the defining restrictions for boxships has been the containers themselves.

“Containers are not strong enough,” he says, “you can only stack them 10 high in the hold or on deck that is the

same for an 8,000TEU as it is for an 18,000TEU ship.”

Effectively as the vessels became larger and they needed to become longer in order to increase the payload. This meant that ships evolved out of proportion, becoming less stable and more prone to hogging and for this reason Panamax ships carry a lot of ballast water.

After the evolution of the container ship reached the post-Panamax stage there was a correction in the proportions of the vessel designs with ships jumping from 32m beams to 37m, “that brought the ships back to their natural proportions,” says our expert.

To increase the capacity of vessels in the latest stage of the container ship evolution the technology and design has effectively remained the same, “there has been no revolution” in container vessel design. The ships are getting longer, up to 400m and with a beam of just under 60m similar problems are occurring with the 18,000TEU designs now suffering from similar difficulties of their earlier, smaller, cousins; namely hogging and stability issues.

A number of 18,000TEU designs are around at the moment, including Maersk’s Triple E design, which was built at Daewoo Shipbuilding and Marine Engineering with the first vessel delivered last year. Maersk solved its stability problems by using anti-roll tanks (*The Naval Architect* June 2013 pages 24-25).

Other designs such as those vessels now being built for the United Arab

Shipping Company by Hyundai Heavy Industries or the Odense Marine Technology design that it has developed with the Chinese yard Shanghai Waigaoqiao Shipbuilding Co. Ltd (SWS) (see pages 26-28 of this issue) are all now tackling this stability problem.

In order to increase their capacity ships would have to again become longer with more steel and an increase in bending moments. So instead the vessels have become wider, around 58-59m. “Stability has again become an enormous problem as the GM becomes too big,” says the naval architect: “Ships are becoming stiff in the water, with loads of forces impacting on the containers so it is necessary to reduce GM, particularly as lashing bridges have also become higher, up to four tiers high, so that heavier cargo can now be stored higher on deck,” he explains.

Putting tanks higher up on the vessel would help with the high GM difficulties, but the stability issue remains and is likely to be solved by existing technology such as anti-roll tanks.

The question for designers is what will the future vessels’ look like? Will they grow further to take advantage of even greater economies of scale, or will there be a design revolution that will see cargo transported in an entirely new and far more efficient way. My money’s on the development of an entirely new technology to take advantage of the emergence of new trades in a new economic climate. Vive la revolution! *NA*

Acquisitions

ClassNK swallows NAPA

In a €53 million (US\$73.75 million) deal Japanese class society ClassNK has acquired 100% of the shares in the Finnish maritime software company NAPA.

Collaboration between the two companies was already significant with the development of NAPA Green and NAPA Steel software. However, the deal will allow NAPA to reinvest profits into R&D for the development of further products according to Yasushi Nakamura, ClassNK executive vice president and Juha Heikinheimo, president of NAPA Group.

Both executives confirmed that NAPA will continue to operate as it has done up to now with no personnel or management changes. Significantly Nakamura emphasised: “We respect NAPA and so there will be no change to NAPA, we accept all the management systems and the managers.”

A joint statement said that the deal had substantial benefits for both companies: “The acquisition will significantly enhance the success and capabilities of both organisations. For ClassNK, which has worked with NAPA for nearly 10 years, the landmark deal is a chance to expand and improve the wide range of services it offers to shipowners and shipyards, whilst also providing NAPA with support to accelerate the expansion of existing operations and access new markets.”

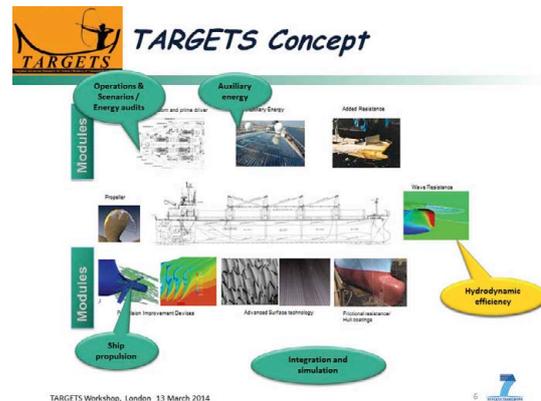
Vessel efficiency

TARGETS practice

An EU-funded research project reported its conclusions after three years of work in London last month. TARGETS, the Targeted Advanced Research for Global Efficiency of Transportation Shipping project, sought to identify fuel efficiency opportunities from vessel design and operation.

A number of industry leaders, academics and research establishments were involved in the research work on TARGETS, including, among others, HSVA, Newcastle and Strathclyde Universities and the Technical University of Hamburg along with Maersk, Star Bulk and ship management companies Tsakos Columbia and OSG.

The stated objectives of the project were to develop a holistic simulation and optimisation concept that would improve the energy efficiency of shipping; based on a Dynamic Energy Model (DEM) the most relevant energy consumers on board and the use of new, alternative energy sources were to be analysed and improved; simulating and optimising energy consumption at the design stage and during operation providing guidelines for future energy-efficient cargo vessels.



The TARGETS concept encompasses all energy consumption points on the vessel

In order to meet these objectives a variety of areas were considered including ship resistance; that is hull form resistance due to the hull design, viscous resistance looking at coatings and lubrication of the hull and environmental resistance through drag caused by fouling, etc.

Another obvious area for improvement was the ship propulsion and the TARGETS researchers used DEM tools to improve vessel efficiency looking at both conventional and unconventional propellers in the preliminary design stage.

DEM integrates knowledge from component level to the ship system level with interactions between energy systems taken into account. For example DEM for bulk carriers and container vessels have been developed and the performance of ship energy systems is assessed by time domain simulations. Scott Gatchell, an HSVA representative of the TARGETS team, says that: “The DEM gives a view of how all the fuel saving devices work together,” so that the entire package can be assessed for effectiveness.

The performance of ship energy systems is assessed by time domain simulation revealing their true energy performance. Such simulations take into consideration the inherent properties of systems in relation to environmental conditions and the operational profile of the ship. This knowledge is then integrated from component level to ship system level.

TARGETS solutions were integrated onto a Capesize bulk carrier and were monitored over a distance of 38,000nm. The vessel called at nine ports and sailed at a maximum 15knots, “the speed/power curve shows that the lowest speed is not always best,” says Gatchell.

Gatchell went on to say that the team had fixed a “boundary layer alignment device” to the underside of the vessel in an effort to improve the hydrodynamic flow into the propeller. Overall the vessel showed significant fuel savings over the monitoring period of up to €400,000 (US\$551,000) in fuel costs and a further saving of 2,620tonnes of CO₂.

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Fuel

Fuelling growth

In an effort to understand how the maritime industry may develop over the next 15 years or so Lloyd's Register (LR) and University College London (UCL) have conducted a study that develops varying scenarios depending on differing social, economic and political projections.

Perhaps the most startling projection from the study, Global Marine Fuel Trends 2030 (GMFT 2030), is that growth in fuel demand is set to double from 2010 levels by the end of the next decade and in all three scenarios the projection is that HFO will remain the key fuel of the immediate future, even if this fuel will be blended with some bio-fuels to make it cleaner.

The base level GMFT 2030 scenario, called Status Quo, projections of fuel consumption rates and the evolution of the fuel market from 2010 levels forward are offered. The study concludes that if the industry continued along the path on which it is now following demand will double by 2030.

A second scenario, Global Commons, looks at a more co-operative sequence of events where increased globalisation leads to collaboration in order to reduce pollution and conserve energy. And the final scenario, Competing Nations, looks at the nuclear option where countries compete openly and globalisation goes into reverse leading to the localisation of production.

According to the study HFO will still be the major fuel in 2030, "but in different proportions for each scenario". In the Status Quo version of the future 47% of fuels used will be HFO, and 66% and 58% in Competing Nations and Global Commons respectively.

Predictably, LNG will see an increase in use in all three scenarios from zero in 2010 to at most 11% while in Global Commons, the appearance of hydrogen is explained by the

authors as due to the scenario "favouring the uptake of low carbon technologies stimulated by a significant carbon price".

Demand for HFO will remain the same in 2030, mainly because of the overall increase in demand for ship fuel, say the authors, adding that: "with the overall fuel demand doubling by 2030, other fuels will see a higher rate of growth to meet this demand".

Four vessel types were included in the projections, container ships, bulk and general cargo vessels, crude oil tankers and product and chemical tankers. Also included in the study were projections for a variety of possible fuels ranging from those currently available, HFO, MDO and LNG; to fuels of the future, low sulphur HFO, bio fuels, methanol, hydrogen and biodiesel.

Classification

Ironing out building anomalies

Class society DNV GL has taken aim at the building variations that occur when different shipyards build the same vessel. A new software package called Build2Design was launched last month which will help yards build the vessel as designed.

Performance variations on eco-ship designs have been highlighted by some owners and research has shown that there is a "wide variation in different ships of the same design," says DNV GL.

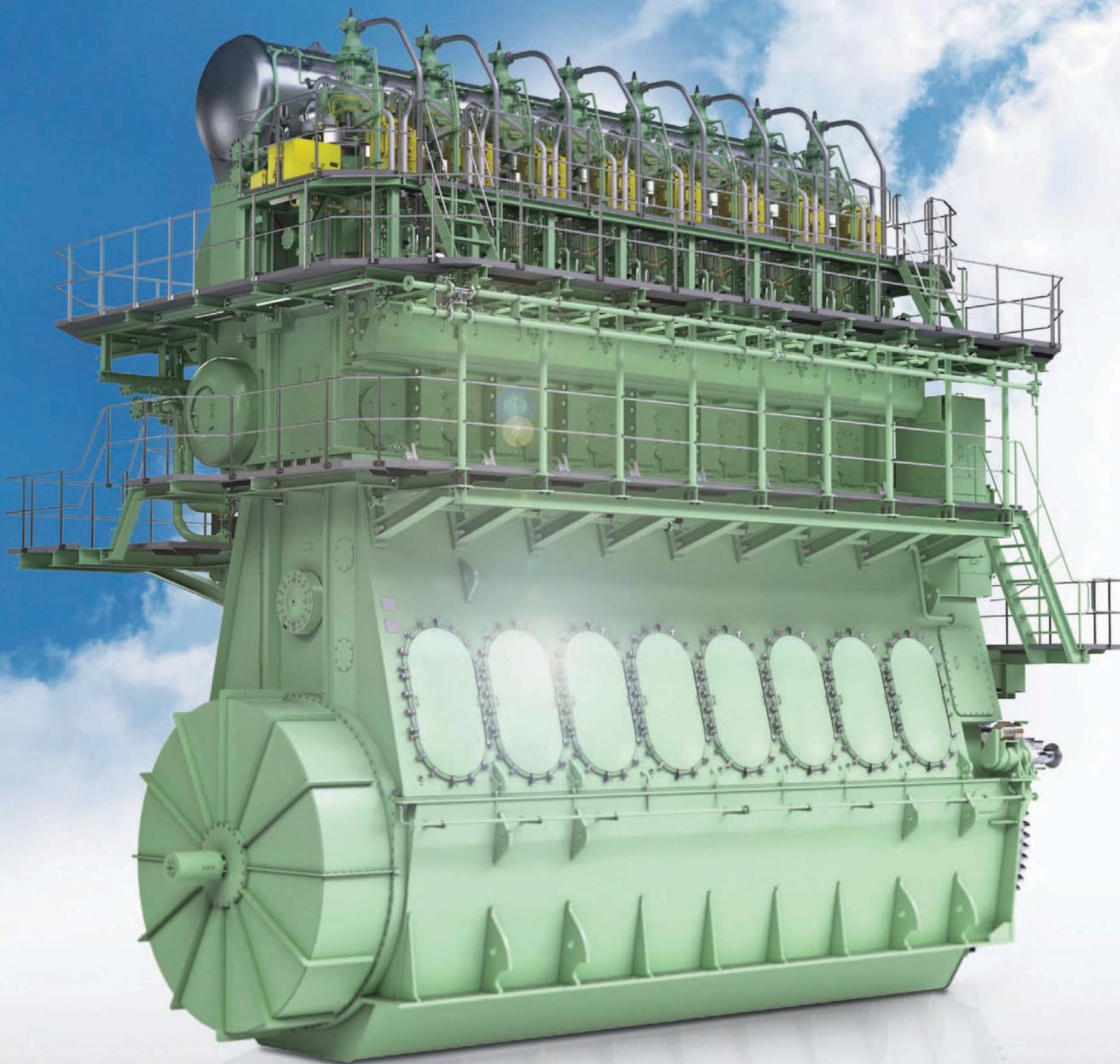
Dr Olav Rognebakke, head of hydrodynamics at DNV GL, adds: "Build2Design is based on a solid theoretical foundation combined with the latest technology and uses advanced CFD calculations to identify the parameters that affect fuel consumption and the effect of each individual parameter." **NA**

Fuels considered in this study

Fuel name	Fuel type	Feedstock	Production technology	Comments
MDO	Marine distillate including marine diesel and gas oil	Oil	Refinery	It is composed of lighter distillate fractions than residual fuel, and has lower sulphur content.
Bio_MDO	Biodiesel (1st generation) Biodiesel (2nd generation)	Rapeseed oil (1st generation) Lignocellulose/Wood (2nd generation)	Trans esterification Gasification	It is commercially available, can be blended with marine distillates and be fully compatible with the engines, it has the potential of reducing GHG emissions
HFO	Marine residual oil	Oil	Refinery	It is the main marine fuel used, is very competitive in price, has high environmental impacts
Bio_HFO	Straight vegetable oil (SVO)	Rapeseed oil	Pressing	It is an easily accessible fuel able to substitute HFO to reduce GHG emissions
LSHFO	Low sulphur fuel oil	Oil	Refinery	Still competitive in price as HFO and lower sulphur emissions (<1.5%), assumed to meet 0.5% sulphur limit from date of global sulphur
Bio_LSHFO	Straight vegetable oil (SVO)	Same as Bio_HFO	Same as Bio_HFO	Same as Bio_HFO
LNG	Liquefied natural gas	Natural gas	Extraction and liquefaction	It has lower GHG emissions than oil derived fuels, is competitive in prices, and is already used in part of the fleet.
Bio_LNG	Biogas	Lignocellulose/wood biomass	Gasification	It has the same benefits as LNG but with the additional life cycle environmental impact reductions.
H2	Hydrogen	Methane	Steam methane reforming with CCS	It has no carbon emissions in the point of operation
Bio_H2	Hydrogen	Lignocellulose/wood biomass	Gasification	It has the potential of being a carbon negative fuel
MeOH	Methanol	Methane	Reforming and synthesis	It has lower carbon content on a mass basis and has good compatibility with
Bio-MeOH	Methanol	Lignocellulose/wood biomass	Gasification	It has the potential of being a carbon negative fuel and its liquid physical form gives it an advantage from the storage point of view. It can be used as feedstock for other alternative fuels production (DME) and as additive for conventional fuels.

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IMO keen to finalise Polar Code this year

Pressing forward with the development of the Polar Code will be a key development at the IMO, heightened by ship safety issues which will form a dominant part of the Maritime Safety Committee discussions in May, writes *Sandra Speares*.

IMO secretary-general Koji Sekimizu is keen to see the new code finalised by the end of this year although there remains plenty of work to be done if this is to be the case. The draft text of the mandatory Polar Code as well as draft amendments to IMO's safety and pollution prevention treaties to make it mandatory, were agreed in principle at the sub-committee on design and construction in January.

The Code would require ships intending to operate in the defined waters of the Antarctic and Arctic to apply for a Polar Ship Certificate, which would classify the vessel in different categories according to its ability to operate in different ice conditions.

An assessment would be needed to take into account the anticipated range of operating conditions and hazards the ship may encounter in Polar waters including identified operational limitations, and additional measures needed to meet safety or environmental requirements.

The draft code outlines goals and functional requirements, including those covering: ship structure; stability and subdivision; watertight and weather tight integrity; machinery installations; operational safety; fire safety and protection; life-saving appliances and arrangements; safety of navigation; communications; voyage planning; manning and training; prevention of oil pollution; prevention of pollution from noxious liquid substances from ships; prevention of pollution by sewage from ships and prevention of pollution by discharge of garbage from ships.

The jury is still out on whether it will be possible to finalise the code by the end of this year.

According to Alistair Hull, technical manager at the International Chamber of Shipping, there remains: "A reasonable amount of substantive work to achieve, but I think it is do-able depending on how things go in the intervening period".

As far as design and construction issues are concerned he says that the code is quite positive on the issue. "As it has been done on a risk-based basis, what

the code is looking at is assessing the capability of the ship for operating in specified conditions in terms of temperature, ice cover and daylight hours, and certifying the ship in accordance with its capabilities. From our perspective, that is a good thing because it doesn't necessarily rule ships in or out."

There are some issues still to be sorted from a naval architect's perspective he adds. These include coming up with design temperatures and test procedures that take account of those lower temperatures.

Agreement has been reached on operating perimeters for standard SOLAS ships. "The tricky bit will be for ships that want to go beyond that, possibly in winter or in more severe ice conditions."

At the moment this aspect has traditionally been handled on a project basis, with discussions between class, the flag state and the potential operator. "I suspect that in the initial stages of applying the code that may still need to be the case."

"So far the mandatory part of the polar code has been the main focus"

In the medium to longer term he believes the maritime community and the IMO will need to look at existing testing procedures for safety and firefighting equipment and lifesaving appliances to look at how design perimeters will be set in the testing process to take account of lower temperatures. Naval architects will need to consider materials, performance, and problems with the brittleness of metal materials or possibly glass reinforced plastic.

Protection of equipment, possibly through providing an auxiliary heating system, also needs to be considered to make sure that the equipment does not simply survive but is capable of functioning at lower temperatures – particularly as far as safety related equipment is concerned. It may not be a question of having a common standard across the board, but more one of a common approach to ensure that, for example, lifeboats would be able to start their engines in a certain temperature, with a margin for safety built in.

So far the mandatory part of the Polar Code has been the main focus, but because it is a goal-based code set in terms of performance levels to be achieved it also needs a lot of guidance to give examples of how that can be done, Hull says. "That needs a lot more attention." **NA**

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Ballast water treatment

AQUARIUS UV certified for hazardous areas

Wärtsilä has announced that its AQUARIUS UV ballast water management system (BWMS) has successfully completed verification testing for explosion proof (EX) requirements. The verification was handled through DEKRA and now means that the AQUARIUS UV BWMS range is EX certified for Zone 1 hazardous area operation in marine and offshore installations.

It is an IMO requirement that the BWMS for ships having hazardous areas onboard must be EX proof certified. Wärtsilä has said that it has taken a systems approach to the EX validation process and to the complete AQUARIUS UV BWMS module, not only the electrical components, to make the system compliant with the EX and IMO regulations. This approach is said to improve the accessibility, since the modular design allows some system components to be located outside the hazardous area, thereby increasing the availability and maintainability of the whole system.

www.wartsila.com

Deck equipment

TTS seals another crane deal

TTS Group has, through its subsidiary TTS NMF GmbH in Hamburg, Germany, secured a new contract with Keppel Singmarine Pte. Ltd. in Singapore for the delivery of one 200tonne Leg Encircling Crane and one 50tonne pedestal offshore crane to the yard Nakilat-Keppel Offshore & Marine in Qatar. The contract has a total value of approximately NOK50 million (US\$8.4 million).

The 200tonne Leg Encircling Crane is based on the design principles of the TTS NMF in-house developed 90tonne heavy-lift offshore crane, which was installed on board the jack-up vessel *Aeolus* in February. The deliveries of the cranes are scheduled to take place in March-May 2015.

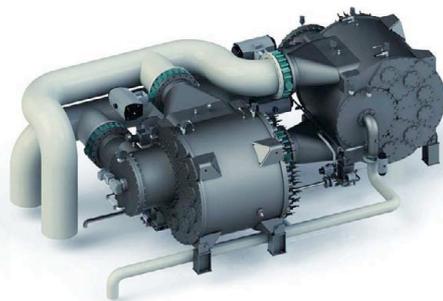
www.tts-group.com

Ballast water treatment

Trojan Marinex gets type approval

Trojan Technologies has announced that its Marinex ballast water treatment (BWT) product has obtained IMO Type Approval from DNV on behalf of the Norwegian Maritime Directorate.

Rather than focusing on being among the first to get IMO Type Approval and testing to minimum



Example installation of two Trojan Marinex BWT 1250 units, in parallel, treating 2,500m³/h.

standards, the focus was instead put on the continual refinement of the BWT treatment technology and a robust testing protocol.

In addition to the rigorous certification and testing methodologies employed, the company said that the Trojan Marinex BWT system is differentiated in that custom-designed filtration and UV is integrated into in a single, compact unit. The TrojanUV Solo Lamp Technology has been utilised to ensure the lowest installed power draw of other systems in the market. This extremely low power draw means that larger vessels, such as bulkers and tankers, can effectively choose a UV-based solution, the company states.

www.trojanuv.com

Bridge & communications

Transas gets into training

Transas Marine International has received Transportstyrelsen (Swedish Transport Agency) approval for its STCW conform generic ECDIS training.

After successful formal and on-site Transportstyrelsen audits, the Transas ECDIS training course was certified successfully and will be re-audited according to the regular Transportstyrelsen audit cycle.

ECDIS Training offered by Transas Marine follows the IMO Model Course 1.27, fully compliant to the STCW 2010. This allows Transas to issue STCW 2010 compliant ECDIS training certificates. Sweden is the second flag state to approve Transas Marine's generic ECDIS Training after the approval by BSH (Germany) in 2011. These trainings are accepted by all other IMO member states due to a standing agreement, the company said.

www.transas.com

Bridge & communications

Safebridge adds CHARTPILOT series

Hamburg-based ECDIS training specialist Safebridge has extended its portfolio with a type-specific

familiarisation course for the CHARTPILOT 1100/93x0 series made by SAM Electronics. The manufacturer approved course is available online and completes the coverage of online training for SAM Electronics' ECDIS products, the company said. The courses for CHARTPILOT 1100/93x0 series as well as the ECDISPILOT series courses can be booked for single officers on demand or be assigned from a fleet training package. They also cover the MULTIPILOT version of the respective ECDIS.

www.safebridge.net

Classification

RINa manages the load

International classification society RINa has launched InfoSHIP EM, a real-time tool for monitoring and optimising the hotel power demand on cruise ships. RINa claims that it is expected to produce hotel load energy savings of over 10%, thus generating significant annual cash savings in fuel costs for a typical large modern cruise ship.

InfoSHIP EM is part of the InfoSHIP Energy Governance suite developed by RINa and software house IB Software & Consulting. It collects live power consumption data from the hotel services, AC systems, accommodation and lighting systems and galley and laundry services. Target values are set by calculation at the design or installation stage and then continuously updated by operational feedback and trend analysis. Target values are optimised according to the season and area of operation, the operational mode, either in port or at sea and the time of day.

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Accommodation & interiors

Bolidt wins backing across the cruise sector

Bolidt has seen numerous orders for its decking solutions for newbuildings in the cruise ship industry. Among others, Bolideck products have been specified by Norwegian Cruise Line (NCL), Royal Caribbean International (RCI), Viking River Cruises and TUI Cruises.

In February this year it installed nearly 17,000m² of decking on the 324m-long, 4,000-passenger *Norwegian Getaway*, covering indoor and outdoor areas. Products supplied included the low maintenance Bolideck Future Teak. *Norwegian Getaway* has also been fitted out with Bolideck 525. Bolideck Future Teak and Bolideck 525 will feature on the 4,200 passenger capacity Breakaway Plus-class *Norwegian Escape*, which is due for delivery in October 2015.

Bolidt is also working with RCI and Meyer Werft on the 248m-long, 4,905-guest capacity *Quantum of the Seas* and *Anthem of the Seas*, due for delivery in November 2014 and March 2015 respectively. Future Teak will be used for the stateroom balconies on the Quantum-class vessels, while Bolideck Select Soft will feature extensively in public areas.

Meanwhile, Bolidt decking will be a feature of the 295m-long, 2,500-passenger *Mein Schiff 3*, which is nearing completion for TUI Cruises at STX Europe, Turku.

Bolidt says that it is also making its mark in the river cruise sector. In particular Viking River Cruises has specified the company's products for a number of new vessels that enter service in 2014, including *Viking Ingwi*, *Viking Eistla*, *Viking Bestla* and *Viking Alsvin*.

www.bolidt.com

Accommodation & interiors

Solar Solve gets onboard with DSME

Solar Solve Marine has received an order from Korea for four ship-sets of its SOLASAFE roller sunscreens. The screens are to be installed at the navigation bridge windows of four very large container carriers currently under construction at Daewoo Shipbuilding and Marine Engineering's Okpo shipyard on Geoje Island.

With a length of 366m, a beam of 48.8m and depth of 30m the vessels will all be 152,700dwt, and whilst not the biggest in the world, they will still be classed as mega carriers with a maximum capacity of around 13,100TEU.

Hyundai Hope, the first vessel in the series, is due for delivery in March this year with the other three following at two-monthly intervals thereafter. They will be named *Hyundai Drive* (May 2014), *Hyundai Victory* (July 2014) and *Hyundai Pride* (August 2014).

www.solarsolv.com

Bridge & communication

OCTOPUS-Onboard for *Stanislav Yudin*

The Dutch offshore contractor Seaway Heavy Lifting has ordered Amarcon's OCTOPUS-Onboard decision support technology for its monohull crane vessel *Stanislav Yudin*.

For *Stanislav Yudin*, Amarcon will deliver an OCTOPUS-Onboard installation including motion monitoring & forecasting in order to increase workability and safety during offshore installation



Seaway Heavy Lifting orders OCTOPUS-onboard for its crane vessel

operations. The motion forecast allows the master to select the most favourable heading during offshore installation projects, with the least forecasted roll and pitch motions, so operations can be executed in a safe and efficient way. Part of the system shall be an interface with the 2,500tonnes revolving crane. This enables the master to monitor, view and store the motions of the crane tip within the OCTOPUS-Onboard system. In addition to the onboard decision support that OCTOPUS offers, SHL will have access to OCTOPUS-Online. This way the onshore operations department is constantly informed about location and status of the vessel, and has an insight in predicted and measured motions and accelerations of the vessel during offshore installation tasks.

www.amarcon.com

Bridge & communications

L-3 SAM Electronics to supply *Ceona Amazon*

L-3 SAM Electronics announced that it has been awarded the contract to provide complete electrical packages, as well as integrated navigation, automation, communications, energy distribution and propulsion systems for *Ceona Amazon*, the 199m offshore construction and pipelaying vessel to be delivered this coming October to Ceona, a London-based subsea contracting organisation.

The L-3 vessel control system consists of a NACOS Platinum integrated navigation system, featuring standardised workstations with multipurpose displays, and an MCS Platinum automated monitoring and control system capable of processing approximately 4,500 input and output signals controlled by 10 processing stations. Supplementary support facilities comprise a full range of internal communications systems as well as a comprehensive range of GMDSS equipment. Power will be available for seven asynchronous thruster drives generated by a series of six diesel alternators supplying three medium-voltage

switchboards. Other associated equipment includes six-pulse and 12-pulse PWM converter drives in addition to 16 medium-voltage propulsion and distribution transformers.

www.sam-electronics.de

Accommodation & interiors

Estillon supplies cruise ship with Fenix Base

Estillon has supplied *Norwegian Getaway*, which recently made its maiden voyage with 20,000m² of Fenix Base. Both *Norwegian Getaway* and its sister vessel *Norwegian Breakaway* were built by Meyer Werft, with Estillon supplying its Fenix Base carpet underlay for both cruise ships.



Estillon fits out Norwegian Cruise Line's latest pair

Norwegian Getaway has been fitted with underlay made of composite polyurethane foam. The company said that the foam is what distinguishes Fenix Base from other IMO-rated underlays on the market.

www.estillon.com

Lifesaving & ship safety

McMurdo offers world coverage

McMurdo Group has announced that its fleet management software platform is now available worldwide for partners to integrate into their existing maritime applications and solutions.

The platform provides users with a robust suite of vessel tracking, two-way messaging, asset/document management and Automatic Identification System (AIS) display capabilities that enables end customers to run their companies more efficiently, safely and profitably, the company said.

McMurdo Group's fleet management software platform is a web-based messaging and mapping software platform which allows the visual management of a fleet with two-way communications.

www.mcmurdogroup.com



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Titanic tonnage taxes tutors

How can the size of modern large ships be objectively conveyed to the general public given that comparisons to *Titanic* are arbitrary and meaningless? Paul Stott, senior lecturer School of Marine Science and Technology University of Newcastle upon Tyne outlines the difficulties

At first sight the question of the size of a ship may appear relatively trivial, but there is a serious underlying point. How can we, as professional naval architects, objectively convey the size of a ship to a lay reader? As any naval architect knows, the size of a ship is a complex matter and finding an appropriate measure is correspondingly complex.

A common comparator used in the general press is to compare a ship to *Titanic* and just such an approach was used in September 2013 when salvors accomplished the heroic task of ‘manhandling’ *Costa Concordia* to a vertical position, ready for salvage. The press almost universally tried to convey the size of the task by stating that *Concordia* is around twice the size of *Titanic*.

Whilst this is approximately correct in terms of gross tonnage the size of *Titanic* is no more than a notion in the minds of most and the comparison actually fails to convey the size of the task undertaken in a meaningful way. The fact is that *Titanic* was no larger than a modern car ferry and if this is put to a lay person the legend for size immediately evaporates. The North Sea Ferry *Pride of Hull*, for example, is 30% larger than *Titanic*: the Channel ferries *Spirit of Britain* and *Spirit of France* are similar in size to *Titanic* and this comes as a revelation to those that have travelled on these vessels.

A better comparator is needed that can give a true sense of the scale of this monumental task, which turns out to have been much greater than the *Titanic* comparison suggests and this was the subject of research published in February. The research first considered, relatively speaking, how large *Titanic* was and whether an Edwardian engineering artefact can be used in a meaningful way to benchmark a 21st Century artefact. The different potential comparators that could be used were then considered and a more meaningful comparator proposed to objectively convey size to a lay reader.

The legendary size of *Titanic*

The legend of the *Titanic* is well founded in public consciousness for a number of reasons: the unprecedented level of opulence: a first class ticket to New York cost the equivalent of £64,000 in today’s money; the irony of the label ‘unsinkable’ that was attached to the ship; the extent of the tragedy: the loss of 1,517 souls remains the 6th worst peacetime loss of life at sea; the catastrophic inadequacy of LSA regulations; the moral bankruptcy in the correlation between wealth and chances of survival.

The legend of the ship’s size remains additionally in public consciousness but, whilst undoubtedly large in her day, in the modern context it no longer has any real significance.

Titanic was not only one of the three largest vessels of her day, those being the three White Star *Olympic* class liners, but these ships were significantly larger than any ship that had come before.

The holder of legendary status for size prior to *Titanic* was Brunel’s nemesis *Great Eastern*, launched from John Scott Russell’s shipyard at Millwall on the Thames between 1857 and 1858. *Great Eastern* was ‘nearly six times as large as any vessel yet built’ and was temporarily named *Leviathan* at launch before assuming Brunel’s preferred name when completed.

The launching date spanning two years, however, gives a clue to the vessel’s fate. It took three months to launch the ship because it was so much larger than anything that had gone before and it had exceeded the bounds of launching technology of the time. Whilst the vessel was technically a success, she made her speed, economically the engineering envelope had been pushed too far and the ship was a disaster. The amount of coal needed to power the paddle wheels using a simple steam engine was uneconomic in terms of both cost and the amount of space that the fuel occupied inside the ship. Technology had been pushed too far and it would be 40 years

before a ship of this size was built again. By 1912, however, *Titanic* was more than double the size of Brunel’s *Leviathan*.

The largest ships prior to *Titanic* were the liners *Mauretania* and *Lusitania* and *Titanic* was 50% larger than these ships, but built less than a decade after them. *Titanic* was seven times larger than the typical cargo liner of the day and around 2.5 times larger than a typical transatlantic liner of the day and by any measure, therefore, *Titanic* was big in the Edwardian era.

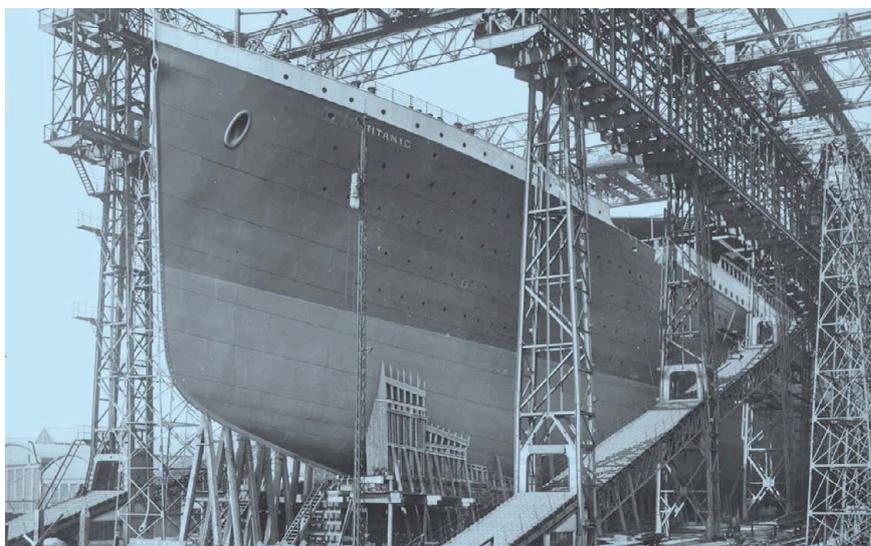
By 1936, however, the size of *Titanic* had been exceeded by a factor of two by the entry into service of *Queen Mary*. If one were to try to convey the size of *Costa Concordia* by saying that it is 40% larger than the *Queen Mary*, however, the listener would undoubtedly wonder about the relevance of the statement, to say the least. Objectively, comparisons with *Titanic* carry no more significance than this. Saying that *Concordia* is around double the size of *Olympic*, which as first of class would possibly be more appropriate than using *Titanic* as the benchmark, would similarly be met by puzzled looks as to the relevance of the information being provided.

What size is a large ship?

To answer this question we need a metric with which to specify the size of ships. The most commonly used metric, and in the opinion of the author the correct metric for commercial ships, is Gross Tonnage (GT). All commercial ships have a registered GT and a ship’s tonnage is readily obtainable from a range of sources. The problem arises because for the uninitiated the term tonnage is normally taken to refer to a ship’s weight, not its enclosed volume. Sadly even the technical press often uses the word ‘weight’ in relation to tonnage.

‘Tons’ or ‘tonnes’

The confusion arises because the word ‘tonnage’ at some time in the past was changed to ‘tonnage’. The ship’s tonnage



We still use *Titanic* as a measurement of size for modern vessels

basically measures the enclosed volume of the hull and superstructures but, originally referred to the number of 'tuns' or barrels a ship could carry, hence it being a measure of volume. Registration of tonnage started in the reign of William and Mary in 1694. A means was sought of taxing colliers according to their earning potential, for which volume (in 'tuns') was used as a proxy, and an Act of Parliament was passed detailing how it should be assessed:

$$\text{Tonnage} = \frac{(L \times B \times D)}{94}$$

The registration has proceeded through a number of conventions since then but, it has been a general principle that changes of convention should as far as possible render size compatible between conventions.

One GT is equal to 2.83m^3 (100 cubic feet) and gross tonnage is therefore a measure of physical size and can correctly convey a sense of size to those that work with ships and who can relate to the number. For those that do not have this privilege an alternative comparative approach is needed and this is described later.

When built in 2006 *Costa Concordia* was undoubtedly a large cruise ship at 114,000 GT, but the largest at that time was the *Queen Mary 2* at 148,528GT. The largest vessels afloat at the time of writing, however, are Royal Caribbean's *Oasis* class (*Oasis of the Seas* being first of class) at 225,282GT, almost double the size of *Costa Concordia*.

Even this is not the largest ship ever, however. That accolade goes to a series of Ultra

large Crude Carriers (ULCCs) built in the 1970s. The largest of these is widely regarded in the shipping industry as a vessel normally referred to as *Seawise Giant*. This vessel is likely to have been the heaviest moving object ever made by mankind when fully laden, with a displacement of 647,950tonnes. The vessel was also the longest yet built at 460m.

Strictly, however, the largest ever (measured by GT) was a ULCC called *Bellamy*, delivered to Shell by Chantiers de l'Atlantique in 1976 at 275,268GT. This vessel was 22% larger than the current largest vessel afloat. Like the *Great Eastern*, the ULCCs turned out to be economically too large and the class of vessel died out (*Seawise Giant* enjoyed a long life of 33 years by conversion into a floating storage unit but the youngest ULCC to go to scrap was only seven years old).

Whilst the *Oasis* class are the largest vessels afloat when measured by GT, the question has to be asked whether they are actually the largest existing ship in terms of physical volume. Doubt arises because GT measurement does not take into account the deck cargo of a container ship which, when the ship is observed, will undoubtedly be part of the physical appearance of the object and will be taken into account by the eye if two vessels were side by side.

Maersk's Triple E class of 18,000TEU container ships (first of class *Maersk Mc-Kinney Møller*) are valid contenders for the epithet of the world's largest ship. *Maersk Mc-Kinney Møller* has a GT about 12% smaller than *Oasis of the Seas* without taking into account the

highly visible deck cargo. It is estimated that the deck cargo, if the vessel is fully laden, could add as much as a further 60,000GT, making the laden ship appear significantly larger than the *Oasis* class although still significantly smaller than *Bellamy*. Tellingly, the deck cargo of the Triple E class alone is equivalent in volume to about 1.3 *Titanics*.

The accolade for largest ship ever will shortly pass to a gas processing vessel under construction at Samsung in South Korea, due for delivery in 2016, which is expected to be around 300,000GT and almost 500m in length, although debate will no doubt be had amongst naval architects as to whether this can rightly be classed as a ship.

In the modern context, therefore, *Titanic* is of little relevance in terms of size. The ship was roughly equivalent in size to a modern panamax bulk carrier, a vessel that is no longer regarded as particularly large, or around the size of a modern car ferry.

Which metrics?

The problem with GT is that it is difficult for lay persons to relate to: the figures do not actually mean anything without a frame of reference. The question then has to be asked whether any other parameter could provide a better point of reference to gauge ship size?

The most obvious contender would be weight, but there are a number of problems in trying to use this. The first issue is that weight is not a routinely reported parameter for ships and it can be hard to find. The second issue relates to which measure of weight is used. The weight of a ship is made up by the 'lightweight' or 'lightship' weight, which is the weight of the ship itself when empty, and the 'deadweight', which is the weight of fuel, cargo, passengers and everything else loaded aboard the ship. The sum of the two is the 'displacement', which is the total weight of the ship and everything in it.

The relative weight of ships will depend on which parameter is chosen and the nature of the ships being compared, in particular being influenced by the relative density of the structure and layout of the ship. The use of lightweight, for example, would conclude that *Oasis of the Seas* is around double the size of *Bellamy* whilst using displacement would suggest that *Oasis of the Seas* is only around 20% of the size of *Bellamy*.

Even for similar ship types the comparison of weight and GT can lead to problems.

Whilst *Costa Concordia* is 2.4 times the size of *Titanic* when measured by GT the two ships actually weigh remarkably similar amounts: 52,310 tonnes displacement for *Titanic* compared to around 55,000 tonnes (estimated) for *Costa Concordia*. The reason for this is that *Titanic* was built with much thicker scantlings, was joined by millions of heavy rivets and was fuelled by coal, which is very heavy when compared to oil bunkers. This reinforces why an Edwardian artefact makes little sense as a comparator in the modern world: stating that *Costa Concordia* weighs about the same as *Titanic* gives a false impression of ship size.

Comparison on the basis of length provides another potential metric but this too has significant issues. Taking the historical comparison first, *Titanic* necessarily had a fine hull form to make the required fast transatlantic speed, with a block coefficient of 66%. This meant that the ship had to be relatively long to accommodate its heavy displacement.

Costa Concordia has an estimated block coefficient of about 76% and the hull dimensions can therefore be relatively smaller to accommodate the displacement. Using length would conclude that *Costa Concordia* is only 8% larger than *Titanic*, which is clearly misleading. Differences in the fullness of the hull also mean that comparing modern ships by length would be misleading. Using length, for example, would conclude that *Oasis of the Seas* is 22% smaller than *Bellamy*, rather than the 14% it actually is if GT is used.

For these reasons neither weight nor length provide reliable comparators for comparing

ship size: the comparator has to be volumetric. It should also relate in terms of scale to give a meaningful comparison and it should be something to which the audience can physically relate to give a direct impression of size. Commonly used parameters in the general press lose impact due to scale. Stating that *Costa Concordia* weighs as much as 10,000 male African elephants or is the same length as 26 London buses both appear arbitrary and give no real sense of the actual size of the ship.

The ideal comparator would be between about 30,000 and 100,000GT, which is to say between about 85,000 and 283,000m³, or three million and 10 million cubic feet. This cuts out the most commonly used volumetric comparator in the general press, the Olympic-sized swimming pool, which is a disappointing 900GT. Stating that *Costa Concordia* is equivalent in size to 126 Olympic-sized pools appears as arbitrary as using elephants or buses.

The only commonly encountered physical objects that are large enough to be used for ships are buildings and this leads to yet another problem. The volumetric size of buildings is not normally quoted: architects deal in linear dimensions or floor area. Building volumes have therefore been difficult to obtain. A number have been obtained, however, and are discussed below.

Sports stadia and concert arenas are generally too large to be useful. Stating that *Costa Concordia* is around one quarter the size of Wembley Stadium loses impact in trying to convey size. Most theatres and concert halls, on the other hand, tend to be too small. The two

exceptions are the Royal Albert Hall in London and the Great Hall of the people in Beijing, both of which have internal volumes equivalent to about 30,000GT. Stating that *Costa Concordia* is equivalent in size to four Albert Halls would be effective in conveying size, but only for persons that know the building and this is therefore a little too specialised for a general parameter.

Large religious buildings provide another potential source for comparison, but volumes have proven to be very difficult to find. St Peter's Basilica in Vatican City is too large at 424,000GT but, St Paul's Cathedral in London is of the right order at about 55,000GT, although a reliable source to verify this has been difficult to find. Stating that *Costa Concordia* is twice the size of St Paul's Cathedral really conveys the message of the task achieved by the salvors in September 2013, but again only for those that know what this building is and can relate to it.

General architecture provides the most useful source if volumes can be found. A building investigated for this research has been the Swiss Re Headquarters in the City of London, affectionately known as the Gherkin, built on the site of the Baltic Exchange that was destroyed by a bomb in 1992. The building is circular in profile and the volume can therefore be relatively easily calculated by applying Simpson's rules to a sectional drawing. The Gherkin has an enclosed volume above ground equivalent to about 128,500GT and is therefore roughly equivalent in size to *Costa Concordia*. Stating that *Costa Concordia* is equivalent in size to a skyscraper conveys very well the size of the ship and the monumental task achieved by the salvors, but again only for those that can relate to this building.

Conclusions

Using *Titanic* as a benchmark for ship size is arbitrary and misleading. Comparison of GT to building volume provides a benchmark that can be assimilated directly by anyone with experience of the building being used. Two buildings in London are suggested for use, but more around the globe are needed. Volumes of appropriate iconic buildings need to be identified and assessed to provide a more reliable basis for comparison that can be used globally. This is put down as a challenge to readers of this magazine and the author would be very interested to hear of other benchmarks around the globe that can be used in the general context to convey ship size to a non-specialist audience. **NA**

Today's modern vessels, such as *Concordia*, above, are larger than the ships of the Edwardian era and call the '*Titanic*' measurement into question



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The story of Shandong Hang Yu Shipbuilding Group

Shandong Hang Yu Shipbuilding Group has built a range of vessels, energy efficient and green ships to conversions to natural gas-power through to pleasure boats, marine surveillance ships and wind power equipment, Li Cheng Wan and Liu Chong report on the yard's development

In 2013, apart from delivering 126 inland river vessels including 60 towboats, 46 barges and bulk cargo vessels, and 20 other inland vessels, Shandong Hang Yu Shipbuilding Group has also achieved two firsts in China – it completed the conversion of a LNG-powered mono-fuel vessel and constructed and assembled a new vessel of the same kind. It also saw the foundation of its 120-acre base for building pleasure boats completed and construction of the shipyard began.

A billion dollar business that started with a dream

Hang Yu is a private joint-equity company which was founded in 1996 by a single person. “It all started with a dream, which was to have inland vessels ‘serving the area built in the area’, that their operators did not have to travel 400 miles down south to Yangzhou to buy what they need, and of course, it was also a test to prove what I could do, to see whether I could live up to my name [Xing means ‘can do’],” says Ding Xing,

founder of the company and currently its chairman.

Starting as a repair technician at a shipping company, Ding subsequently joined a shipbuilding company and, by working hard, he earned professional qualifications in shipbuilding at Tianjin University School of Civil Engineering and became an assistant engineer in the company.

Taking with him a strong technical background, thorough understanding of the needs of vessel owners and ideas of better shipbuilding techniques, he chose to give up the security of an assured income and leased a plot of about 10 acres, withdrew his RMB4600 (US\$744) savings from the bank and borrowed about RMB300,000 (US\$48,560) from classmates and friends and put all the money into acquiring equipment to set up his shipbuilding plant. “From the original design to the improve and upgrade stage and then producing in batches, we compete on quality” – this business development strategy laid down by Ding bore fruit quickly. The 200- and 300tonne bulk cargo ships were sought after in

the market and orders streamed in. The company delivered 29 of them in the first year and more than 100 in the second and the yard's value surged to more than RMB20 million (US\$3.24 million).

“You wouldn't know what it takes before you really got into it, and after you do it gets more and more interesting.” After “getting into it” for four years, Ding came to know the shipbuilding market well. In addition to applying his shipbuilding expertise, he also availed himself of management and sales strategies, which brought him high business returns. On top of being able to repay his debts, he had also earned his first “bucket of gold” for expanding production.

At the turn of the century, the Chinese economy rocketed and the global economy was prospering. It was then that small and medium shipbuilders based on the shore of inland rivers in Suzhou and Anhui started to move east. They built larger plants on the shores of Yangtze and began to take export orders and coastal vessels, whereas builders of inland vessels especially canal boats moved to stations on lakeshores inland.

The headquarters and plant of Shandong Hang Yu Shipbuilding Group



A 1,000tonne coastal bulk cargo carrier ship built by Hang Yu

Keeping tabs on this development, Ding gave up running a small workshop-style shipbuilding operation and invested in leasing a 32-acre intertidal plot with a good berthing depth and major facilities such as portal cranes and new equipment. He also started producing inland towboats, bulk cargo boats, container carriers, oil tankers and pleasure boats. By 2005, after three years of hard labour, the company's total production value rose to RMB50 million (US\$8.01 million) and placed itself among influential private shipbuilders in the enclave.

In 2006, from the intertidal plot, the company moved onto a leased piece of land on the north-eastern shore of Lake Weishan and RMB120 million (US\$19.43 million) was invested to build the largest modern shipbuilding plant in the area.

The company designed and made its own dredger for mud from the bottom of the lake for reclamation and hired professionals to help with the plant's design plans that incorporated the "L" shape and "U" shape production line layouts for small boats and large ships respectively.

Other ideas that went into the design included a slipway that could move sideways, a large canopy that shields the pre-treatment and assembly workshops and building berths to allow all-year-round production. To date, Hang Yu Shipbuilding is capable of turning out steel towboats of between 300 and 3,000 horsepower, 1,000- to 5,000tonne bulk cargo vessels, 80- to 3,000m² dredgers, 50- to 3,000TEU container carriers, inland and coastal pleasure boats that can accommodate up to 500 passengers, 100- to 2,000tonne oil and chemical tankers, coastal fishing boats and high-speed government vessels.

It is equipped for the modulated production of large vessels, production lines for smaller vessels and parts production. From the import of raw materials, automatic descaling, phase production, application of protective



coatings to troubleshooting, launch siting and quay fitting-out, works are conducted smoothly following set procedures, in phases and corresponding work areas, thus helping to remove redundant processes and minimise idle and wasted labour.

The company's labour efficiency record stands high against its local counterparts. Hang Yu Shipbuilding reportedly had RMB260 million (US\$42.1 million) worth of fixed assets and a market value of RMB200 million (US\$32.38 million) in 2013.

The story of the company turning from a RMB4600 start-up to a RMB200 million

enterprise has been hailed as a miracle and has earned a host of local business awards.

One model dominates the market

"With a relatively low entry barrier, inland vessel-building is a competitive business. For a company to stand out, it has to have its champion products and unique offers and advantages, which Hang Yu has diligently made sure," Ding shared his insights.

By keeping its finger on the pulse of the inland shipping market and practice the yard was able to prosper. Hang Yu



A marine surveillance boat, a Hang Yu product

An 80-passenger pleasure boat carrying the Hang Yu brand

Shipbuilding started early on to keep track of changes in the inland bulk cargo ship designs, “from fixed power driven, to single heavy draught vessels to a shallow draught fleet, vessels of all shapes and sizes to standardised models”.

In 1999, when its many peers were focusing on building small heavy draught cargo boats and competing on price, Hang Yu and its designers headed down south. They checked out the depths of the waterway and the different canal locks and also visited professional academies and research institutes for a full grasp of the carriage capacity of canals, asked ship owners what makes the best model they need, sought advice from professional designers and looked for potential technological partners, and received very warm responses.

Back at the plant after the trip, the company set up dedicated design and production teams which worked round-the-clock to come up with a new towboat prototype that can serve as the main “engine” to tow and guide a fleet of smaller no-engine boats, hence allowing shallow draught carriage of massive loads. “The main towboat is like the mother hen with little chicks trailing behind her and everybody in the family arrives at the destination safe and sound,” Ding explained.

When the vessel model was first launched, shipowners who were not confident of the vessel’s performance were hesitant to place orders. “Time is money”, said Ding, who came up with an idea: Give it a try then pay, and just return it if it fails to impress. He called it “a boat on loan operation”.

Tempted by the no upfront or lease payment offer, several owners made their move, and after a number of successful trial runs they paid for the boats. But the policy paid off as the trial owners spread the Hang Yu name among their peers and orders started to flood in.

“We did not expect the ‘try first, pay later’ tactic to work so well. We thought it would be great if it brought us eight



or 10 orders. But, it turned out that we managed a much sought after model. We have made more than 400 of the vessels within a few years,” said a very proud Ding.

“A great boat is like a great horse, they both need tempering.” There was no resting on his laurels for Ding though Hang Yu has become an important shipbuilding brand. He has plans to establish a design studio to focus on bettering the towboat including the hull design, the main engine, manual hydraulic pressure adjustment and power transformation and transmission control, on top of making the bridge more friendly and comfortable to work in for the skipper.

Building on one platform

Just when the company’s RMB120 million shipbuilding base that spans 360 acres and stretches along a 1.5km shoreline was completed, the shipbuilding market for ocean going vessels showed strong demand whereas the inland vessel market went into decline.

Rising steel prices driven up by deepsea demand and a fear from inland owners to invest in new boats were the driving forces behind the change in market conditions. With new plants and facilities then left in the cold, Hang Yu was forced to adjust its business structure and transform production.

The Board of Directors decided that “the company’s transformation cannot be arbitrary, but that it will extend its industrial chain with shipbuilding as the platform”. The company branched out into marine equipment production and sale of diesel engines and secured an agency agreement from Weichai Power Company Limited.

Nurturing the new business was the emphasis of the company in the first year, consolidating in the second year and profits came in the third. In 2009, Hang Yu’s subsidiary dedicated to selling Weichai Power’s diesel engines sold an impressive 700 units. The company survived its toughest times with a marine equipment business that did better than its shipbuilding operation.

Meanwhile, the company expanded its service scope to include vessel design, technical consultancy, trouble-shooting inspection, after-sale service and information sharing and subsidiaries specialising in those areas were set up to take business within and outside the company and to also assist customers in providing good after-sales services.

“Should there be glitches with engines, anchor gears, axle systems and power circuit equipment carrying the Hang Yu brand, the service team would be there on the customer site at first instance” as written down in the company’s customer service commitment.



A 46.3m trawler built by Hang Yu

Furthermore, in the form of a joint-equity partnership, it brought in expertise from marine equipment, mechanical processing, logistics, electrical and electronics enterprises and in doing so transformed into a company capable of R&D, design, production, repair, marine engineering, sales, logistics and servicing. It has forged a complete industrial supply chain where it operates and boosted its overall influence in shipbuilding. The town of Hanzhuang, where Hang Yu is based has been labelled a shipbuilding park and most of those operating there now are the “little chicks” born of the “mother hen”.

“Transformation continues and diversification begins,” Ding said adding that Hang Yu will leverage its shipbuilding platform to expand its business. Its goal is to turn the area around Lake Weishan in Jining, Shandong into an inland vessel production base and an eco-tour destination. With high-tech shipbuilding helping it break waves, the company will march into the high-end, low-carbon arena and “transform two ways”.

Firstly, it is going to replace heavy energy consumers and polluters by energy efficient and green vessel models. It will produce in batches and convert its vessels into ones powered by natural gas. It has completed

the conversion of its first LNG-powered mono-fuel inland vessel for delivery soon.

The second vessel to be converted has entered pre-treatment, and a brand new 63m LNG-powered mono-fuel inland bulk cargo ship is being assembled. “We hope the newly developed LNG-powered mono-fuel ship will be easier to promote than our first self-designed towboat,” said the company’s head of sales. Secondly, in terms of value-added products, Hang Yu

will move towards the high end with its eyes on pleasure boats, marine surveillance ships and wind power equipment.

Furthermore, the company will go on the quest for quality instead of quantity, and follow a development path that emphasises “professionalism, uniqueness, specialisation and superb quality”. It will step up quality and safety management, raise the overall competence of its workforce, consolidate operational procedures, and strictly enforce relevant regulations and standards, all in the bid to make sure its products are impeccable with zero deficiency.

“With the standard inland vessel model launched, it means the hull design, internal structure and related devices of inland vessels will eventually become consistent and the margin for improvement in terms of design will be small. The value differential then will be product quality and we must acquaint ourselves with the new quality standards and requirements as soon as possible and maintain a quality awareness that can allow us to deliver exquisitely fine ships and boats and associated products,” Ding spoke from the depth of his heart. **NA**



The champion towboat of Hang Yu in action

OMT seeks eastern promise

Following the closure of the Odense Steel Shipyard in 2010 Odense Marine Technology emerged as a ship design consultancy and acquired Grontmij naval architects late last year. This year the company has signed a co-operation agreement with MHI as it looks to broaden its horizons

Maersk's shadow is cast over Odense, but the former shipbuilding centre which saw the end of vessel construction for the Danish operator some four years ago is reinventing itself, amongst other things, as an advisor to yards and owners and a ship designer in its own right.

Connections with its past remain, but Odense Marine Technology (OMT) is evolving as a company and is looking to strike up strategic partnerships with other industry players. In February OMT announced a deal with Mitsubishi Heavy Industries (MHI). Under the terms of the deal MHI will be responsible for propulsion performance and that will include hull form design, model testing and the development of energy-saving devices, such as MHI's air lubrication system, and propellers. OMT will be responsible for the conceptual and basic designs.

OMT CEO Kåre Groes Christiansen told *The Naval Architect* that the company was: "Working towards a licence based business model," he added that "MHI and Japan have a



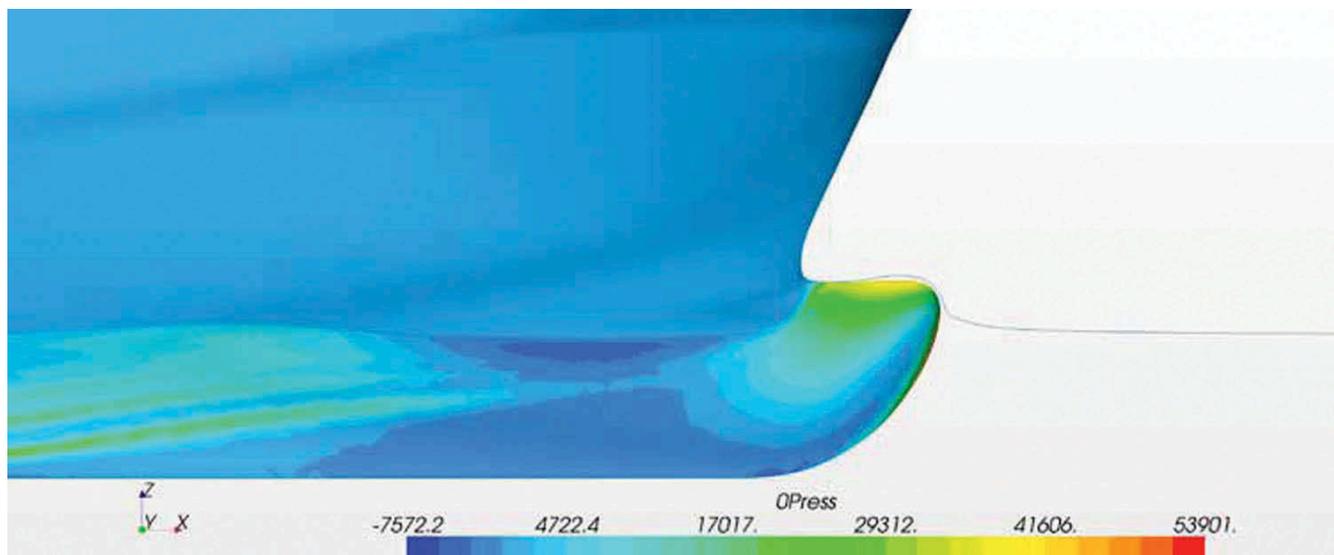
OMT/SWS 18,000TEU design

strong maritime heritage and this partnership will combine the best of Europe and Japan".

Christiansen says that while both MHI and OMT are strong on container ship design, MHI has experience with LNG vessels and Grontmij, the naval architect division acquired by OMT late last year, are strong in bulk carrier design. Grontmij's Seahorse bulk carrier design is already under construction in China and this vessel type remains a favourite among owners that operate the ship.

"There is always room for improvement," in the bulk carrier sector, says Christiansen, "We need to come out with solutions to deal with the uncertainty [in the regulatory landscape], do you want LNG or do we design a vessel that can retrofit LNG, a flexible design. We must allow retrofitting without jeopardising the performance from day one," he explains. And that mantra will be applied to all the ship designs undertaken by OMT.

A lower bulb with more volume was proposed in order to improve efficiency at low draught and low speed



In order to design vessels that can adopt new technology as it becomes available Christiansen says that the partners must first identify which technology will be the most likely to be adopted.

LNG would fall into the category of technology that is likely to be used increasingly in the future and LNG carriers and LNG powered vessels will all be part of the co-operation agreement between the two companies says Christiansen, but, he adds: "it's still early days in the cooperation"

According to Christiansen the two companies have a lot of work to do to appreciate better the operational profile of the different vessel types and to make sure the yards with which the partners are working understand the new arrangements and design specifications. Grontmij already has its Chinese yard partners and MHI also has partner yards in both Japan and China.

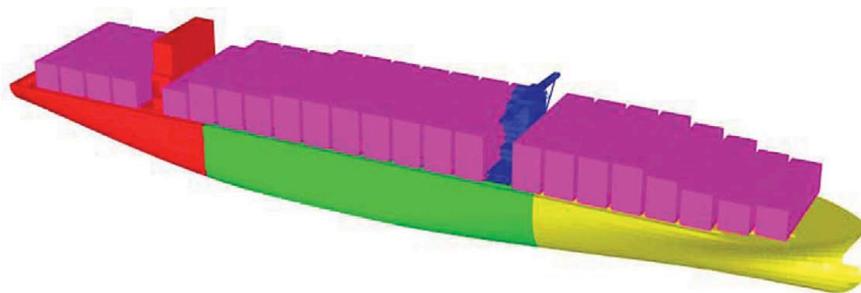
Another major sector in which both MHI and OMT are developing designs in is the range of containers ships, from feeder vessels up to modern 18,000TEU vessels. Christiansen believes that the feeder range is an interesting sector and says that technology for LNG power will be used in this vessel sub-sector.

"We are looking at dual fuel vessels with some changes to the main dimensions, length and breadth, we have agreements with some shipbuilders and MHI has the technology to put into these designs," explains Christiansen.

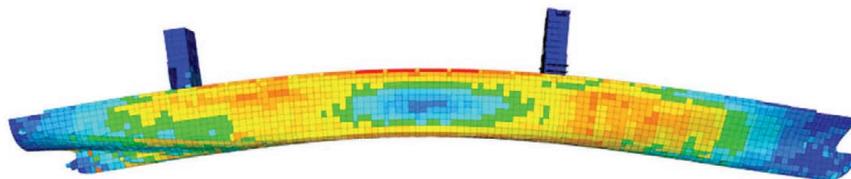
As far as deepsea vessels are concerned the early adoption of LNG power is considered unlikely, but Christiansen believes that there is plenty of scope to improve the efficiency of the larger ships designs. OMT has developed its own 18,000TEU vessel and it is this larger container vessel design at the other end of the scale that really catches the eye.

OMT claims great experience with large container vessels from its involvement in the design of the 16,000TEU E-class of ships, of which *Emma Maersk* was the first in the series. The company says that its experience in designing these vessels gave rise to the 18,000TEU design, but the vessel design was added to by its partners, class society DNV, Shanghai Waigaoqiao Shipbuilding Co. Ltd (SWS) and the testing tank MARIN of The Netherlands.

The vessel's optimised hull form was achieved through extensive CFD analysis and



Global final element model



Maximum hogging condition

model testing and is a model of flexible design standards. The ship is optimised for speeds of between 14-18knots, but can be adapted for faster speeds in the unlikely event, according to OMT, that ships start to cruise at faster, pre-financial crisis levels; or as one OMT executive described it, should the market turn back "towards water-skiing speeds".

Emphasising the requirement for flexibility in the design the OMT/SWS 18,000TEU vessel can be built with twin skeg or single skeg options. According to the designers the single skeg option is for owners that want the lowest capital and operational expenses, whereas the twin skeg option offers lower voyage costs allowing an owner to recoup any extra capital outlay over the long term.

Hull lines have been optimised for speeds of between 14 and 22knots, but the owner can opt for a bulbous bow optimised for speeds up to 18knots or another bulbous bow design optimised for speeds between 18-22knots. If the owner changes his mind at a later date an alternative bulbous bow can be retrofitted.

In addition the vessel has been designed to operate with a minimum of ballast water. "This is a capital expenditure/voyage expenditure trade off. It makes the design more expensive to build for the yard, due to the extra steel, but the additional cost is money well spent for the owner," says the designer.

Slim container guides have reduced the vessel width by 0.8m and the ship is optimised for a high number of hi-cube containers without losing container slots in the holds.

But, perhaps one of the vessel design's greatest features, in terms of flexibility, is the option for owners to choose the length, with "a built-in option to extend the design at a later stage," says OMT.

In terms of machinery the vessel design will allow owners to choose an engine type from a suitable range of engine configurations all with a number of retrofit options that could include scrubber technology or a fuel switch to LNG or dual fuel power. All the ships can be built as "LNG-ready" with the pipework and space available for a comparatively straight forward switch to LNG at a later date.

Other energy saving technology, such as waste heat recovery and a shaft generator are optional, depending on the owner's choice. "We must come out with solutions to deal with the [regulatory and fuel price] uncertainty," explains Christiansen.

With the emphasis on efficiency and design flexibility the 18,000TEU container ship will help OMT emerge from the shadow of Maersk a little. Its strategic alliances with yards and other shipbuilders, along with astute acquisitions such as Grontmij will mean that European ship design will not be eclipsed any time soon. **NA**



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Conoship innovates for further efficiencies

For decades innovation in the inland shipping sector was perceived as being slow, mainly caused by a lack of budget and technical knowledge of the majority of companies active in the inland shipping sector.

Wieger Duursema, Jan Jaap Nieuwenhuis, and Guus van der Bles explain Conoship's latest developments

Innovation over the last couple of years has spurred developments in the inland shipping sector.

Inland shipping companies, such as the Dutch Mercurius Shipping Group and Millenium Shipping started to innovate, but so have design offices such as Conoship International BV, in cooperation with academic institutions such as Delft University of Technology and research institutes, such as the Maritime Research Institute Netherlands (MARIN).

This has resulted in numerous research projects, such as CREATING, INBAT and TOPSHIPS, creating innovative applications, such as the fuel-saving ConoTwinDuctTail-concept.

Recent innovations in inland shipping focus on the same areas of innovation as the developments for seagoing ships:

- Improving fuel efficiency through optimised propulsion trains and hull forms
- Reducing emissions through using LNG as fuel
- Development of new concepts, to enter new (niche) markets.

Although Conoship International mainly designs sea-going cargo vessels, it closely follows the developments in inland vessel design, as it occasionally designs the smaller craft; usually about one per year. Being specialist in the niche-market of sea-river vessels, Conoship are also interested in any potential "cross-over" effects between development in inland waterway vessel design and seagoing vessel design.

Innovative 'O-Foil' propulsor

One development for inland vessels from Conoship is the O-Foil, a "wing type" propulsor. Its oscillating horizontal blades move up and down in the water and thereby generate thrust. The length of the blades is almost equal to the width of the vessel, providing a much larger 'thrust generating area' than that of a conventional propeller, potentially resulting in a far higher propulsive efficiency.

The inventors of the O-foil claim that fuel consumption can be reduced by a about 50%. Currently the first prototype O-foil propulsion is in operation onboard the inland vessel *Triade*. Full scale results are therefore to be expected in the near future.

LNG fuel for inland navigation

Conoship International is also very active in developments in LNG-driven sea-river and inland waterway vessels. Just as for seagoing vessels, the emission requirements for inland ships have become more stringent. In order

to meet the new requirements operators of inland vessels are, like their deepsea colleagues, also considering operating on LNG fuel.

In The Netherlands, various designs are under development and a number of inland vessels already operate on LNG such as *Argonon* with a dual fuel propulsion system and Greenstream tankers with Lean Burn gas engines, operating 100% on LNG.

It is expected that the development of inland ships operating on LNG will help to accelerate the development of LNG-bunkering regulations and LNG-bunkering infrastructure in ports, such as Zeebrugge, Rotterdam, Amsterdam and Zwijndrecht, which, in turn, will pave the way for LNG bunkering of seagoing vessels.

Conoship XXB Rhine container carrier

Conoship International together with Millenium Shipping has developed a new concept for a Rhine container carrier. The aim

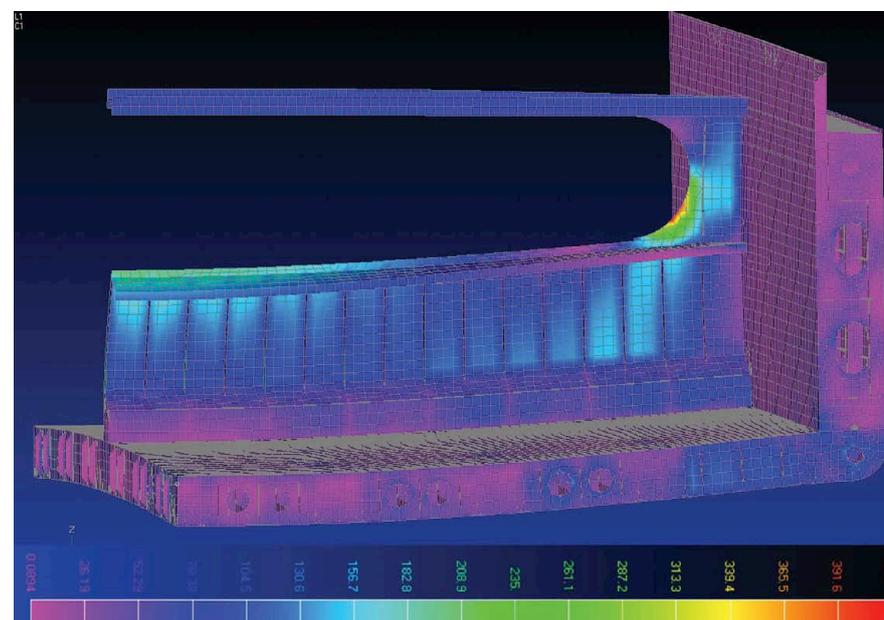
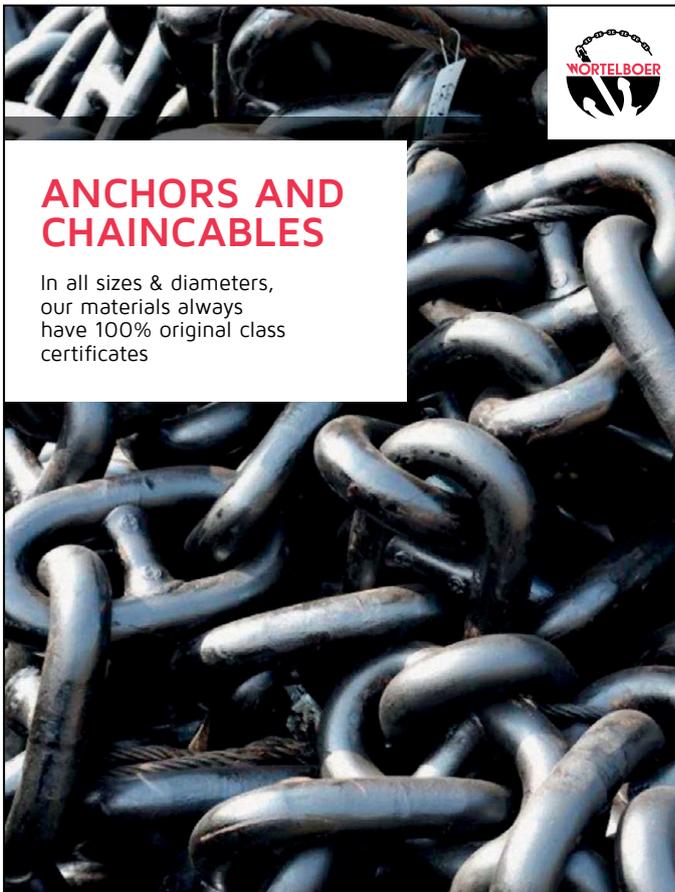


Figure 1: Von Mises Stress in bulk head connection





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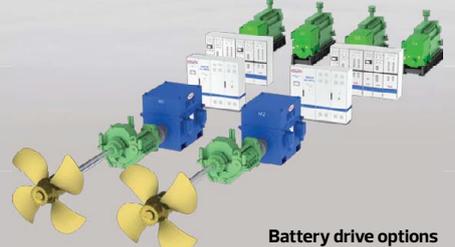
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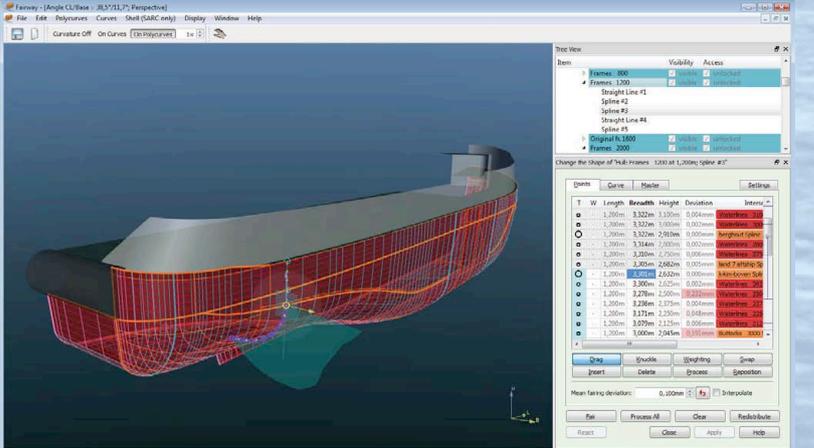
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PIAS software for intact and (probabilistic) damage stability calculations, longitudinal bending, shear and torsion, resistance, speed, power and propeller calculations, etc.

LOCOPIAS software for on-board evaluation of loading conditions with a wide range of options for definition of different types of cargo.

Fairway software for hull design, fairing, modifications, transformations and plate expansions.



Q	T	W	Length	Breadth	Height	Displacement	Integrity
0	1,200m	3,322m	3,322m	3,322m	0,000m	0,000m	0,000m
0	1,200m	3,322m	3,322m	3,322m	0,000m	0,000m	0,000m
0	1,200m	3,322m	3,322m	3,322m	0,000m	0,000m	0,000m
0	1,200m	3,322m	3,322m	3,322m	0,000m	0,000m	0,000m
0	1,200m	3,322m	3,322m	3,322m	0,000m	0,000m	0,000m
0	1,200m	3,322m	3,322m	3,322m	0,000m	0,000m	0,000m
0	1,200m	3,322m	3,322m	3,322m	0,000m	0,000m	0,000m
0	1,200m	3,322m	3,322m	3,322m	0,000m	0,000m	0,000m
0	1,200m	3,322m	3,322m	3,322m	0,000m	0,000m	0,000m
0	1,200m	3,322m	3,322m	3,322m	0,000m	0,000m	0,000m

In addition to the software listed, SARC BV provides services, training and engineering support to design offices, shipyards, ship owners, classification societies and many others.

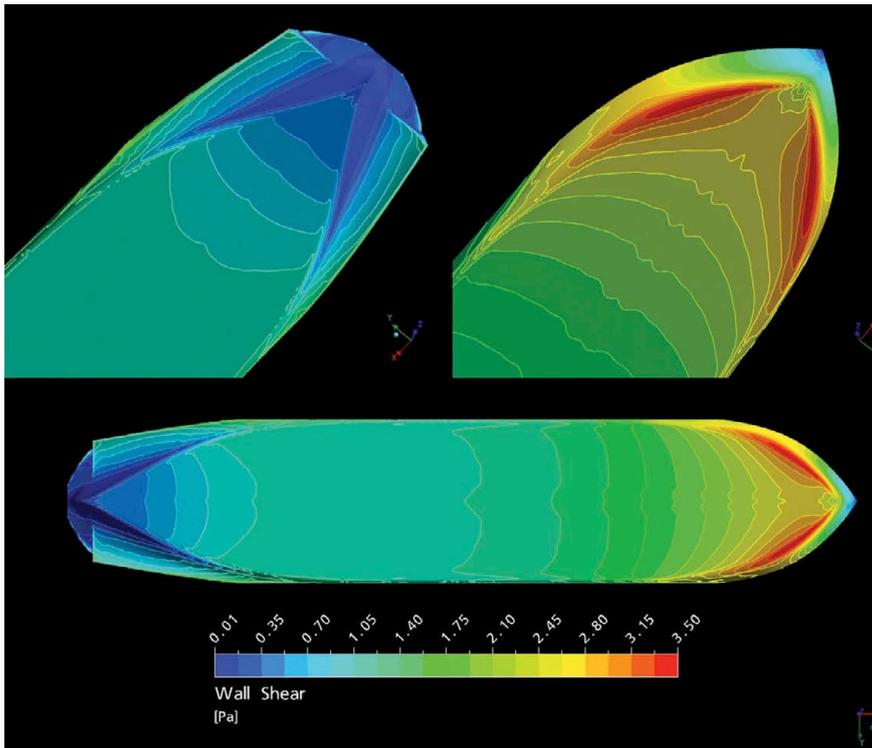


Figure 2: CFD results on Conoship XXB concept design

However, to make the design even more challenging, the customer requested a high speed combined with low fuel consumption. Consequently, an efficient aft ship design for an extremely wide and shallow ship needed to be developed. This design challenge was solved in close cooperation with tank test facility DST at Duisburg, Germany. In a first configuration, the two propellers and tunnels were placed relatively far to the sides of the ship, to gain as much water inflow from the sides of the ship as possible, as shown in figure 2.

However, the tank tests showed that this configuration was not suitable as it resulted in large Von Karman vortices behind the vessel, which considerably decreased the performance of the vessel. With the use of CFD calculations the hull form was further analysed. These CFD calculations showed that the Von Karman vortices were the result of an extremely large wake behind the ship, caused by a blockage of the inflow to the centreline through the propeller thrust.

Based on the results of these model tests and with use of CFD calculations, various alternatives were developed, analysed and evaluated, see figure 3.

of this concept is to maximise the container capacity at low draught when sailing on the Rhine with an extremely low water level. Due to the climatic changes it is expected that in summertime longer dry periods will occur, resulting in extremely low water levels on the river, which reduces the transport capacity of the current fleet of inland container carriers. To be able to provide a continuous container transportation schedule, an innovative vessel has been designed with a lower draft than currently common, through an extreme breadth-over-depth ratio.

The new vessel designs require a special construction and a special hull form. The construction weight of the vessel has been minimised developing an innovative bottom construction customised for carrying containers, based on Finite Element (FE) calculations. In close cooperation with Lloyd's Register, extensive direct Finite Element Method (FEM)-calculations were performed to support the containers, necessary to reduce as much material as possible in the intermediate construction, thereby reducing the weight and draught of the vessel.

The resulting construction was over 30% lighter than a conventional bottom structure

for inland vessels calculated for comparable breadth. The complete construction has been extensively analysed with FEM. See Figure 1.

The beam of the vessel was maximised to the largest allowable beam for the Rhine, resulting in the lowest possible draught.

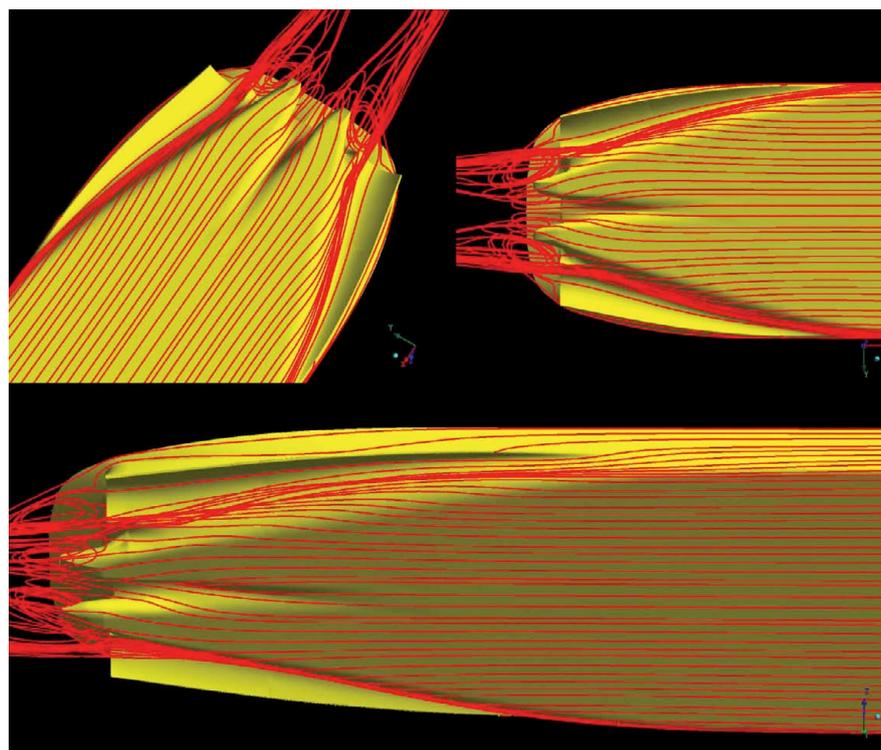


Figure 3: ConoTwinDuctTail-double gondola

Figure 4: ConoTwinDuctTail for best propulsive efficiency and lowest fuel consumption at shallow draught

The resulting aft ship design, the 'ConoTwinDuctTail-shallowdraught', see figure 4, has a considerably improved shallow water performance. With the propellers placed much closer to the centre line of the ship, the majority of the inflow of water still comes from the side, but as the water is guided by the ConoTwinDuct, the resulting wake behind the ship is much smaller. Impressive fuel savings were further obtained through a large increase of propulsive efficiency by using specially designed propellers that rotate in the opposite direction of the 'wake-vortex' that is generated in the propeller-disc area. This principle is similar to the principle of



contra-rotating propellers and the efficiency gain can be over 20%. Eventually the newly designed ConoTwinDuctTail hull form was tested in the model basin of DST and the results proved the predicted efficiency gains.

To be able to further optimise the efficiency of its inland waterway vessels, Conoship International joined the TOPSHIPS research project, which was

initiated by Delft University of Technology. Together with partners such as Delft University of Technology and MARIN, in TOPSHIPS our holistic approach to integrate optimisation of hull form and propulsion system will be developed to a new level. The development of the ConoTwinDuctTail for the XXB Rhine container vessel and the super fuel efficient ConoDuctTail for the eCONology Trader 3700 (sea/river vessel) has shown that a joint optimisation of hull form and propulsion system provides the best results, instead of first optimising the hull form and consequently optimising the propeller. In TOPSHIPS this approach will be continued and extended with an analysis of the influence on the propulsive efficiency of several design aspects including appendages, a trimmed draught and sailing at very low water levels. **NA**

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Groot's inland developments

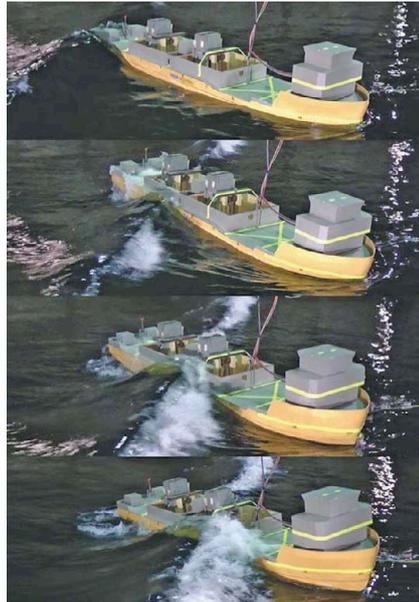
Groot Ship Design in The Netherlands has seen the launch of its first Indian Feeder 100 design with further design developments for other inland vessels on the way

Chowgule ordered two of the Indian Feeder 100 type vessels mid-2012 from Groot Ship Design, to be named *Chowgule 10 and Chowgule 11*. The vessels have been designed for local operation (Indian ports and coastal waters) with the purpose of moving containers over relatively short distances and if necessary upstream on the local rivers.

The vessels will be equipped with a Liebherr container crane and an anti-heeling system allowing loading/discharging at ports/quays without container handling facilities. Besides containers the vessel can also load some general cargo.

“Originally the vessel was designed to operate without hatches. Model testing was performed to show the vessel will survive conditions that can be expected along the coast of India. The actual vessels are built with pontoon hatches covering the holds, but the feature to sail open top will be available if requested for the next vessels to be ordered”, says Jan Willem Cuperus, managing director, Groot Ship Design.

The keel laying for the vessels was started on 12 December 2013 with the first vessel launched 18 February. Seatrials for the first vessel is planned for the end of April with



Model testing of the Indian Feeder design

the second vessel at the end of September. The vessels are designed and built for Chowgule's own account.

Further to this Groot Ship Design is also planning a larger design of this feeder type. “The design of the Indian Feeder 100 was received with large enthusiasm. It was

decided to introduce a larger version for 200TEU as well”, says Cuperus. The design for this vessel has been made with further plans to develop and build this design now under consideration.

After the success of the Sea-River Liner 3700 for Dutch based Wijnne Barends, Chowgule requested Groot Ship Design to provide a new design, similar to this vessel specifically designed for Indian coastal waters. After investigation of the area a design was made for a max 2,600dwt vessel with very limited draught.

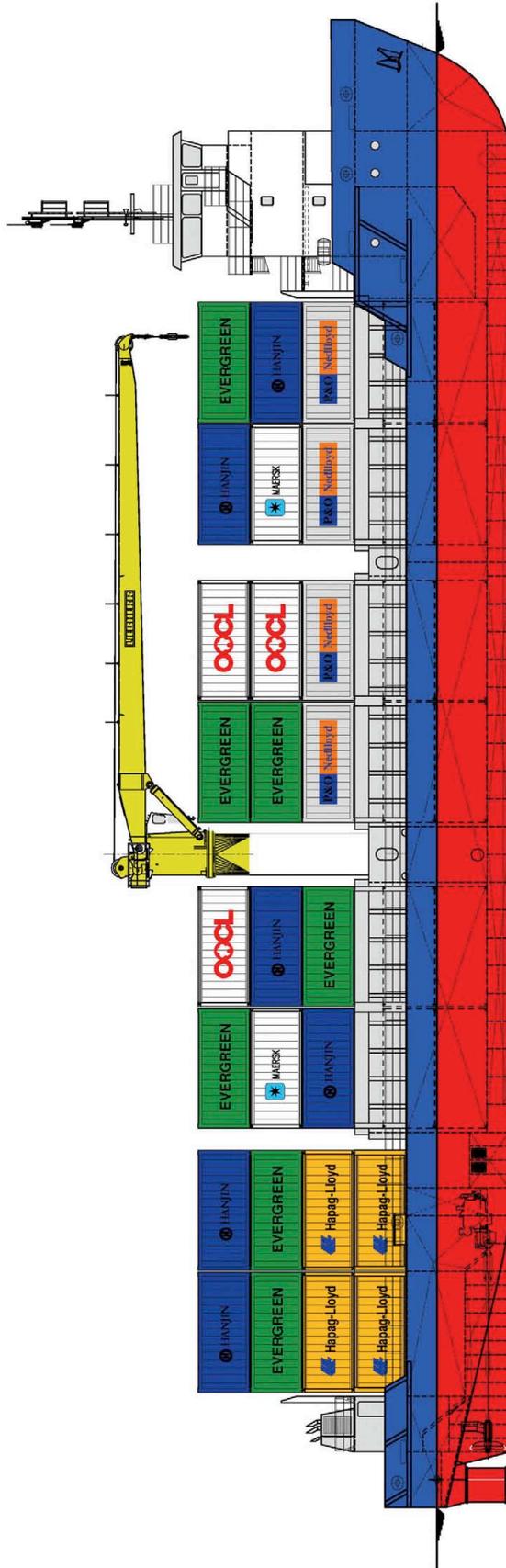
“Although an owner is not yet contracted the yard will start steel cutting end this month. The vessels are scheduled for delivery by December 2014 and March 2015”, explains Cuperus.

The vessel will be equipped with a propeller-nozzle combination from Wärtsilä ensuring the efficiency is the same as on the 3700 design.

“This design is performing very well. At the moment we are in discussion with several potential clients interested for this design. It is expected the series of four already delivered will be extended with a substantial number of vessels”, says Cuperus. **NA**



Indian Feeder 100 design being launched at Chowgule shipyard



BV sees growth in inland market

The global strength of Bureau Veritas' inland fleet grew rapidly during 2013 as authorities around the world recognised the value of class for inland waterways

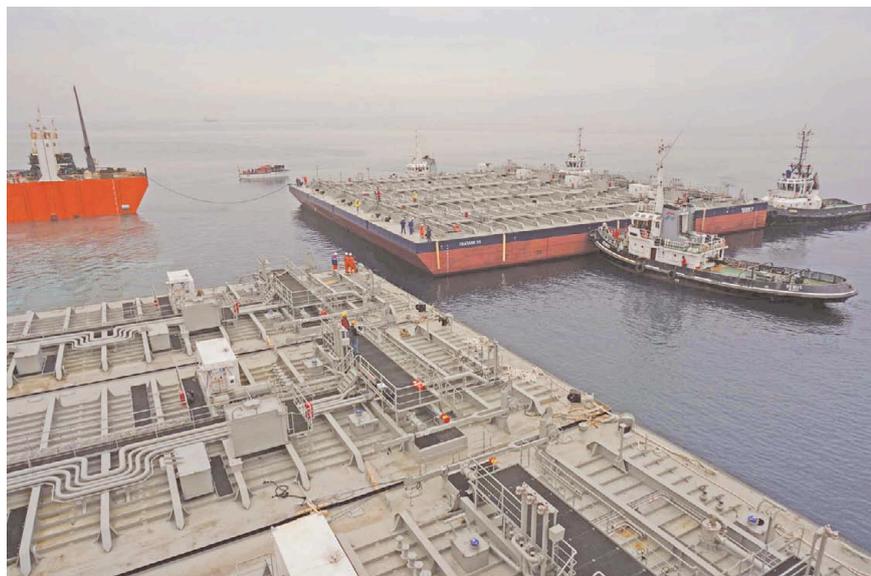
At the end of the year Bureau Veritas (BV) classed 3,104 inland vessels in service and had 302 new vessels on its order books. Outside its traditional European waterways area BV was involved with inland and coastal vessels in Eastern Europe, Colombia, Peru, Brazil, Egypt, India and Kuwait and was helping to set up a multi-national framework for safe inland waterways vessels in the Congo River basin.

Seventy-nine new inland vessels were built and delivered to BV class during 2013, including 19 tankers, 21 special service vessels, 13 passenger vessels, nine pusher barge and 17 vessels of other types such as dredgers. Examples include the series of 11 Magbit asphalt/oil barges built in Croatia for Impala Colombia and the 15 product carriers built in Peru and Brazil for Perenco Peru. There are 39 new construction projects in progress under BV classification in South America including 18 with a Paraguayan flag, two for Colombia, five for Argentina and 14 for Peru.

Over 110 new inland vessels will be delivered to BV class in 2014, including 36 tankers and 14 passenger vessels. Increasing focus on the environment and emissions will be mirrored by BV's investment in these areas including developing specific guidelines for the safe application of LNG propulsion systems for inland vessels.

Class rules

During 2013 BV also published new rules for thickness measurements for inland vessels and its own new UTM software package. The new rules for thickness measurements now include a thickness measurement that determines the structure wastage, which is a major part of the hull condition assessment during maintenance for class. The requirements for thickness measurements have been developed in the Rule Note NR 597. Inland UTM is software (based on Rule Note NR 597) allowing for easy reporting and analysis of thickness measurements.



Product carriers being built in Peru and Brazil for Perenco Peru

It also adopted VeriSTAR CHEM for inland vessels and the new ADN requirements and issued new corrosion protection guidelines. The main updates brought to VeriSTAR CHEM software were the integration of amendments in compliance with ADN 2013 and the development of modules allowing the product list to be put into German and Dutch.

Corrosion is one of the main causes of structural problems encountered on vessels in service. Large areas of vessel structures such as water ballast tanks, bulk carrier holds or cargo tanks can be subject to severe corrosion. Many factors contribute to the spread of corrosion, notably severe stress in certain zones, water retained on horizontal surfaces, condensation and streaming of water, corrosive cargoes and inadequate cleaning of bulker holds.

BV says that some of these factors can be taken into account at the design stage, by examining the behaviour of the structure in relation to corrosion. However, such measures are not sufficient to prevent or reduce the effects of corrosion. The durability of a structure subject to corrosion depends mainly on corrosion protection applied to the newbuilding.

The new BV Guidance Note NI 606 "Guidelines for Corrosion Protection Applicable to Inland Navigation Vessels" has been developed with the intention of providing owners, building and repair yards, and surveyors with information and recommendations aimed at meeting the requirements for hull structure preservation laid down in the Rules NR 217. In particular, they will enable all interested parties to:

- make a proper choice and draw up specifications of corrosion protection systems
- ensure proper maintenance of the corrosion protection system
- perform efficient inspections necessary for corrosion protection systems within the scope of surveys for class assignment and maintenance.

Added to this, asbestos is becoming a hot topic in the inland marine industry, with significant potential adverse implications for both health and financial loss. To help address these issues, BV has created an asbestos training centre in Antwerp. [NA](#)



Marine Heavy Transport & Lift IV

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Call for Papers

The marine heavy transport and lift sector has enjoyed a buoyant and growing market due to the boom in offshore renewables and large project cargo work. The rapidly growing Wind Farm sector in particular has increased the number of offshore projects requiring transportation, installation or removal of a wide range of structures and modules. The project cargo transport market has been growing, particularly power generation and refineries work in US, South America, Africa, India, Pakistan and China.



As the structures and cargo become bigger and heavier and destinations seemingly more difficult to access the market is looking for more and better equipped vessels. There are also increasing safety and greater environmental concerns for all aspects of marine operations. The new generation of heavy lift vessel designs are responding to the demand for higher lifting capacity and larger outreach. There are also an increasing number of new design concepts aimed at servicing this increasing demand in the marine heavy transport and lift industry.



This conference, the Fourth in the series from RINA, aims to bring together naval architects, operators, project engineers, warranty surveyors and designers to examine the various design and operational issues associated with this industry. Papers are invited on all related topics including the following:

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- Ballast control, stability and stress monitoring
- Weather routing
- Design criteria for short trip scenarios
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V-POD technology moves to higher power ratings

Dutch-based SARC has been working with Verhaar Omega to develop a propulsion pod with an integrated electric motor. Creators, Markus van der Laan, Dick-Jan de Blaeij and Herbert Koelman, discuss the background and development of this POD and present potential applications

It requires no elucidation that electric POD propulsion may offer significant benefits for certain ship types or operational profiles. However, the combination of hydrodynamic requirements, the properties of an electric motor and the limited available spaces may make it hard to find a favourable design solution. In The Netherlands a group of researchers has conceived of a way out of these design dilemmas, and proposed a solution called V(erhaar)-POD, which has been applied on some inland vessels.

Some 20 years ago, electrical POD drives were developed with the same characteristics: a gondola below the ship containing an electric motor, which is fitted directly to the propeller by means of a shaft. The whole gondola can be steered in the horizontal plane, thereby delivering flexible thrust in all directions. Such a POD offers in general the following advantages:

- High efficiency direct drive motor to propeller
- No wear of gear wheels
- Propulsion in all directions
- Low noise levels
- Easy installation and service.

Unfortunately, also a number of disadvantages are inherent to this solution:

- Losses in diesel-electric conversion (typical figures in range of 7%)
- Flow resistance of the large and thick gondola shape/surface
- High price of POD, related to the large and expensive E-motor
- Additional price of diesel-electric installation and controllers
- Higher propeller revolutions, leading to lower efficiency.

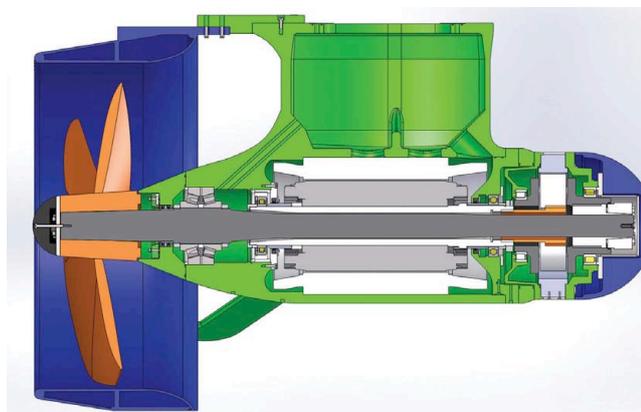


Figure 1: Cross section of V-POD with long propeller shaft towards planetary gear on opposite side

For maximum propeller efficiency the propeller should have a large diameter and run at low revolutions, however, this requires a large torque and a large and expensive electric motor. Therefore direct drive PODs are in general a compromise between propeller efficiency and motor size and cost. Although there are clearly certain advantages, the backsides have limited broader application of PODs.

A novel solution

In many conventional ship designs a gear box is mounted between the high(er) speed engine and the low(er) speed propeller. This allows for a relatively small (and cheaper) diesel engine to drive a large propeller at low revolutions and with a higher propeller efficiency. The same principle also applies to PODs with electric motors (E-Motor) and propellers: a smaller (and cheaper) high(er) speed E-Motor drives a large propeller with high efficiency through a gear box. The propeller efficiency gain is significantly higher than the small energy losses in the gears (typically 2.5-3%).

The geared V-POD is based on a new mechanical concept: The propeller shaft runs from the propeller through the hollow E-motor shaft to the opposite side of the gondola and is connected to a planetary gear, as depicted in figure 1. Detailed investigations and consultation with E-motor and gear manufacturers showed that this new arrangement offers a compact size, efficient, cost attractive and robust mechanical solution.

With this layout the following advantages are achieved:

- The planetary gear allows the E-motor to run at higher speeds than the propeller, so higher motor revolutions – allowing for higher powers – can be combined with lower propeller revolutions, which is beneficial for its efficiency
- With the higher revolutions the motor can reduce in size, leading to a cheaper motor and a more slender gondola with consequently more favourable hydrodynamic properties
- The long shaft acts as a torsional spring, thus preventing the propeller induced vibrations to reach the planetary gear.



Figure 2: Twin V-PODs mounted under *Kratos*

From this design, which is covered by several international patents, around 2011 a prototype was constructed by Verhaar Omega, a supplier of manoeuvring and propulsion equipment of Sassenheim, The Netherlands. The prototype was extensively tested, first stationary, followed by an endurance test mounted under an inland waterway tanker. This proved that the concept is not only feasible, but can also be constructed ruggedly.

Installation

The first application of the V-POD was on a series of diesel-electric inland waterway tankers, in particular *Zeus* and *Themis* (600dwt with a single V-POD) along with *Metis* and *Kratos* (1,200dwt with a pair of V-PODs, see figure 2). These vessels have now operated successfully for a number of years, showing that the design

is sound and the incarnation sturdy. Specifically these vessels have shown a rapid acceleration combined with superb manoeuvring and instantly reversing, as well as low vibration and sound levels. A movie of *Zeus* navigating in confined waters can be found at www.youtube.com/watch?v=KgGXhnZ2bbw

At this moment orders for a number of V-PODs are close, including 900kW for an inland waterway tanker, 2,300kW for a pusher and 1,700kW for a yacht, all equipped with twin PODs. For larger power requirements triple PODs are applied, as on a 1,230kW coastal barge and a 2,600kW offshore vessel.

Development and application

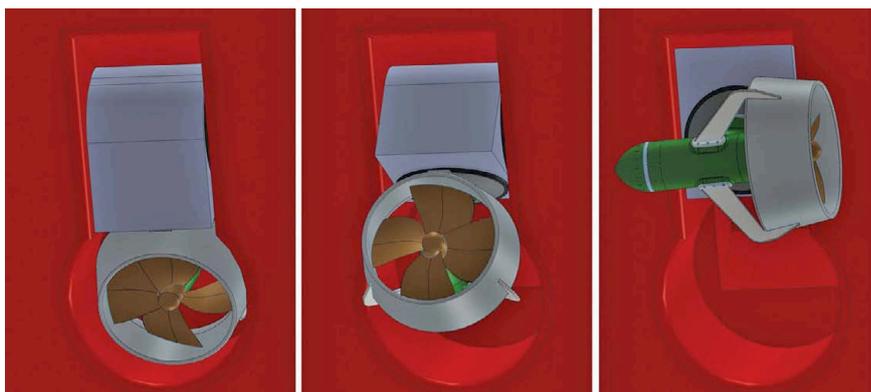
The Verhaar V-PODs in the range up to 500kW are now in production and service, and at this moment the range is

being extended to 1.5MW. These larger PODs follow the same proven design with a larger gondola diameter, a larger E-motor and a larger planetary gear. Gear specialists have been involved in developing a compact gear with a higher reduction ratio for even larger propeller efficiency. Meanwhile, the market is increasingly focusing on still larger sized PODs up to several MW power. Although the design of the V-POD allows to mechanically scale the whole drive, Verhaar has decided to limit their range to some 2MW. However, the patented design can obviously be licensed to other producers for larger power applications.

With higher power ratings becoming available, application on larger, sea-going, vessels comes within reach. A case study has been performed on a 7,500dwt all-electric offshore project cargo vessel with an Lpp of 120m. Equipped with two V-PODs of 1,350kW, and a propeller diameter of 2.50m at the stern, a transit speed of abt.13.5knots can be achieved. The combination with a single retractable 1,000kW V-POD (D=2.10m) in the fore ship gives the vessel a versatile configuration which is – by the benefit of the azimuthing PODs – suitable for dynamic positioning during offshore installation assistance. Furthermore, this triple V-POD configuration offers some redundancy, because even in the case of damage to the aft ship, the vessel can still sail home on the forward POD only, at a speed of 9-10knots.

One step further than such a retractable V-POD is a *swing-up* retractable configuration, as depicted in figure 3.

A further version also offers (like a bow thruster) in retracted condition, transverse thrust.



Future outlook

With the V-POD some non-conventional configurations become possible, as demonstrated by the application in *swing-up* mode. Another development aims at propulsion for low draughts: by tilting the vertical rotation axis longitudinally, the POD can be used in the conventional position for larger draughts,

Figure 3: V-POD applied in *swing-up* mode

and in fully reversed position – which makes the propeller extend below the baseline – for the smaller draughts.

An application would be as a Contra Rotating Propeller (CRP) behind a conventional propeller shaft line. Literature reports that this arrangement not only recovers rotational losses and improves the efficiency, but also offers propulsion redundancy and improved independent manoeuvring in port. Currently the use of a V-POD in this application is being investigated.

Conclusion

- Direct drive PODs have been applied in shipping for over 20 years, but are primarily limited to specialised vessels

with shared power consumers. Reasons might be found in the high price of the direct drive POD and the lower propeller efficiency as a compromise with motor size

- A geared POD, called V-POD, offers interesting perspectives to reduce size and cost of the E-motor combined with improved propeller efficiency. This design comprises a long and flexible propeller shaft through a hollow E-motor shaft, which enables a robust and long lasting solution
- The V-POD brings diesel-electric propulsion within reach for a wider range of ships
- The present power range of V-POD is now up to 1.5MW, however, the

concept is scalable to higher powers

- Interesting applications are:
- for shared power consumers
- for large load variations or prolonged low power operation
- for improved manoeuvrability
- for low draught
- swing up V-POD for DP or additional ‘take-home’ propulsion.

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- SARC, Bussum, The Netherlands, www.sarc.nl, sarc@sarc.nl.

ANSYS launches 15.0

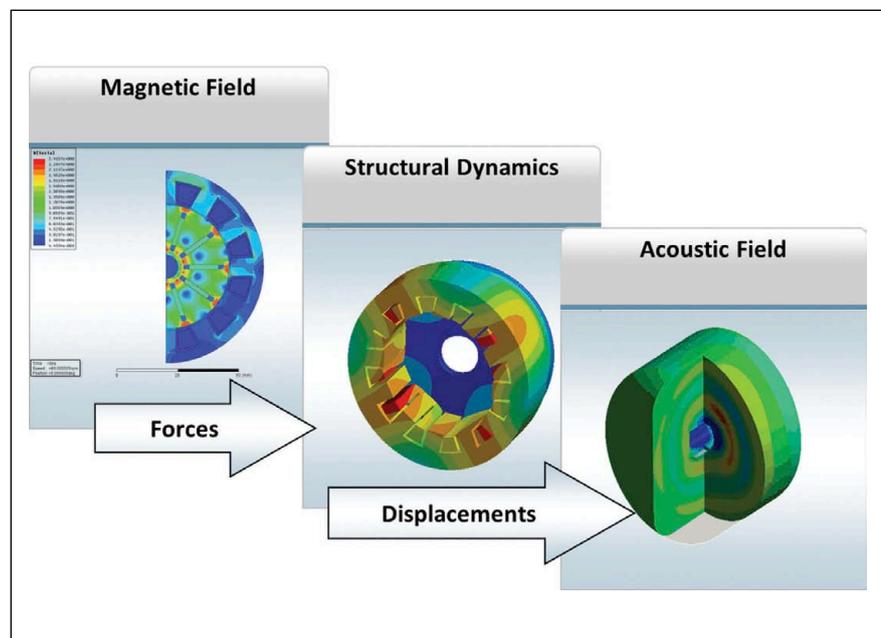
ANSYS has launched its latest version of its software ANSYS 15.0 that will offer greater capabilities to its users

The latest release in the company’s simulation portfolio, ANSYS 15.0 brings together new capabilities and enhancements that offer a more comprehensive approach to guide and optimise complete product designs, the company says.

As products are now being developed toward greater complexity, with advanced functionality and features, novel materials (such as composites), embedded electronics and their resulting thermal issues, and control software for smart operation, single-physics analysis (or uncoupled multiple physics) is not adequate for designing optimum products.

Jackie Mavin, PR, ANSYS comments that the latest development: “delivers major advancements across its entire portfolio, which is the largest of any simulation provider. Three particular areas have special focus in this release: pre-processing, complete multi-physics workflows and high-performance computing.”

The release introduces pre-processing capabilities that boost automation and ease of setup as well as high-performance computing enhancements that enable analysis of ever-larger models and faster



ANSYS Workbench coupling technology delivers an advanced work flow to perform NVH (noise, vibration and harshness) analysis on electric machines

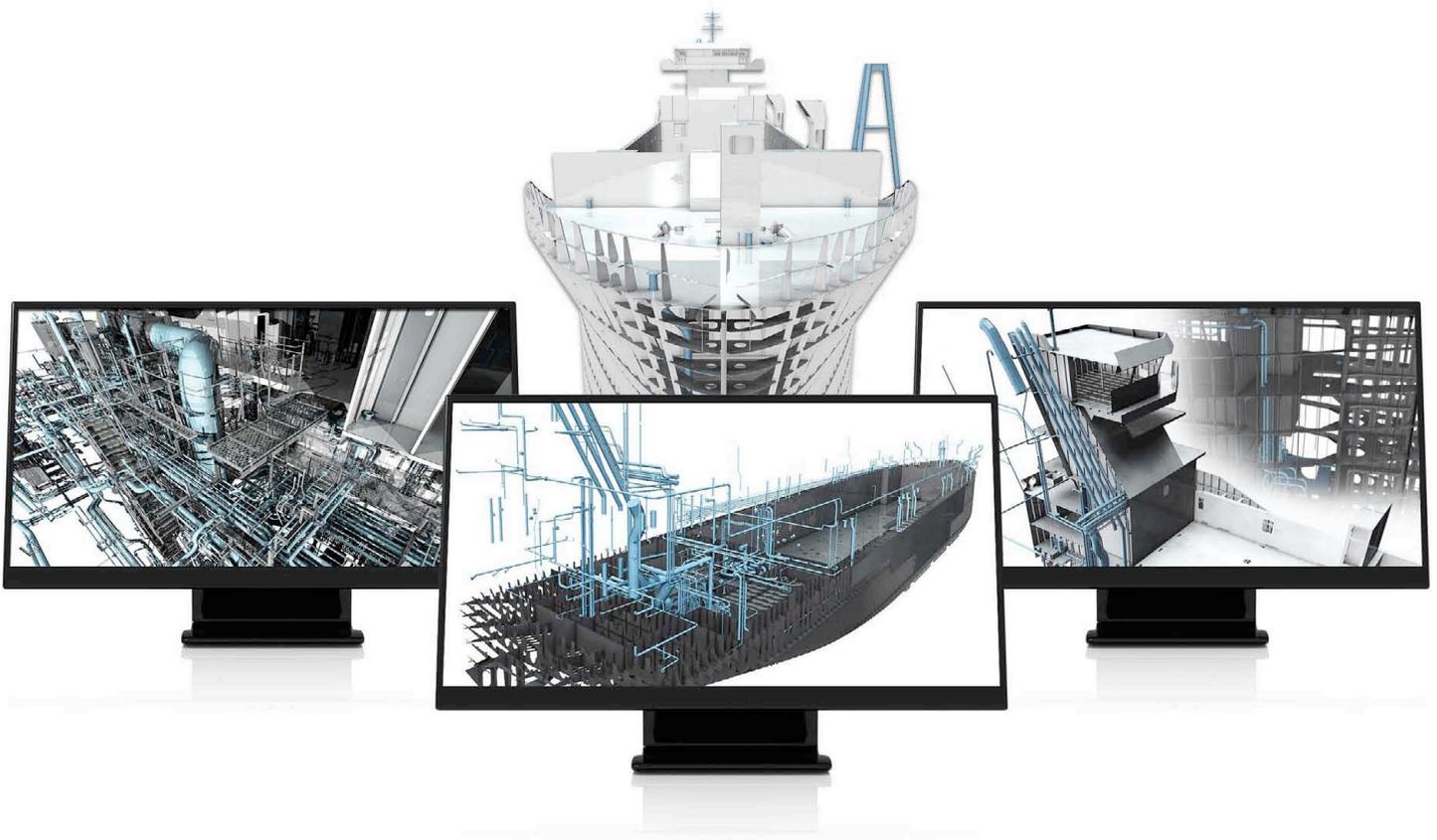
processing times. This latest version also features complete multi-physics workflows including those for electric machines, turbo flow path system design and robust electrical and electronics design.

Mavin adds that: “This latest release enhances ANSYS’ pre-processing capabilities, enabling users to quickly and accurately mesh the widest range of simulation models, regardless of type of physics involved.” **NA**



Autodesk® based Shipbuilding & Offshore Solutions

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SSI develops ShipConstructor®, an AutoCAD based CAD/CAM software suite that leverages the world's most popular CAD platform. SSI applies information technology expertise to address industry specific challenges including sharing engineering data with other business processes and applications such as MRP, ERP and PLM tools.

ShipConstructor's AutoCAD foundation provides a user environment that is a globally recognized CAD/CAM standard. This results in an existing labor pool of expertise, a common DWG format for sharing information with other applications, and a portfolio of complementary Autodesk products.

www.SSI-corporate.com

Towards lean shipbuilding

Stéphane Neuvéglise, head of business management, Marine Systems, AVEVA Solutions, explains how the shipbuilding industry can adopt Lean Construction methodologies to meet demand for ever more complex projects

Technologies that support highly efficient, concurrent design will aid the development of Lean Construction, and allow the maritime sector to mirror the dramatic improvements achieved by Lean Manufacturing. For shipbuilders, Lean business processes not only offer a means of sustaining profitability in a tight market, they also help to reduce business risk in the less familiar market for challenging offshore projects.

Integrated engineering & design

No complex entity can be designed 100% correctly at the first attempt; design is an inherently iterative process. Each design decision has far-reaching consequences on other areas of the vessel. The design process is not linear, but a design spiral that is steadily refined and perfected over time (this concept was articulated as long ago as 1959). The design spiral applies, not only at the overall project level, but also at lower levels and within individual disciplines.

Unfortunately, the design spiral rapidly becomes unmanageable as projects become larger and more complex, with more interdependencies, longer lines of communication and – significantly – where the use of incompatible technologies makes information sharing difficult. Early FPSO projects were dogged with problems as shipbuilders and plant contractors (EPCs) together wrestled with unfamiliar challenges and incompatible design tools.

Controlling change

An efficient design-spiral workflow on a complex engineering project can, however, be achieved by integrating engineering and design information to provide three essential capabilities:

- collaborative sharing of engineering and design information by all disciplines
- robust control of information ownership and changes



The shipbuilding design spiral

- clear visibility of information maturity status.

These capabilities are provided in AVEVA Marine. Information integration also ensures that Integrated Engineering & Design can be carried out effectively on collaborative projects involving shipbuilders and plant EPCs. The technology barriers that once hindered the early FPSO projects have been substantially removed and an efficient design-spiral process can now embrace all project participants.

Collaboration across the various engineering and design disciplines is supported by the use of Compare & Update functionality. This enables all disciplines to work efficiently at their own pace while synchronising their work through

periodic, controlled comparisons. Change highlighting enables each discipline to eliminate inconsistencies in a controlled, prioritised manner. Such visibility of changes must be supported by effective change management to achieve an efficient workflow.

The design spiral is inherently change-intensive; the flexibility provided by Compare & Update enables preliminary design information to be created and then progressively revised in a controlled manner. It provides the necessary functionality for a design-spiral workflow that embraces all project participants. It is one important enabler of Lean Construction methodologies and can be extended to multi-site projects by the use of AVEVA Global.

Controlling the design spiral

Lean engineering & design plays a key role in the success of a project, but achieving it requires control of the design spiral, ensuring that the huge number of design changes are properly managed and shared effectively across the multi-disciplinary team. This requires six enablers:

1. All disciplines take part

Every engineering discipline must be part of the same integrated process, confidently sharing information with each other to function as a multi-disciplinary team.

2. Pervasive integration

Information integration must be an inherent and all-encompassing feature of the engineering and design process. Efficient design practices demand that this integration must be at the level of the design object and universal across the authoring applications, rather than simply based around the transfer of drawings or model files between systems.

3. Common descriptions of design status

To understand the appropriate use of engineering and design information, its status must be presented in a commonly agreed manner. A common understanding of what must be completed to achieve a certain status must also be agreed – a status checklist. Knowing where you are in the design spiral, i.e. knowing whether the data you are working with is approved or

still subject to change, is essential for efficient design.

4. Each engineer can see changes quickly

Because not all the effects of a change can be properly assessed without each discipline engineer's input, all engineering information authors and reviewers must be able to easily see design changes over time. Being able to track the changes made within each discipline is essential to ensuring that every contribution to the design is up to date and that changes are clearly visible.

5. Each discipline can compare and update information

Visibility of the work of other disciplines must be complemented by control over one's own. Each engineer or designer must be able to control whether or when to accommodate new changes, rather than have them automatically percolate through the entire design. The key to maintaining consistency across disciplines is the ability to inspect changes made by others and then make an informed selective update to one's own information.

6. Access rights are essential

Particularly in shipbuilding, and increasingly on complex projects, designs can cross many contractual boundaries. Managing access rights across a multi-contractor project is essential to protect intellectual property and maintain

the correct separation between elements of the design.

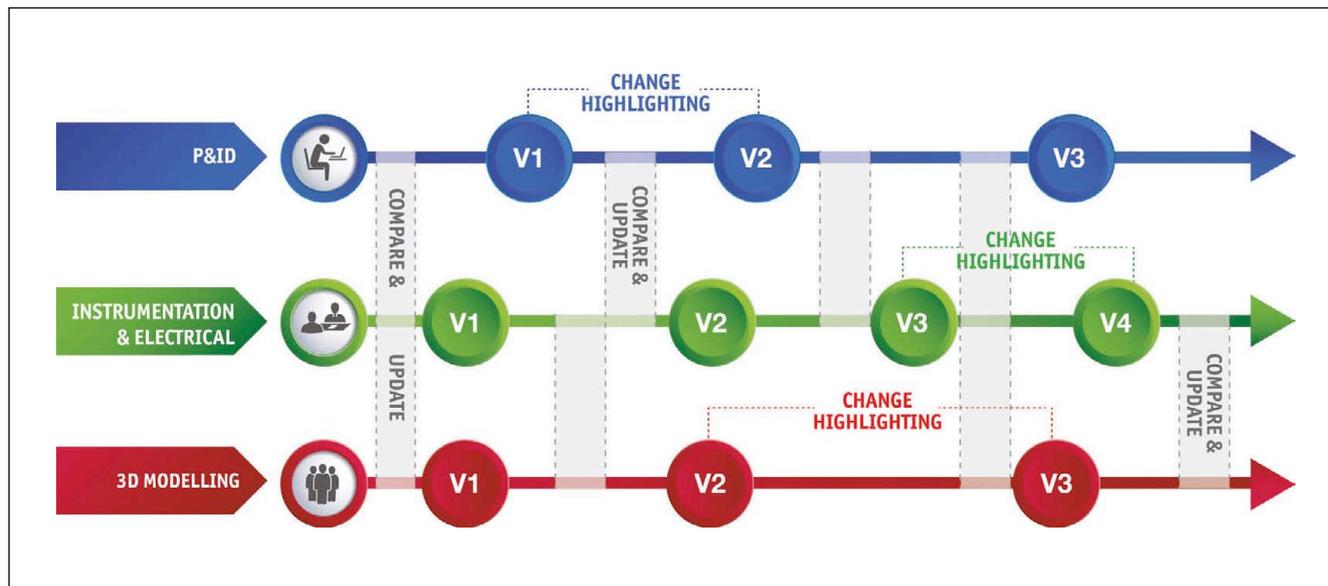
Closing the loop

AVEVA technology enables pervasive sharing of a common information asset across all disciplines and project participants, even when distributed across remote sites, to allow for concurrent working. All six of the above prerequisites are met. In particular, the Compare & Update functionality provides the necessary combination of flexible working with robust change control.

The use of 3D laser scanning adds valuable capabilities for extending Lean methodologies into the construction stages. For shipbuilding, this is of most use on conversion and refit projects, where new design must fit accurately with existing structure and/or outfitting. However, it is already used in the offshore sector for verifying the construction accuracy of major modules before despatch; it is simply not an option to ship something halfway around the world only to find that it does not fit onto the platform.

State-of-the-art technology in plant design now enables laser scanned as-fabricated data to be imported directly into the 3D design environment, where it can be quickly and accurately compared with the as-designed. This closes the feedback loop between design, fabrication and construction and will be an important enabler of Lean Construction. *NA*

Change highlighting and ease of comparison and updating keep disciplines in step while permitting freedom of each to work in an efficient manner



The way of the weld

SSI says it has revolutionised weld management with the latest release of its ShipConstructor application. The specific requirements of SSI’s customers in the offshore industry sparked the idea for this development and a further analysis of weld management practices around the world

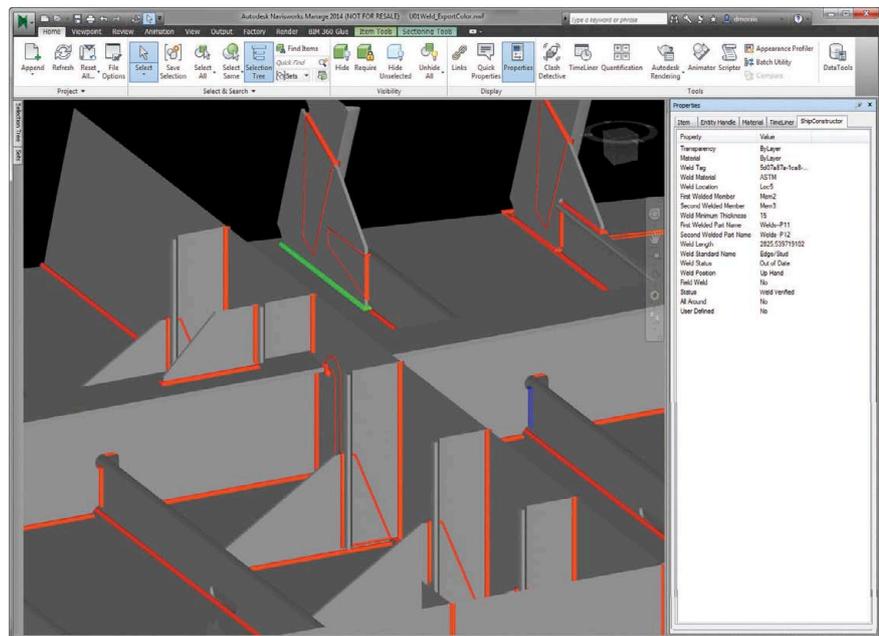
Weld management processes have been neglected by shipyards that often use cumbersome tools with inefficient systems to check and oversee this critical shipbuilding element.

As a consequence SSI saw a need for this process to be streamlined, adding automation and developing existing software in an effort to improve the welding process and to further improve the weld checking systems available to shipbuilders.

“I was surprised at the number of ship designers and engineers who *manually* trace all the weld paths, despite the fact that using the 3D geometry is a much better way to identify which items/ parts need to be welded together,” says SSI Chief technology officer, Denis Morais.

He also noticed that shipyards are typically using clumsy tools such as Excel spreadsheets to create and manage weld schedules and verification. He further saw that there is a huge amount of looking back and forth between paper printouts to analyse standards and statuses of specific weld tags. In essence, management of welds is inefficient, non-intuitive and error-prone because it is done outside of the prime engineering programme and 3D data model.

Seeing that there was a need in the market for a better tool and process, SSI developed its existing WeldManagement product within the AutoCAD based ShipConstructor CAD/CAM software suite. ShipConstructor WeldManagement lets ship designers/engineers more easily identify the welds that are needed by fully immersing weld management within the 3D design and engineering process. Welds can be applied to the 3D model using specific colours to correspond to various weld



ShipConstructor introduces its WeldManagement programme to improve weld management practices

standards, which can later be easily checked in Autodesk Navisworks. After that, instructions for welds then show up on AutoCAD based production documentation which is created directly from the 3D model using ShipConstructor’s Associative DWG technology.

Once the welds for a given panel, assembly or block have been created in production, non-destructive testing is required to validate the welds. ShipConstructor’s new capabilities help track and manage this effort in a more systematic fashion by allowing the application of different statuses (Pending, Approved, and Verified) to welds in the 3D model. Using out of the box tools within Autodesk Navisworks, the status of a given weld, or all of the welds in a given area, can be visualised;

there is no need to go back and forth looking up various welds tags and their locations. The ability to see the status of all of the welds in a 3D model significantly improves manageability of welds and allows better traceability throughout the project.

“The enhancements to ShipConstructor WeldManagement once again leverage the Autodesk Platform to deliver maximum value in a production context; a capability unique to SSI technology,” says SSI’s marketing manager, Michael Viala.

In summary, as a result of SSI’s recent enhancements to its ShipConstructor WeldManagement programme, for the first time ever, welds can be managed in a truly “holistic” fashion, starting in engineering all the way to final verification and documentation. **NA**

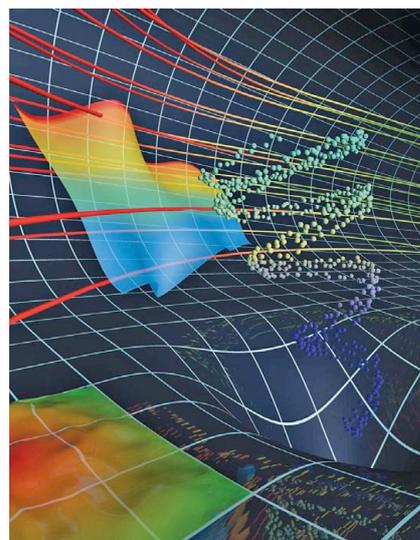
MDX the future of engineering simulation

Great designs are not born fully formed and beautiful. They evolve, shaped by exposure to the rigour of real-life operation. Stephen Ferguson, marketing manager, explains the development of CD-Adapco's MDX design concept

Engineers know that designs must evolve and for that reason there are few words that cast as much fear into the heart of an engineer as untested. From the very earliest days of our careers, we learn the hard way that untested things, such as components, ideas and designs, break under the stress of real-life operation.

In the old days testing happened in the lab; with the rigours of real-life operation reduced to a series of idealised physical tests, usually aimed at testing only the extremes of operation. Although this approach was often successful it had flaws.

For many years, engineering simulation was simply a new-fangled alternative to this type of lab testing, sharing all of the same flaws. It was expensive, in terms of licensing and hardware costs; the numerical models were often unable to capture all of the important physics;



and often it was deployed so late in the design process that only a few worst case simulations were possible.

CD-Adapco's MDX concept will allow designers to test from the design concept stage

CD-Adapco is introducing a concept called MDX, which is short for Multidisciplinary Design Exploration. MDX is a methodology for automatically testing designs from early in the concept stage, against all of the physics that might influence its performance, working out which set of design parameters will break, and which will improve it.

MDX is possible because engineering simulation software now increasingly allows engineers to determine how a product will perform under the actual conditions that it will face during its operational life without resorting to gross simplification. If necessary this can involve multiple simulation software tools working in concert, each specialised in addressing a specific part of the problem, which together allow an engineer to simulate the entire system, rather than just a particular piece of it.

Another enabling factor is the emergence of robust multi-purpose design exploration and optimisation tools that automatically drive the design in directions that engineering intuition alone could never take it. The combination of design exploration tools and mature engineering simulation results in products that are truly "better, faster, cheaper" under real-life operating conditions.

A final factor is affordability. As a result of new licensing schemes, the cost of simulating multiple variations of a single design is substantially reduced, enabling organisations to harness all of the computing resources available to them. This allows MDX to be deployed from the earliest stages of the design process, and helps to ensure that great concepts evolve into great designs, and eventually great products.

In the coming months CD-Adapco will be looking at more applications that will strengthen the view that MDX is the future of simulation, and of engineering as a whole. [NA](#)

CD-Adapco adds realism to simulation

CD-Adapco has announced the release of STAR-CCM+ v9.02, the latest major release of its flagship simulation tool. The company says that it has focused on increasing users' productivity and simulation turnaround time, as well as a range of new application areas while making simulation more realistic for customers.

"Since engineering simulation is a results-based discipline, in STAR-CCM+ v9.02 we enhanced our workflow capabilities and the speed and scalability of our solvers. This leads to greater throughput and ensures the product development process is fed with a constant and accurate stream of simulation data," said Senior VP of product management, Jean-Claude Ercolanelli. "All aspects of our v9 release cycle will stay focused on adding realism to the simulations, and driving optimal results for customers in a shortened amount of time."

This new version brings features that add realism to the design process, enhance user workflows, increase throughput and improve accuracy. New features such as the volume rendering capability allows engineers to "see inside" a flow-field for the first time; the adjoint solver broadens applicability and ease-of-use with the tumble and swirl cost function; and the Dispersed Multiphase model helps accomplish the goal of greater adoption of realistic use of simulation.

Integrating CAD/CAM in a PDM/ERP environment

Shipbuilders are increasingly investigating or implementing PDM software to operate at the heart of product management. Theodoor de Jonge, managing director, Paul Filius, technical director, and Teuvo Hokuni, product manager for design applications, Nupas-Cadmatic explain how they have incorporated this into the company's software

Implementing product data management (PDM) systems at shipyards has proven to be a challenging task in many cases. A major advantage of using PDM software in shipbuilding is that the data of previously engineered vessels can be used easily for new vessels.

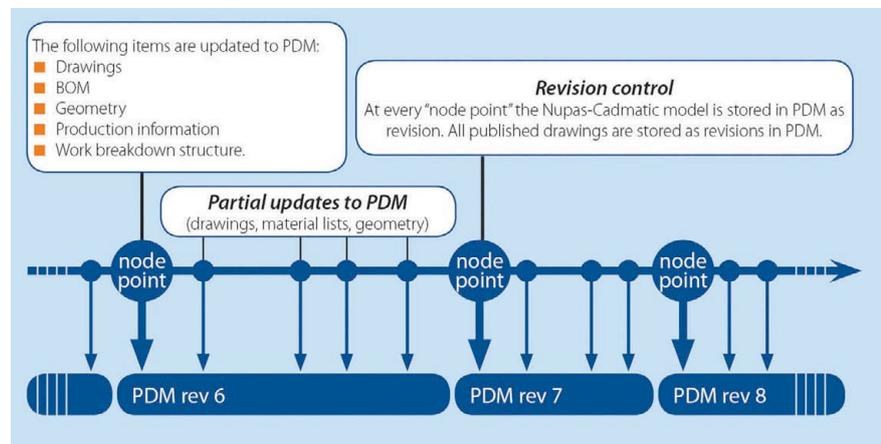
Each shipyard, however, has its own requirements for production documentation, which complicates matters considerably. Nupas-Cadmatic's solution to this challenge is to use ready-made "building blocks" to create interfaces between dedicated PDM and CAD systems and the eShare module to visually show information stored in multiple systems.

Before the advent of PDM software it was clear that CAD software was the owner of all engineering data. Nowadays, part of the information ownership has shifted to the PDM system, and CAD is allowed to use it. This requires that processes are explicitly defined. One of the challenges here is to create processes that leave enough flexibility for the engineer, and thus support his creativity when engineering.

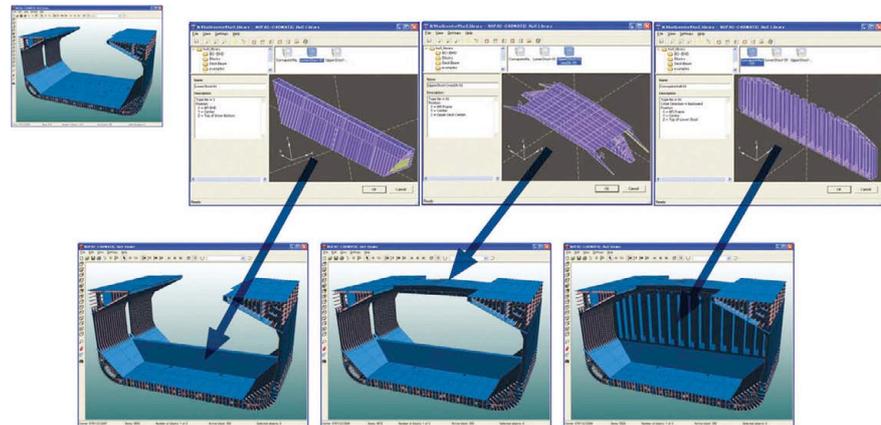
Interaction between software and engineering

It needs to be decided how PDM software will interact with the dynamic engineering environment. On the one hand all changes should be traceable from the PDM system, on the other hand an overflow of data would render tracing unnecessarily complicated.

One of the challenges is to define processes that combine the desired flexibility in engineering, and delivered from software tools such as



An example of ready-made synchronisation blocks to and from a PDM system



Re-using standard data in vessels

Nupas-Cadmatic, with proper storage and traceability in PDM software.

Global engineering and production also plays an important role. Different shipyards often have different requirements for production documentation, the available materials and yard layout. If there are discrepancies between the design and shipyard requirements this can have serious consequences for the shipbuilding process or vessel operation.

As a solution an automatic process seems ideal, but is not always desirable because of all the details that will be influenced. Nupas-Cadmatic has chosen a solution with tools that support the engineering process of making the virtual ship ready for building in other locations.

When connecting PDM software to CAD software in principle all older projects should be stored so that they can easily be retrieved. Nupas-Cadmatic

has a functionality to easily incorporate data from other projects to a new project, including options for automatic adjustment of e.g. changed hull shapes.

PDM integration

The company has developed a single interface for integrations with PDM systems. The interface consists of different building blocks, each focusing on its own specific target. This provides the required flexibility for each desired interface between Nupas-Cadmatic and PDM.

The design and engineering of a new vessel starts with using what is available from earlier vessels. This data is available from PDM. In some cases during the process data is copied to the new ship, in some cases it is referenced to the same source. The goal is to create as little data redundancy as possible.

The PDM software contains a database with the data for components, parts of vessels built earlier or complete vessels as well standard modules. The database becomes more complete after each vessel.

Nupas-Cadmatic provides tools that allow the re-use of existing data from different software versions at the same time. It also includes the intelligence to let the data adapt to the new surroundings, with reference to the original sources. This is shown for example when using structures related to hull shapes, which adjust automatically to the new situation.

PDM data and storage

PDM software data for materials and logistics, new design data and historical design data can be used in the design of a new vessel.

The PDM database stores Nupas-Cadmatic data such as drawings, material listings, geometry, production information and work breakdown structure. Each time data is stored in PDM data can be used for the rest of the production process of the vessel, but can also be used for the design of future ships.

In order to deliver the data in manageable chunks to PDM the control over the chunks is allocated to the work breakdown manager. At that point it is

decided how to store the data, either as individual objects, a group belonging to the current vessel, a standard module or other possible entities.

To create the optimal balance between the flexibility to return to a certain stage of the project, and data storage, a system of full and partial updates is used. These updates stay within the framework of the data chunks defined in the work breakdown manager.

eShare solution

Providing the right data to the right persons in an organisation is a major challenge. Shipyards and engineering companies need to utilise design and engineering information more efficiently in digital format. There is also a need to utilise digital information for ship production, coordination, follow up and reporting design, engineering and production activities easily.

Most of the desired information is stored in PDM and enterprise resource planning (ERP) databases. This data is in many cases hard to access, especially when coupled to 3D objects accessed through viewers.

Nupas-Cadmatic has developed a solution for this called eShare. This software uses eBrowser visualisation functionalities combined with technology to access databases.

eShare can ideally be used as a user application to access and examine data from PDM and ERP systems combined with the 3D model. It has the capability to use not only Nupas-Cadmatic CAD models, but also 3D models from other sources can be viewed and even combined into one viewable model.

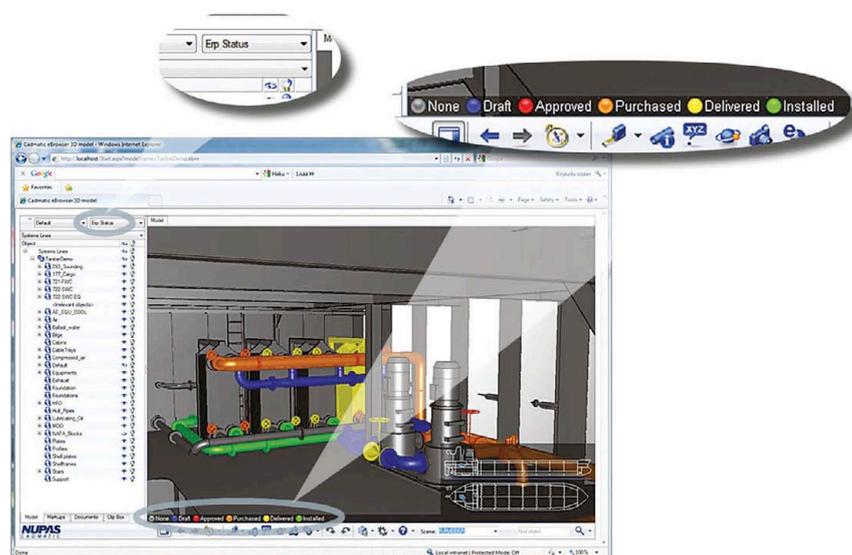
Data is not copied to eShare, rather the eShare server allows direct access to data from external data sources. This has the major advantage of avoiding data redundancy. The system also allows classifications of objects to be shown in a certain colour scheme.

Some companies have implemented their ERP application company-wide, while others work with Excel sheets. Both work with eShare. With more and more adoption of registration techniques such as radio frequency identification (RFID) for object locations a new level of accuracy in object location registration, with less work, can be reached.

Future developments

Unification of the platforms used for Nupas-Cadmatic will make the building of interfaces in the future an even easier task. The focus of development is to continuously bring more user-friendliness to these interfaces. This ensures maximum flexibility when working with CAD software. **NA**

eShare showing ERP statuses in the eBrowser



Fuel optimisation with HydroComp NavCad

New features for HydroComp's resistance and propulsion software NavCad will allow better fuel optimisation

HydroComp NavCad is the most widely used software for predicting vessel resistance and propulsion within the marine design community. With growing emphasis on fuel consumption and efficiency, naval architects and marine engineers are continually looking to reduce fuel consumption; both as part of the design spiral and also during operation.

Summary		Parameter				
Technique:	Prediction	Length on WL:	Increase [+]	1.384	1.228	1.364
Prediction:	Holtrop	Bulb section area:	Increase [+]	0.624	0.371	0.592
Friction line:	ITTC-57	Wetted surface:	Decrease [-]	0.443	0.492	0.449
Primary operation		Displacement:	Decrease [-]	0.289	0.828	0.357
Speed:	20.00 kt	Transom area:	Decrease [-]	0.221	0.348	0.237
Time at speed:	80.00 %	Max beam on WL:	Decrease [-]	0.231	0.231	0.231
Secondary operation		Max molded draft:	Decrease [-]	0.198	0.119	0.188
Speed:	16.00 kt	Half entrance angle:	Decrease [-]	0.065	0.039	0.062
Time at speed:	20.00 %	Waterplane area:	Increase [+]	0.060	0.053	0.059
Note: A higher sensitivity has greater influence on drag. Values greater than 1.0 are considered significant and shown in blue.		LCB fwd TR:	Increase [+]	0.045	0.052	0.046
		Max section area:	Increase [+]	0.075	0.641	0.017
		Stern shape factor:	Decrease [-]	0.014	0.016	0.014
		Bow shape factor:	Increase [+]	0.000	0.000	0.000
		LCB fwd TR:	Increase [+]	0.045	0.052	0.046

HydroComp NavCad "Drag reduction" tool

Drag reduction

Strategic design-side fuel savings can be found by using optimised hull forms. According to Donald MacPherson, HydroComp technical director: "NavCad's drag reduction tool provides designers with a meaningful metric to identify changes to the original hull design that will reduce drag and increase performance and efficiency. For example, it offers practical insight into the 'What if' questions: What if the half angle of entrance is decreased? What if I add a bulb? What if the LCG is shifted aft? Designers and naval architects now have the ability early in the design to rapidly evaluate the influence of various hull parameters on vessel drag, and more importantly, on real operational efficiency."

The drag reduction analysis can be applied to any vessel in NavCad. Once the initial hull parameters have been entered, the predicted resistance can be calculated using one of NavCad's more than three-dozen resistance methods. The designer's selection of the most appropriate resistance prediction model is assisted by NavCad's Method Expert ranking system.

The resistance curve for the initial design is known as the "basis" resistance. The drag reduction analysis then evaluates the influence on resistance (increasing or decreasing plus its significance) of the change in various hull parameters – length, displacement, and transom immersion, to name a few. The hull parameters are then organised by influence, with the most

significant parameter presented at the top of the table. (See figure)

Development of an optimised system also needs consideration of the hydrodynamic influences of the parameters across the operating speed range. For example, transom immersion is beneficial at high speed, but detrimental at lower speeds. In order to consider the influences on overall operation, NavCad's drag reduction analysis allows the user to enter primary and secondary operating profiles using speed and time at speed.

Additionally, since the motivation for drag reduction is typically fuel consumption, the magnitude of the drag at speed must be part of the assessment, not solely the proportional reduction in drag. In other words, since resistance at top speed can be substantially higher than lower speeds, it should have greater significance in the analysis. NavCad's Drag Reduction analysis includes a "Total energy" weighted influence, which is calculated based on the primary and secondary operating profiles. This "total energy" approach allows the user to truly evaluate the effect of a hull parameter on the change of overall energy consumption of the vessel.

Effect of initial trim

The benefits of trim optimisation have been well documented for some years.

NavCad's Effect of the initial trim tool provides useful information to designers and operators alike. In an effort to reduce fuel consumption, ship operators are often interested in the effect of the initial trim on the performance of the vessel. This supplemental tool will provide an essential assessment of the effect of initial trim on bare-hull resistance for ships large and small.

Once hull data has been entered and a resistance prediction built, you can use the supplemental effect of initial trim calculation to evaluate how much change in bare-hull resistance can be achieved for a constant displacement with different amounts of trim. A trim range of +/- 20% draught is presented. Like the Drag reduction tool, you can define primary and secondary speeds of operation, and NavCad evaluates a Total energy weighted average of two speeds.

This analysis modifies certain hull parameters based on the trim position, and then the new resistance for the revised "trimmed" hull is predicted. Given that the hull data is parametric, NavCad will internally predict the changes in corresponding hull data based on fundamental geometric and hydrostatic relationships. A change in trim will also affect other data, such as things like LCB position, bulb or transom immersion, and wetted surface.

Is “optimum” attainable?

NavCad’s tools specifically do not identify a singular optimum figure, but rather indicate trends and influences. “How much authority does a designer really have to implement a drag-optimised hull form? Or an operator to run with a precise trim?” asks MacPherson. “So many different design requirements – stability, structure, loading, producibility – influence a vessel’s design and construction that employing a unique hydrodynamic optimum is rarely attainable. The same is true for operational constraints. You can only trim so far.”

The hunt for precise optimum design characteristics and operational settings can also lead to increasingly complex design procedures. “You will not need to go to school to effectively utilise these tools” states MacPherson. “By

Effect of initial trim

Summary		Trim [%T]	Trim [m]	Primary [%]	Secondary [%]	Total energy [%]
Technique:	Prediction	-20	-0.850	-3.91	-6.16	-4.20
Prediction:	Holtrop	-16	-0.680	-3.16	-4.97	-3.39
Friction line:	ITTC-57	-12	-0.510	-2.40	-3.75	-2.57
LCF fwd TR:	39.470 m	-8	-0.340	-1.61	-2.52	-1.73
BML:	132.602 m	-4	-0.170	-0.81	-1.27	-0.87
Primary operation		0	0.000	0.00	0.00	0.00
Speed:	20.00 kt	4	0.170	0.83	1.29	0.89
Time at speed:	80.00 %	8	0.340	1.68	2.60	1.79
Secondary operation		12	0.510	2.54	3.92	2.71
Speed:	16.00 kt	16	0.680	3.41	5.26	3.65
Time at speed:	20.00 %	20	0.850	4.31	6.62	4.60

Note: Results are percent change in bare-hull drag. Changes greater than 2% are shown in blue (reduction) or red (increase).

Calculate Influence Save report OK Help

HydroComp NavCad “Effect of initial trim” tool

knowing the general hydrodynamic influences and trends as suggested by these tools, a designer can fulfil exceptional hydrodynamic performance in a way that does not compromise the

larger system. It is extremely valuable for a naval architect to simply know which direction to push a parameter when juggling the various – and often competing – design requirements.” *NA*

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NSR offers shortcut to the East

Following Hansa Heavy Lift's transit of the Northern Sea Route at the end of last year the company says it sees further possibilities for this route in the future

HHL *Lagos* and *HHL Hong Kong*, both E3 ice-class vessels equivalent to Russian class notation L1, safely delivered infrastructure cargo and large tugs from the Russian Baltic to the Far East using the Northern Sea Route (NSR) at the end of last year, which will reopen in June.

The vessels are Hansa Heavy Lift's (HHL) P2-type vessels, which are the first vessels in the fleet to make a journey via the NSR. Previous vessels in the HHL fleet have only transited half way to Novoport. Both *HHL Lagos* and *HHL Hong Kong* are equipped with two 700tonne cranes, combinable to 1,400tonnes.

Steve Hutty, director chartering and operations, Hansa Heavy Lift comments on why the company has opted to take this route: "It is purely down to the economics of the route. It is cheaper to go through the NSR, plus we can get cargoes over to East Asia quicker."

To be able to transit the NSR Hutty explains that HHL needed to get permission from the Russian authorities. "It takes three months to get a certificate and you need to show that you meet with the criteria to be able to transit the NSR", he says.

This required the vessels to load special fuel for the route, along with having



HHL Hong Kong makes its way through the frozen north

Russian speakers onboard the vessels, specialist insurance for the journey and a form of risk assessment plan that showed the authorities that the vessels are capable of transiting the route.

Hutty notes that the challenges of navigating this route is the timing of transiting it and the chance of the route closing, which can happen in 10 days. "The ice that you have to get through is new ice and is about 3m thick. In summer the ice moves north and in winter the ice moves south, this ice can be up to 3m thick, which causes the problem. *HHL Lagos* made the

last transit of the NSR this year and only just made this due to delays at the start."

Hutty says that the P2-type *HHL Lagos* and *HHL Hong Kong* were ideal for the NSR as they are both ice classed and also have a bubbling air filter in the ballast water tanks to stop the water from freezing. Along with this the two vessels also have other machinery installed to deal with extreme conditions.

HHL expects to do between two to 10 journeys a year through the NSR, compared to using other routes HHL says that it expects to see more savings by using this route, but not necessarily in costs. "We will get charged ice dues from the Russian authorities who operate the route, but this is on par with the Suez charges. Where we will see savings is in transit times and vessel running costs", Hutty explains.

Further developments at HHL will see a newbuild programme for new heavy-lift vessels with a higher ice class of 1A. The vessels will be 16,000dwt and have a crane capacity of 1,600tonnes and if the vessels are constructed, they will be built in Asia, as this is where previous vessels have been constructed for HHL. Hutty says: "These vessels will let us surpass the competition in our fleet's capabilities." **NA**



HHL Hong Kong in warmer climate

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Allseas thinks big

Swiss-based Allseas has announced that the latest vessel to join its fleet will be bigger than its predecessor *Pieter Schelte* giving greater operating capability

The new vessel, a second single-lift platform installation and decommissioning vessel, will be able to remove all platform topsides in the North Sea which are beyond the capability of *Pieter Schelte*. Besides decommissioning, the vessel has also been designed for worldwide installation of very large topsides.

The topsides lift capacity will be 72,000tonnes, exceeding the capacity of Allseas' *Pieter Schelte* by 50%. The vessel will have a width of 160m, whereas *Pieter Schelte* is 124m wide. "Allseas has decided to build this vessel because a number of platforms in the Northern North Sea are too large or too heavy for Allseas' *Pieter Schelte*. This new vessel will be able to lift all of them", says Jeroen Hagelstein, manager PR, Allseas.



Allseas new single-lift vessel compared to *Pieter Schelte*

Allseas has designed the vessel in-house, just like all its other vessels. The company says that it is not known yet where the vessel is going to be built. [NA](#)

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Going strong in 2014

Liebherr says that the ship crane market is looking strong after it receives further orders for its CBB type crane

A positive trend in the heavy-lift crane segment has been highlighted by Liebherr, which has seen an upturn in contracts in recent times. Tobias Froehlich, strategic marketing & communications, Liebherr says: "We are seeing some good signals from the ship crane market, though we are still facing over capacity in the market."

Froehlich says that the challenges in the heavy-lift market today come from the low activities in the newbuilding market and the low price level of the new buildings, which in turn affect budgets for components.

However, one example of the company's success has been an order of six Liebherr cranes for Rickmers-Linie for its latest PX-900 design. The cranes will be installed on the 20,000dwt heavy-lift multipurpose vessel design. The



The CBB type cranes that will be installed on the Rickmers-Linie heavy-lift vessels

vessels are scheduled to be delivered in 2015 from Hudong-Zhonghua Shipbuilding, China.

Liebherr will supply four cranes, two of its CBB 4700 type heavy-lift cranes that have a lifting capacity of 450tonnes (900tonnes in a

single tandem lift) and another two CBB 3450 type that have a lifting capacity of 120tonnes. The company has highlighted that the heavy-lift cranes of the CBB series excel in their fast and precise Litronic control system. Moreover, the CBB cranes have a comparatively low total weight and a low centre of gravity, allowing for better ships' stability.

"The six heavy-lift cranes are being built by Liebherr-MCCtec Rostock GmbH and will be delivered to the customer in 2014. They will be installed on two ships at Hudong-Zhonghua Shipyard in Shanghai, China," says Froehlich.

In comparison with previous units of the same ship type, the crane capacities have been increased from 400 to 450tonnes, which will improve the ships' utilisation as requested by the owner, the company says. *NA*

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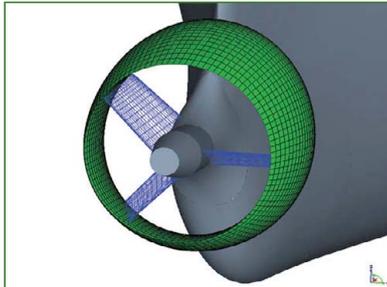
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Influence of EEDI on Ship Design

24-25 September 2014, London, UK



Call for Papers

The reduction of CO₂ emissions has been a key target in the Marine Industry since the IMO's Marine Environment Protection Committee published its findings in 2009. From which a number of measures resulting in technical and operational reductions were made mandatory in 2011. Foremost amongst these measures; nearly all new builds have to conform to the limits of the Energy Efficiency Design Index (EEDI).



The EEDI will enter into force in a number of phases that increases the restriction on CO₂ emissions. The current phase has led designers and operators to retrofit existing technologies and make operational changes that make slight gains in hull and engine efficiency. However as later phases introduce tougher restrictions, more fundamental changes in ships design will be needed in order for a vessel to comply. The EEDI will become an ever more important design parameter.



To further investigate the impact of the EEDI on ship design, RINA invites papers from naval architects, class societies, regulators, operators, and researchers on all related topics, including:

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Happy S duo hit the seas

Happy Star is the second in the series of BigLift's Happy S design that will be delivered in mid-2014

Happy Sky was the first vessel in the Happy S series that was delivered in 2013 (see also *Significant Ships 2013*) along with *Happy Star*, scheduled for delivery in mid-2014 from Larsen & Toubro shipyard, India. The ships will be BigLift's flagship vessels and will be able to handle larger loads.

Vessel designs were changed during the design process to meet with larger carrying capacities that the owners required. The hull of the vessels has been made bigger and features a beam of 29m that will give the vessels better stability when in operation. Special attention has also been given to optimising the power performance, resulting in a trial speed of 17knots.

Along with changes to the hull form, adaptations to the cranes have also been



Happy Sky, the first Happy S design launched in 2013

made with the crane pedestal raised by 4m and the jib which has been extended by 6m, providing 10m more lifting height and 6m more outreach. Having this

height and outreach the company says that it will allow cargoes to be lifted higher and further away when compared to the vessel's original design. **NA**



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Introduction to Naval Architecture

By David Andrews

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By Eric C Tupper - £49.99

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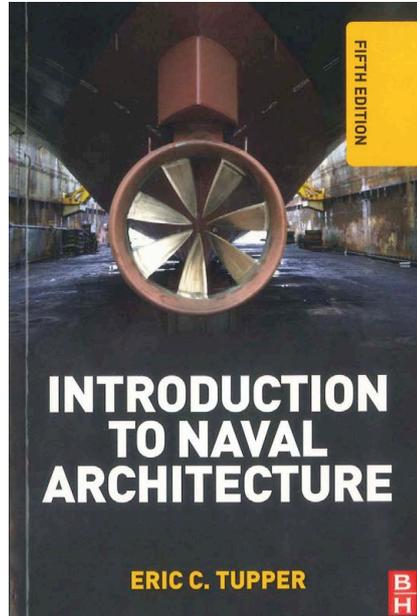
ISBN: 978-0-08-098-237-3

476 pages

This latest edition is said to be the fifth edition of the series, replacing the fourth edition of 2004, a revised reprint of 2000 and the 'third edition' of 1996, which was actually the first of the series with the current title. The first edition of the book was *Naval Architecture for Marine Engineers*, published in 1975 and written by Professor Muckle of Newcastle University and the second edition of 1987 was renamed *Muckle's Naval Architecture*, so perhaps this new edition can be considered *Tupper's Introduction to Naval Architecture*? Given this ubiquitous textbook was originally conceived for the non-naval architectural undergraduate in the broader disciplines in maritime technology, but is now a general introduction, one could ask what is the market it is addressing?

The author states: "It is a wide ranging yet clear and concise technical guide to the basis of this broad field, with minimal emphasis on complex equations and mathematics". In this respect it can be compared to the well-established text for undergraduate naval architects co-authored by Eric Tupper with Ken Rawson, namely *Basic Ship Theory*, which was published in its fifth and final edition in 2001. There are of course many similarities between the two textbooks, with the larger *Basic Ship Theory* being more extensive and with a greater degree of mathematics.

The extension to what might be called "advanced naval architecture" appropriate to most master level courses, including the main route to UK Chartered Engineer, the MEng, is clearly beyond any 'introductory' textbook.



Having said this, the new edition remains targeted at the more general maritime engineering undergraduate, its coverage is still comprehensive and it certainly introduces the reader to advanced topics, such as CFD, FEM and even probabilistic methods applied to seakeeping and structural reliability. However, the intention to avoid extensive mathematics limits coverage of these topics to conveying a broad awareness.

This new addition also has coverage of recent developments in marine design, such as probabilistic damage stability and the Energy Efficiency Design Index. After introductory and background chapters, there are chapters on Flotation, Stability and Launching, etc., which are followed by those on Resistance, Propulsion, Ship Environments (including the internal environment, but with a separate chapter on Vibration, Noise and Shock), Seakeeping and Manoeuvring. The remaining chapters on Structures, Ship Design and Ship Types are somewhat contrasting, with the former being a compression of the topics covered in two chapters in *Basic Ship Theory* (on the Ship Girder and on Structural Design and Analysis, respectively), while that on Ship Design is if anything more comprehensive and up to date than in *Basic Ship Theory*. The final chapter on Ship Types, if having less technical detail,

does have a wider scope of vessels than its equivalent in *Basic Ship Theory*.

This reviewer was naturally pleased to see in this new edition an extensive updating of the Ship Design chapter. This draws both on recent developments in propriety computer aided ship design (CAD) tools (notably FORAN and Paramarine) and provides a greater insight into design theory applied to ship design. The author makes specific reference to this reviewer's UCL team developments in this field with copious illustrations. Given that such publications are on limited distribution, this is an excellent way for such on-going research to reach a wider audience. It is understandable that all the illustrations are monochrome to keep the price down, however modern CAD modelling, such as the two tools just mentioned, and the output of CFD and FEM analysis essentially rely on colour to rapidly convey much of the insights now accessible. It thus is a good question as to whether printed books should not also have at least some full colour illustrations as rival ePublishing does so as a matter of course.

Mention should also be made of an excellent set of references (and further reading) and a comprehensive index, both invaluable for the student and practitioner alike. In addition there are five very useful appendices on respectively: Presentation of Data; Displacement Sheet and Hydrostatics (including over 20 tabulated sheets for easy reference to guard against just pressing the button on a standard naval architecture CAD package); Basic Ship Dynamics (a little more mathematical background); Froude's notation (given "its importance in early work on ship resistance"); and finally a set of questions covering each chapter (model answers to which can be freely accessed online).

All in all this edition is nicely presented and provides an up-to-date introduction to naval architecture that would be hard to better in one volume by a single author of eminence in naval architecture. It may be targeted at the less mathematically equipped maritime engineer, but has much to commend in keeping the fully capable naval architect abreast of recent developments, with the direct knowledge provided and guidance to further detail through not just publications, but also useful websites in the comprehensive reading list. **NA**



Historic Ships

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Call for Papers

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IMPROVING SHIP OPERATIONAL DESIGN Compiled By The Nautical Institute Ref: ISOD

This book has been prepared to assist with the feedback from the user and is based upon a survey of the Institute's membership and the solutions advocated by experienced practitioners. The book is essential reading for all those involved in the design process whether in a shipping company, independent design office or shipbuilder. Also sea staff will understand more fully their essential role in communicating with design staff, particularly when standing by a new building.

Price: UK £20.00 EUR £23.00 OVS £25.00
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John Lingwood

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By Klaas Van Dokkum

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www.rina.org.uk/education_2014

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www.rina.org.uk/annualdinner.2014

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www.maritime-conferences.com/ASRANet

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www.boatshow.tw

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www.thedigitalship.com

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www.europort.nl

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www.rina.org.uk/basic-drydock-2014

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www.maritimeindustries.org/Annual-Conference-2014

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www.rina.org.uk/containership2014

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www.navalia.es

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www.torsional-vibration-symposium.com

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www.rina.org.uk/

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www.sydneyboatshow.com.au

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www.ubmnavalshore.com.br

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www.rina.org.uk/marine-design2014

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www.reedexpo.com/en/Events/3194/Indonesia-Maritime-Expo

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www.smm-hamburg.com

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www.ibexshow.com

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www.rina.org.uk/ship_eedi

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www.icefish.is

September 28-30, 2014

Seatrade Offshore Marine & Workboats Middle East, international conference, Dubai, UAE.
www.seatrade-middleeast.com

October 7-9, 2014

Contract Management for Ship Construction, repair & design course, course, London, UK.

October 15-17, 2014

HSMV 2014, international conference, Naples, Italy.
www.rina.org.uk/HSMV_2014

October 21-24, 2014

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www.shiptec.com.cn



Marine Design

3-4 September 2014, Coventry, UK



Call for Papers

RINA Marine Design 2014 will provide a forum for reporting and discussing the design practice and technical issues associated with aesthetic design. The full spectrum of marine design from small craft to super yachts, including commercial and specialist vessels, will be examined.

An exhibition celebrating the 30th year of boat design at Coventry University will be opened at the end of the conference, which will include a virtual 3D exhibition of Coventry University students' design work. This will show the breadth of capability within the department of Industrial Design including automotive, transport and boat design.

The conference will present technical papers on a number of aspects of aesthetic marine design, including:

- **Design Visualisation** (including design methodologies, design practice, innovative concepts, design analysis tools, Computer Aided Design, TOI (Transfer of Innovation) from other industry sectors).
- **Human System Integration** (including HFE (Human Factors Engineering), Maritime Security, UCD (User Centred Design) methodologies, Emotional Design methodologies, Empathic Design methodologies, 'Ageing in Place', TOI from other industry sectors).
- **Sustainability in construction** (including one-off construction and series production issues, facility design, materials, joining technologies, reconstructions and rebuilds of historic craft, results of simulation).
- **Sustainability in operation** (including, equipment, results of sea trials, results of instrumentation, results of simulation, TOI from other industry sectors).
- **Implementation of regulations** in the design process (including international, national, and regional regulatory frameworks, classification, codes of practice, rating rules).
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www.rina.org.uk/marine_design2014

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