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Lifesaving and ship safety / Korea /  
CAD/CAM / Container ships / **October 2010**



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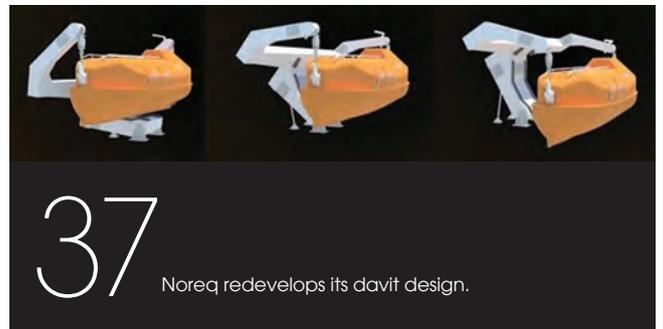


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MARINE APPLICATIONS

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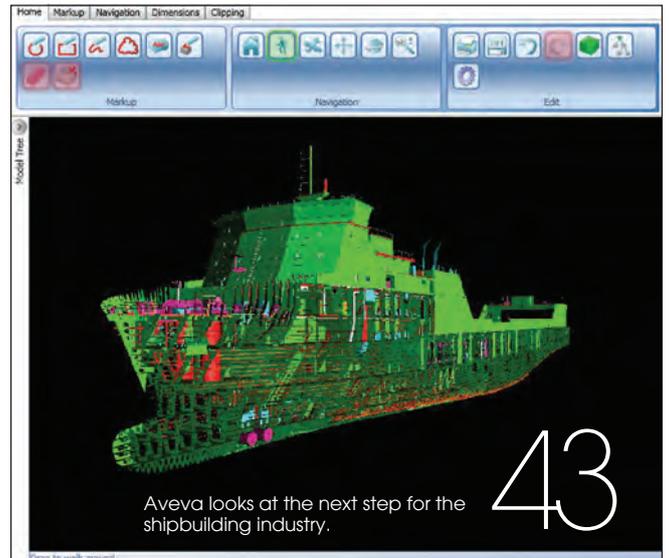
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### On-line Edition

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



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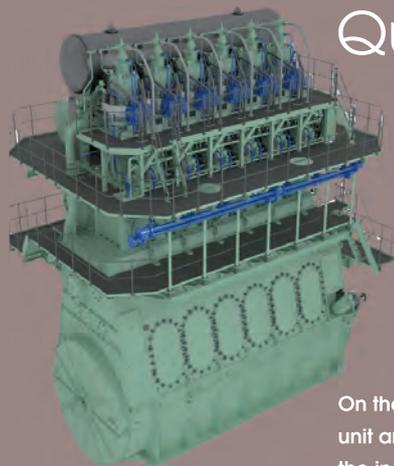
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## Quantum easing

On the left MAN diesel and Turbo's exhaust gas recirculation unit and on the right MAN's ME-GI LPG injection engine typify the industry's move to greener technology.

**M**aking the most of new regulations designers are delivering a mass of new ideas that will see the maritime industry develop into a third millennium business, a cleaner, leaner business.

Cost is a driver that ship operators clearly understand, they are definitely not alone in this perception, and this fact is not lost on regulators who seek to change the behaviour of those in the maritime industry by hitting them hard where it hurts most, that is by introducing regulations that financially penalise ships that pollute the air over and above strict limits.

In response the maritime industry has belatedly moved to the promptings of the Kyoto agreement, which required shipping to reduce its emissions with a view to saving the world for future generations. This motive was clearly insufficient to move the shipping elite, as for 12 years they sat on their hands and did little.

When at last the rest of the world demanded that shipping clean up its act a new course was quickly established and new innovations are now flooding the market like the sudden breaching of a dam.

In this respect the raft of new LNG coastal vessels that reduce CO<sub>2</sub> by some 20%, NO<sub>x</sub> by around 90% and cut SO<sub>x</sub> emissions altogether is welcome news. Innovations and collaboration between industry leaders, such as classification societies, owners, shipyards and component manufacturers has led to a shift over the last two years that puts the previous 10 year torpor in sharp perspective.

Often in the firing line when the environment has been debated are the owners and regulators, the first for their reluctance to break new ground and the latter for its lava-like response to demands that shipping play its part in reducing greenhouse gas emissions.

It is then a significant change when the VP for Maersk Maritime Technology's Bo Cerup-Simonsen, possibly the world's biggest shipowner and operator, says that he supports the International Maritime Organization's (IMO) Energy Efficiency Design Index (EEDI).

He told the G-MEC conference at this year's SMM that, "Indexing is key to our ability to measure our performance and it is key to improving our performance".

Mr Cerup-Simonsen went even further later: "We [Maersk] support regulations on CO<sub>2</sub>", adding that EEDI was the most realistic regulation for shipping... it is a balance between accuracy in the sense that it really indicates the performance of a vessel, while on the other hand it is a practical, verifiable, regulation. The current design index, in our view, is pretty much at the right level."

It is not often that regulators and owners sing from the same hymn sheet so when they do, the resonance can be startling. Of course Mr Cerup-Simonsen and Maersk have not suddenly joined the Samaritans, he quite rightly points out that "energy efficiency is good business". A fact the green movement have been quick to emphasise in a hope that the captains of industry would understand this type of language.

Never mind, all that is in the past, the new shipping order is more responsive, more innovative and shows greater social responsibility. It is to be applauded and all those who still doubt that global warming exists should be made aware that even if they deny that human actions are damaging the atmosphere and the ecological balance of our Earth, they cannot deny the value of being energy efficient.

That is why when Mr Cerup-Simonsen said "speed reductions are here to stay," the industry must sit up and listen. New ships on order at Daewoo Shipbuilding and Marine Engineering and Hyundai Heavy Industries will have a raft of energy saving devices attached to them. Not least the de-rated engines, similar to those used in a tanker, will see container vessels operating at significantly lower speeds than had hitherto been the case.

Evergreen too have been proactive in the energy saving sphere and their order of 10 container vessels from Samsung Heavy Industries will cost them about 10% more in capital costs, but save them significantly more. Maersk says their ships will be 23% more energy efficient compared to the conventional designs.

As is so often the case it is up to the major ship operators to lead the way in new innovation. The big boys have now finally shown their hand, the more modest operators must also now follow, if not for the sake of the Earth, then for their own bottom lines. *NA*

## Green ships

## LNG coasters all the rage at SMM

Three major class societies unveiled plans for new coastal vessels operating on LNG at this year's SMM.

French class society Bureau Veritas (BV) revealed that one of its European owner clients has ordered a 1000TEU container feeder ship that will be powered by a dual fuel engine operating on HFO and LNG.

Bernard Anne, BV's MD of the Marine Division, said the vessel will be of an existing design of container feeder with standard HFO tanks with LNG containers stored close to the engine and used for fuel. According to BV up to 12 forty foot containers would be sufficient to power the vessel from Hamburg to St Petersburg and back again, that would be just 1.2% of the total container capacity.

This journey, entirely within a Environment Control Area (ECA) would meet all the new regulations on air pollution from ships, including the stringent Tier III NOx requirements that will be applied in all ECA areas from 2016 and the 0.1% SOx requirements due to be established in ECAs from 2015. LNG eliminates SOx emissions and reduces NOx emissions by almost 90%. CO<sub>2</sub> emissions are also reduced significantly – by some 20 to 25%.

A similar plan to the BV vessel has been hatched over at DNV who with partners, Reederei Stefan Patjens (RSP) and TGE Marine Gas Engineering, is ready to retrofit LNG on board the 5044TEU *Maresk Drury* with four auxiliary engines and a main engine. The group claim that when this conversion is completed it will be the first use of LNG as fuel on board a container ship and of LNG as fuel in worldwide trading.

RSP MD Stefan Patjens said that these ships had cold ironing systems built into them, but they have never been used. The new arrangement allows for LNG containers to be stored near the LNG fuel tanks. The fuel is transferred via a manifold from the containers

*Bit Viking* is GL's first LNG powered vessel.



to the tanks. Mr Patjens said: "This arrangement can be used on any container ship in use today".

DNV President Tor Svensen said: "As with all industrial improvements LNG will be introduced as a shipping fuel step by step. Our LNG rules were introduced in 2001, and the first LNG-fuelled coastal ferry started in ordinary service later that same year. We have learned from coastal shipping operations every year since. With this container ship project, we are ready to use LNG for global trades too."

Germanischer Lloyd's (GL) 25,000dwt product tanker, *Bit Viking* will also be converted to run on LNG. It will be the first ship classed by GL to operate on the gas. Sea trials are planned for May 2011.

With two 500m<sup>3</sup> tanks, the vessel will have a range of 12 days. It is owned by Tarbit Shipping and operated by Statoil along the Norwegian coastline.

The *Bit Viking* has twin screw propulsion, each powered by a 6-cylinder in-line Wärtsilä 46 engine running on HFO. The conversion will replace the original engines with 6-cylinder in-line Wärtsilä 50DF dual-fuel engines. The ship is built with double engine rooms, propellers, steering gears, rudders and control systems.

## Lubrication

## New rules need new lubes

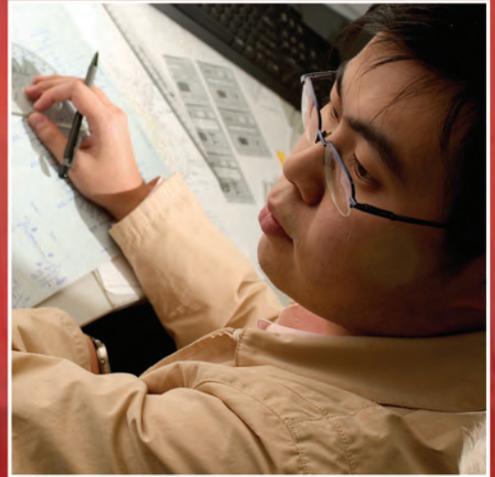
One of the lesser considered elements of the raft of new regulations that will hit the industry is the impact on lubrication oils of the new legislation. According to Lubmarine marketing and analysis department manager, Patrick Havil, many operators may have to consider separating lube oils for use outside of the Emission Control Areas (ECA) from those they will need inside the ECA.

"High sulphur fuel requires lubes with a high BN number, while low sulphur fuel requires a low BN lube," said Mr Havil. Naturally, Lubmarine have a solution that is already tested with low sulphur fuels on the 11,400TEU *CMA CGM Andromeda* between September 2009 and April 2010.

Talusia Universal can be used with all fuels without any need to adjust feed rates. Mr Havil said that with Talusia there will be less on board storage difficulties, with no additional tank needed and no additional equipment.

Lubmarine said that the universal lube had been approved by MAN Diesel and Turbo, MHI and Wärtsilä for use in their engines.

The new rules applied in Environment Control Areas (ECA) could affect 50% of shipping and the proposed extension of these ECAs would affect 90% of shipping said Mr Havil.



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## Shipyards

## Vinashin seals Damen yard deal

Construction of a new yard in Vietnam is due to start in next year following the signing of a contract by the Vietnam Shipbuilding Industry Group (Vinashin) and Damen Shipyards Group of The Netherlands in August.

The signing ceremony for the new facility, which will be known as Damen Vinashin Shipyard, and based in Haiphong, took place in Vinashin's head office in Hanoi.

Song Cam Shipyard has been allocated by Vinashin to act as the local partner in the construction and operation of the new shipyard. Completion of the first phase of the project is planned for February 2012. In the first phase the shipyard will concentrate on the outfitting, under cover, of hulls built by Song Cam Shipyard. Total capacity is approximately twelve vessels per year, all current orders are for export.

Facilities in the first phase include a Syncrolift of 2500 ton capacity, an outfitting hall of 80m by 40m and various workshops and offices. In the second phase of the five year plan the capacity will be increased to a maximum of 30 tugs, workboats and high speed craft per year in a dedicated outfitting hall of 160m by 150m. Sufficient room is available on the 42hectare site for the construction of hulls as well as for sub-contractors and suppliers in the final phase of the five year plan.

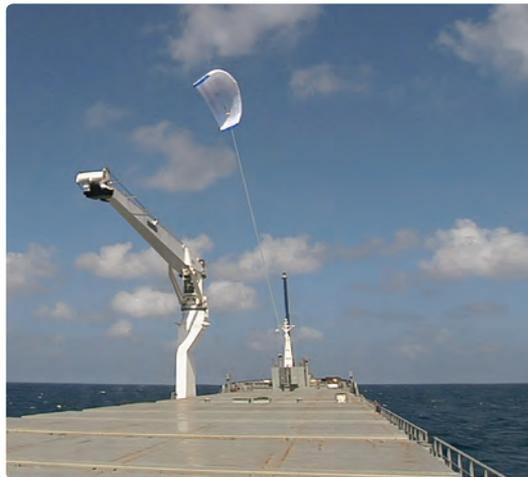
## Green Ships

## Kite makes its mark

Skysails which makes attachable kites that help reduce a vessel's fuel consumption has said that the Skysails concept has been integrated into the International Maritime Organization's Energy Efficiency Design Index (EEDI), if a vessel operates with Skysails for a period of a year it can reduce its EEDI baseline, said the company.

A number of companies have bought into the kite system, including the German heavy lift operator and the Norwegian Wilson, in total there are now five customers operating 10 ships with the kite attached. Though Skysails MD, Stephan Wrage, did concede that the kite was not for everyone, "Fast ships are not suitable, 15-16knots is the maximum for Skysails," he said.

Currently the sail has an area of 160m<sup>2</sup> but work is continuing that will see the next generation of kites



A Beluga vessel demonstrates the use of the Skysails kite.

double in size and the company plans to eventually double this to 640m<sup>2</sup> said Mr Wrage.

Tests on the Skysail show that it can reduce fuel consumption by up to 50% in perfect conditions and can be used for up to 33% of the time on average. Its effectiveness changes with the direction of the wind, however.

## Safety

## Boardley backs RNLi

Lloyd's Register's maritime director will be joined by senior figures from the aviation and rail industry in a one-day safety and performance conference aimed at raising money for a Royal National Lifeboat Institution vessel that will be stationed on the Thames.

At the event, which is being held on November 15 in General Committee room at Lloyd's Register headquarters in the City, leading safety professionals will highlight the priorities for the corporate health and safety agenda, providing guidance and advice.

For more information contact: Latifat Ajala, Safety and Performance Conference 2010 on +44 (0)20 7423 1744 or email at [info@safetyandperformance.org](mailto:info@safetyandperformance.org)

## Correction

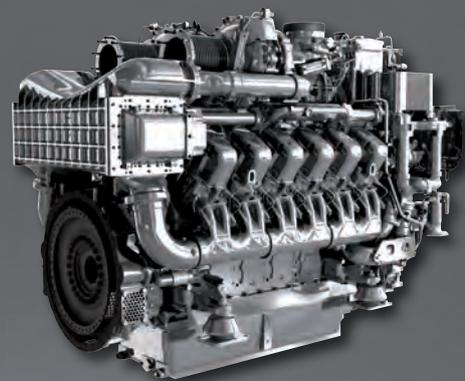
## Sinopacific Shipbuilding Group

In the September issue of *The Naval Architect* in the feature on Sinopacific Shipbuilding Group entitled 'Building a Future' we published the GA plan for the Crown 63 bulk carrier, under the incorrect title of the Tiger FP5000 LPG carrier. *The Naval Architect* would like to apologise for this error to Sinopacific.

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## Engines

## MAN brings more to its range

MAN Diesel & Turbo has signed a cooperation agreement with German company, Couple Systems, to bring clean and efficient engine technology to the market.

As an environmental technology leader within the marine world, Couple Systems has developed and patented DryEGCS, a dry-scrubbing system suitable for marine applications. DryEGCS dry-scrubbing system was certified by German classification society, Germanischer Lloyd, in April of this year.

“The cooperation agreement aims to jointly develop customer solutions for dry scrubbing technology and to expand its application as far as possible,” says Dr. Dirk Thum, MAN Diesel & Turbo, head of marine engineering medium-speed, emission and gas. “As a system supplier, MAN Diesel & Turbo will offer integrated solutions to its customers for engines and exhaust-gas cleaning systems featuring a scrubber and SCR (selective catalytic reduction) catalyst for NOx reduction. This enables ships to operate economically on HFO and simultaneously comply with even the most stringent emission regulations.”

While current scrubbing systems mostly work on a wet base that has some inherent drawbacks, dry scrubbers represent a simpler solution that removes up to 99% of SOx from exhaust gas by means of a reactor filled with granulate of calcium hydroxide.

Further, MAN Diesel has introduced its PrimeServLube premium lubricating oils that is formulated to the group's specifications for high, medium and low speed engines.

MAN Diesel & Turbo is to provide a special package of lube oils for its engines under the PrimeServLube brand in association with a leading, global lube-oil producer.

Lube oils for high and medium speed engines have already been released, with an initial sale of 60,000 litres to an Australian power station served by MAN 51/60DF medium speed engines, and will be followed by products for low speed engines.

The HSeries40D lubricants are fully synthetic Extra High Performance Diesel (XHPD) oils designed to meet the most severe performance requirements of the latest European Euro-2 and Euro-3 type high speed diesel engines with high power ratings and low emissions.

A range of MSeries crankcase and trunk piston engine oils for medium speed engines can be tailored to the requirements of gas-powered designs (MSeries40G) and engines burning marine diesel (MSeries40D) or heavy fuel with low, medium or high sulphur contents (respectively MSeries40H2, H3 and H4).

Low speed two-stroke engine requirements are covered by LSeries system oils and cylinder oils. The LSeries30s product is a SAE 30 grade alkaline system oil for the crankcases of two-stroke engines, and is suitable for those

with oil-cooled pistons.

Two-stroke engines burning low sulphur fuels will benefit from the LSeries40c product, a high performance 40 BN/SAE 50 cylinder lubricant delivering excellent lubrication properties in conjunction with wear protection. Similar benefits are offered by a high performance 70 BN/SAE 50 cylinder oil (LSeries70c) formulated for two-stroke engines burning high sulphur fuels.

**Contact** MAN Diesel & Turbo, Teglhølmegade 41, DK-2450 Copenhagen SV, Denmark.

**Tel** +45-3385 1100

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**E-mail** info-cph@mandieselturbo.com

**www**.mandieselturbo.com

## Ancillary equipment

## W R Systems gets approval

W R Systems Ltd., has announced the successful completion of its Emsys Product Design Assessment (PDA) programme with the American Bureau of Shipping (ABS) by being awarded formal Type Approval on 1 September 2010.

Emsys, is the first Quantum Cascade Laser (QCL) based emissions monitoring system to receive Type Approval for onboard verification of marine diesel engines and Exhaust Gas Cleaning Systems (EGCS) in line with the Revised MARPOL Annex VI and the NOx Technical Code (2008). The approvals cover both NOx and SOx emissions and additionally, Particulate Matter (PM).

Emsys incorporates 2nd generation laser based emissions sensing technology, combined with an ‘outside the stack’ PM sensor (Patent applied for). The system can sample multiple stacks and provide real-time and historical emissions reporting.

In addition to the MARPOL based Approvals, Emsys becomes the first system to be certified for the calculation of totalised emissions, PM measurement and

W R Systems gets Type Approval for its emissions monitoring.



# THE SUPERYACHT PAVILION AT METS 2010

## Getting down to business

### What is the SuperYacht Pavilion?

The SuperYacht Pavilion (SYP) and its service-oriented Refit Boulevard form a show-within-a-show at METS. Dedicated to companies who offer equipment and services specifically to the large leisure yacht sector, the SYP is a destination in its own right, but also sits at the heart of METS, the world's biggest and best attended leisure marine trade show. Over 115 exhibitors assembled in the SYP and Refit Boulevard in 2009 – to sell, promote and network. It's busy, it's professional – and it's special.

### Why special?

The SYP/METS combination is unique. At no other trade-only event can you visit a thriving superyacht equipment exhibition and also have access to over 1,000 other marine trade exhibitors, some of whom also cater to the superyacht sector. It's also a unique launch pad, as Ian Taylor, group sales manager of Quest International, reveals: "As a supplier of new and novel technology we were looking for the right approach to allow us to undertake a technology transfer into the superyacht and megayacht arena. METS provided us with a fantastic platform... and the organisers invited our managing director to be part of the Superyacht Forum. All of this support led to a fantastic reception from the industry and what we believe to be an unprecedented level of interest on the stand."



### Why should you attend?

The SYP is a meeting point for true industry professionals - superyacht captains, designers, builders, project managers, brokers and owners, and many others. The SYP is of interest to nearly half of the 20,000 professionals who visit METS each year and is also a must-visit for all the speakers and delegates who take part in the associated Global Superyacht Forum (GSF), the high profile HISWA Yacht Symposium and the Member's Mixer event organised every year by the International Superyacht Society – the society for captains and crew members. The result is a varied and appropriate display of products, a vibrant conference programme and networking galore.

### What is the GSF?

The GSF is one of the world's leading summits for superyacht professionals. As a conference, it delivers in every way – with top profile presenters and excellent interaction between speakers and delegates. Organised and presented by The Yacht Report Group in association with METS organisers, Amsterdam RAI, the Global Superyacht Forum attracts around 650 delegates and includes social highlights like the Global Superyacht Party. To register as a delegate for GSF, go to [www.superyachtevents.com/gsf](http://www.superyachtevents.com/gsf).



All GSF delegates have free entrance to SYP. Visitors of the SYP do not automatically have access to GSF.

### Register for your free entrance badge

To visit the SYP you need a FREE three-day entrance pass to METS 2010. Please pre-register for this on [metstrade.com](http://metstrade.com). To help with your planning, Amsterdam RAI can also book hotel rooms for you and assist with other travel requirements. Go to [metstrade.com](http://metstrade.com) and click on 'visit' and 'hotel & travel service'. To exhibit at the SYP, please contact the organisers.

### METS – at a glance

"It sounds simple but just by attending METS, you will be able to take advantage of networking opportunities. Your contacts will introduce you to other contacts. Remember, the world comes to METS!" Tom Douglas, vice president global sales, Teleflex Marine.

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the calculation of the CO<sub>2</sub> Operational Index in line with International Maritime Organization (IMO) Guidelines.

The Emsys system has been designed to meet the requirements of all current and future marine emissions regulations. A further enhancement to include Ammonia Slip (NH<sub>3</sub>) measurement within selective catalytic reduction systems (SCR) is planned for release subject to the finalisation of IMO Guidelines in early 2011.

**Contact** W R Systems, Ltd., 11351 Random Hills Road, Suite 400, Fairfax, Virginia 22030, USA.

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**Fax** 703.934.0202

**www**.wrsystems.com

Ancillary equipment

## Alfa Laval launches separator

Alfa Laval has announced the arrival of a latest version of the well-known S-separator. In addition to a range of key features that make it more robust, the new S-separator offers greater efficiency that allows the same amount of oil to be handled with a smaller separator.

The S-separator provides greater separation efficiency, not least due to a major increase in separation area. In addition, it features stronger discs and a more robust drive system, which combine with existing advantages to create the lowest possible lifecycle cost.

The increased efficiency of the S-separator is the result of enhancements in the separator disc stack. Increased separation area, disc modifications and other improvements allow up to 20% more flow with retained separation performance. Since these changes do not affect the separator's small footprint, ship operators can now handle the same amount of oil with a smaller separator.

Additional changes can be found in the S-separator drive, including sturdier friction blocks, a more resilient bearing system and a more powerful lubrication system. Together, these modifications further boost the S-separator's high reliability.

Despite the many changes in the S-separator, there is also much that remains the same. This includes the wear-reducing CentriLock snap ring and CentriShoot discharge system, as well as the S-separator's unique Alcap function, which automatically detects and adjusts to the nature of the oil.

"Naturally we've kept the groundbreaking features that have given the S-separator its leading position on the market," says Joakim Thölin, General Manager of Alfa Laval Marine & Diesel. "Combined with the new features, they give the updated S-separator the highest possible reliability and the industry's lowest lifecycle cost."

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Ancillary equipment

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# The Royal Institution of Naval Architects

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# Naval architects today

Mark Charman, group CEO of specialist maritime recruitment firm Faststream looks at the employment market for naval architects.

**D**espite the continuing uncertain economic climate, naval architects are hot property. Nearly 90% of the 200-plus naval architects who responded to a Faststream survey at the beginning of September revealed that they have been approached at least once about a potential new job opportunity over the past 12 months. A fifth of the respondents claimed to have been approached over five times.

This confirms what most in the naval architecture business already know – their skills are very much in demand and there are plenty of other jobs out there for them should they tire of their current position. Be it in the offshore or commercial shipping sectors, whether at a senior or more junior level, there are numerous opportunities for qualified naval architects across the shipping, offshore and defence sectors.

This may be great news for employees, but not so good for organisations striving to ensure continuity in their business and to deliver consistent levels of service to clients. As in so many other areas of the maritime industry, employers need to continually work to ensure that their naval architects remain both professionally and personally fulfilled in their jobs, not to mention appropriately well paid in order to retain their services.

The growth of the offshore market over the past 20 years is mainly responsible for the boom in demand for naval architects' skills. Offshore projects have become bigger and bigger and continue to move further and further offshore into harsher environments, necessitating more and more naval architects. The level of complexity and sophistication of many of these offshore projects has grown and increasingly naval architects' skills are being called for in the renewable sector.

At the same time, the growth in global trade has seen the merchant marine fleet mushroom in size, but the corresponding number of universities producing new naval architects has not. There are no more universities providing undergraduate courses for naval architects today than there were in the 1980s and the pool of naval architects has not



The growth of the offshore market is responsible for the boom in demand for naval architects says Faststream chairman Mark Charman.

increased significantly. Graduate schemes are vital and it is important that employers, both large and small, continue to invest in good well structured graduate training programmes, to enable the industry to meet future manpower demands.

Training graduates is of course a big commitment for employers in both time and money and, according to the results of our survey, potentially a risky one. Over half of the respondents with three or less years of naval architecture experience under their belts said that they had been approached about three or more new opportunities in the past 12 months. This should ring alarm bells in any company running a graduate recruitment programme. Faststream recommends that companies taking on graduates ensure that their programmes are well managed, offering a clear path of direction and a supportive learning environment. We are all too often approached by disillusioned recent graduates who have been allowed to drift within an organisation or whose companies have not been flexible enough to meet changed personal circumstances.

A good example of a successful programme is one recently put in place by the London Offshore Consultants Group (LOC), a marine consultancy providing services to the shipping and energy industries. The group, which has

over 200 employees worldwide, launched a formal The Royal Institution of Naval Architects (RINA) accredited graduate scheme in 2009 and has been taking on two graduates a year. According to Paris Mangriotis, a naval architect himself and a director of LOC, the programme is highly valued by the company and the graduates are seen as a vital source of talent for future senior positions.

Initially drawn from UK universities such as Southampton, Newcastle or Strathclyde, the graduates are given an opportunity to work in many of the offices of LOC and its subsidiary design company Longitude Engineering around the world. Graduates conduct work ranging from marine claims investigations to marine warranty surveying and engineering design over a four year period. The programme involves a placement with shipyard A&P for familiarisation with production processes and industrial health and safety and with shipping companies for time at sea.

"We've been really impressed by the graduates' level of technical competence and attitude," says Paris Mangriotis. "For an organisation such as ourselves, the key skills we are looking for are analytical rigour, clarity in report writing and an ability to interpret the client's demands. It cannot be taken for granted that someone with say four or five years experience will be able to acquire these skills faster than a graduate."

He notes that the graduates at LOC quickly take on responsibility for managing their own assignments at an early stage in their careers.

Class societies are very significant employers of naval architects and during the commercial shipping sector's recent boom years took on large numbers of graduates straight from university to meet demand. One major society for example put an accelerated graduate scheme together taking on around 100 graduates a year. The graduates were then taken on a whistle-stop tour of the organisation's offices and shipyards with the intention of training them quickly and well.

To our knowledge, the programme has been successful with most staying with the company. However, class societies do struggle



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to match the packages offered by oil majors and shipping companies and will always face an uphill challenge in retaining staff. One consultancy told us that around half of applicants for positions come from class societies. For some naval architects, a career within a large hierarchical organisation does not suit them and after a few years learning the ropes are open to new career ideas. Others thrive in these large organisations and greatly enjoy the benefits of working with a large team of experts.

The results of our survey also show that a common concern is the lack of time that naval architects have spent at sea. Nearly two thirds of the respondents felt that graduate naval architects do not get the opportunities to spend time at sea and learn how the ship functions as an organisation: a key skill when designing for the real world. Whilst gaining time in shipyards is relatively easy to organise, in a world of increasingly stringent security and health and safety requirements, opportunities to spend time at sea are more difficult to arrange.

Naval architects work in a huge variety of markets, from the design and build of luxury yachts to providing expert witness work for insurance and legal firms, and the various sectors have of course been affected in different ways by the global downturn. Naval architects in the luxury yacht sector are naturally very concerned by how many customers will be interested in their products in the future and are adapting their designs to ensure that they can be built efficiently.

Jonathan Goldie, design manager at

Sunseeker, the renowned Poole-based luxury yacht builder, says: "Anything we produce now has to be exceptional, new, amazing and innovative. Three years ago the pressure was on to produce as many new models as possible. Price is of course a big issue and the naval architect plays a vital role in producing a cost-effective design and one which is as production friendly as possible."

He believes that the role of the naval architect in the yacht sector has had to change and become more hands on and involved with issues such as supply chain management of parts.

"Managing the supply chain is a huge challenge and critical to the success of a project. Companies need to learn how to ensure that all the correct parts arrive at the right time and the right amounts are ordered in the first place. How do you create a part number: should it be from a list or does production come up with a solution? Naval architects need to design 'correctly' enabling things to work first time. We need to be involved in the minutiae. It's not an aspect of the role that most naval architects enjoy, but it's vital to making things work. In the recession naval architects don't have the luxury of saying no to this type of work."

The picture is very different in the commercial consultancy sector according to Colin Barker, technical director of TMC, the London-based consultancy that provides technical investigation and surveying services to the marine insurance, shipowning and legal professions.

The shipbuilding boom of the last few years,

followed by the market downturn has meant more disputes between ship owners and yards over construction quality, compliance with the contract or unwilling owners refusing to take delivery and therefore a greater demand for TMC's team of naval architects, master mariners and chief engineers. He notes that London continues to be the world's leading centre for arbitration and dispute resolution and that many foreign companies continue to regard the UK place as the best place to turn to for a quick and fair decision.

The shipping industry does need to compete with the offshore sector for the best naval architectural brains, and our survey shows that both sectors are considered as equally attractive places in which to work. Just over a third felt that the commercial shipping sector was the most attractive while an almost equal proportion felt that the offshore market offered the best opportunities. Around 15% felt that the naval sector was the most attractive and a similar number said that the marine leisure sector was most appealing.

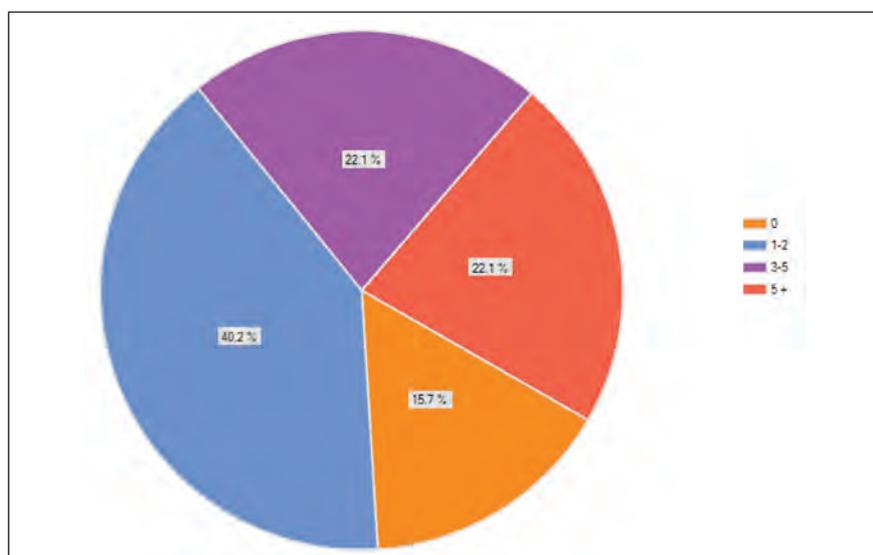
Whilst the offshore sector does generally offer the highest salaries, Mark Martecchini, managing director of shipowning at Stolt Tankers believes that working for a shipping business gives naval architects a level of responsibility early on in their careers which can't be matched in the offshore sector.

"At a young age you can play a leading role on a newbuilding team, working closely with shipyards and suppliers or even managing a site team," he says. "Even a big shipping company feels small and will take a more holistic approach to your career."

Stolt, which runs a global network of parcel tankers and terminals, employs naval architects in all of its newbuild departments. According to Mark Martecchini, the role of a Stolt naval architect is to "translate the business need into a preliminary idea and apply it to a physical asset. It's not a purely technical role, but one which can take you out in the field and also requires you to bring parts of the business together."

Working for a shipping company as a naval architect can take your career in many different directions and to the very top. Mark Martecchini himself is a good example of a naval architect who has worked in a wide range of functions within the Stolt empire, including senior positions in chartering, fleet personnel, ship management and account management. He believes that his degree from the Webb

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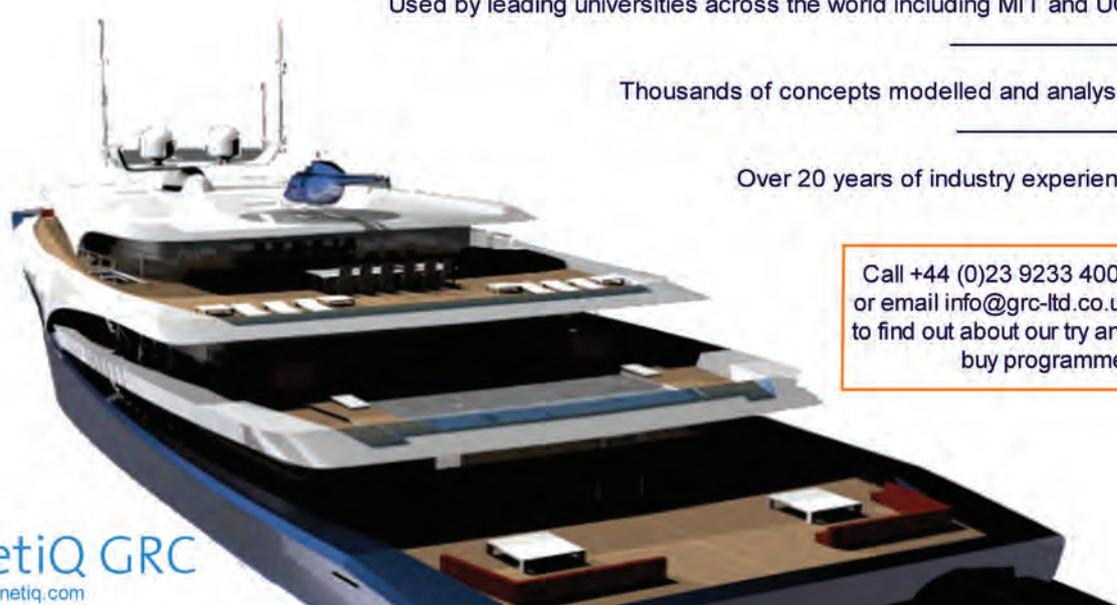
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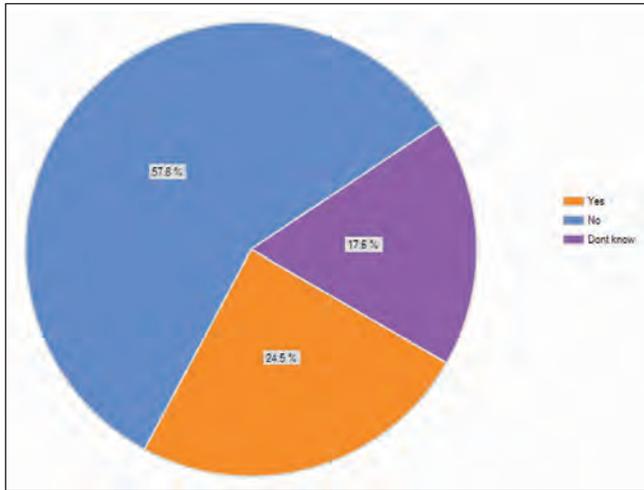
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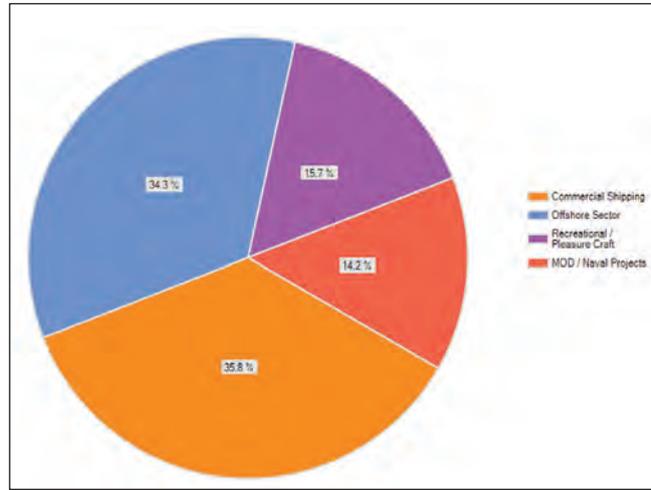


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Do you think graduate naval architects have enough opportunities to experience life at sea?



Out of the following, which sector do you feel is most appealing to work in?

Institute of Naval Architecture in the USA has stood him in good stead in his career.

Close to 60% of the recent graduates who responded to our survey said that they viewed their degree in naval architecture as a stepping stone into a more commercial aspect of the business. It is important that employers recognise their key employees' different and changing motivations and career aspirations by offering continual professional development opportunities, a change of office or a completely new role within the company if they are to retain the services of highly trained naval architects.

The key question that faces the offshore and shipping industries as they address increasingly stringent environmental and safety challenges, is whether or not the future crop of naval architects will be up to the task. Are the universities managing to attract the best brains to the industry? Two thirds of the respondents to our survey, whilst praising the current quality of the graduates and the quality of teaching they receive, do worry that the industry is not doing enough to sell naval architecture as a study choice to teenagers. This is a problem that the engineering sector in general faces as well as the maritime industry and one that is not going to be solved overnight. **NA**

**Table**  
**Naval architect salaries 2010**

The figures below are a professional assessment on naval architect salaries based on what Faststream has seen in the market in 2010

**UK Based Graduate salaries**

- £21,000 – £22,000 for SME companies of up to 50 employees
- £26,000 - £30,000 for larger organisations such oil majors and class societies. A comprehensive benefit scheme is usually available in addition.

**Basic salary for naval architects with five years of solid experience**

- Leisure market (yachts, recreational craft) & shipyards - £35,000
- Offshore consultancy - £42,000
- Marine consultancy - £38,000
- Oil Major - £48,000
- Class society - £35,000
- Oil & Gas EPC contractor - £45,000.

**Basic salary for naval architects with 10 years + experience**

- Leisure market (yachts, recreational craft) & shipyards - £50,000. Many shipyard employees are contracted as consultants at this level, and are paid £40 per hour
- Offshore consultancy - £55,000
- Marine consultancy - £50,000
- Oil Major - £60,000
- Class society - £45,000
- Oil & Gas EPC contractor - £60,000. Many are contracted consultants paid £50 per hour.

The UK salary progressions seen above are broadly similar globally.

**Survey results:**

We surveyed over 2000 naval architects

registered on the Faststream database by email on 4 September 2010.

Respondent profile:

Experience	%
0 to 3 years	15%
3 to 5 years	12%
5 to 10 years	26%
10 to 15 years	18%

Company type	%
Consultancy/ design house	30%
Class society	24%
Shipping company	14%
Shipyard	19%
Oil major	8%
Manufacturer/ product supplier	1%
EPC/Subsea installation contractor	4%



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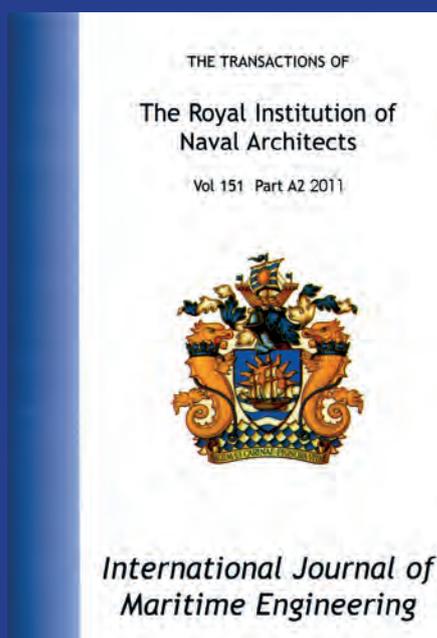


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# The Royal Institution of Naval Architects



## *International Journal of Maritime Engineering 2011*

The RINA will publish the first part of the *International Journal of Maritime Engineering (IJME)* in March 2010, and the subsequent parts in June, September and December.

The *IJME* provides a forum for the reporting and discussion on technical and scientific issues associated with the design and construction of marine vessels and offshore structures. The *IJME* will be published four times a year as Part A1-A4 of the *Transactions of The Royal Institution of Naval Architects*. The *IJME* is essential reading for all those concerned with this sector of the global maritime industry.

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# Finding faults

In the third and final instalment of Lloyd's Register's paper on shipyard fabrication and quality control David J Howarth and John Durkin discuss, amongst other things, defect acceptance, repairs, hydrogen cracking and thermal correction.

**F**indings of non-destructive examination are compared to acceptance standards. These universally reject cracks but may accept small areas of lack of fusion, porosity and slag. Since all planar imperfections are damaging, most standards do not allow them. However, some will allow small lengths provided they are generally within the mid third of the weld.

## Defect acceptance standards

Non-planar imperfections are less damaging in service and generally the standards specify a limit on how much is allowed and in most cases this limit is lower than necessary. For example, in radiography the presence of blow holes could mask the presence of a more damaging crack.

It should always be remembered that acceptance standards are workmanship standards; that is they apply a standard to be achieved by welders throughout the vessel. This approach is therefore counter to the Fitness for Purpose (FFP) approach because no account is taken, for example,

of the design fatigue loads on a particular weld to determine the acceptability of leaving planar defects in the structure.

In ship construction, cases commonly arise where the workmanship standard rejects welds containing defects only to find that a fitness for purpose assessment finds the same defect containing weld perfectly acceptable. Figure 1 shows the relationship between the QC and fitness for purpose approaches.

Whereas a quality control approach is based on workmanship standards with a go or no go acceptance criteria, FFP techniques which are based on fracture mechanics ask slightly different questions:

- Do the welds contain unacceptable flaws?
- Is the flaw harmful?
- Are repairs acceptable?
- Are cracks in service acceptable?
- Can we extend the life of the structure?

It is more than likely that the quality control approach will remain in ship construction rather than fitness for

purpose due to the simplistic approach needed for such large structures.

## Repair

Once unacceptable defects have been found, they have to be removed. If the defect is at the surface, the first consideration is whether it is of a type, which is normally shallow enough to be repaired by superficial dressing. Superficial implies that, after removal of the defect, the remaining material thickness is sufficient not to require the addition of further weld metal.

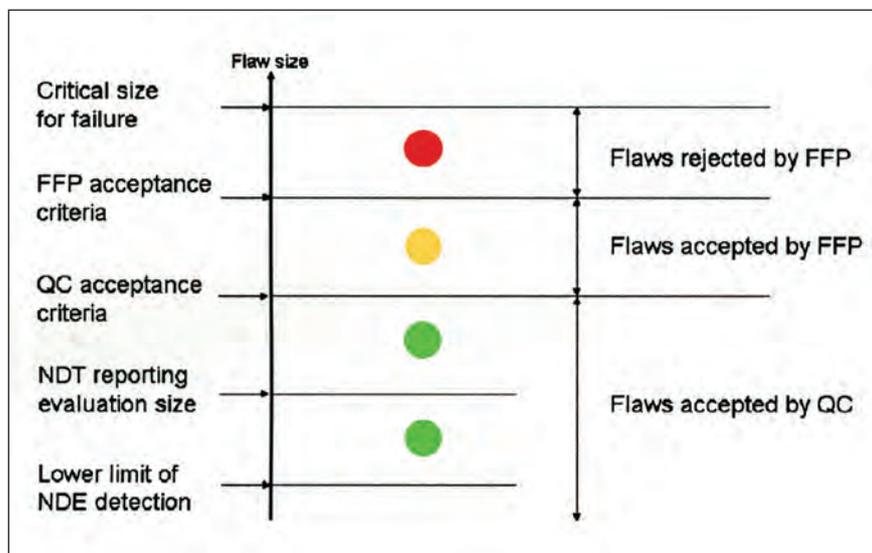
If the defect is too deep, it must be removed by some means and new weld metal added to make up to size.

Replacing removed metal or weld repair (as in filling an excavation or re-making a weld joint) has to be done in accordance with an approved procedure. The rigour with which this procedure is qualified will depend on the application standard for the job. Generally, in ship construction, it will be acceptable to use a procedure qualified for making new joints, whether filling an excavation or making a complete joint. If the level of reassurance required is higher, the qualification will have to be made using an exact simulation of a welded joint which is excavated and then refilled using a specified method. In either case, qualification inspection and testing will be required in accordance with the requirements of the classification society.

## Effects of welding and fabrication on ship steels

Weldability of a material can simply be defined as its ability to be welded. However, a more technical definition would be the ease with which material can be welded to achieve the required mechanical properties in the welded joint without the risk of either hydrogen or solidification cracking. Weldability is influenced by several factors:

Figure 1: Comparison of QC and FFP approaches.





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- Chemical composition
- Parent material processing route
- Welding process and heat input
- Welding consumables
- Forming and straightening.

Concerns with regard to joint strength arise from two aspects. The first relates to softening of the heat affected zone (HAZ); that is, the volume of parent material where the microstructure is changed or affected by the heat of the weld. The second relates to the weld metal itself. Toughness too is a consideration of weldability, the context being the risk of brittle fracture. Factors that lower the toughness as a result of welding include:

- increase in the micro-structural grain size
- increase in hardness from rapid cooling rates
- increases in size and numbers of second phase particles that can act as crack initiators.

### Hydrogen cracking

Hydrogen cracking arises from embrittlement of the microstructure from the conjoint action of three factors: the presence of hydrogen; a susceptible microstructure; and a tensile or bending stress (see Figure 2). Hydrogen will arise mainly from the welding consumable or to a lesser extent from the presence of moisture during welding. Susceptible microstructures are promoted by two principal factors: an increase in hardenability through composition in

particular increases in carbon content; and increases in the cooling rate after welding, either by reduced heat input or increased thickness.

Hydrogen cracking is also known as delayed or cold cracking.

Where a risk of hydrogen cracking exists, it is usual to delay non-destructive testing for 48 hours. This is because hydrogen damage is a diffusion process that occurs with time and research has shown that 48 hours is a reasonable interval. Usually considered as high risk are steels with a specified minimum yield stress of 420N/mm<sup>2</sup> and above. Therefore, on these steels non-destructive testing should not be carried out before 48 hours after completion of welding. Where post weld heat treatment (PWHT) is carried out, the requirement for testing after 48 hours may be relaxed.

Hardenability is a measure of the ease with which hardened microstructures are produced and is a function of the chemical composition and also grain size. The International Institute of Welding carbon equivalent formula is shown below. This formula is used as a measurement of hardenability in carbon and carbon manganese ship steels:

$$CE = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15}$$

General guidance on the use of this formula is given in Lloyd's Register's *Rules*. Where the carbon equivalent of ship steels is in excess of 0.45 per cent, approved low hydrogen welding consumables and preheating are to be used. Where the carbon equivalent is above 0.41 per cent but is not more than 0.45 per cent, approved low hydrogen welding consumables are to be used, but preheating will not generally be required except under conditions of high restraint or low ambient temperature. Where the carbon equivalent is not more than 0.41 per cent, welding consumables that have no hydrogen grading may be used and preheating will not generally be required except as above. The driver in the shipbuilding industry is not to apply preheat: therefore, control of composition while still obtaining the required strength is important. This is best achieved with the higher tensile steels by the use of the

Thermo-mechanical Controlled Rolling Process (TMCP).

### Solidification cracking

Solidification cracking is influenced mainly by composition and the effect of weld metal dilution can be an important factor here. Other factors having an influence include weld bead shape, welding speed and joint restraint. The probability of solidification cracking can be assessed for submerged arc welds in ship steels from the following equation:

$$Ucs = 230C + 190S + 75P + 45Nb - 12.3Si - 5.4Mn - 1$$

Cracking in fillet welds is likely if  $Ucs > 20$  and in butt welds if  $Ucs > 25$ . Bead shape will affect the cracking risk to some degree. The above can be summarised such that risk of solidification cracking in the weld bead is minimised by:

- low carbon weld metal
- low sulphur and phosphorous
- high manganese content.

In assessing the above, due cognizance is required of the dilution effects from the parent material.

### Effects of Alloying Elements

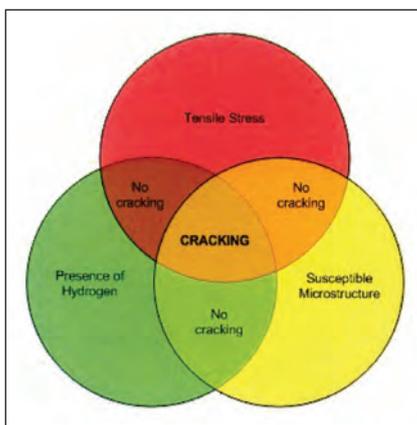
The effects of composition have already been described with respect to hydrogen and solidification cracking. This section is aimed at providing the reader with a general appreciation of the effects that individual elements have on the welded joint.

**Carbon** is a low cost strengthening element but creates difficulty in welding due to the adverse effects it has on cracking susceptibility and HAZ toughness.

**Manganese** is another low cost strengthening element to steel. Like carbon, it increases the risk of hydrogen cracking due to the associated increase in HAZ hardness. This effect is not as great as carbon as signified in the carbon equivalent formula. It does, however, have a beneficial advantage in reducing the risk of solidification cracking.

**Silicon** is used as a deoxidant in steel, it has been found to be detrimental to

Figure 2: Hydrogen cracking as the conjoint action of hydrogen, stress and microstructure.



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HAZ toughness in multipass welds but is beneficial in terms of solidification cracking.

**Phosphorous** is an impurity element which is difficult to remove from steel. If present in the upper levels permitted by the Rules it has been seen to have a detrimental effect on HAZ toughness. It is also prone to segregation during solidification of the parent material which then, due to dilution, can have a detrimental effect on solidification cracking of the weld bead.

**Sulphur**, like phosphorous, is an impurity in steel but differs in that it can be readily removed to low levels during steelmaking. Low sulphur contents are beneficial in terms of through thickness of steel and reduction in the risk of lamellar tearing. High sulphur levels in the parent material will, through dilution effects, have an adverse effect on solidification cracking. It should be noted, however, that low sulphur levels will increase hardenability and can increase the risk of hydrogen cracking. The relationship between the through thickness reduction ductility, as measured by a tensile test in the through thickness direction and the sulphur content of the steel, is shown in Figure 3. The curve shown is the lower bound from a data set for plates 12.5mm and 50mm thick [1].

**Aluminium** is used in the steelmaking process as a grain refining element. As such it is found beneficial to HAZ toughness at low heat inputs. At higher heat inputs the effects are lost due to the ease with which it dissolves in austenite, allowing rapid grain coarsening in the HAZ close to the fusion boundary. High

aluminium contents through dilution effects may cause deterioration of weld metal toughness.

**Niobium** is a microalloying element (<0.05%) used to modify the mechanics of recrystallisation in the steel rolling process. It has a rather neutral effect on the properties of the weldment except in high heat input welds where it can be detrimental to HAZ toughness.

**Vanadium** is also a microalloying element in steel which provides strength to the parent material through precipitation hardening. It increases the HAZ hardness and therefore the risk of hydrogen cracking, it has no effect on solidification cracking. In the levels specified in the Rules it has little effect on HAZ toughness.

**Titanium** is a microalloying element in steel which is predominately used in shipbuilding steels to retard grain growth in the HAZ close to the fusion boundary in high heat input welds.

**Boron** is not intentionally added to shipbuilding steels. If present (0.0003-0.0005%), boron would have a detrimental effect in terms of increased hardness of the HAZ increasing the risk of hydrogen cracking.

### Effects of high heat input welding

The term ‘high heat input’ welding is a misnomer, and really refers to ‘slow cooling rate’. What may be considered to be a high heat input when welding 15mm thick plate may be quite normal for 50 mm thick plate. So what is the definition of high heat input welding? On hull steels with a thickness of, say, 20mm, a heat input of 5kJ/mm is considered high heat input.

The thermal cycle imposed on parent steel by welding may have a number of effects, depending principally on two factors:

- the total time in the austenite range (typically characterised as time >1000°C), and
- the cooling rate over the transformation range (typically characterised as time to cool from 800-500°C,  $t_{8/5}$ ).

Therefore, in defining heat input in terms of  $t_{8/5}$ , our original consideration of 5 kJ/mm on a joint in 20mm plate would give a  $t_{8/5}$  of 64 seconds. For a thicker joint in 50mm thick plate, a  $t_{8/5}$  of only 30 seconds would arise. This demonstrates the difficulty of defining high heat input.

Heat input (H) is traditionally reported in kJ/mm and can be calculated from the following equation:

$$H = \frac{V \times A}{S} \times 1000 \times E$$

where

- V = voltage
- A = current in amps
- S = travel speed in mm/sec
- E = process efficiency (e.g. GMAW=0.85 SMAW=0.85, SAW =1.)

It is generally considered that low carbon and low carbon equivalent are desirable for best HAZ toughness. It is difficult to achieve good Charpy V-notch toughness at a carbon equivalent above 0.36%. Below this figure, toughness depends on other elements that need adjustment to maintain joint strength especially softening in the HAZ. A lower limit of carbon equivalent of 0.32% is suggested to maintain joint strength in higher strength steels.

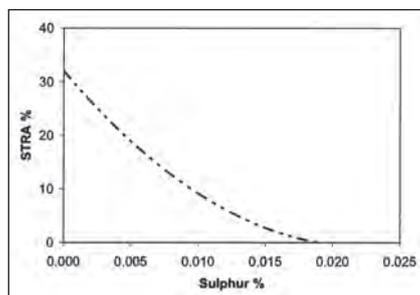
From the statements above, it is obvious that the use of thermo-mechanical controlled processed steel is beneficial with regard to high heat input welding because of the lower carbon equivalent composition involved.

With electro gas welds very high heat input welds of 30 kJ/mm are experienced with a  $t_{8/5}$  time of 200 seconds or more. With such a high heat input the use of base materials containing Titanium is beneficial to help pin the grain boundaries in the heat affected zone.

### Thermal correction of steel

This heating and cooling process is such that the microstructure is modified creating an isolated area where the resulting surface residual stresses are in tension. By applying this technique in a predetermined sequence, the plate is gradually formed into the desired shape (see Figure 4). Temperatures applied

Figure 3: STRA as a function of sulphur content.



# The *W*orld Superyacht Awards

## Young Designer of the Year 2011

A prestigious award for talented young superyacht designers is to be awarded at the  
Boat International Media 2011 World Superyacht Awards

The Royal Institution of Naval Architects, the Boat International Media and Camper & Nicholsons International invite entries for the 2011 World Superyacht Young Designer Award competition.

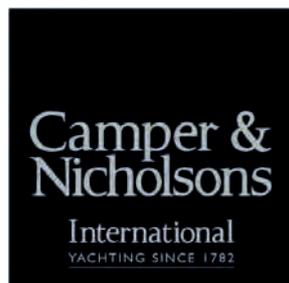
Introduced with great success in 2008, the World Superyacht Young Designer Award competition provides a showcase for young designers to demonstrate their ability and talents, and encourages the development of the next generation of superyacht designers.

The World Superyacht Young Designer Award will be presented to the winner of the competition at the World Superyacht Awards ceremony in May 2011, at which the remarkable ingenuity and innovation demanded in the design, engineering and construction of the world's finest luxury yachts is demonstrated, and is the most obvious place for new designer talent to be recognised and celebrated.

### The Competition

The competition is open to anyone who is studying for a degree or vocational qualification in a subject relating to yacht or small craft design, or anyone who has already graduated within three years of the closing date for entries, which is 31 January 2011.

The 2008, 2009 and 2010 competition saw many entries from all over the world, as far afield as NZ and China, as well as from all over Europe. RINA's CEO Trevor Blakeley is proud that RINA is continuing to support this award for young designers: 'The superyacht industry is one of the most successful sectors of the maritime industry, and owes much of that success to the work



of its designers who provide that unique combination of form and function, which is the modern superyacht.'

### The Award

The World Superyacht Young Designer Award will be presented to the young designer who produces the best concept design for a superyacht. The entries will be judged by a group of leading world-class designers selected by the Royal Institution of Naval Architects and Boat International Media. The winner of the Award will receive a prize of €5,000 and will be invited to receive the award at the renowned World Superyacht Awards ceremony.

### The sponsor

The Award is organised by the Royal Institution of Naval Architects and Boat International Media, and is sponsored by Camper and Nicholsons International: 'Following the joint Camper & Nicholsons International - Boat International initiative four years ago to reward the work of yacht

designers and naval architects, we thought it was only natural to continue to collaborate with the Boat International Media and RINA in order to identify the young designers of the future,' says Camper & Nicholsons International's CEO Jillian Montgomery. 'Taking an active part in this competition prepares the grounds for the future in many ways. Firstly, by giving up and coming designers exposure and the opportunity to get in touch with potential clients, and secondly by offering our existing and future clients a glimpse of designs that could soon be on the drawing boards,' explains Laurent Perignon, director of marketing for CNI.

The closing date for entries is 31 Jan 2011. If you are interested in submitting an entry or would like more information, contact Giuseppe Gigantesco, E-mail: [ggigantesco@rina.org.uk](mailto:ggigantesco@rina.org.uk), Tel: +44 (0)20 7235 4622

The Royal Institution of Naval Architects, 10 Upper Belgrave Street, London, SW1X 8BQ The rules for the competition can be viewed at [www.rina.org.uk/wsyaward](http://www.rina.org.uk/wsyaward)

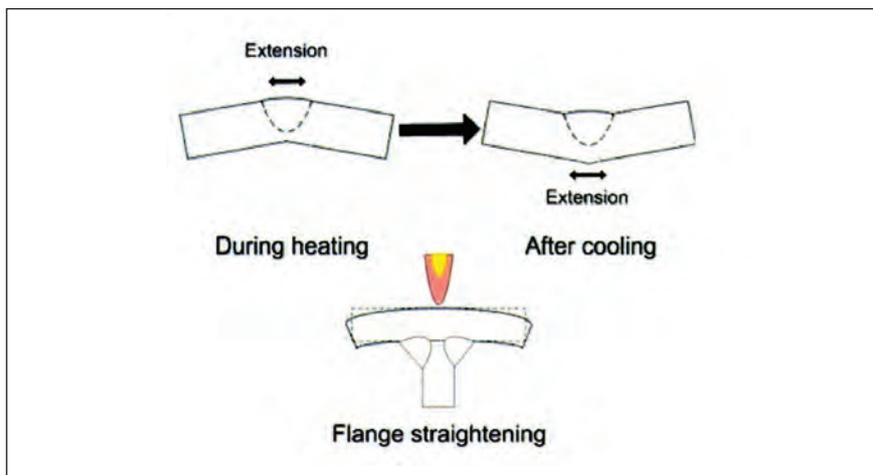


Figure 4: Principle of line heating.

are typically 600-700°C, but may go up to around 1000°C because of poor control.

Generally, temperatures above 550°C are required to produce a useful effect

and it is generally accepted that thermal correction carried out under well controlled conditions poses a minimum risk unless temperatures above 700°C are experienced. Higher temperatures

are a concern especially where a loss of toughness may be an issue. It is also acknowledged that water quenching after heating will enhance the thermal correction effect.

Another aspect of line heating is temperature control. Control by thermocouple or pyrometer would be ideal but more often than not temperature control is done by eye (see Table 1).

As an alternative to line heating, wedge heating may be used. This involves heating through thickness to produce in-plane deformation. Wedge heating, as the name suggests, involves heating in the form of a wedge or 'V' with a steep temperature gradient at the edges of the heated region in the plane of the thermally correct T or I beams.

It should be noted that local loss of strength may occur with thermal mechanical controlled rolled steels

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Surface	Temperature range, °C
Dark red	650 - 700
Cherry red	700 - 800
Light red	800 - 900
Yellow red	900 - 1000
Yellow	1000 +

Table 1: Visual control of surface temperature

oxy-acetylene, is reported to be more controllable [2].

### Strain age embrittlement

The ageing of steel is a phenomenon related to the interstitial elements of carbon and nitrogen in steel. It is the interaction of these free atoms with dislocations in the atomic lattice to increase strength but reduce ductility that can cause embrittlement. In steels, it is possible to avoid the problem by ensuring that the steel contains sufficient aluminium to combine with the nitrogen present to form aluminium nitride and also allow the small amounts of free carbon to be combined as carbide. Such precautions are not possible in most weld metals

where heating exceeds 750°C involved with the slow heating cycles of wedge heating.

It should be noted that line and wedge heating are usually carried out by the use of oxy-acetylene burners. However, electro magnetic induction heating equipment is also available which, although more expensive than

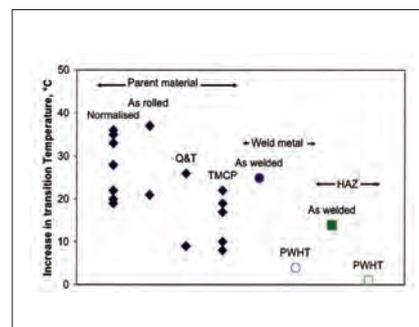


Figure 5: Effect of process route and cold straining on embrittlement.

because of the rapid cooling of the weld metal and the fact that all contain sufficient nitrogen and few contain sufficient free aluminium to combine with the nitrogen.

The fabrication of steel structures, especially those involving ships, involves many forming operations; some planned, some not so planned,

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as in the case of fairing. Cold forming or fairing will reduce the toughness and increase the strength of steel by an amount depending on the degree of cold work and the extent to which any nitrogen or carbon ageing subsequently takes place. The extent of ageing will depend on the amount of free nitrogen and carbon present and, in the case of carbon ageing, any subsequent thermal cycle experienced. Nitrogen ageing occurs naturally at room temperature. Post weld heat treatment reduces or eliminates the risk of embrittlement depending on the temperature of the treatment. A higher temperature normalising heat treatment eliminates it totally.

In a review [3] carried out by TWI Ltd on behalf of Lloyd's Register, it was evident that strain ageing can produce quite considerable shifts in ductile to brittle transition temperature, even in modern steels and weld metals.

Furthermore, cold work alone can have a considerable effect and in such cases there is an apparent effect of process route (see figure 5). However the combined effects of straining and ageing fail to show a clear correlation. Thus, the only way of being certain that strain and/or strain age effects will not compromise structural integrity is either to require a sufficiently conservative baseline level of toughness to allow for degradation, or to test the steel after straining and ageing. **NA**

### Summary

This paper has discussed the principles of quality control in ship construction and some of the background that justifies these requirements. The principles are well established, not only in ship construction but in all heavy construction industries. Unfortunately, the industry in which we work still needs to learn from these lessons, not

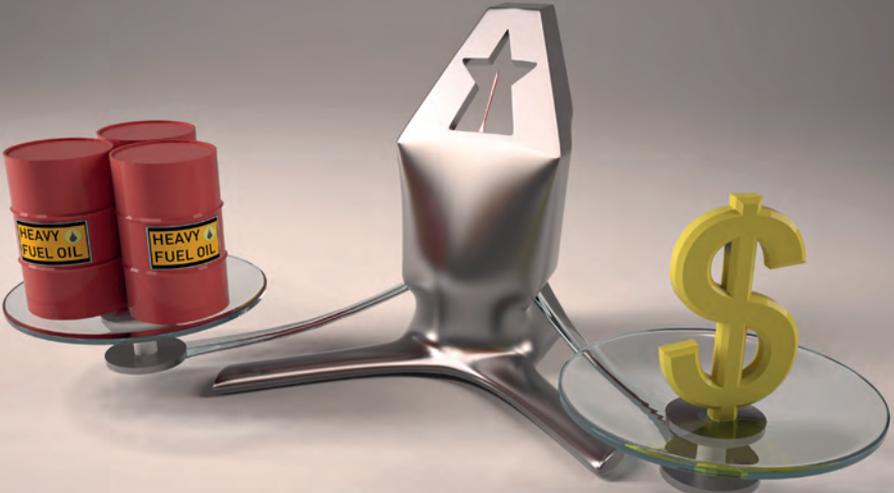
only to improve quality and ultimately safety but also to reduce costs and improve efficiency. One rogue welder will always cause problems, but the quality systems should be in place to react to this and minimise the risk.

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# Schat-Harding set to meet new safety regulations

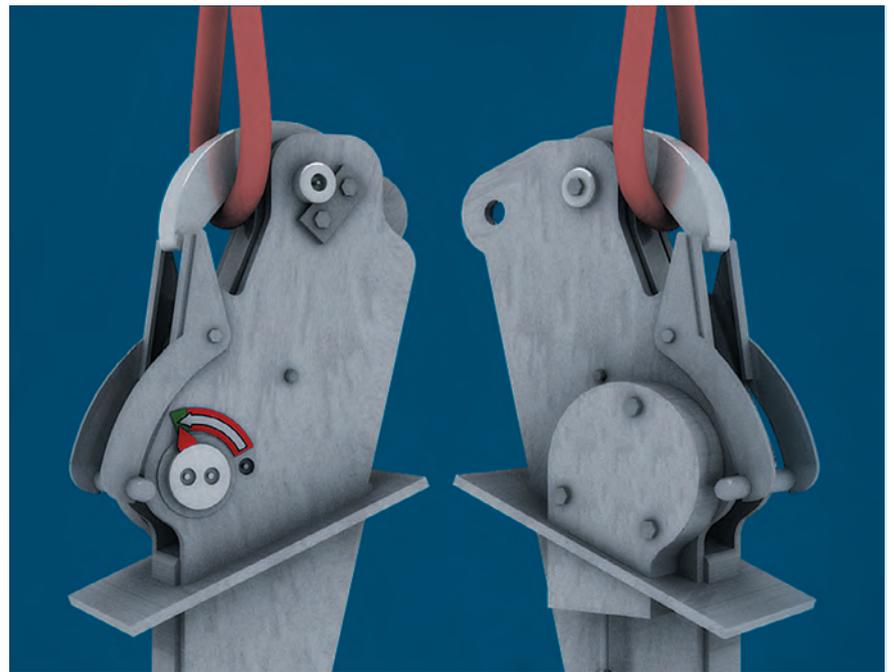
Lifeboat and davit manufacturer Schat-Harding has introduced its latest product, of an on load release hook, the SeaCure hook that also comes with a training package.

Schat-Harding has invested in the future safety of load hooks that are fully compliant with the pending revisions to SOLAS. It has taken the step in investing in a product that it believes will meet the up coming International Maritime Organization (IMO) guidelines also in creating a hook that could potentially last the lifetime of the lifeboat.

“We have always said that the safety of on load release hooks had three components”, explains David Torres, sales director, Schat-Harding Service. “These are design, maintenance and training. With this new hook we have designed it to be fail-safe and we have designed out a lot of maintenance by making sure there is no wear and tear on the critical parts. But, like all on load release devices, every lifeboat hook has to be used correctly. That is why we have also developed a simple computer-based training (CBT) package to help owners ensure that their crews are familiar with their lifesaving equipment. Good training is the key to avoid accidents.”

Developing a hook that will meet the new standards has been the focus for the latest design. Schat-Harding when developing the hook took into consideration the pending guidelines, but also associated problems that were linked with past accidents, both in maintenance and operation. For this Schat-Harding undertook failure mode and effect analysis (FMEA) on the hook and also looked at specific areas that were likely areas for wear and tear, and corrosion.

“The whole design of this hook has been developed with safety first, from material to functionality”, said Mr Torres. “Then we have run exhaustive FMEA tests to ensure there are no unexpected gremlins. We are pushing through national delegations at IMO, for the same



The SeaCure hook is set to meet the pending IMO guidelines.

standard to be made mandatory for all other hooks”, he adds.

The outcome of the testing has been that the SeaCure hook has been made from duplex steel, giving the hook a non-corrosive quality and also higher strength against wear and tear. Mr Torres has highlighted that although a more expensive material has been used, if you do not use what is best then you can not be committed to producing a good quality product.

The SeaCure hooks have a stable fail-safe system and are available in 3.5tonne, 6tonne, 9tonne and 12tonne versions. The design ensures that there is no wear and tear on critical hook components and no pins, fall prevention devices or additional loose equipment is required. The hook is user friendly, easy to understand and operate and is fully compliant with IMO’s latest DE53 standard.

Mr Torres highlights that the pending IMO guidelines are what is in focus for lifesaving equipment manufacturers. He points out that they will have to approach the new guidelines with control and not rush in. The industry is looking at this area more seriously and looking to improve systems by 100%.

“IMO has approved the new criteria for on load hooks”, said Mr Torres. “Now they are debating the date of which retrofitting will be made obligatory. But, many owners are moving now, getting their boats upgraded before the rush. Hooks can be replaced during a port stay, the lifeboat is then fully recertified by us as manufacturer and the crew will be much more confident in their safety when they see both the new equipment and are able to use the very clear CBT programme to familiarise themselves with it”

To make training and use of the SeaCure hook easier Schat-Harding has kept the hook design as standard, believing that the crew

The lengthened Stinger 760 from Schat-Harding goes faster than the previous Stinger.

will find a standard design easier to use.

### Extended Stinger

Schat-Harding has also stretched its Stinger 630 jet rescue boat to meet demand for fast-stable rescue boats. The latest variant the Stinger 760 is 7.8m in length and is capable of a speed up to 40knots.

The Stinger 760 has a double curvature hull that can reach speed of 30-40knots. The fast rescue boat has a length overall of 7.8m and breadth overall of 2.85m and an all-up service weight of 2200kg. The boat is to be fitted with a STEYR 230hp engine as standard, with a range of optional engines up to 350hp available.

The Kullman double curvature deep V hull has a bow knuckle, which maximises waterline length and wave piercing. At the same time the hull shape reduces slamming and delivers easy transition from



displacement mode to planning speeds. The hull, inner liner, streamlined and aft angled console and fixed forward spray hood are all moulded in GRP. Modular multifaceted composite construction is used to keep weight down and strength up.

A self-draining cockpit gives good drainage both while loaded underway and when stored on the davit. Crew seating is aft of the console for high-speed protection, while the forward spray hood protects survivors and stretchers after rescue. **NA**

## Wilhelmsen goes green with Unitor 1230

Fire extinguishing systems for the maritime industry often contain environmentally unfriendly components such as halon and CO<sub>2</sub>. But Wilhelmsen's Unitor 1230 is a clean agent fire extinguishing system.

**H**alon has a negative impact on the environment such as ozone depletion. The Montreal Protocol of 1987 mandate included the phase out of halon in developed countries by 2000 and less-developed countries by 2010.

Dealing with the need for a more environmentally safe fire extinguishing system Wilhelmsen's Unitor 1230 is an alternative for halogen with all components designed for optimal performance. The Unitor 1230 has been designed as a total flooding system for machinery spaces of category A, cargo pump rooms on tankers, cargo compressor rooms and other spaces onboard vessels or an offshore installation needing fire protection.

"The Unitor 1230 has limited impact on the environment and is harmless to people. The Unitor 1230 system is a high quality, compliant fire extinguishing system using a clean agent. The system has a space saving installation, and is safe for use as a total flooding agent in occupied spaces as an alternative to halon and CO<sub>2</sub>. The system has the largest nozzle coverage designed specifically for the offshore and marine industry, with a unique nozzle discharge pattern," highlights Cecilie Heavens, marketing officer, Wilhelmsen Ships Equipment.

The halon replacement that is used in the extinguisher has limited environmental impact that uses Novotec 1230 fluid stored in steel cylinders

pressurised with nitrogen to 34.5bar at 21°C. The cylinder valves assembly can be equipped with a supervisory pressure switch connection for monitoring cylinder pressure, a pressure gauge and safety bursting discs. By different actuator, valves can be actuated electrically or manually by handle.

Different types of installation can be used depending on storage place accessibility. As a modular system the cylinders are stored directly in protected compartments. As a central system, the requested amount of extinguishing fluid is stored in central cylinders out of the protected spaces and distributed as needed via distribution valves. The system can also be installed as a combination of these. **NA**

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## Robbing hoods

Hollywood notions of piracy mask the sinister reality of piracy in the modern world. In recent years piracy, particularly around East Africa, has again become a major problem for shipping in the region. But are owners doing enough to protect crews from these robbers on the high seas?

Dealing with thieves intent on doing harm or stealing from those going about their daily business on land is difficult enough, protecting people hundreds of miles out to sea is significantly harder.

Piracy is, says Nick Davis of the Merchant Maritime Warfare Centre (MMWC), here to stay. Ship owners have been slow to react to the danger that now confronts crew onboard vessels and a lot still needs to be done to help to protect crews further.

Mr Davis adds that a major problem is that the decision making has been taken away from the master of the ship and decisions are now being made by shore-based personnel who do not have enough knowledge of the situations that the vessel may be heading for.

Some owners have invested in private guards onboard their vessels, as the military can only offer limited protection. "The military are not helping the vessels as much as they could; this is mainly to do with the law being on the pirate's side. Where change is going to come is from the military working with the private sector and maritime colleges," said Mr Davis. "Ship owners have taken on private security because the military does not know what it is doing," he added.

"Companies are now looking for advice on security," said Mr Davis, but he added that this is not necessarily the way forward. "Crew awareness would help. It would stop the crew from being scared and help them adjust and get used to the situations that they may face. It is also about having the right counter-measures onboard," he said.

Solutions are now coming on to the market that will enable the crew to create a better defence against piracy. These solutions are not aimed at



A pirate's fast attack craft stages a mock attack in the Solent.



A pirate's boat becomes entangled in the arrestor ropes during the mock attack.

attacking the pirates, but are passive, designed to make a vessel look like an unattractive and very difficult target.

According to Mr Davis one way to do this is to make certain that your vessel has lots of defensive layers, such

as razor wire, navigation systems that can recognise small fast moving vessels along with crew training. All of these go towards 'hardening' the ship (making a vessel less susceptible to attack) and gives the crew more confidence that

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they can defend the vessel successfully. And all of these solutions are available from companies like MMWC.

Its latest product is a propeller arrestor that is designed to stop small vessels approaching larger commercial vessels. It is made out of several lines of polypropylene with a weak link in the line. The idea behind it is that a pirate's outboard engine propeller gets snagged in the line stopping the vessel in seconds and causes the vessel to spin through 180deg.

As the rope tightens around the propeller it will cause the rear of the vessel to sink into the water allowing the boat to take on water. As the ropes pull on the propeller stress on the weak link reaches breaking point and it snaps, by this time, however, the pirate's boat is disabled.

The propeller arrestor can be deployed in five minutes and its booms extend 100-150m behind the vessel. The arrestor was tested on a 240m vessel with 30 reels of rope at 14knots with no measure of drag recorded over 1200m distance. The arrestor itself takes approximately one hour to be installed. Mr Davis highlights that this adds another layer of security to the vessel.

Ultimately though even with solutions on the market that can give a vessel and its crew better protection at the end of the day this amounts to another cost for the ship owner. As Mr Davis emphasises if it is not low cost then the solutions will not be taken on.

"You need to train crew and ship owners so that they have good intelligence about the situation that they are entering, you can spend a million on

different products and solutions onboard a vessel but there are no guarantees. Ship owners cannot have an open cheque book approach to the solution," said Mr Davis. He continues to say that investment into anti piracy solutions onboard a vessel should not exceed £30,000-40,000 for the ship owner.

Anti piracy equipment is now being installed on vessels that are currently under construction. And Mr Davis believes that more ship owners should be looking to do the same with future new build vessels, as the cost of modifying an existing ship is greater and can also be time consuming.

A clear message stands out that now is the time to act for ship owners. Piracy is a problem that is here to stay, but with the correct advice and solutions it is a problem that can be managed. **NA**

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# Autronica launches ISEMS

Norwegian-based Autronica has introduced its latest integrated safety and emergency management system (ISEMS) on to the market.

With fire safety an important part of a ship maintenance Autronica's has launched its AutoMaster ISEMS, which is an integrated safety and emergency management system combining the strengths of a powerful fire detection system with functions dedicated to make sure the crew are in control in case of an emergency.

AutoMaster ISEMS can be used together with the AutoSafe Interactive Fire Detection System. The system has an intuitive control and monitoring interface, providing users with an easy-to-understand graphical presentation of the situations that may occur. It has fast navigation and powerful zoom functions that allow the user to monitor all areas in great detail.

AutoMaster ISEMS is the full AutoMaster edition, including all functionality. In addition, there are three editions; one for the oil & gas market, the maritime market, and the onshore market.

Adding to this Autronica has also launched its Autosafe 4. The enhanced generation AutoSafe 4 operates on a high-speed and fully redundant Ethernet-based network solution; AutoNet, providing extremely fast data transmission. A maximum of 64 system units (panels, controllers) can be connected to the AutoNet. The system has a great capacity, and the fact that all types of loop units can be connected to the same detection loop gives large flexibility.

Uploading of configuration data or

system software to the entire system can be done from one single point. The USB port is used for downloading data from a USB memory stick. AutoSafe 4 provides advanced functionality within fire detection for a wide range of applications. The system is designed to meet requirements in the high-end segment of the land, maritime and offshore market, and has been developed for worldwide standards and regulations.

AutoSafe 4 has been certified in compliance with the Construction Products Directive (CPD) for CE marking and the Marine Equipment Directive (MED) for Wheel marking. Both these directives require compliance with EN 54-2 and EN 54-4. [NA](#)

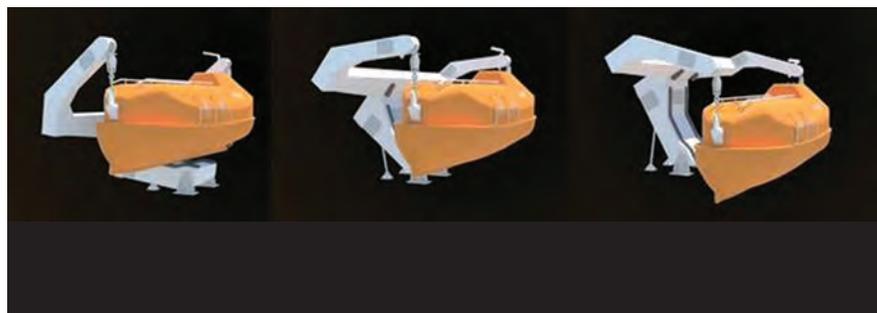
# Noreq breaks the mould

Norwegian-based Noreq has taken the next step in davit design, producing a system that incorporates the latest technology.

The Noreq compact davit has seen orders for around €3 million over recent months for the davit system with further orders coming through. The latest davit from Noreq has been designed around the principles of safe and efficient launch and retrieval.

"In a hundred years the davits haven't changed much. We wanted to do something about that and there are a lot of advantages with the new davits," said Thomas Bruvik, marketing director, Noreq.

The davit is easier to launch than previous davits with further technical development to the system. "Electrical and hydraulic systems and components are totally enclosed into the davit structure and gives optimal protection against wear and tear. The davit design and construction, gives advantages when



Noreq's has developed its davit keeping up with the latest technology, creating a davit system that is easier to use.

it comes to maintenance and service, installation and deck preparations. The new davit concept also solves the problems related to operation affect by extreme climates," adds Mr Bruvik.

The launching of the lifeboat can be done either from inside the boat

or from a remote control unit. The lifeboat is operated by a hydraulic/diesel driven system and is designed in accordance with the latest IMO/SOLAS requirements, LSA Code and European Council Directive 96/98 on Marine Equipment (MED). [NA](#)

## Going Large!

Plans for a new class of mega container ship with a container capacity of 22,000TEU were drawn-up as long ago as 2008, but to date not a single example has been built. Does bigger necessarily mean better or have we reached a glass ceiling? Ask Jeroen De Haas and Simon Burnay from the BMT Group.

The largest container ships currently in service are around 157,000dwt with a cargo capacity of approx 14,770TEU. While going larger has potential benefits, it certainly presents challenges operationally and from the infrastructure and naval architecture perspectives.

The exceptional size of the hull and its inherent flexibility could ultimately prove to be limiting factors for the mega container ship. Issues such as 'springing' or 'whipping' are still to be fully understood and more research and full-scale measurements are required to ensure adequate structural capacity over the ship's lifetime.

Relocating the accommodation structure from the stern, to amidships can help reduce the longitudinal bending moments but the naval architect must still resolve related issues such as shaft alignment and manage the deflections that will occur during operation – the larger the ship, the longer the shaft and the greater challenge to ensuring satisfactory shaft alignment. The ultimate hull girder strength could still be limited by the thickness of the steel used as practically it is very difficult to manufacture mild steel plate much thicker than around 100mm.

Areas such as hatch coaming tables can be very sensitive to excessive forces, especially in bending and hence the natural tendency would be to look at utilising high tensile steel, but the significant increase in material costs could have a negative impact on the profitability of operating the vessel. The design of larger vessels must also take account of hydrodynamic effects such as parametric rolling which is affected by the relationship between ship length and wave length.

The main appeal of larger container ships is the economy of scale. Certainly a larger ship carrying twice as much cargo as two smaller ones will be more efficient in terms of fuel consumption per TEU transported. But, the propulsion plant required to transport a 22,000TEU vessel presents significant



The 2002 built 6400TEU *MOL Priority* could be the flexible work horse of the future for the container industry.

challenges to the designer. Current container ships are almost exclusively single screw with slow speed diesel propulsion but as ship size increases (especially if operating at higher speeds of circa 25knots) then propeller loadings are higher and we start to see diminishing returns in terms of propulsive efficiency as well as greater challenges with cavitation and erosion.

Assuming that the traditional service speeds of large containerships will be required again in the future, the only viable option is for a twin-screw design. This will inevitably lead to a higher build cost and specific design requirements including a beam of around 50m due to draft limitations. A twin-screw design would have a greater wetted surface area, higher frictional resistance and a less efficient wake field but can have improved propeller efficiency due to lighter propeller loadings (due to the reduced power per shaft to be transferred to the propeller), which may overcome deficiencies in hull form and is therefore a more efficient design on a relative basis.

Another more innovative option would be the contra-rotating concept with an

azimuthing pod mounted behind a single shaft propeller. It is a relatively untried idea with greater mechanical complexity and the potential for increased cavitation due to the 'pod' operating in the highly unsteady flow behind the main propeller and the constant turning of the pod for steerage.

However, if the current move towards slower steaming is maintained as many industry analysts predict, it is possible that a single screw design could now be achievable for ships of this size. It is unlikely that engines much larger than those currently available would be used despite the increase in hull size due to the practical difficulties in transferring that power to the propeller which is limited to circa 9m diameter by the ships draft and cavitation. This could, therefore, give a viable solution of using tried and tested propulsion arrangements that could be optimised for the slower service speed of the ultra large containership providing a more efficient vessel and mitigating the risks associated with running these engines at slow speeds that they were not originally designed for.

Factors that will affect a mega containership are not only limited to the vessel's hull and

machinery. In order to accomplish the desired cargo capacity in excess of 15000TEU, current proposals are to stack containers up to ten high rather than the maximum of nine that is currently used. The updated design criteria have ensured that all new containers fabricated post-2005 are suitable for stacking ten high. However there are still millions of containers in service that were built pre-2005 which do not meet these criteria and are, therefore, unusable within the proposed scheme. How these unsuitable units would be segregated and barred from transit within ten-high stacks is a minor but important issue that would need to be resolved.

Even if all the containers comply with the 2005 standard, stacking 10 high will exacerbate existing stacking and lashing issues. BMT De Beer's work with container casualties has indicated that some of the current methodology might underestimate the forces acting on a container stack. Current design criteria are based on a 25 year return period using data from 1980. However, hind-cast research carried out by BMT ARGOSS using met-ocean data as part of casualty investigations has indicated that actual wave heights are significantly higher and occur far more frequently than the design data suggests. If this is correct, then a fundamental rethink on how a ten-high container stack might be lashed and secured will be required. It is worth noting, however, that since the first launch in 2006, none of the

new generation of 14,000+TEU container ships have been involved in a weather related incident. While this can be attributed to a wide range of mitigation measures, it is important to highlight the investment in weather-routing technology made by many of the major container lines.

With in-house weather centres now providing accurate up to date information to ships at sea it is far easier for Ship's Masters to adjust their routing to avoid heavy weather. Rather than purely routing on the basis of the shortest course with the least bunker costs, safety is the dominant factor.

Larger ships with larger volumes of cargo don't necessarily equate to a higher level of risk. However, the consequences of a loss are far greater. There is a real concern within the salvage community that in the event of a large container ship running aground, suitable marine cranes just isn't available to offload the cargo in a limited timeframe. Without the means to lighten these big ships and reduce the draft, refloating a vessel before widespread damage is inflicted might not be possible.

This is a major risk for the operators and insurers and something where there is not currently a viable solution. Another major concern is with the cargo itself. BMT De Beer has been involved in the aftermath of two recent casualties where a dangerous cargo was not properly prepared and the containers caught fire. Fire in a container stack is notoriously difficult to control and the scale

of the implications increase with the size of ship and volume of cargo. The major shipping lines have started to implement schemes to determine exactly what is inside each container, but it is still far too easy to declare that there are benign cargos in the container, when it might be a highly flammable chemical such as calcium hypochlorite.

One potential downside of the mega container ship is that existing infrastructure will not always be able to support the new vessels. Because of their scale, only 20-25 ports around the world can currently accommodate these very big container ships because of the manoeuvring space required, draft limitations, locks, tidal restrictions and the need for shore-side facilities such as gantry cranes with sufficient reach to load / un-load containers from a single side of the ship. It is likely that any port wishing to accept such vessels would have to invest in new infrastructure that might include capital and maintenance dredging as well as purpose built dockside facilities including specialist long-reach container cranes.

The whole concept of the mega container ships arose in an era when economic buoyancy was never in question. The current economic situation however, does not lend itself to long term investment in either mega container ships or port infrastructure. Furthermore, challenging trading conditions have lead to companies becoming strongly risk-averse. There is a school of thought that suggests that any investment in new ships should focus on the 6000 to 7000TEU size of vessel, which allows greater flexibility to the operator as these vessels can be sent to a far wider spectrum of ports and can be easily re-routed when the need requires.

Certainly a larger ship will be more efficient in terms of fuel consumption per TEU transported but it is more likely that other factors will probably dominate the decision. The argument at the end of the day is an economic one, so these leviathans might be stillborn, not because of an insurmountable engineering or technical problem, but by the downturn in the global economy. The desire to go bigger and push the design envelope reflects very well on the naval architecture community; however, we will have to wait and see whether economic conditions will improve sufficiently to shepherd in a new age of mega container ship. **NA**

**Bigger ships mean economies of scale - but bigger container stacks could see an increase in collapses like this one.**



# Costs and green regulations underscore DNV's brave new world

New regulations conceived to make shipping more environmentally responsible are driving an unprecedented period of innovation as designers seek to meet the deadlines for the imposition of new rules that will define the brave new maritime world.

**F**ortune, they say, favours the brave, but few in the maritime business would look at a great wave of recession looming and, instead of running for cover, hold firm and face the fiscal tsunami head on. Effectively that is what Norwegian class society Det Norske Veritas (DNV) did when it faced the decline in its business in 2008.

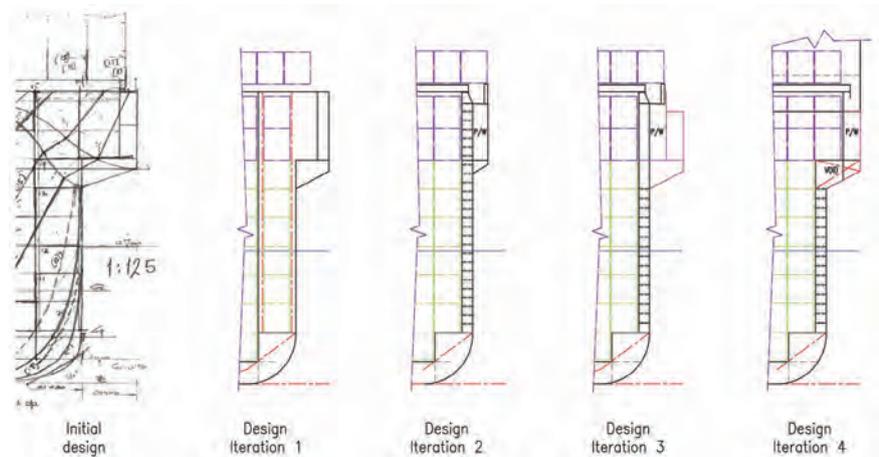
Instead of down-sizing by laying staff off DNV CEO Henrik Madsen decided that the company's personnel were too valuable and it asked them to go away and innovate. Quantum, a container ship for the future, or rather a futuristic container ship using available technology was one result.

Quantum, a 6,210TEU baby post panamax, has been designed to transport more cargo while using less fuel and with a reduced environmental impact. The focus has been on flexibility while also ensuring efficient and reliable operations, said DNV.

By starting to look at where this new concept design might trade, with a little help from broker Alphaliner, and then asking owners what were the most important elements of the ship's design to them the



The Quantum container ship is designed with a spread of operational criteria in mind giving it an advantage at differing speeds and drafts.



The five stages of the Quantum design development.

TECHNICAL PARTICULARS	
Quantum	
L o, a .....	272.3m
Beam (at waterline) .....	42.5m
Beam (at deck level) .....	49.0m
Design draft .....	12.0m
Depth moulded .....	26.4m
Total container capacity .....	6210TEU
Container capacity on deck .....	3336
Container capacity in hold .....	2874
Reffer capacity .....	1200
Duel fuel engines .....	L6 +3xL9
Installed power .....	33MW
Propulsion power .....	23MW
Fuel capacity LNG .....	5000m3
Fuel capacity MDO .....	3000m3

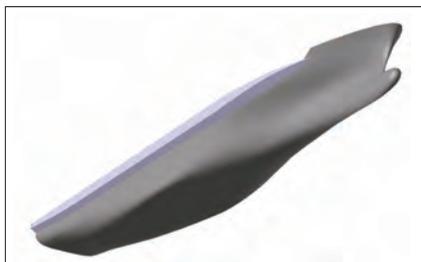
final result was startling.

Expectations in the maritime industry are that the emerging markets will require a different type of vessel. India, the Middle East and South America will require smaller, more flexible vessels than the massive 13,000-16,000TEU ships that are currently in vogue. Modern container ships will be slower, wider with a shallower draft, have a minimal need for ballast and they must be more manoeuvrable.

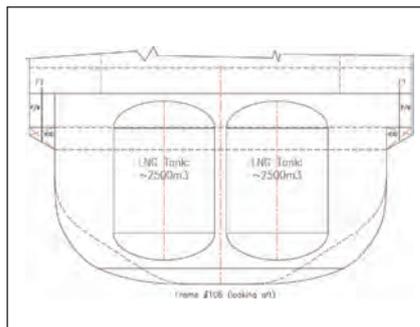
Owners also had a hand in determining the

design. The top five features for owners were no real surprise; fuel efficiency, reliability and ability to meet schedules, to comply with future regulations, general operating costs and environmental footprint.

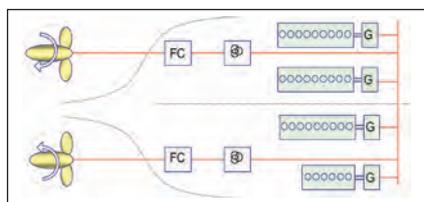
In addition owners wanted flexibility and variable speeds and a high loading capacity. The resulting vessel design, known as Quantum, and branded a baby post panamax at 6,210TEU is seen by DNV as a concept vessel that incorporates many of the existing technologies that can be used to



The broader hull definition of Quantum reduces ballast requirements while the bow is slender and raked to soften head seas.



Layout of the LNG tanks.



The Quantum propulsion arrangement.

make shipping more efficient and greener.

Though DNV naval architect Vebjørn Guttormsen, who was one of 30 DNV staff involved in the development of Quantum, concedes that this ship will never be built he believes that it is an important design.

“We think of Quantum in the same way that the car industry thinks of its concept cars, we looked at the technology in use today and applied it to a concept ship”.

Not all the features of the vessel are to the taste of owners, he admits that the “pod solution is maybe a little on the edge, it’s more expensive than traditional solutions, but for this trade it is useful it means the ship is more manoeuvrable and it can make savings on tug assistance.” However, owners are still not convinced by pod propulsion even if it means doing away with rudders, thrusters and propeller shafts.

The ship is shorter and wider than traditional designs which reduces the need for ballast and increases the loaded capacity of the vessel, but the extra weight could increase the fatigue levels of the vessel structure and so narrower sides were introduced with longitudinals, explained Mr Guttormsen.

However, the number one need identified by owners was for greater fuel efficiency and to this end the new ship was designed to operate at 21knots. This not only significantly reduces fuel consumption it also reduces emissions as a result.

“Ships are designed for particular speeds, usually 25knots, down below 20knots resistance on the hull is much greater,” said Mr Guttormsen, adding that draft and speed must be considered together. “If the ship is too high out of the water resistance can be high and the bulb [at the bow] will not work or it will make things worse,” he said.

However, when designing Quantum the DNV team considered the actual operational speeds that the vessel would trade at rather than merely the service speed. “Under many operational conditions we see ships going at

## WAVE MONITORING

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- For optimized vessel speed and course, improved regularity and reduced heavy weather damages.



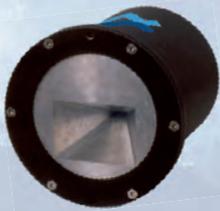
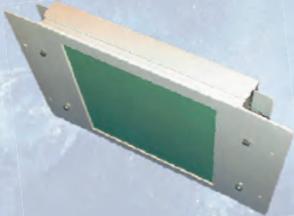
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much lower speeds so big savings can be made – draft and speed are important, if the ship is too high out of the water, resistance can be high as the bulb will not work or make things worse,” explained Mr Guttormsen.

The vessel would be powered by four dual fuel generating sets that can operate on MDO or LNG producing electric power to drive the podded propulsion. Electric power offers a greater flexibility in power usage. DNV say that with a conventional power set up “long periods of low engine load operation will result in soot formation due to a lower compression temperature and reduced exhaust gas velocity”. The result is that a regular “blow out” is needed with high fuel consumption.

“Diesel electric systems are much better than traditional mechanical systems with respect to operational flexibility, engine location and the utilisation of space”, claim DNV.

Operational flexibility allied with speed is the key for Quantum and with the DNV designed open top frame that enables terminal operators to load and unload eight empties at a time the efficiency in the cargo handling operations can be also be significantly improved.

The frame fits around eight empty 20ft containers (or four 40ft boxes) two high and two long and the quay crane lifts the bundle of boxes and stows them in a single move. The containers have

to be pre-loaded into the frames, but a significant advantage of this system is that there is no need for any modifications to lashing equipment, boxes or terminal cranes and equipment, all the existing technologies can be used. However, boxes of similar height must be stowed together meaning that some extra planning must take place.

Quantum is designed to offer real savings opportunities to ship operators in the business, but the team that designed the concept vessel have not stood still, and Mr Guttormsen says that several follow-up studies are now running, including a study on the use of LNG in two-stroke engines. [NA](#)

## Hull optimisation

### Bulb optimisation

Normally the bulb is optimised for a design condition that is fully loaded and at high speed. However, the uncertain container ship market has caused changes in the normal operational profile, resulting in a need to have a bulb design that is efficient for a range of loading and speed conditions, rather than one optimum point (Figure 1).

Taking this into account a bulb optimising study will include:

- Evaluation of several bulbs with comparison of the new wave making resistance coefficient and the total resistance to the original hull
- Investigation of parameters like bulb length, vertical location of bulb tip, longitudinal and vertical location of bulb top and bulb volume
- Showing the effect of changing operational profile on the bulb design

It is not achievable to have a bulb design that will result in low resistance for all speeds and drafts. However, by sacrificing some efficiency in a high speed design condition, it is possible to achieve a large improvement in loading conditions which the ship normally trades in.

### Trim Optimisation

One of the most cost-efficient measures to reduce the fuel consumption and emissions to air for an existing ship is to optimise the vessel trim to minimise the hull resistance. The study does not result in modifications to the hull structure and in many cases it may be easily implemented by shifting ballast water from one tank to another. The service consists of:

- Study the effects of different trim settings
- Hull efficiency changes are shown compared to even keel results used as base cases
- Trends are predicted for optimum operations for different loading conditions and speeds

A trim study for a Panamax container ship has been carried out with the following results (Figure 2):

- Potential annual fuel savings of about US\$170,000 or 1100tonnes of CO<sub>2</sub> (Assume operating in design conditions for 30% of the time)
- Optimum trim setting is very speed sensitive
- A decision chart assisting the crew in voyage planning (Figure 3)

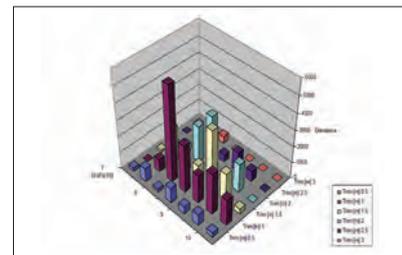


Figure 1 Operating profile for a typical feeder containership.

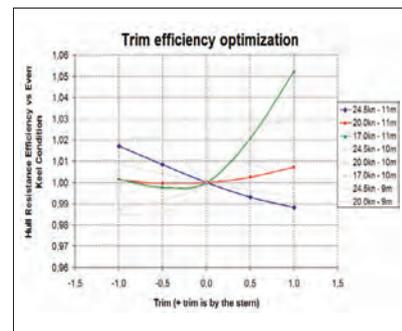


Figure 2 Trim effect for a Panamax container ship

		Speed				
		18-20 knots				
Draft	Trim	1.0	0.5	0.0	-0.5	-1.0
	9.0-9.0 m	Good	Good	Fair	Good	Good
	8.0-8.0 m	Good	Good	Fair	Good	Good
	7.0-7.0 m	Good	Good	Good	Fair	Good

Figure 3 Example of matrix-style results to assist during voyage planning

# Shipbuilding needs an industry-specific data management solution

Martin Gwyther, head of business capture, AVEVA NET Solutions (EMEA) takes a closer look at how data management solutions can improve the process of ship design and shipbuilding.

Within the commercial and naval shipbuilding sectors there is a strong need for integrated IT solutions, which address the industry's information and data management needs. Data management technology has been used successfully in a variety of manufacturing industry sectors to store and manage product definition data and to integrate, control and optimise product-related business processes. However, in the shipbuilding industry there are few shipbuilders actively using these conventional data management systems, and those who have tried to adapt them to shipbuilding design processes have had limited success.

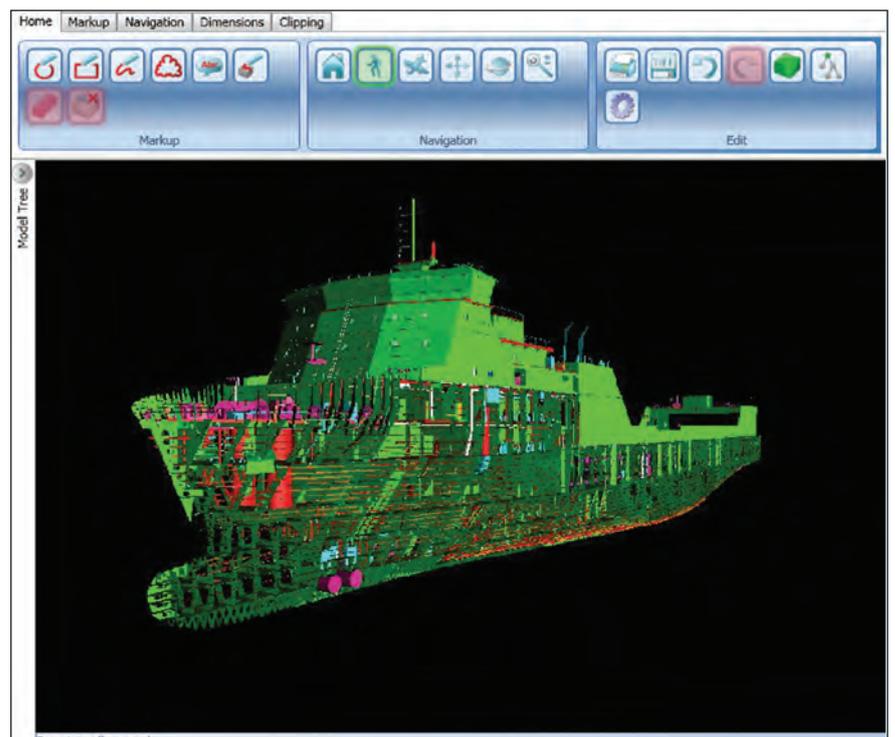
There are many questions to be asked, therefore, about the data management needs of the shipbuilding industry and the characteristics which differentiate this sector from other manufacturing industries. What is the key design criteria required of a data management system in this sector? What are the necessary practical capabilities? To answer these questions, we need to look more thoroughly into the nature of shipbuilding as an engineering and commercial activity.

## Shipbuilding – a special case

Shipbuilding is distinct from most other manufacturing industries. Firstly, vessels are almost always unique, enormously complex and hugely expensive to create. Secondly, these one-off products are designed and constructed to breathtakingly short timescales, involving vast material supply chains, production facilities and manpower logistics.

To date, most major shipbuilders have settled on two key areas of enterprise system investment:

- Advanced, industry-specific, multi-discipline 3D CAD / CAM systems
- Integrated Enterprise Resource Planning (ERP) systems



Making data dynamically available across multiple locations enables collaboration to drive the designs to the next stage. In this example, note the collaborative mark-up tools at the top of the screen.

These investments have delivered, undeniably, significant productivity and data quality improvements. However, to build on these gains, shipbuilders are looking, additionally, for information and data management technologies, which will enable them to integrate and enhance their existing key systems, embrace a wider community of (potentially geographically distributed) project participants, and wring more efficiencies out of the flow of information throughout the enterprise.

## Shipbuilding industry background

Existing conventional data (cdata) management solutions are manifestly

unsuitable for this job. They are suited primarily to standard mass production engineering/assembly line facilities. They support the production and manufacturing process in a passive sense, managing product design data and recording some of the relationships between manufacturing facilities, resources and the designs they are producing.

In contrast, large scale commercial and naval shipbuilding is fundamentally project-based. A single basic ship design may be used to produce a series of vessels, but, in practice, each ship is a unique design and production is generally executed as a one-off capital project. In this model, the product design is based

on a complex network of inter-connected component designs, which evolve through a series of iterations into the final product configuration.

The potential financial and schedule risks associated with this parallel process mean that component design iterations, their status and their availability, must be well recorded, certainly - but this information must also be used to actively control and drive the workflow across departmental and organisational boundaries.

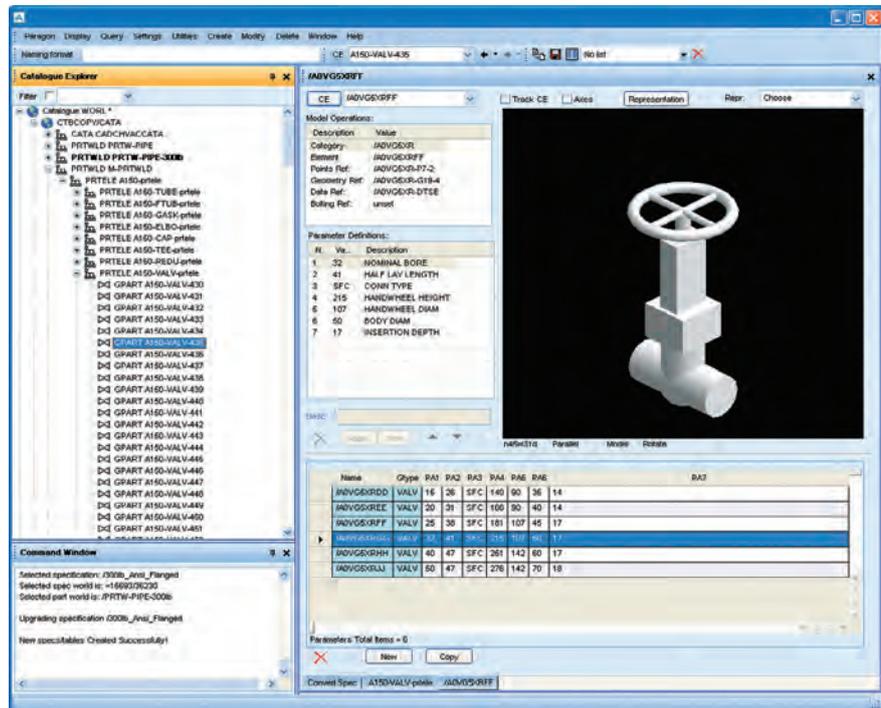
For example, the ability to dynamically distribute design data across project locations, down to the smallest attribute, is certainly helpful to create a view of complex parallel design processes. However, the ability to actually collaborate on that data will actively help to move designs through to the next stage of the workflow, even across time zones and continents.

### The shape of the solution

What is required, therefore, is a solution that:

- Provides an information and data management infrastructure through which all the various organisations involved in shipbuilding projects can optimise their project execution capabilities - enabling them to deliver higher quality products and to do so faster and more cost-effectively
- Helps to reduce the lifetime cost-of-ownership of marine assets by providing a consistent foundation for information integration, evolution and re-use
- Provides not only a strong foundation for managing the storage and flow of information throughout the enterprise, but also integrating seamlessly with other applications, which author, or work with, product and project data
- Enables project participants to interact and collaborate, both within and across enterprise and geographic boundaries
- Combines internet communication standards and technologies with intuitive, more usable user interface designs
- Enables controlled, real-time access to a single source of correct, consistent, version-managed information.

For a data management system to meet these criteria, it must provide capabilities



Effective data management means that any and all data associated with a particular object can be instantly accessed through that object. Here, there's no guesswork involved in establishing the exact characteristics of this valve, as the relevant data, from several different sources, is visible on the screen.

that work independently of the applications used to create and edit the information - yet it must also still support the management of the information these systems author.

This can, in turn, be used to provide a neutral data management platform, in which all types of information, and all the processes they support, can be accessed, evolved and shared - as well as re-assembled, revised and re-used - throughout, and after, the vessel's operational lifetime.

### Building the neutral platform

But then what does this 'neutral' or 'data-agnostic' platform actually look like? In most conventional data management systems, the individual data structures and relationships between data elements are built into the database schema and application logic. This has a number of principal limitations:

- it restricts the product and project structures (configurations) that can be supported; the project and product have to fit the tools available, rather than the other way round
- it requires an upfront understanding of the data compositions of individual items and

the relationships between them

- it typically requires specialist database and application programming skills to extend / amend the structures and relationships
- it relies on user-unfriendly database tables and columns
- it generally requires the roll-out of new software versions to accommodate changes to database schema and application functionality
- only a limited range of data and information formats can be accommodated.

To support the complex and varied data structures and formats needed to describe shipbuilding components and processes, a different approach is required - that of "real-life" objects and their associations to one another.

This approach is visual and intuitive; clicking on an image of a pump, for example, will generate all the information associated with that pump - from engineering data to supplier details, to the full maintenance history, to the other objects (including processes and workflows) that may be impacted if the pump is replaced, or a change is made to it.



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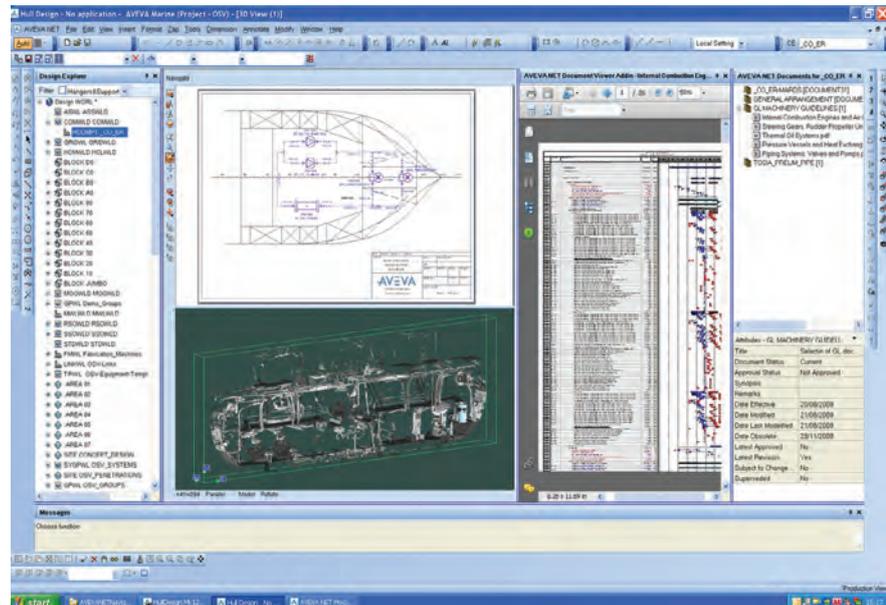


Moreover, these associations can be defined and evolved without the need for any database modelling skills, or any specialist understanding of the data structure. Objects and associations can be simply re-defined or extended at any time, to accommodate additional data properties and associations. Design changes, revamps, reengineering and repairs present much less project/schedule risk in this more flexible environment.

### Conclusions

The market experience of software suppliers has shown that within the commercial and naval shipbuilding sectors there is a strong interest in, and business need for, integrated data management solutions. These must address, among other needs, data and document storage, workflow and process management, product structure management, application and data integration, and visualisation / collaboration.

However, in practice, the industry has a number of key operational characteristics which differentiate it from the discrete / repetitive manufacturing industries where cdata management technology originated and is most successfully deployed. Clearly, cdata is



A neutral environment enables the use of data of any kind. Here, laser-scanned data is combined with drawings, project management tools, document processes, and so forth - all accessible and manageable through one interface.

not the answer to the industry's needs.

Shipbuilders looking to deploy a data management solution within their business should be very aware that, when it comes to

data management, they can either struggle to stay afloat, or they can adopt technologies that will put clear blue water between themselves and the competition. **NA**

## Autoship releases latest Autoload tool

Autoship Systems Corporation has announced its latest tool for generating Autoload databases.

The development of Autoship's Autoload software will have a feature that will allow ship designers to automatically export their 3D model and stability database into Autoload regardless of the 3D design package being used.

The feature has been developed to meet the demands of the ship designers, say Autoship, as it allows designers to export designs at an early stage into the Autoload databases, where by simulations can be shown to potential clients and also the necessary changes can be made as part of the design evolution.

Autoload is a robust, intuitive, easy to use programme that offers a simple to understand display of key hydrostatic values that are critical for safe vessel loading, says Autoship.



Sample of Autoload 3D vessel model with IGES imported surfaces.

With minimal input from the user, the programme provides a quick and accurate assessment of the vessels current stability status, loads and important margins. The user is then free to make critical decisions while the computer takes care of the mathematical complexity. The basic system has used a 3D model and has a simple

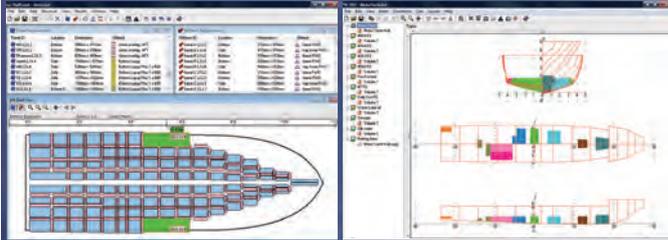
control for weights. Additional modules can be added for more complex control of weights ie: bay plan for containers and deck plan for ro-ro cargo. It can be connected directly to the fleet's booking system to import cargo booking and vessel scheduling data. The cargo stowage plan is developed in deck plan views and can be shown in 3D.

Furthermore, this software is for use for all ship types, the offshore oil and gas sector requires ship owners to be able to tender for a complex project in the initial stages, even before the vessel is delivered, has led to the realisation by clients through Autoload, with the tool having the added ability to be used as a loading instrument. The software is also in initial graphics exchange specification (IGES) format. **NA**



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# ShapeSpace offers a new solution to ship designers

ShapeSpace the latest idea of Andy Sherlock a mechanical engineer from Edinburgh University, offering ship designers a tool that will save time and costs.

ShapeSpace technology is an enterprise scale, 3D CAD data search and parts management solution. It has been specifically designed for users in the fields of engineering and manufacturing to help them quickly find CAD files held in product data management (PDM) and product lifecycle management (PLM) systems, to improve efficiency and productivity. Search information can be instantly presented collectively in a 3D visual format for easy identification and comparison.

Until now, finding a specific 3D CAD/CAM file in a large organisation, which has a large vault of part files, has been manpower intensive with users finding it an impossible task to trace files, to the point where designers will

not bother to try and search for a file or existing design because it is easier for them either to start from scratch or to redesign the part that is needed.

ShapeSpace is capable of text searches, which has been a priority for the development of the software that is able to understand engineering terminology. The advantages of ShapeSpace's 3D search engine allows the users to visually search for and browse for a component that is needed using 3D shape, without having to know the part number or description.

The software has been designed to integrate with any CAD/CAM system or PLM system (including disparate and multiple sites) makes part identification easy. Mr Sherlock highlights that the software stands alongside other data management software packages on the market, but ShapeSpace is less about the management and more about the advanced searches that it can perform.

Mr Sherlock has said in regards to the shipbuilding industry:

"This will save designers time when it come to looking for parts and not having to redesign them. They will also save money and up the productivity. At the moment

we are only seeing 5-10% of products getting reused."

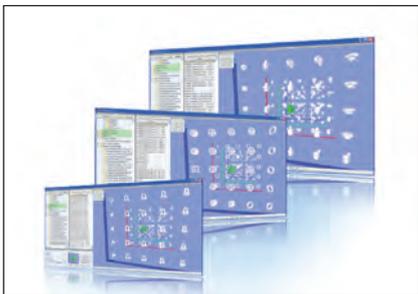
The challenge seen by Mr Sherlock is to quantify the amount of duplicate parts that are on a market, which can be found when two companies have merged and both have their own file vaults that have not been cleared out. With ShapeSpace users will be able to view the duplicates and near duplicate parts/components, quantify them, de-duplicate/ cleanse the data, or archive non essential files.

ShapeSpace was launched last month and is now working towards version 2 that is expected to be released next summer. *NA*

Andy Sherlock the creator of ShapeSpace.



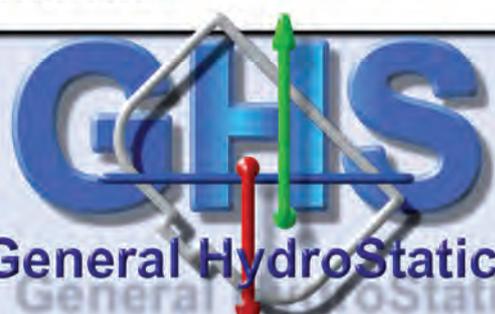
ShapeSpace visually allows the user to find the part that need.



**2010 Update Highlights  
GHS Version 12.00**

Improvements and additions in Floodable Lengths, Longitudinal Strength, Multi-Body, Load Editor, Model Converter and Condition Graphics. Rewritten Tank-Soundings module with improved formatting and easy-to-use wizard. Oil Tank Outflow extensions for compliance with MARPOL Annex 1 reg 23. Volume vs. temperature extended to asphalt. Many additional new features and enhancements. Faster performance. 75 bug fixes.

**GHS Load Monitor (GLM)**, the onboard configuration of GHS, gives naval architects the ability to provide their clients the best combination of features including damage stability.



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General HydroStatics

**Ship Stability and Strength Software**

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GHS Load Monitor (GLM) .....	Onboard configuration
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# Investigating the influences of surface imperfections

The quality of a ship's hull surfaces and its influence on the hydrodynamic performance, mainly ship resistance, has been questioned for a long time. Hamburgische Schiffbau-Versuchsanstalt GmbH (HSVA) and IMAWIS Maritime Wirtschafts- und Schiffbauforschung GmbH take a closer look at how this resistance affects the hydrodynamics of the hull in its HYDROFERT project.

**W**hile manufacturers have made significant efforts to improve production quality over the years, this was mainly to achieve higher accuracy and to minimise the rework. The effects that weld seams, shell buckling or other production related surface imperfections have on hydrodynamics and a ship's resistance in particular have not been investigated fully.

In a range of High Reynolds number experiments carried out in HSVA's large circulation tunnel HYKAT and numerical investigations, different types of surface imperfections have been investigated to determine their effects on hydrodynamics. Studies of the boundary layer as well as cavitation inception have been performed.

The HYDROFERT project has investigated three separate, but related hydrodynamic topics. The first topic involved turbulence modelling and forces on the plates. The second topic

focused on cavitation inception on rudders, and the final topic involved the effects of surface imperfections on model tests and computational results for a torpedo-shaped test body.

## Fundamental study on plates

The fundamental study on plates shows an important result; both in the measurements and in the simulations it was nearly impossible to get reliable results for body forces and detailed boundary layer profiles at the same time. The simulation required transient calculations for the boundary layer and the laminar/turbulent transition and also a steady state of calculations for the forces, but this required different numerical models. The same applies to model testing; during measurements and the use of particle image velocimetry (PIV) does not allow force measurements with three-component balance in our facilities.

The transition process and the turbulence predicted by large eddy simulation (LES) are represented accurately, however, a RANS-simulation (Reynolds Averaged Navier Stokes) is more suitable for determining the forces. Measured and simulated velocity profiles have shown good agreement for all cases. Generally the predicted forces by LES seem to be of the same character as those predicted by RANS.

## Investigating the rudder models

The investigation of the model rudders in HYKAT used two geometries; an idealised semi-balanced rudder as reference and an actual rudder geometry provided by IMAWIS. The rudders were fitted behind a typical container ship.

The cavitation observation concentrated on the most critical region, the gap between rudder horn and rudder. Here, cavitation inception began at small rudder angles and increased

Figure 1: Production related imperfections: welding seams (Left) and plate buckling (right).



Figure 3: Turbulent structures in the boundary layer using LES.

rapidly with larger rudder angles. For the actual rudder geometry (including castings, plate buckling and welding seams provided by IMAWIS) the cavitation was much more pronounced, compared to the ideal rudder geometry.

Based on this result, for cavitation it is much more beneficial to use the actual detailed rudder geometry instead of an ideal rudder geometry when judging full scale erosion damages.

### Investigating the effects of buckling

To investigate the effects of buckling and welding seams a torpedo test body was used in HYKAT as a basis for different surface structures. The torpedo body consists of a tube with a diameter of 0.5m and a length of 6m in total. The welding seams are designed from plastic ribbons attached every meter, closely matching the actual welding seams provided by IMAWIS. Consequently, each tube had six buckle arrays, each with three buckles in a realistic as possible dimension to that of a real ship array size. The buckles were generic from first-order plate theory with fixed mounting all around and subsequently transformed to cylinder coordinates.

Four cases were investigated, both in model tests and in numerical calculations; flat surface, flat surface with welding seams, buckled surface without and buckled surface with welding seam. For the numerical simulations the in-house code FreSCO<sup>+</sup> was used.

The measurements indicated that the plate buckles and the welding seams contributed to the same amount to the resistance increased, compared to the idea test body with flat surface. Model test results and numerical calculations were found to be in agreement with this and will now be used to develop a method for estimating the full scale added resistance caused by plate buckling and welding seams. *NA*

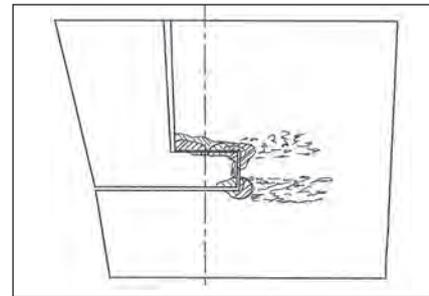
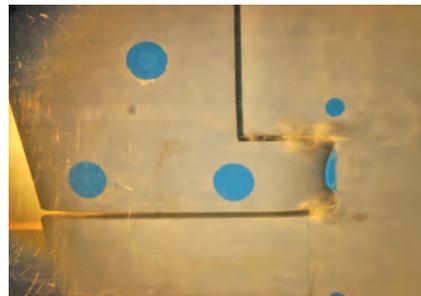
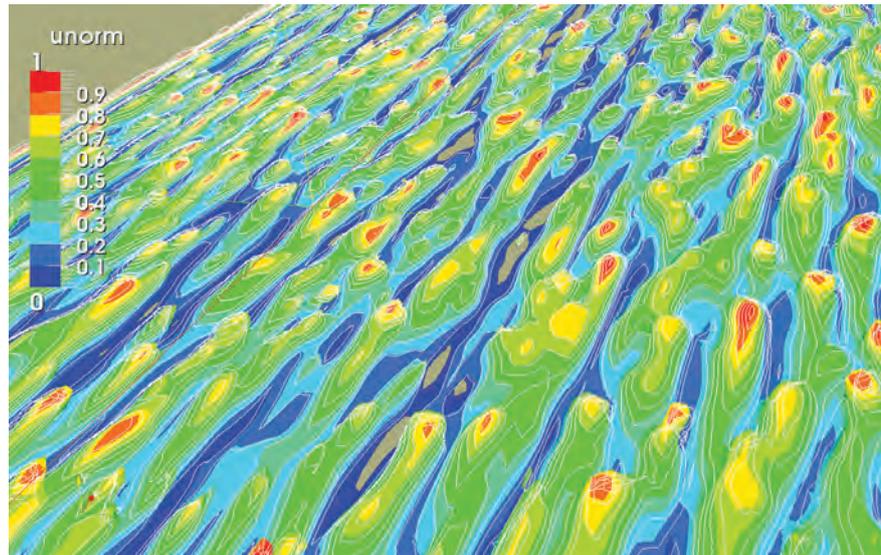


Figure 4: Cavitation on actual measured rudder geometry.

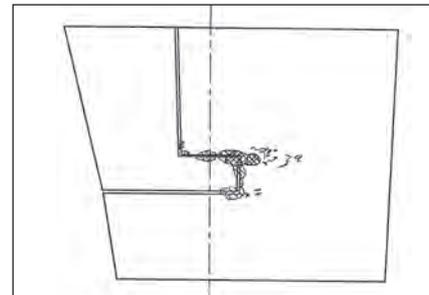
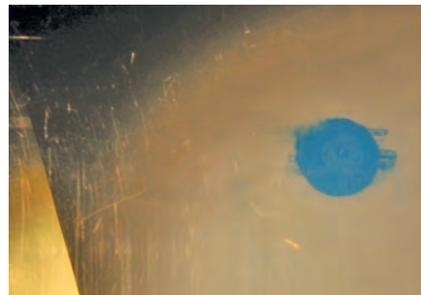
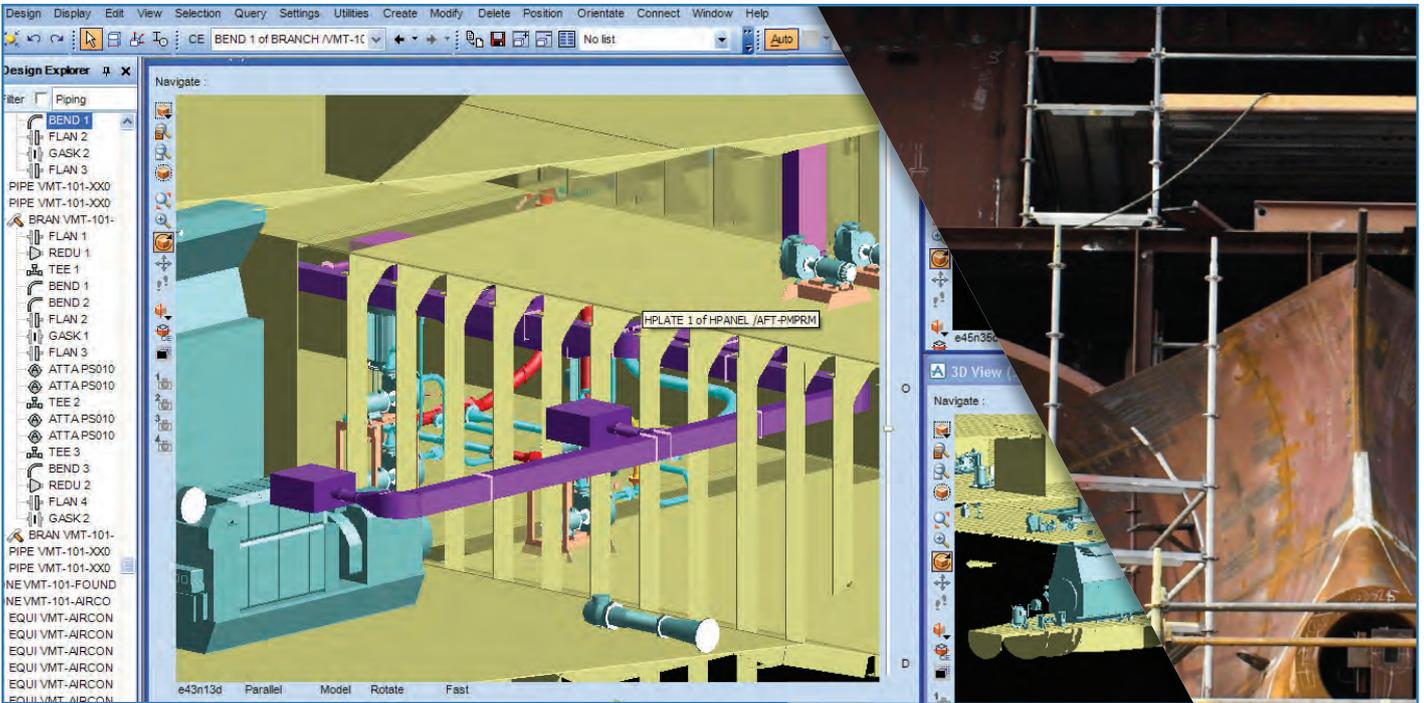


Figure 5: Cavitation on ideal rudder geometry.



Buckling on the test body.



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# ABS launches research project into propeller efficiency

ABS and the Shanghai Merchant Ship Design & Research Institute (SDARI) have announced a two-year joint research and development project into a energy saving device to enhance the propeller efficiency on a bulk carrier.

The add-on device that ABS and SDARI are looking into has the potential to reduce both the greenhouse gas emissions and lower fuel consumption, say ABS.

“We will use computational fluid dynamics (CFD) technology to analyse the flow field and specifically look to see if the device developed by SDARI does indeed create more efficiency by equalising the wake quality and recovering certain rotation energy”, explains Sing Kwan Lee, ABS principle engineer.

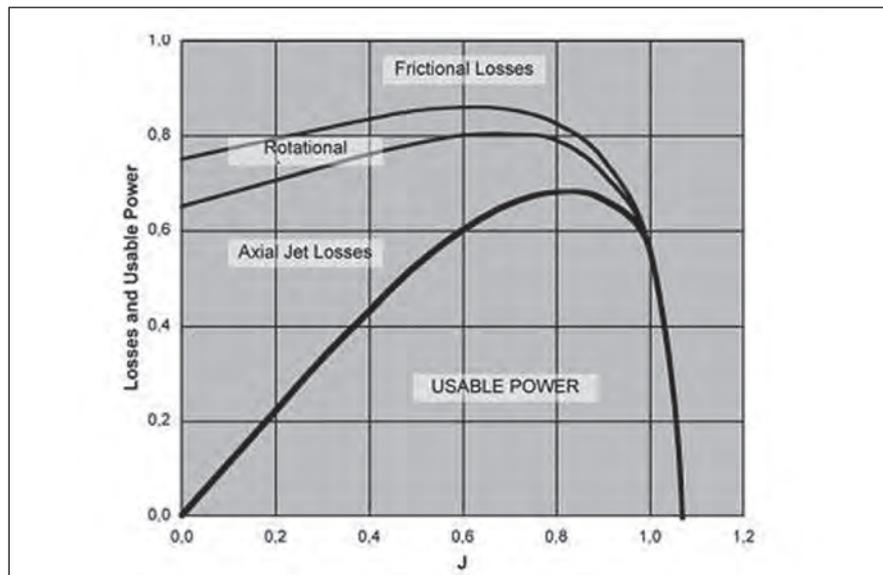
There are many ways in which energy is lost from the propeller and, therefore, reducing its efficiency. For example, friction resistance, wave resistance, propeller friction and propeller axial and swirl flow loss.

“Wave resistance is just one part of the total resistance”, explains Mr Lee. “Even if a large reduction of wave resistance through hull optimisation can be achieved, this won't bring significant impact to the energy-saving propulsion. The dominant resistance of a full form ship, like a bulk carrier, is mainly due to the viscous resistance.” The study will concentrate on creating detailed flow characteristics through CFD in order to study and assess the suitability of the design device.

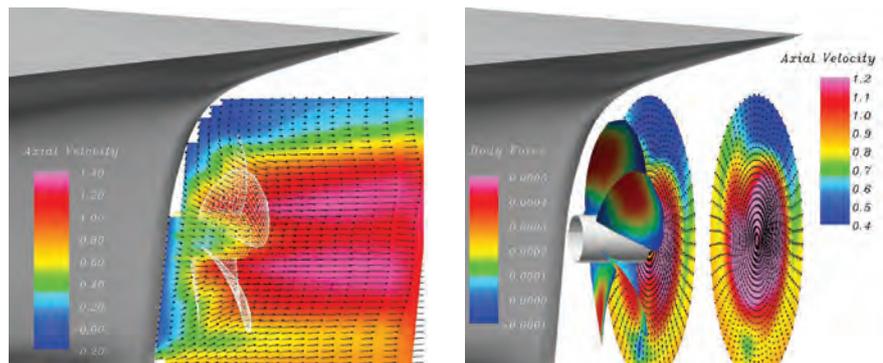
“The detailed flow field obtained from CFD simulation will be essential design information for selecting the type of energy-saving device and locating it to the appropriate position”, added Mr Lee.

The study started at the end of July and will last for two years, with the first year of the study focusing on analysing different energy-saving device selection and design. The second year will concentrate on model test verification for the designs that show potential from the previous year's study.

The study will evaluate the design device based not only from a resistance standpoint but, also from a more holistic propeller/hull/rudder interaction optimisation perspective. The study will be conducted in two phases; phase one will focus on analysis and design



An energy loss schematic diagram such as this shows which energy loss mechanism dominates so systematic parameter studies based on CFD simulation can be performed to determine the optimum design. (Graph courtesy of ABS)



CFD simulation showing propeller/hull interaction. (Graph courtesy of ABS)

while phase two will focus on model testing of the device.

Mr Lee expects that the analysis will see a 3-4% increase in the efficiency with the use of the device placed in front of the propeller, such as a pre-swirl stator. If the propeller/hull interaction CFD results show rich axial and rotational energies behind the propeller then further studies will be conducted using a special rudder with a fin and bulb. With this

range of efficiency and data published in the second greenhouse gas study in 2009, a capsized bulk carrier could save between 450-460tonnes of fuel over the period of a year.

## New web portal

Further, ABS will be launching the preview to its latest web portal for equipment manufacturers this month, with general availability scheduled for January 2011.

ABS' new portal will manage users' class-related information for their products.

The supply portal is a website that has been specifically designed to meet the needs of marine equipment manufacturers. The supply interface will be integrated into the MyEagle web portal and provide a tool that manages users' class-related information for their products from design through to fabrication.

Customers will be able to create new items, request design reviews and surveys, view comments and track findings. Design requests may also include calculations run through the online ABS web Calc

Select	Product Type	Product Name	Model	Purchaser	Supplier Ref. No.	Shipyard, Hull No.	Design Inquiry State	Comments	Survey State	Findings	Quantity
<input type="radio"/>	Accommodation Ladder	Accommodation Ladder	324-rev				Requested		Request Survey		
<input type="radio"/>	Accumulator	Accumulator	YC-ACC-01234	SAHDURG	Y190621		Request Design		Request Survey		
<input type="radio"/>	Accumulator	Accumulator	ACC-000123	SE Technologies	CA-1124		Requested		Request Survey		
<input type="radio"/>	Air Cooler	Air Cooler	432332				Request Design		Request Survey		
<input type="radio"/>	Air Heater	Air Heater	1324123				Requested		Request Survey		
<input type="radio"/>	Analyser	Analyser (T)	21		21		Request Design		Request Survey		
<input type="radio"/>	Analyser	Analyser-01	1212		1212	BOLLINGER MACHINENBau & S.V INC-76, BULLCOTT INTERNATIONAL-75, COGNAC ST-ALEXIS-VALENT AIS-75	In Progress	2	Requested		
<input type="radio"/>	Anchor	Anchor AC14	AC14	SHOVAS helena	10130		Requested		Request Survey		
<input type="radio"/>	Automatic Sprinkler System	Automatic Sprinkler System	3232				Request Design		Request Survey		
<input type="radio"/>	Diesel Engine	Diesel Engine	NTA-495-QHTA-495-G				Request Design		Request Survey		

Structural and Machinery programmes to improve service delivery time.

“The user experience really sets this tool apart from other web-based class programmes,” said ABS president and COO, Chris Wiernicki. “Before,

manufacturers have had to work with the online software developed for designers or ship operators who have a different focus. Now they will have the details of their class services presented in a format that makes the most sense to them.” **NA**

## ShipConstructor gets faster for 2011

ShipConstructor has announced the launch of its latest software release ShipConstructor 2011 that will bring further tools to the user along with better efficiency.

The latest update of the software will give the user the ability to organise a project in multiple ways and to generate multiple designs, through multiple product hierarchies other than the build strategy, which reflects each stage of the building assembly sequence. The capacity of enhancing support for multiple product hierarchies allows clients to do even more with the ShipConstructor product than in previous updates. The added applications range from the ability to define an alternate product hierarchy to the definition of a second or third product hierarchy defined to build the same vessel at another location.

The enhancements to ShipConstructor's latest update have been made to improve the speed and efficiency of the software and to add more tools requested by market demand, say ShipConstructor. The most important update to the software as highlighted by ShipConstructor is the split and merge tool that allows several users to collaborate on one project from different sources. ShipConstructor has improved the performance by up to 10% of this tool.

Other features of the update include; Scheduled database maintenance that allows the user to schedule database maintenance operations including the clean up of unused data, compacting of database files and the rebuilding of database indexes.

The project revisions dialog has been updated, which now allows the user to quickly find and understand a specific set of revisions and also manage a large number of revisions if it is in a particularly large project. ShipConstructor 2011 also has the ability to export these revisions to common formats including Microsoft Excel and HTML.

The global unique identifier (GUID) information has now been made clearer and easier to access with access to these identifiers now available in the AutoCAD OPM and in the COM programming interfaces that can be used to extract information about ShipConstructor parts in an AutoCAD DWG. This makes GUID's available in AutoCAD and therefore accessible via AutoLISP and VBA code (tools that are commonly used to customise and integrate with AutoCAD based



Screenshot of ShipConstructor 2011.

applications like ShipConstructor). GUID's are also now automatically included in Autodesk Navisworks models.

Negative X co-ordinates are now possible in the latest version of ShipConstructor to specify individual cut origin locations. Parametric shapes can be cut from the profile to be centred on a location that is outside the extents of the part. Amongst other benefits, this allows the user to avoid situations that would previously have resulted in a sharp point or smaller segment remaining after the cut, which is undesirable in production. **NA**

# Dassault Systèmes predicts 3D future

Dassault Systèmes is investing in the future of online 3D solutions that bring more efficiency to the design, system engineering, operation and maintenance processes for shipbuilders and naval architects.

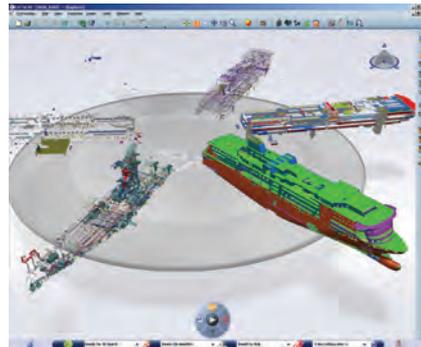
**D**assault believes that online 3D PLM (Product Lifecycle Management) solutions save shipyards and ship designers time and make the whole design through production process more efficient.

With further classification rules and regulations being managed by naval architects and the need to deliver on time, if not ahead of time, the design and manufacture of vessels is getting pushed harder at every step of the process.

Christian Barlach, Dassault Systèmes global shipbuilding industry specialist commented on the take up of the latest digital design solutions in shipbuilding. "We are seeing many yards around the world adopting 3D technology with Asia Pacific Region experiencing the greatest take up of the technology."

"There is a new generation of system engineering using PLM that brings great benefits to commercial shipbuilders. Increasingly we are seeing ship design and development rapidly evolving from traditional methodology to sophisticated 3D digital solutions.

"The most advanced shipbuilding technology yet conceived is commercially available and scalable to suit shipyards of any size. With further rules for zero



Dassault Systèmes V6 technology delivers concurrent online engineering by providing digital 3D models within and beyond the enterprise.

emissions ships will change radically. Our PLM tools meet these design, production and operating challenges by cross-fertilising experiences and best practices from one industry to another."

Mr Barlach continued: "Shipbuilders need to adopt PLM methodologies not only for design and engineering but also to retain, utilise and build up IP as a company asset. This leads to more assured progress and means that companies can be better managed through any economic climate, while reducing risk.

"This PLM technology offers solutions that are future proofed. With a software research and development team comprising half Dassault Systèmes 10,000 staff we provide shipbuilders with software solutions that meet their needs and help them maximise commercial and technical potential. We have launched a solution [3DVIA], which allows 3D models to be easily developed, animated and distributed within and beyond the enterprise.

Using a free 3D viewer anyone can now interact in 3D. Our shipbuilding customers make use of this technology so the impact of design and engineering changes is fully understood by stakeholders and recorded at every stage of the ship's life.

Shipbuilding requires a great number of teams and individuals to have access to current accurate data at all times. A central online data repository that provides broad but, secure access improves efficiency in many areas. It also enables concurrent working so that engineering, production, and maintenance planning, can commence before designs are fully completed. This alone has improved overall productivity in some shipyards by 50%." **NA**

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# NUPAS

## CAD M A T I C

### 3D Ship Design Software



Ship model courtesy of Wärtsilä Ship Design Norway AS



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ease of use and efficiency**

Nupas-Cadmatic latest software version, V6, is an extremely powerful tool for ship design and engineering. The most eye catching feature of V6 is the introduction of a new user interface that will further ease work and bring new efficiencies throughout the ship design process.

The new user interface combines a modern Office 2007 look and feel with enhancements welcomed by both novice and experienced users. It will change the way the software is used and allow for faster and more efficient work. In V6 it is available in Plant Modeller with other modules to follow in due course.

The software's easy-to-use 3D modelling tools can be used for early and basic design, detailed engineering, and the production of workshop drawings and generation of ready-to-use production data for production machinery.

With Nupas-Cadmatic you can successfully carry out the entire ship design project, right from the early start, up to the detailed engineering and final production phase. It improves engineering quality and shortens design and construction times. Nupas-Cadmatic seamlessly distributes engineering projects globally between different sites while ensuring effective communication between project partners.

#### Version 6 highlights

**New GUI** For the first time in history an Office 2007 style User Interface has been applied to 3D software, making it easier and faster to learn than comparable systems. Nupas-Cadmatic's intuitive and efficient User Interface speeds up design projects. **Distributed design** Nupas-Cadmatic's CoDesigner technology is the most advanced and easiest tool to use for distributed projects. It does not require massive hardware or very fast internet connections. **Easy administration** Administration of 3D software has never been so easy. Nupas-Cadmatic has the most modern tools for library and catalogue management. **Internet-based technology** Nupas-Cadmatic was the first developer to launch an Internet-based 3D model viewer and data query tool on the market in 2003. Today eBrowser is the most advanced software to visualize 3D models, to walk through, to query data and to communicate design details interactively with other users and project parties. The internet-based technology has unlimited scope for easy integrations.

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O P T I M I Z I N G R E S O U R C E S

# Orderbook revival boosts South Korean yards

The abrupt halt to new ship orders that followed the onset of the banking crisis in 2008 appears to have been reversed as South Korean orderbooks swell in the first half of this year.

A recovery in the global markets has seen a boost to the global shipping industry which has been good news for South Korea's ship builders as they report more orders in the first half of 2010 than for the whole of last year.

South Korea's foreign ship orders soared during the first half of the year after a steep two-year slump, and the recovery will continue, said the Economy Ministry.

South Korean yards secured contracts for 207 vessels with a total capacity of 4.62 million gt during the first half of this year, up 450% from the same period in 2009, an Economy Ministry statement said. South Korea won more than 3.2 million gt in orders in 2009, when orders dropped sharply for a second consecutive year, the ministry said.

South Korea won 38% of the total new ship orders awarded globally during the six-month period in terms of capacity, second only to China, which secured 45% of the total orders, the ministry said.

Despite the recovery in new orders, ship deliveries fell 13% in terms of capacity in the six months from a year earlier after a 1% drop in the whole of last year, it said.

The ministry said new ship orders would continue to post hefty growth in coming months on the back of a sustained recovery in the global shipping industry.

The shipbuilding industry accounts for about 10% of South Korea's total exports in terms of the value of ships delivered and the industry's performance has a strong influence on the local foreign exchange market.

Korean yards appear to be winning more orders for vessels with a greater design complexity, though the major



Bo Cerup-Simonsen VP Maersk Maritime Technology says LNG is the fuel of the future for shipping.

yard's bread and butter designs, the container ships, bulk carriers and tankers are also showing an improvement.

Delivered in April this year the 170,000m<sup>3</sup> LNG carrier *Methane Julia Louise* built by Samsung Heavy Industries (SHI) for the UK-based gas company BG Group is one of these advanced new vessels. The ship has a tri-fuel diesel electric (heavy fuel oil/gas/marine diesel fuel) propulsion and reliquefaction capability.

*Methane Julia Louise* is the first in a series of four vessels that will be the first in the world to integrate onboard reliquefaction with the propulsion system, allowing natural gas boil-off to be consumed as fuel or reliquefied for return to the cargo tanks. The re-liquefaction plant is based on the N2 cycling system and is capable of liquefying 2.5 tonnes of boil off gas per

hour which preserves the cargo for delivery at the end of the voyage.

The vessels will be equipped with four tri-fuel engines driving twin propellers and will operate at speeds of a little under 20 knots with propulsion power of 25,000kW. The service speed has been achieved while using around 6% less propulsion power compared to standard designs, benefiting the operator both commercially and environmentally.

In order to achieve the fuel savings new technologies developed by SHI have been applied including the Samsung Tip Advanced Raked propeller – also known as the STAR propeller. The STAR propeller offers greater efficiency and speed while also cutting vessel vibrations.

Vibration on ships is known to stress crews working onboard so the STAR technology will offer a more relaxed working environment. Further vibration mitigation is achieved through stern attachments known as SAVER (SAMSUNG Vibration & Energy Reduction) Fins that have been attached to the aft section of the hull. SAVER can reduce the hull vibration by approx. 30% - 40% according to the results taken during the vessel trials say SHI.

In addition the ships' cargo containment system a Mark III membrane supplied by Gaz Transport & Technigaz (GTT) has been reinforced in an effort to mitigate sloshing pressures.

The upper area of the cargo tanks have been reinforced while the corner areas of the upper cargo tanks have had wedge material inserted to provide a further "robust reinforcement against internal sloshing pressures", said the yard. These reinforcements to the cargo containment system will make the ships more reliable during operations in a variety of sea states.

The vessels will also be fitted with an Integrated Navigation System which is a single system consisting of collision avoidance, route planning and monitoring, alert management systems and a host of other navigational aides. By combining and these critical functions and information systems operators have a single simplified system to safeguard the vessel against accidents.

SHI has also applied the SAVER and STAR attachments to a recently confirmed order of 10 container ships placed by Evergreen. In addition the Evergreen ships will be fitted with a Samsung Asymmetric Rudder Bulb (SARB) that will also reduce fuel consumption.

Built to Evergreen's own specification these latest ships will be 334.8m long with a beam of 45.8m and a container capacity expected to be close to 9000TEU. The Evergreen vessels will be split between two Evergreen subsidiaries, the Taiwan listed Evergreen Marine Corporation and the Panamanian registered Evergreen International. The price of the vessels was reportedly higher than most vessels of a similar size and type due to the additional equipment included and the higher specification to the design.

In a further development to the LNG market in South Korea Daewoo Shipbuilding & Marine Engineering (DSME) has developed the ACT-IB (Aluminium Cargo Tank – Independent type B) LNG cargo containment system.

DSME said that the ACT-IB is the world's largest independent-type LNG cargo containment system, which it says is essential for LNG carriers and LNG-FPSO (Floating, Production, Storage and Offloading) vessels.

Development of the ACT-IB system means that DSME no longer has to rely on acquiring systems from French and Japanese suppliers, that would save significant costs in royalties said DSME.

However, for DSME and their competitor at Hyundai Heavy Industries (HHI) it is their partnership with the Danish operator Maersk Line that is coming to a mutually beneficial



The 8100TEU *Ever Chivalry* was delivered in 2006 and formed part of a 12 ship order placed in 2003 by Conti Reederei. The vessels are on long term charter to Evergreen. The new generation of ships ordered this year will be of a high specification and much greener.

climax. Maersk Maritime Technology's VP Bo Cerup-Simonsen told *The Naval Architect* that the company had been working with the two yards to develop container ships with significant operational cost savings, up to 23%. Orders for 16 ships of 7,500TEU from DSME and a further 22 ships of 4500TEU from HHI have been made with deliveries due to start in 2012.

Mr Cerup-Simonsen said: "Our idea was to design ships for a real operational profile," however, he conceded that by designing for a number of different speeds and drafts is necessarily "a compromise" but that overall the design was far more efficient.

In its partnership with DSME Mr Cerup-Simonsen said that the company's Odense Shipyard, currently in the process of being closed down, was very helpful in guiding and advising DSME. "We gave them our ideas and DSME provided the detailed engineering," he said.

Essentially Maersk along with DSME and HHI in two distinct collaborations has optimised the hull shape, opted for slow running engines, "a tanker engine effectively", optimised the propeller for the de-rated engine and added a waste heat recovery system to the new designs. "Altogether the new designs will realise

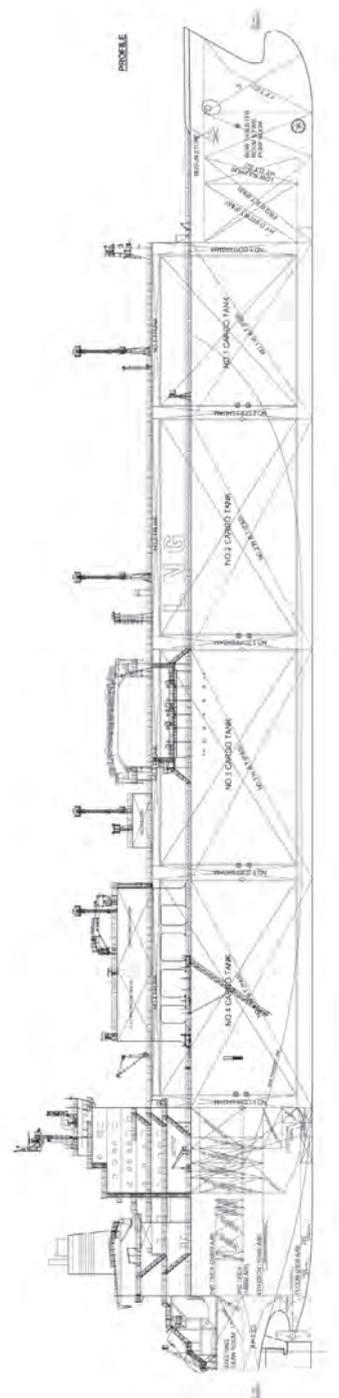
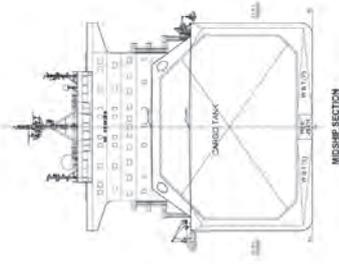
savings of 23%," though this is offset by the higher capital costs, in the order of 10%, said Mr Cerup-Simonsen, but even so the fuel savings mean the new designs "make sense".

Future developments could well centre around the use of liquefied natural gas (LNG) in the medium term, said Mr Cerup-Simonsen. "LNG can become a very important source of fuel for shipping in the medium term, I can see a major development in this area."

Even though Maersk has not ordered any LNG powered vessels to date, Mr Cerup-Simonsen says the company is "looking very carefully at this option", adding that "it will most likely happen in the environmental control areas (ECA) first. However, he said: "We must understand operational issues such as bunkering during loading first".

DSME currently has a design for a 13,500TEU LNG powered container ship, but this vessel is considered to be one for the future. However, South Korea's ability to innovate along with their yard's skills developed over decades of ship construction could mean that the industry, currently suffering from tough competition from China, will emerge from this recession in far better shape than many had originally anticipated. **NA**

*Methane Julia Louise*



# Hyundai expands HiMSEN range across a broad front

The success of Hyundai's HiMSEN engine over the last 10 years means that the company is continuing to develop the unit, to comply with modern requirements. David Tinsley reports.

**A**s a microcosm of Korean industrial endeavour, Hyundai's HiMSEN engine brand has gone from a standing start to a position of substantial market influence in less than a decade, and is building an ever-stronger business platform through continuous development of the product range.

While the gas engine family is being rapidly expanded, new vee-type diesels are to be launched in 2011, including a high-speed design, and the range is to be further augmented by the impending roll-out of common-rail and dual-fuel models. In addition, a number of the existing engine types have been upped in power in new versions compliant with International Maritime Organization (IMO) Tier II NOx(oxides of nitrogen) emission requirements.

Since the 2001 introduction of the 210mm-bore H21/32 and 250mm-bore H25/33 medium-speed engines, the larger type having been developed in cooperation with Rolls-Royce Bergen, the HiMSEN family has grown inexorably. Today's offering from HHI-EMD (Hyundai Heavy Industries' Engine & Machinery Division) encompasses five designs of diesel and five gas engine types, serving the power band up to 10,000kW. Current, multi-faceted development work will see the market release next year of a new high-speed, vee-form diesel, the H17/21V, and vee-type models of the H25/33, incorporating various improvements on the in-line series. These engines necessarily reflect impending IMO Tier II limits.

The H25/33V design will be available in 12- to 20-cylinder formats, giving 340kW per cylinder in 900 and 1000 rev/min versions. Catering to the power band from 4080 to 6800kW, projected



HiMSEN develops its engines to meet the latest regulations.

specific fuel oil consumption is 187g/kWh, on a par with that of the Tier II in-line series, but marginally higher than that of the Tier I H25/33.

The H17/21V will give added dimension to the HiMSEN offering. It has been developed for a maximum running speed of either 1500 or 1800rev/min, the highest in the company's diesel range. This compact power unit, embodying a bore of 170mm and stroke of 210mm, will be available in 12-, 16-, 18-, and 20-cylinder layout, with a maximum power concentration of 3,200kW. Whereas the H17/21G gas engine series, introduced this year, yields 145kW/cylinder at 1800rev/min, the H17/21V diesel will deliver 160kW/cylinder.

For marine auxiliary applications, power upratings up to around 10% have been secured in a number of engines adapted to meet Tier II emission criteria, due to be enforced for installations in newbuild vessels laid down from 1

January 2011 onwards.

Extra power yield has been achieved without modifications to engine components, although changes have been made as regards turbochargers. One important result of the higher ratings is that a customer who might previously have chosen a derated engine may now obtain the requisite power from an engine with one cylinder less, consequently saving both on outlay and through-life costs.

In the case of the 720 and 1000 rev/minute versions of the H25/33 in-line series, for instance, output per cylinder for the Tier II models will be 260kW and 330kW, respectively, up from 240kW and 300kW in the Tier I engines. As a consequence, the in-line H25/33 will cater for a power band to 2970kW compared with 2700kW hitherto.

Similarly, the Tier II H21/32 will have its power boosted from 160 to 175kW/cyl in its 720 and 750 rev/minute models, and from 200 to 220kW/

cylinder in engines designed to run at 900 or 1000rev/minute. Increases will also be obtained in H17/28 installations engineered for Tier II limits.

Tier II edicts have been achieved in the existing range through engine-internal measures, such as optimised combustion and control, and adoption of an enhanced Miller Cycle and attendant higher boost pressure. The latter has been achieved using ABB's new A100-series turbocharger, and has also entailed modifications to the charge air cooler arrangements.

The brand's market potential was considerably increased by the 2006 entry of the H32/40 medium-speed engine, which took HHI-EMD into the hotly competitive but broad business reaches covered by 320mm-bore machinery. The H32/40 series has provided shipowners and yards with a further option in a segment traditionally dominated by European and Japanese designs, and has given the HiMSEN brand a boost at home by helping HHI's own Ulsan yard and other Korean builders to cover the huge demand for deepsea vessel auxiliaries.

The H32/40 family has grown through the addition of vee-form models, extending the HiMSEN power band to 10,000kW in its 20-cylinder configuration, and has provided the basis for the development of the H35/40G series of gas engines. Prototype tests with an eight-cylinder in-line model of the H35/40G were completed at the company's techno centre gas cell in mid 2010. The design project has entailed the simultaneous preparation of vee-form versions up to 9600kW as well as the in-line engines up to 4320kW.

The H35/40G is aimed at applications and sectors where gas-fuelled prime movers will increasingly be favoured on environmental and operational grounds. Lean-burn technology is encapsulated in the design, which is attributed with a thermal efficiency of 47.2%.

The new gas engine produces 480kW per cylinder and has a brake mean effective pressure of 20.8 bar at 720 rev/min running speed. It has a reduced component count, to save engine weight and fuel consumption, and is claimed to emit 20% less CO<sub>2</sub> than diesel engines of

comparable power, and to reduce NOx by 97%, reaching a very low emission level of 50ppm.

“One important result of the higher ratings is that a customer who might previously have chosen a derated engine may now obtain the requisite power from an engine with one cylinder less”

While the piston stroke of 400mm is the same as that of the H32/40 design, the latter's 320mm bore has been widened to 350mm in the H35/40G gas engine.

HHI-EMD already has several years' experience in the market for gas engines, having augmented its range in 2007 with a wholly gas-fuelled engine, the H17/24G. Derived from the H17/28 medium-speed diesel, the H17/24G was developed by HHI in conjunction with the Austria-based engine technology specialist AVL. Many components are common to the H17/24G and H17/28, which share a 170mm-bore size.

The H17/24G provides a compact, in-line unit to suit power applications between 550 and 880kW, and the design has been employed in the development of a slightly more powerful type, the H17/21G. This was released in vee-form as well as in-line configurations to the market during 2010. To achieve a higher rated power of 145kW/cylinder relative to the 110kW/cyl of the H17/24G, crankshaft speed has been upped to 1800rev/minute in the H17/21G from the 1200rev/minute of the earlier engine, taking the output band coverage to 2900kW.

Hyundai's gas engine offering is also to be expanded by means of a derivative of the H25/33V vee-form diesel, whereby

the 250mm bore will be increased to 260mm, as reflected in the nascent type's H26/33GV designation. To be made available at the various running speeds for which the H25/33 series can be obtained, the H26/33GV will have lower ratings, to a maximum of 270kW at 900 and 1000rev/min speeds, providing solutions to unit power needs up to 5400kW.

HHI-EMD's development of a dual-fuel(DF) models of existing HiMSEN diesel machinery has been driven by the prospect of tougher environmental rules, including the designation of emission control areas(ECAs) and also port-specific requirements as to NOx and smoke. In the latter respect, having part at least of the auxiliary plant based on DF engines could be a solution for deepsea vessels when berthed in such locations. The first HiMSEN DF type is scheduled for release during the early stages of 2011.

The raft of new technological initiatives expected to reach maturity in the short-term include the HiMECS intelligent engine control system and hybrid common-rail(CR) engines incorporating both electronic and mechanical control of fuel injection. The hybrid approach is intended to maximise the merits of CR systems while minimising certain demerits, which HHI-EMD cites as price, onboard maintenance scope and other factors.

While the range has been readied for the Tier II emissions regime, measures are also being taken by the company's technicians to prepare for IMO's Tier III NOx criteria and stringent local controls. This sphere of the company's R&D endeavours includes work on selective catalytic reduction(SCR) and charge air moisturiser(ChAM) systems. In addition, an exhaust gas recirculation(EGR) solution is under development for application to HiMSEN engines.

A common thread in the HiMSEN design activities, encompassing both engines and related equipment and systems, is the bid to blend technology with a level of practicality that acknowledges customers' actual requirements as to self-maintainability, relative design simplicity, and costs of acquisition and maintenance. **NA**



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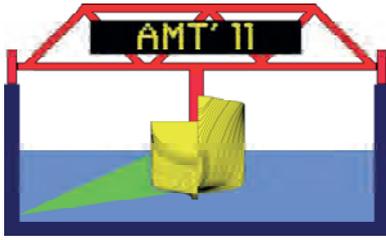
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# 1st Announcement and Call for Papers



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In combination with the inauguration of Newcastle University's new and improved Marine Testing Facilities  
4-6 April 2011, Newcastle upon Tyne, U.K.

Organised by, Newcastle University & FP6 Hydro-Testing Alliance Network of Excellence ([www.hta-noe.eu](http://www.hta-noe.eu))

This conference is of benefit to professionals, academics and students interested in advanced model and full-scale testing methodologies and measurements in the marine environment. The conference topics are: PIV operation in hydrodynamic experimental facilities; Flow data analysis and visualization; 3-D wave field measurements; POD/Dynamic forces; Wireless data transmission; High speed video; Intelligent materials and production methods; Wetted surface; Free running model technologies; Noise measurements; and other advanced measurement techniques and benchmarking and validation.

The conference will also inaugurate the recent major upgrade to Newcastle University's Experimental testing facilities and launching of the new Research Vessel in compliance with the University's increased focus on "Environmental Sustainability". Delegates will be able to visit and interact with the researchers from the Hydro Testing Alliance and School of Marine Science and Technology as well as enjoying several demonstrations with the facilities.

Abstracts of a maximum length of 300 words are to be submitted by December 2010.

Conference website: <http://conferences.ncl.ac.uk/amt11> E-mail: [amt11@ncl.ac.uk](mailto:amt11@ncl.ac.uk)



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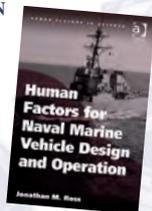
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By Jonathan M Ross MRINA Ref: HFNM

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By Lisa C. Hix Ref: IDMYD

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By V. Dubrovsky FRINA, A. Lyakhovitsky Ref: MHS

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By Fred Walker FRINA Ref: SAS

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#### 2011 SUBSCRIPTION

Period	12 Months	24 Months	36 Months	Ref: J6
Inland:	£150	£260	£375	
Europe:	£156	£272	£390	
Overseas:	£168	£292	£420	

#### 2011 SUBSCRIPTION

Period	12 Months	24 Months	36 Months	Ref: J7
Inland:	£114	£200	£285	
Europe:	£120	£208	£300	
Overseas:	£138	£240	£345	

#### 2011 SUBSCRIPTION

Period	12 Months	24 Months	36 Months	Ref: J8
Inland:	£52	£92	£130	
Europe:	£58	£100	£145	
Overseas:	£64	£110	£160	



## October 21-22, 2010

**Systems Engineering in Ship & Offshore Design**, international Conference, Bath, UK.  
**Contact** Conference Department, RINA, 10 Upper Belgrave Street, London, SW1X 8BQ, UK.  
**Tel** +44 20 7235 4622  
**Fax** +44 20 7245 6959  
**E-mail** conference@rina.org.uk

## October 26-28, 2010

**Middle East Maritime Dubai**, international conference, Dubai.  
**Contact** Nicky Hale, Project Manager, Seatrade Communications, 42 North Station Road, Colchester, CO1 1RB, UK.  
**Tel**+44 1206 545121  
**Fax** +44 1206 545190  
**E-mail** nhale@seatrade-global.com  
**www**.seatrade-middleeast.com

## October 25-29, 2010

**Euronaval 2010**, international conference, Paris, France.  
**Contact** Sogena, 19/21 rue du colonel Pierre Avia, 75015 Paris, France.  
**Tel** +33 1 47 36 80 80  
**Fax** +33 1 40 93 57 72  
**E-mail** info@euronaval.fr  
**www**.euronaval.fr

## November 9-11, 2010

**MAST 2010**, international conference, Rome, Italy.  
**Contact** Evolution International Events Ltd, 58 Maidstone Road, Pembury, Kent, TN2 4DE, UK.  
**Tel** +44 1892 824418  
**Fax** +44 1892 824455  
**E-mail** admin@mastconfex.com

## November 11-12, 2010

**ICSOT 2010: Developments in ship design and construction**, international conference, Surabaya, Indonesia.  
**Contact** Conference Department, RINA, 10 Upper Belgrave Street, London, SW1X 8BQ, UK.  
**Tel** +44 20 7235 4622  
**Fax** +44 20 7245 6959  
**E-mail** conference@rina.org.uk

## November 16, 2010

**METS Marine Equipment Trade Show**, international conference, Amsterdam, The Netherlands.  
**Contact** Amsterdam RAI, Metstrade.com, P.O. Box 77777, NL-1070 MS Amsterdam,

The Netherlands.  
**Tel** +31 20 549 12 12  
**Fax** +31 20 549 18 89  
**E-mail** info@metstrade.com  
**www**.metstrade.com

## November 24-25, 2010

**William Froude Anniversary**, international conference, Portsmouth, UK.  
**Contact** Conference Department, RINA, 10 Upper Belgrave Street, London, SW1X 8BQ, UK.  
**Tel** +44 20 7235 4622  
**Fax** +44 20 7245 6959  
**E-mail** conference@rina.org.uk

## November 30, 2010

**RINA President's Invitation Lecture, Dinner**, London, UK.  
**Contact** Conference Department, RINA, 10 Upper Belgrave Street, London, SW1X 8BQ, UK.  
**Tel**+44 20 7235 4622  
**Fax** +44 20 7245 6959  
**E-mail** conference@rina.org.uk

## November/December 30-2, 2010

**Seatrade Med**, international conference, Cannes, France.  
**Contact** Seatrade Communications Ltd, Seatrade House, 42 North Station Road, Colchester, CO1 1RB, UK.  
**Tel** +44 1206 545121  
**Fax** +44 1206 545190

## December 1-3, 2010

**International Workboat**, international conference, New Orleans, USA.  
**Contact** International WorkBoat Show, 121 Free Street, PO Box 7437, Portland, ME 04112, USA  
**Tel** +1 207 842 5508  
**Fax** +1 207 842 5509

## January 26-27, 2011

**The Damaged Ship**, international conference, London, UK.  
**Contact** Conference Department, RINA, 10 Upper Belgrave Street, London, SW1X 8BQ, UK.  
**Tel**+44 20 7235 4622  
**Fax** +44 20 7245 6959  
**E-mail** conference@rina.org.uk

## February 23-24, 2011

**Design & Operation of Passenger Ships**, international conference, London, UK.  
**Contact** Conference Department, RINA, 10

Upper Belgrave Street, London, SW1X 8BQ, UK.  
**Tel** +44 20 7235 4622  
**Fax** +44 20 7245 6959  
**E-mail** conference@rina.org.uk

## March 1-3, 2011

**Asian Work Boat 2011**, international conference, Singapore.  
**Contact** Baird Events, 135 Sturt Street, Southbank, Melbourne 3006 Australia.  
**Tel** +61 3 9645 0411  
**Fax** +61 3 9645 0475  
**E-mail** marinfo@baird.com.au  
**www**.bairdmaritime.com

## March 2-3, 2011

**Innovation in High Speed Marine Vessels**, international conference, Fremantle, Australia.  
**Contact** Conference Department, RINA, 10 Upper Belgrave Street, London, SW1X 8BQ, UK.  
**Tel** +44 20 7235 4622  
**Fax** +44 20 7245 6959  
**E-mail** conference@rina.org.uk

## March 22-23, 2011

**Developments in Marine CFD**, international conference, London, UK.  
**Contact** Conference Department, RINA, 10 Upper Belgrave Street, London, SW1X 8BQ, UK.  
**Tel** +44 20 7235 4622  
**Fax** +44 20 7245 6959  
**E-mail** conference@rina.org.uk

## April, 2011

**Design & Operation of Passenger Ships**, international conference, London, UK.  
**Contact** Conference Department, RINA, 10 Upper Belgrave Street, London, SW1X 8BQ, UK.  
**Tel**+44 20 7235 4622  
**Fax** +44 20 7245 6959  
**E-mail** conference@rina.org.uk

## May 18-20, 2011

**Ship Manoeuvring in Shallow and Confined Waters**, international conference, Trondheim, Norway.  
**Contact** Conference Department, RINA, 10 Upper Belgrave Street, London, SW1X 8BQ, UK.  
**Tel**+44 20 7235 4622  
**Fax** +44 20 7245 6959  
**E-mail** conference@rina.org.uk

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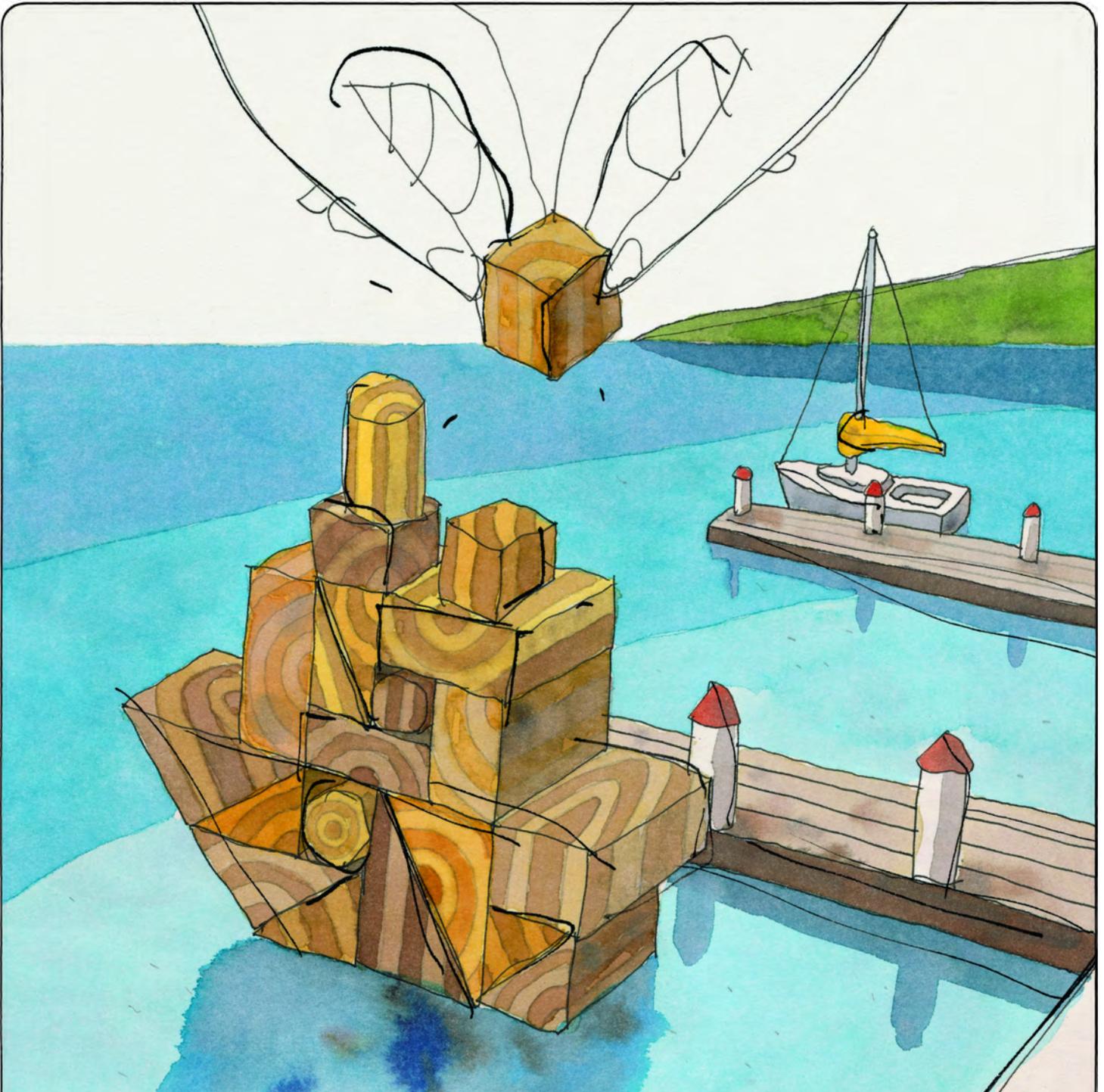
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