GL Group

nonstop

The Magazine for Customers and Business Partners

ISSUE 1 · 2010

Maritime Solutions

Efficiency Gains Momentum

Delivering more miles for your fleet

More miles through efficient ship management

- GL ShipManager

More miles between repairs through 3-D hull modelling

- GL HullManager

More miles per fuel-tonne through optimised trim

- ECO-Assistant

www.gl-group.com/more-miles

GL Group
Head Office · Brooktorkai 18 · 20457 Hamburg · Phone: +49 40 36149-0 · headoffice@gl-group.com

Dear Readers,

Dr Hermann J. Klein

While it might be too early to call the shipping crisis a matter of the past, there are a few conclusions the industry can draw right now. As the past 18 months have shown, next-generation ships will have to be much more efficient to enable the shipping business to respond swiftly and flexibly to changing tides in the marketplace.

The worldwide fleet in service will continue to grow over the coming years. At the same time the shipping industry will be expected to lower its greenhouse gas emissions. A 20-per-cent reduction based on 2005 levels by the year 2020 is currently being discussed.

True, the maritime sector offers by far the most environment-friendly means of transport. But to satisfy the expectations of the public, its commitment to sustainability will have to be underpinned by even more decisive action. A vigorous search for alternative sources of propulsion energy is essential, and it does produce results: Liquefied Natural Gas (LNG) is being investigated as a possible replacement option for heavy fuel oil.

With the number of newbuilding orders at a low level due to the financial crisis, the maritime industry is seizing the opportunity to study new approaches to design and operational parameters. According to GL research, average service speeds play a much more prominent role in advanced ship design than anybody had ever imagined.

The conclusion is obvious: Hulls and machinery should be designed not only for a maximum speed but for an assumed lifetime average service speed, as well. Our calculations have shown that optimizing ships on this assumption can achieve double-digit savings.

As for ships in service, there are other, proven strategies of cutting operating costs. The most straight-forward one is generally referred to as “slow steaming”, or cruising at reduced speeds. Furthermore, GL offers a whole range of additional concepts for lowering fuel consumption and emissions while increasing operating efficiency.

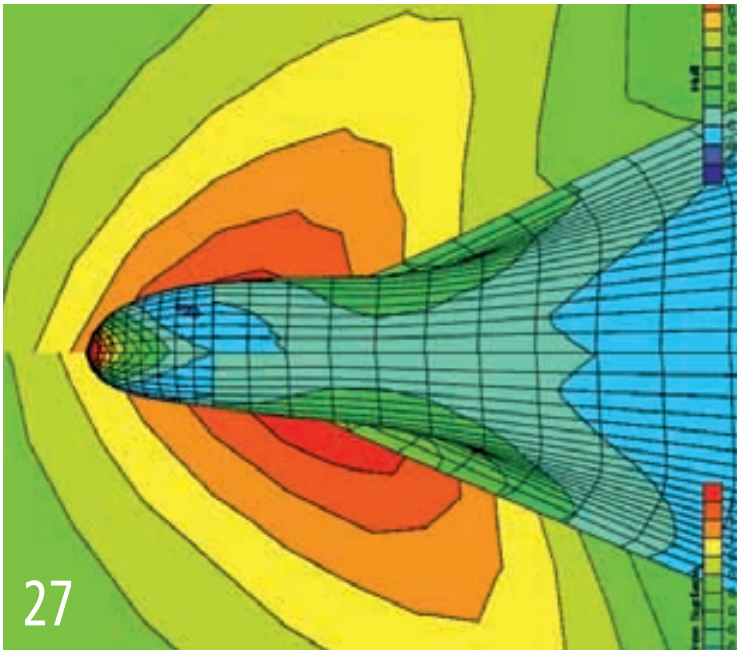
All these are good enough reasons to dedicate the present issue of *nonstop* to the topics of energy efficiency, new ship operating software, and innovative ship design. In addition, we are taking a closer look at GL Noble Denton and GL Garrad Hassan, the new brands for GL’s Oil&Gas and Renewables business segments.

As you can see, many exciting things are happening, both here at GL and in the industries we serve. While the challenges haven’t gone away, we see plenty of reason to look into the future with renewed optimism.

Yours sincerely,

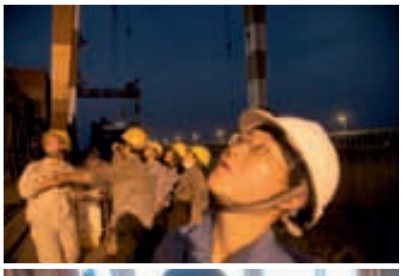
Dr Hermann J. Klein
Member of the Executive Board
Germanischer Lloyd

contents



Cover Photo: Joachim Affeldt

Photo: Joachim Ladefoged/Vestas



Close Surveillance

More than 3,000 small islands, nearly 6,500 km of shoreline: no region in China has more islands than Zhejiang Province, located near and in the coastal waters of the East China Sea on the south-eastern fringes of the country. Wei Jiangyan is Germanischer Lloyd's Surveyor for this region, in charge of attending to local ship newbuilding projects. Among her responsibilities are monitoring hull and machinery construction and equipment installation at shipyards as well as performing safety-related tests on board. She ensures compliance with all class-relevant and statutory requirements and adherence to high quality and efficiency standards in the construction process.

news

SHIP EFFICIENCY

GL Forum in Madrid

PRESENTATION. Karsten Fach, Vice President of GL's Engineering Services and Managing Director FutureShip.

Technical and software solutions to increase ship efficiency" was the topic of the first GL Forum in Madrid. 50 participants from shipyards, shipping companies, the Spanish navy, the Spanish authorities and engineering consulting companies attended. Karsten Fach, Vice President of GL's Engineering Services and Managing Director FutureShip, answered the questions why efficient ships are needed and how to cope with technical challenges for ships in service. In addition, he presented software solutions for shipowners and shipyards.

Range of services. Energy saving potential for newbuildings, consulting services for the maritime industry and how fuel consumption for ships in service can be reduced was explained by Volker Hoeppner, Managing Director of FutureShip. FutureShip offers a range of services addressing both, ships in service and planned newbuildings. Furthermore, the topic was introduced by presentations of the Spanish Shipyard Association UNINAVE which talked about the "Future of European shipbuilding" followed by a speech about "Challenges raised by current and foreseen environmental rules for Spanish shipowners" by the Spanish Shipowner Association ANAVE.

OFFSHORE. Comprehensive international regulations are needed.

Photo: Nordcapital/Sabine Vielmo

OSV

More Specialized, More Sophisticated

The technical evolution of Offshore Service Vessels (OSV) has prompted GL to publish new rules for ships designed for offshore support and supply, offshore towing, well stimulation, and other specialized offshore services.

Further notations. In January 2010, the new Rules for Hull Structures of Offshore Service Vessels came into force. This ship type is assigned the class notation OFFSHORE SERVICE VESSEL, complemented by optional further notations, such as HNLS for ships carrying hazardous and noxious liquid substances, AH for anchor handling tug/supply ships, WSV for well stimulation vessels, and WTIS for wind turbine installation/construction support ships.

Complex requirements. The design and operation of offshore vessels differ significantly from those of general cargo ships. Comprehensive international regulations are needed to account for the unique practical requirements that OSVs must meet.

The new GL rules reflect the state of the art in Offshore Service Vessel engineering. Compared to their predecessors, these ships are larger, more specialized, and technically more sophisticated to meet the demands of complex deepwater field development. The latest review of the OSV rules is intended to support the design process to build safer and more robust offshore service vessels while minimizing operational risks.

The new Rules for Offshore Service Vessels, I-6-1, Hull Structures, are posted on the GL website at **www.gl-group.com**.

EFFICIENCY. The new scheme offers the chance to extend the dry-docking period from five to seven and a half years.

Photo: Fotolia

DRY DOCKING

Flexible Scheduling Saves Docking Costs

A new extended dry-docking (EDD) option for container vessels, general cargo ships and multi-purpose dry cargo vessels has been introduced by GL to acknowledge longer lasting coatings.

More flexibility. GL offers owners and operators the chance to extend the dry-docking period from five to seven and a half years. Owners who previously would have had to look for an available dry-docking facility every five years can now have their ship inspected at dock-side.

This option provides maximum scheduling flexibility while maintaining the highest standards of quality and safety. The new scheme reflects advancements in coating technology, such as self-polishing coatings, which have a longer life and reduce organism growth on hulls. While the extended dry docking offers tremendous flexibility and savings in positioning and docking costs, it also reduces the off-hire times and allows owners to bring additional scheduling options to the table during charter party negotiations.

Great benefit. "We are convinced that owners who implement the current technological options, and who maintain a stringent planned maintenance programme, can take advantage without undermining quality or safety," says Matthias Galle, GL's Vice President Classification and Technical Matters.

For further information: Matthias Galle, Vice President, Classification and Technical Matters, Phone: +49 40 36149-134, E-Mail: matthias.galle@gl-group.com

2008 IS CODE

Mandatory Criteria

The International Maritime Organization (IMO) has revised their Code on Intact Stability. The amended code released as Resolution MSC.267(85) under the synonym 2008 IS Code will take effect on 1 July 2010 in conjunction with respective amendments to the 1974 SOLAS Convention and 1988 Load Line Protocol. An early application clause of the 2008 IS Code was granted by the IMO inviting member states to take account of the Code on or after 5 December 2008.

General descriptions. The Code reflects mandatory criteria, but also considers recommendations for certain ship types and additional guidelines.

In addition to stability criteria, it contains general descriptions concerning dynamic stability phenomena in waves.

For further information:
Antje Fleischhauer, Head of Department Stability, Phone: +49 04 36149-635, E-Mail: antje.fleischhauer@gl-group.com;
Boris Altmayer, Stability, Phone: +49 04 36149-4854, E-Mail: boris.altmayer@gl-group.com

CERTIFICATION

Stolt Tankers Demonstrates Environmental Commitment

Volcanic ash with limited impact. What chaos in Europe's air space: Flights were cancelled and airports closed for days. This did not stop GL certifying Stolt Tankers to the environmental management standard ISO 14001.

Proved commitment. In Rotterdam Harald Seibicke, Vice President GL Area Office Benelux/Northwest Europe, handed the certificate over to Mark Martecchini, Stolt Nielsen's Managing Director Shipowning.

The certification proves that Stolt Tankers follows the principles of ISO 14001 and monitors environmental aspects of its business activities. Prior to ISO 14001, Stolt Tankers already received GL certification for ISM, ISPS and ISO 9001:2008.

Stolt Tankers & Terminals is one of the leading providers of transportation and storage of bulk liquid chemicals, edible oils, acids and other special chemicals, holding a prominent market position.

DOCUMENT. Handover in Rotterdam (f.l.t.r.): Patrick Russi, Bill Millar, Mark Martecchini (all Stolt Tankers), Harald Seibicke and Roland Brück (both GL).

COOPERATION

DLR and GL Join Forces to Apply Next Generation Technologies

A cooperation framework agreement has been signed by the German Aerospace Center (DLR) and Germanischer Lloyd (GL). Both companies agreed to develop and apply novel technologies in the aerospace and shipping industries. Focus areas of future joint projects are ship emissions, indoor navigation, advanced materials, wave and wind predictions via satellite, AIS-based service via satellite and GNSS/Galileo-based services.

New solution. "Many technologies developed for the aerospace sector can be adapted and simply transferred to the shipping sector," explains Dr Pierre C. Sames, Senior Vice President Strategic Research and Development, GL. Dr Wolfgang Mett, Head of Site Development Neustrelitz, DLR, confirms: "Entirely new solutions may be found by bringing experts from both industries together. We are fully aware that if we want to operate in the shipping industry we need a strong partner like GL."

GL and the DLR Institute of Communication and Navigation are both founding members of the "network for maritime applications" at the Research Port Rostock.

The issue ship emissions is jointly covered by GL and the DLR Institute of Atmospheric Physics in Oberpfaffenhofen, Germany.

About DLR

DLR (Deutsches Zentrum für Luft- und Raumfahrt) is Germany´s national research centre for aeronautics and space with approximately 6,500 employees. Its extensive research and development work in aeronautics, space, transportation and energy is integrated into national and international cooperative ventures. DLR's mission comprises the exploration of Planet Earth and the solar system, research into ways of protecting the environment, finding environmentally-compatible technologies, and means of promoting mobility, communication, and security. DLR's research portfolio ranges from basic research to innovative applications and products of tomorrow. In that way DLR contributes the scientific and technical know-how that it has gained to enhancing Germany's industrial and technological reputation.

SIGNING. Dr Wolfgang Mett, Head of Site Development Neustrelitz, DLR (l.), and Dr Pierre C. Sames, GL's Senior Vice President Strategic Research and Development (r.), sign the contract.

Photo: ESA/AOES Medialab

MLC ANALYSER

On-Board Inspection

The Thai based container shipping line Regional Container Lines (RCL) has nominated GL to carry out an MLC gap analysis. RCL owns and operates 41 container vessels from 500 TEUs to 2,600 TEU covering more than 70 destinations in Asia, Australasia and the Middle East.

Working conditions. The Gap Analysis is part of GL's MLC ANALYSER which is tailored to the needs of ship managers. This service is a shipboard inspection by specially trained ML Inspectors to determine the present status. The service is based on the MLC 2006 requirements introduced by the ILO and the present working and living conditions for seafarers onboard the subject vessel.

HANDSHAKE. Mr Mongkol, Capt. Sutep for RCL with Dr Grünitz and Mr Sutthi from GL after contract signing.

"RCL is a good example of a company that is preparing for the new regulations well in advance. This will safe them time and money once the regulation comes into force. They can thus avoid the predicted bottle neck in MLC, 2006 certification," says Dr Lars Grünitz, GL's Business Development Manager for ASEAN.

Photo: Ingrid Fiebak/Meyer Werft

BESST

Brussels Sponsors Maritime Research

The heads of the maritime research project "BESST" signed the contractual grant agreement with the European Commission. "BESST – Breakthrough in European Ship and Shipbuilding Technologies" is formed of Europe's leading shipbuilders, including STX Finland, STX France, Fincantieri, Meyer Werft, ThyssenKrupp Marine Systems and Damen Group. In addition, GL along with 20 research institutes and universities, four other classification societies and 31 industrial companies is part of the research network.

Initiated by the european economic interest group EUROYARDS, BESST aims to achieve a breakthrough in competitiveness, environmental friendliness and safety in EU-built ships with a focus on passenger ships, ferries and megayachts.

Less impact. The primary goal is to increase the competitiveness of ships built in Europe through decreased lifecycle costs, drastically reduced environmental impact and continually improved safety. The maritime research project will be completed in summer 2013.

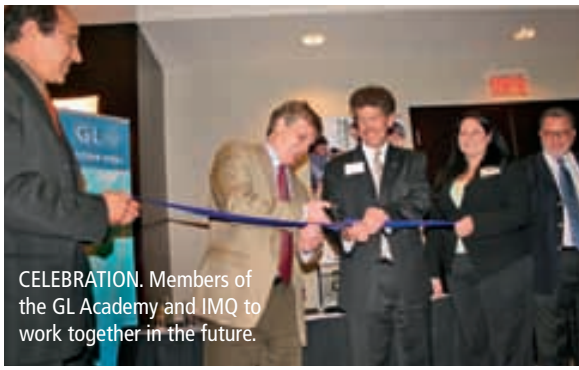
GL ACADEMY

Combining Forces for Education

A cooperation agreement between the Institut maritime du Québec (IMQ) and the GL Academy was signed promoting joint maritime training. It will mark the beginning of an extensive cooperation and exchanges between the two institutions, seeking to improve maritime safety, security and environmental protection through appropriate training developments and delivery. The first joint course "Implementation and Internal Auditing of an Environmental Management System in Shipping Companies" will start in June at the Institut maritime du Québec.

Excellent reputation. The IMQ is dedicated to training skilled, specialized professionals for the maritime, transport logistics and professional diving sectors. Due to numerous internships with shipping companies, students benefit from a solid theoretical education and excellent preparation for the concrete realities of working life well before receiving their diplomas. IMQ has a track record of highly qualified personnel, recruited from the four corners of the world. It is the largest maritime training centre in Canada and offers training at a high technical level in exclusive special fields such as Naval Architecture Technology, Navigation and Marine Engineering.

The cooperation with the GL Academy will expand the spectrum of courses and introduce new formats for exchanging experiences and knowledge by jointly developing new training topics relevant to the local market.



CELEBRATION. Members of the GL Academy and IMQ to work together in the future.

Proper Trim, Fitter Ship

Energy-efficient ships pay off twice over: by cutting fuel consumption, they also prevent unnecessary CO_2 emissions. The ECO-Assistant of FutureShip gives the ship's command valuable support in optimizing ship operations

PRACTICAL. On board the "Berlin Express", Till F. Braun enters the key parameters: speed, water depth and draught. "There is only one point at which the ship is truly energy-efficient," the FutureShip expert emphasizes.

Photos: Jörn Iken

For centuries, it has been a fact widely known, not only in commercial shipping: the trim is a significant variable which affects the efficiency of the entire ship as a system. The aspect of the ship as it moves through the water has a direct influence on its fuel consumption. The quantity of fuel saved – or wasted by poor trim – can certainly reach proportions of economic interest, explains Till F. Braun.

Standing on the bridge of the "Berlin Express", he bends over his notebook PC. "There are always points you can fine-tune without actually having to modify the ship," says the 49-year-old consultant and marine engineer. In working for FutureShip, a member of the GL Group, Till Braun was instrumental in the development of the ECO-Assistant, and is now installing the software solution on merchant vessels like the "Berlin Express", a 7,500 TEU carrier. It is not necessary to wait for a whole new generation of ships to steam with the optimum use of fuel.

"With the ECO-Assistant, our aim was to find a simple and practicable solution that could also be implemented quickly and easily in an existing fleet," says Braun. "A ship can only be operated in an energy-efficient way if it has the proper trim."

The Bridge Remains the Master

This has always been the case. Besides the speed, efficient trim depends on the draught and the depth of the water flowing under the keel. It is only at water depths greater than about 150 metres that the depth no longer plays a significant role for efficient propulsion. However, the conventional procedure applied thus far places great demands on the experience of the ship's officers. "Normally, the bridge officers observe how the ship is lying in the water," Braun explains. "Then the bridge adjusts the trim so that the vessel presents as little resistance as possible to the forward motion." By its very nature, this trimming method is time-consuming, frequently inaccurate if the conditions are unfavourable, and also dependent on the subjective skills of the ship's command.

Which is not to say that the new ECO-Assistant aims to dispense with the valuable experience of the bridge crew. "If this were the case, we would have called the software ECO-Master," Braun says with a grin. On the contrary, the ECO-Assistant calculates the optimum static trim under the current operational conditions. "You can view it as →

CONTAINERS. The draught of the ship (shown here: the cargo of the "Berlin Express") is a primary factor in the calculation of efficient operation.

→ a well-founded suggestion," says Braun. As always, the final decision is up to the ship's master.

Under the hood, the ECO-Assistant has a lot of computing power. The package is not an off-the-shelf product. The main body of work, which can take several weeks, involves an analysis of the hull and the digital modelling of the hull shape. This forms the foundation for the motion simulations with the aid of "computational fluid dynamics" (CFD) tools – extremely complex and time-consuming calculations which can keep even a powerful computer busy for a long time. The ECO-Assistant condenses these complex operations down to an convenient user interface.

The software therefore only yields useful results if it is individually tailored to a particular ship. "Over 20,000 coordinates and parameters are used in describing the hull shape and capturing the various operating states," is how Till Braun portrays the immense effort involved. The number of variables is so high because the entire speed range of relevance, for example from 12 to 26 knots, has to be registered in the smallest of speed gradations.

Rapid Amortization

Back to the bridge of the "Berlin Express". It is only one of several vessels belonging to the shipping company Hapag-Lloyd that have recently been fitted with the brand-new ECO-Assistant software. The user interface of the Assistant is clear, intuitive and focuses on the main points: the added or decreased quantity of fuel needed for the various trims of the ship. Even the smallest changes can lead to surprising results.

Till F. Braun counts off the primary constraints: speed, water depth and draught. "There is only one point at which the ship is truly energy-efficient," the expert underlines. This point – that is, the optimum trim of the "Berlin Express" for precisely these boundary conditions – is calculated after only a few seconds. Just what consequences even

BACKGROUND

FutureShip Sets a Bold Course

FutureShip is a new member of the GL Group. The company offers a large portfolio of advisory services for the shipping and maritime industries, including and expanding on the engineering services already familiar to the GL clientele. "Nothing will be lost by the restructuring," stresses Volker Höppner, the Managing Director of FutureShip. "All areas of expertise will be retained – and even extended." The consulting portfolio is organized into five key areas:

- **Fleet Development** is concerned with current and future market scenarios and investigates how well the fleet is prepared to meet these demands. The consulting vista includes the shipyards: what kind of ships are needed and when?
- **Ship Design** produces conceptual studies, conducts efficiency and risk analyses for the design, investigates non-class-relevant safety requirements, and offers independent third-party support for newbuilding projects.
- **Ship Operations** develops maintenance concepts and analyzes the operation of the vessel with regard to its energy efficiency. One of the main tasks is trouble-shooting, for example regarding problems with noise abatement and vibration reduction.
- **Environmental Issues** considers the international regulations for environmental protection and their implementation in ship design. This area conducts CO_2 studies and addresses all issues related to recycling.

BRIDGE. The ECO-Assistant supports the ship's master – who then takes the decision.

Photos: Jörn Iken

a trim that is only "slightly off" will have can clearly be shown by the ECO-Assistant. Braun simulates a poor trim and lets the aft body of the ship squat only a bit deeper – a change that is hardly visible to the naked eye over a ship length of 350 metres. The astounding result: the ECO-Assistant indicates an increased consumption of three tonnes of fuel per day. "That is equivalent to the energy used by a single-family home in a whole year," Braun points out, "and so this tiny inaccuracy in the trim signifies an added cost of up to 30,000 dollars for the average voyage to Asia."

As a result, the Assistant pays for itself after only a few weeks of operation. With an average of 250 days at sea, fuel savings of several hundred thousand dollars per year are possible for a containership of this size.

Cutting Fuel and CO_2 Costs

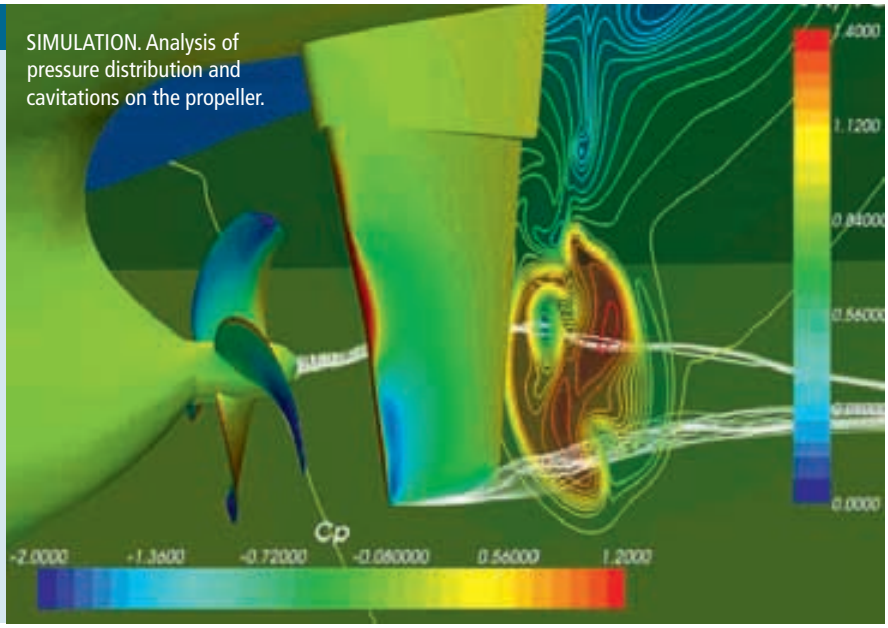
Good trim leads not only to immediate benefits in terms of reduced costs. Lower fuel consumption also means less CO_2 emitted. As a climate-killer, carbon dioxide took a backstage position to sulphur dioxide and the nitrogen oxides in the discussions about ship exhaust gases. Till Braun is not the only one to believe that these times are past.

The CO_2 emissions of ships have come into the focus of attention – in the medium term, the corresponding regulations, coupled with a CO_2 tax or the introduction of emission permits, must be expected worldwide. What is more, the customers are posing stricter requirements on the eco-balance of the shipping companies with whom they place their orders. Energy-efficient ships will then enjoy a clear competitive advantage. "Optimized trim will form an important building block in the CO_2 prevention strategies," asserts Braun. ■ JI

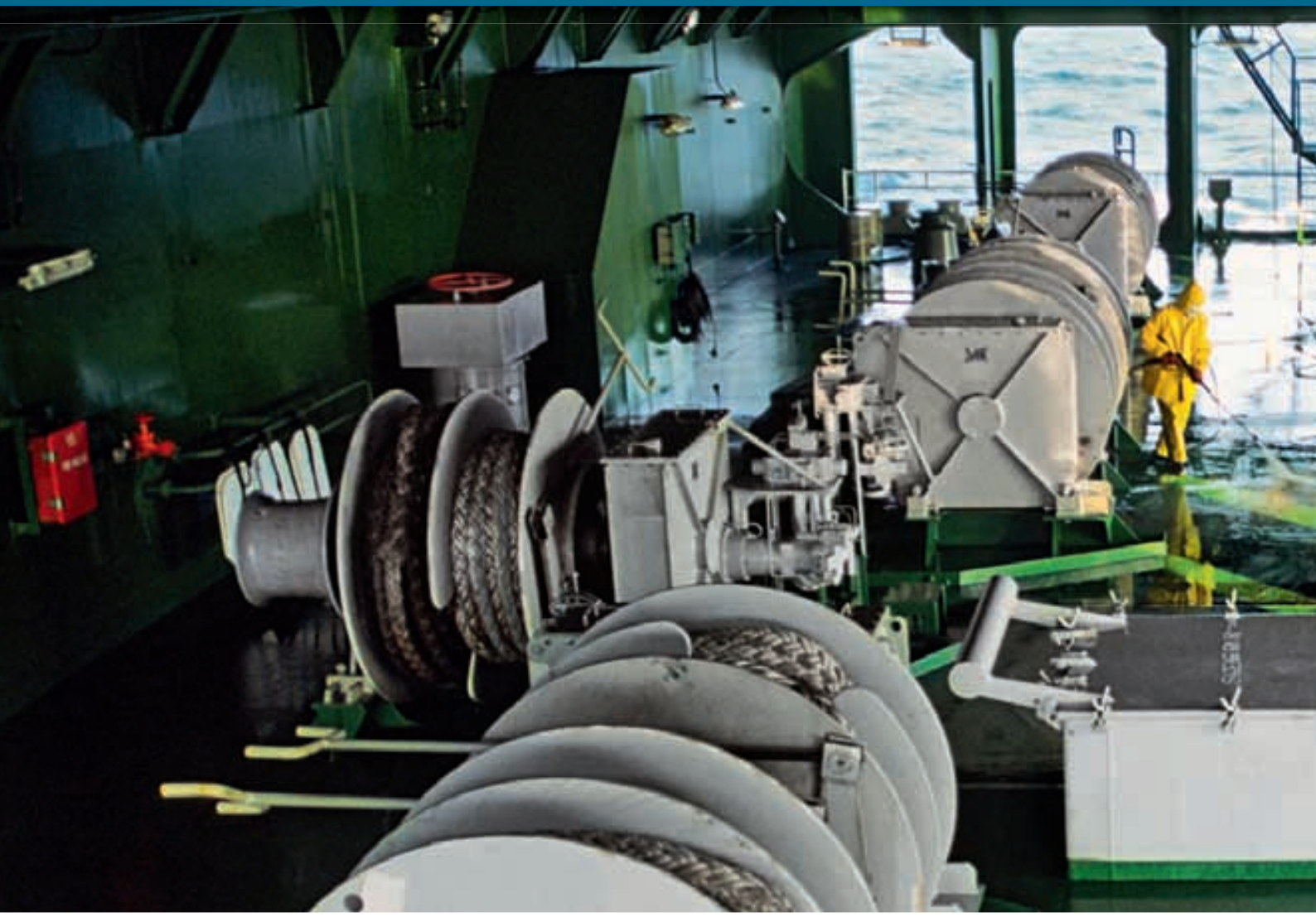
For further information:
Till F. Braun, FutureShip,
Phone: +49 40 36149-337, E-Mail: till.braun@futureship.de

■ **Management Systems** identifies which international standards must be met, and also assists with the desired certifications, internal audits and documentation management systems.

"In these times of heightened competition, the motto more than ever before is survival of the fittest," says Höppner. "Enterprises have to ask themselves: have we taken all the steps needed to ensure that our company belongs to the survivors in the long term? We at FutureShip are able to give plenty of answers."



SIMULATION. Analysis of pressure distribution and cavitations on the propeller.



Seafarer's Bill of Rights

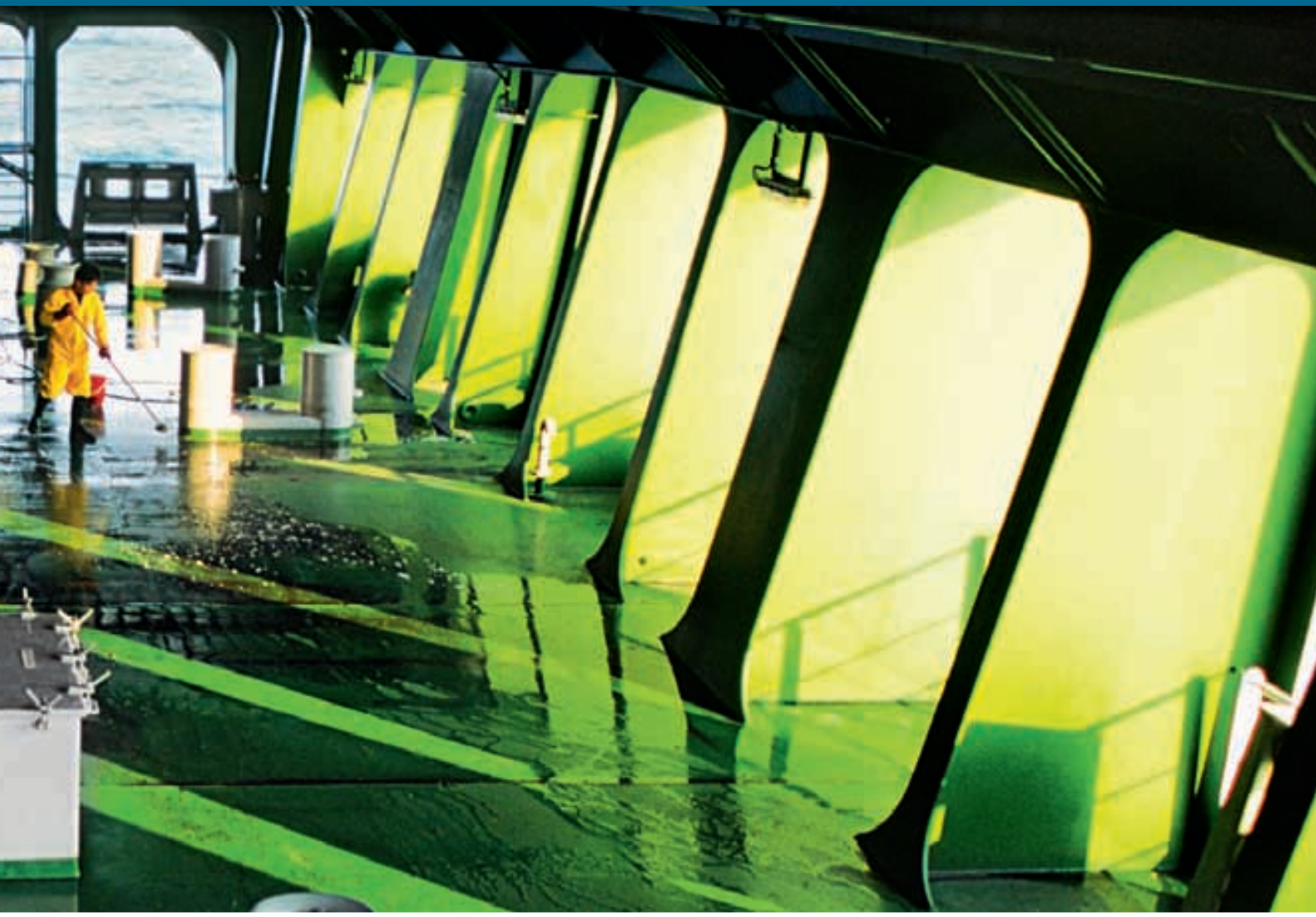
The Maritime Labour Convention, 2006 was developed to establish minimum requirements for working conditions on board a 21st-century ship. Drawn up by the ILO through the tripartite efforts of shipowners', governments' and seafarers' representatives, it defines a uniform standard for the employment of seafarers

Since 1919, the International Labour Organization (ILO), one of the oldest inter-governmental organizations and today a specialized agency of the United Nations, has been promoting social justice. Improving the working conditions of seafarers has long been on its agenda. Over the years, a complex body of conventions and recommendations was developed, some of which date back to the days of sailing ships, having long been rendered obsolete by the passage of time and the evolution of technology.

By the end of the past century, it became evident that the shipping industry needed a more effective system to eliminate substandard conditions on ships. As a result the ILO updated and consolidated its existing instruments, merging them into one structured version. In 2006 the ILO adopted the comprehensive new Maritime Labour Convention, 2006 (MLC, 2006). Replacing more than 65 international labour standards related to seafarers that were adopted over the last 80 years, the MLC, 2006 provides a comprehensive, harmonized framework consisting of mandatory requirements and voluntary guidelines pertaining to the working and living conditions of seafarers. At the same time, the convention helps to create fair competitive conditions for shipowners while giving individual countries a certain flexibility in implementing the guidelines.

Globally Harmonized

Forming the fourth pillar of the international framework of legal and quality standards in shipping besides SOLAS, MARPOL and the STCW, MLC, 2006 is expected to eliminate substandard conditions for crews in the shipping business once and for all. For the first time in the history of the ILO, regulations protecting the rights and well-being of seamen are truly enforceable by Port States and Flag States. It is the



PURPOSE. The Maritime Labour Convention, 2006 intends to safeguard the right of every seafarer to decent working conditions.

responsibility of the ratifying Member States to ensure global implementation and enforcement.

Compliance and Enforcement

Any ship over 500-GT trading internationally will be obliged to carry on board a Maritime Labour Certificate and a Declaration of Maritime Labour Compliance documenting how the shipowner has implemented the national regulations based on MLC, 2006. Although it is likely that most Flag States will delegate inspection and certification to Recognized Organizations (ROs), the ultimate responsibility remains with the Flag State. The MLC certification process will be similar to ISM and ISPS for ships. Each certificate will be valid for a five-year period and involve a series of inspections.

All Vessels Big and Small

The MLC, 2006 will enter into force twelve months after its ratification by at least 30 ILO member countries that jointly account for a total share of at least 33 per cent of the world's gross tonnage. By April 2010, the Bahamas, Liberia, Panama, Norway, the Marshall Islands, Spain, Croatia, Bosnia and Herzegovina and Bulgaria had ratified the convention, representing more than 45 per cent of the worldwide gross tonnage. This means that one of the criteria has been fulfilled. It is expected that all member states of the European Union will submit their ratifications before the end of 2010, thereby satisfying the second requirement. The MLC, 2006 is expected to become effective at the end of 2011, requiring some 55,000 seagoing vessels of 500 GT and above – excluding traditional, navy and fishing vessels – to carry on board a Maritime Labour Certifi- →

ILO – INTERNATIONAL LABOUR ORGANIZATION

The ILO was founded in 1919 and became the first specialized agency of the UN in 1946. Its main aims are to promote rights at work, enhance social protection and strengthen dialogue in handling work-related issues. Working with its 184 Member States, the ILO seeks to ensure that labour standards are respected in practice as well as principle. The ILO is the only "tripartite" UN agency in that it brings together representatives of governments, employers and workers to jointly shape policies and programmes.

Photo: ILO/J.Maillard

SEAMEN. Work on board is often tough. Now there is a legal basis for enforcing the social rights of sailors.

Photo: ILO/J.Maillard

→ cate and a Declaration of Maritime Labour Compliance. Since the rules of MLC, 2006 apply to all modern commercial ships, those below the 500 GT limit will likewise be subject to Flag and Port State inspections. The "no more favourable treatment clause" of the convention makes all ships accountable regardless of origin. In other words, ships will be subject to inspection in any country that has ratified the Convention, and non-compliance with the minimum standards can result in detention.

A seafarer is defined as any person who is employed, engaged or works in any capacity on board a ship that is covered by the Convention. It is estimated that there are 1.2 million seafarers worldwide.

Guidance and Assistance

Olaf Quas, Head of Department Global Practice ISM/ISPS/MLC, 2006 with Germanischer Lloyd, emphasizes the importance of ensuring compliance with the requirements of MLC, 2006 well in advance: "We encourage shipowners to begin assessing their compliance with the MLC, 2006 as soon as possible." To help shipowners and ship managers be prepared for the first round of inspections and avoid the typical inspection and certification bottleneck during the first effective months of the Convention in 2011, Germanischer Lloyd offers a comprehensive ILO certification package. GL's self-assessment tool and on-board gap analysis assist shipowners in identifying necessary improvements and recommended modifications to comply with MLC, 2006.

As soon as a Flag State has completed Part I of the Declaration of Maritime Labour Compliance and authorized Germanischer Lloyd to conduct inspections and certification to MLC, 2006 on its behalf, Germanischer Lloyd can provide its pre-certification service to ensure certification readiness before the official effective date of the Convention. GL's MLC PRE CERT offering, a pre-emptive voluntary statement of compliance, will guarantee a smooth transition to the Maritime Labour Certificate once it becomes mandatory.

Getting Informed

To help all parties involved in the compliance process, GL Academy offers seminars and workshops for shipowners, ship managers and yards. In addition, GL in-house presentations can deliver concise information to companies about the upcoming Convention and its potential impact on internal procedures. Participants are welcome to discuss the next steps with GL's MLC experts.

Being Ready

Many employers will find themselves already in compliance with a substantial part of MLC, 2006. The requirements related to the construction and outfitting of new ships will apply to all vessels built after the effective date of the Convention. Ships in operation must continue to comply with the requirements of ILO 92/133 to the same extent as before. In all cases it is imperative to ensure compliance with the national requirements implementing the Convention. Early assessment of existing gaps will allow sufficient time to find and apply practical solutions that optimize performance well in advance of many competitors.

It will be a challenge for the shipping community to obtain certification for the large number of affected vessels within a 12-month period. Germanischer Lloyd's global network of expert Maritime Labour Inspectors can provide everything that is needed to ensure trouble-free implementation of MLC, 2006. ■ NL

For further Information:
Olaf Quas, Head of Department Global Practice ISM/ISPS/MLC, 2006,
Phone: +49 40 36149-7013, E-Mail: olaf.quas@gl-group.com

ILO CONSOLIDATED MARITIME LABOUR REGULATIONS, 2006

Contents (excerpt):

1. Minimum Requirements for Seafarers to Work on a Ship
2. Conditions of Employment
3. Accommodation, Recreational Facilities, Food and Catering
4. Health Protection, Medical Care, Welfare and Social Security Protection
5. Compliance and Enforcement

5.1 Flag State Responsibilities
5.2 Port State Responsibilities
5.3 Labour-Supplying Responsibilities

Software on the Seven Seas

Visiting a contemporary freighter, you will be surprised at the number of computer screens flickering everywhere, not just on the bridge. Computers continue their conquest of modern shipping, enabling more and more processes to be supported by information technology. With software applications such as GL ShipManager, Germanischer Lloyd contributes to ship and process efficiency

"You can find a personal computer in every major room on board nowadays," says Wilko Büscher, Fleet IT Administrator with Hartmann Schiffahrts GmbH & Co. KG in Leer, Germany. Just ten years ago, computers on ships were considered something "nice to have"; today, they are "expected", he adds. Büscher is responsible for 57 out of nearly 180 Hartmann vessels: 28 containerships ranging from 1,000 to 2,700 TEU, 20 gas tankers, seven bulk carriers and two oil tankers. Since 2005, GL ShipManager has been among the applications installed onboard the ships, with Planned Maintenance and Order Management as core functions.

Maintaining loading, staff, ordering and maintenance lists in electronic format is standard procedure on almost all ocean-going ships these days. But frequently these functions are spread among separate, isolated software applications that are not routinely synchronized across the entire fleet. Deploying an integrated solution can deliver significant benefits. The Maintenance functionality is a good example: Columbus Shipmanagement GmbH, →

Photo: Shutterstock

DISPLAY. To ensure trouble-free operations, all relevant subsystems of a ship must be controlled centrally.

BRIDGE. A shipmaster's workplace without information technology is unimaginable today.

→ which operates 30 containerships of shipowning company Hamburg Süd, has been using GL ShipManager since 2006, including the Planned Maintenance module. "Before that our maintenance was Excel-based," reports Fleet Manager Mathias Günther, in charge of ensuring the operational safety of the fleet. Today he monitors the maintenance needs of all ships from one central, land-based office. The maintenance data is synchronized via satellite. Software also helps to keep track of the 30-some safety-relevant certificates each ship needs, making sure they are renewed in time. The GL software supports Günther in planning and dispatching surveyors to ships in port in a timely manner whenever a certificate is about to expire.

IT Investment Lagging Behind

Forward-thinking shipping companies such as Hamburg Süd and Hartmann lead the pack in terms of software use in ship management. But looking at the industry at large, they are by no means typical, says Torsten Büssow, Vice President Maritime Software with Germanischer Lloyd. Based on GL surveys among clients, shipping companies are currently spending about 300 million euros per year on core shipping software, no more than 0.7 per cent of their overall capital expenditures. In contrast, oil and gas companies invest as much as 3.5 per cent. "The shipping industry has not shown much enthusiasm for software yet," Büssow concludes. "It is deeply rooted in tradition," comments Günter from Columbus. Norbert Buro, dean of the Computational Mechanics department at Bremerhaven University of Applied Sciences, confirms: "Shipowners tend to be people of habit who mistrust the IT world to some extent." Many therefore to not recognize the benefits, let alone the necessity of software, he adds.

In a well-designed software environment, integrated ship management software can improve data visibility and operational efficiency significantly, GL's Büssow emphasizes. "Today, maritime software is much more than planned maintenance," he says. "By using software, we can make safer navigational decisions in bad weather, optimize a ship's trim to conserve fuel, or maintain the structural components of a ship more effectively with the help of an interactive 3D ship model to maximize the service life of the vessel." Software can lower the costs of providing quality-related documentation to charterers substantially. It can prevent costly errors such as double-ordering spare parts, helping to keep maintenance and repair costs from escalating. The complex task of complying with myriad regulations and requirements can be simplified using integrated ship management software. Aggregating consistent information from ship management databases can be accomplished in a fraction of the time it takes to gather the same information from scattered data silos. All things considered, the investment cost of just under 10,000 euros per ship for an integrated software solution will pay back quickly, says Büssow.

Just a few years ago, profits in shipping were so high that software had little to offer. But the global financial crisis and shrinking profit margins in the transport business are convincing shipowners that it is time to review their processes to remain competitive in the long term. But buying software doesn't automatically optimize processes, expert Buro warns. "First and foremost you must streamline the procedures on board as well as between ships and their operators. Once this has been accomplished, you can look for software that is a good match for those processes."

High Expectations of New Functionality

Meanwhile, pioneers among the shipowners are anxiously awaiting new, optimized software releases. Software devel-

GL SHIPMANAGER – HOW YOU BENEFIT

GL ShipManager improves processes and decisions for your business, onboard and ashore:

- **Increased productivity** – the same number of employees can accomplish more or manage more vessels in the same time; scheduling and task management is more efficient
- **Greater transparency of vessel data** – key information on demand as the basis for better business decisions and fewer "surprises"
- **Easier** compliance with industry requirements (ISM, TMSA, SOLAS, etc.) – fewer problems and less effort with the "paperwork"
- **Cost savings** – save costs in procurement, repairs and spare parts, only spend what you really need
- **Consolidation of IT landscape** – fewer individual systems needed due to GL ShipManager's integrated solution

opers themselves are engaged in an evolutionary process and still have a number of challenges to overcome before being able to offer the degree of maturity standard solutions such as SAP have reached for other industries. As a user of GL ShipManager, Hartmann IT specialist Büscher is "very anxious" to see what the upcoming software release will offer. He is looking forward to using the new ENOA/D feature (Electronic Notification of Arrival/Departure), the Crew Management module as well as the Port Clearance functionality for automatic filling of customs forms.

Another innovative feature of the GL suite still under development is Incident Manager. Mathias Günther, Head of Operating Safety at Columbus, is dreaming of an interface enabling communication with external authorities and companies not working with the same software. Rumour has it that new functionality designed to synchronize databases between ships and shipping company headquarters is essentially in existence and just needs some fine-tuning.

Norbert Buro is sure a generation change at shipping companies will help establish state-of-the-art business management principles. But the industry still has a long way to go. It will be "a slow, arduous journey", says the professor. Ultimately, however, software supporting the required processes will prevail. "The shipping industry must automate many of its processes. This simply cannot be done without software," says Nikitas Nikitakos, Head of the Shipping Trade and Transport Department at the University of the Aegean on the Greek island of Chios.

Trend Towards Networking

The current trend among shipping companies towards establishing internal IT networks is just the beginning. Nikitakos envisions a dynamic, intercompany platform, a "digital business ecosystem" with an open process and system architecture. Software deployed in such an environment, Nikitakos predicts, could improve efficiency across the entire industry. ■ HS

For further information:

Torsten Büssow, Vice President Maritime Software,
Phone: +49 40 36149-5237, E-Mail: maritime-software@gl-group.com

Photo: Dreamstime

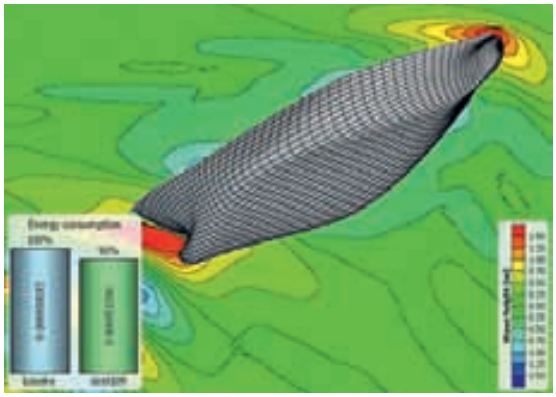
INTEGRATION. Important information on the operating condition of the vessel can be accessed from anywhere, even from company headquarters.

Efficiency Is the Key

Dr Pierre C. Sames, Senior Vice President Strategic Research and Development at Germanischer Lloyd, on possibilities for optimization and new designs for containerships

nonstop: Last year GL presented a study for the new design of a Post-Panamax ship belonging to the 5,000-TEU class. Why are you interested in this particular ship type?
Dr Sames: In recent years, the yards have concentrated more on efficiency in shipbuilding processes than on optimization of the actual product. In fact, containerships have not improved in terms of energy efficiency appreciably over the last decade. When the fuel prices increased dramatically in 2007/2008, everyone started thinking: how can we improve the operating efficiency of the ships? GL has been considering this question for several years now. We believe that future oil prices will demand ship speeds that are lower than those still being taken as a basis for design and construction today. Moreover, the size of this vessel is in line with the expected needs of our customers.

nonstop: But does the concept really suit the times? In view of the worldwide crisis, many shipping companies are faced with much more pressing problems.
Dr Sames: When the markets recover, the maritime industry must be well positioned and ready to operate profitably again. This will not be possible with designs that were developed ten years ago. The yards must turn their sights to efficient ships again. It is our aim to get the ball rolling here. This also means applying our ideas to an existing shipbuilding order and modifying certain components. Any shipowner who has a containership on his order today will be getting an outdated design. It will undoubtedly be overpowered and hence not energy-efficient. Anyone ordering a ship should be focused on matching the order to the future challenges. And if the yards change their designs now, they will also stand a better chance of selling ships again after the crisis has passed.



VISION. Broader and slower: according to GL's Head of Research, Dr Pierre C. Sames, tomorrow belongs to a new type of containership.

nonstop: What is the basic idea behind the new design?
Dr Sames: Up to now, the Panama Canal represented an artificial limitation for ship designs. Containerships were adapted to the width of the canal – with the result that the designs have become increasingly slender, but by no means more energy-efficient. Until recently, fuel was so cheap that you could also make a profit with "bad" ships. In our calculations, we ignored the expansion of the Panama Canal by 2014 on purpose, with a view to developing a new containership without this misleading restriction. The outcome is the "Baby Post-Panamax" ship.

nonstop: Why this name?
Dr Sames: It is called "Post-Panamax" because it is wider than the Panama Canal, and "Baby" because it is only a little bigger than the canal locks. This ship size is entirely new. All Post-Panamaxes are much larger. We chose a design that is about as long as a Panamax vessel, namely 246 metres, offers a nominal capacity of 4,620 TEU, but is two container rows wider at 37.3 metres.

nonstop: How does it differ in other respects from conventional ship designs with a maximum breadth of 32 metres?
Dr Sames: As the reference for the study, we took a Panamax with a length of 283.6 metres, a capacity of 5,091 TEU and a speed of 25.2 knots. These extremely slender ships actually represent the standard nowadays. In addition, we also included an older ship design with 247.1 metres, 4,250 TEU and 24.5 knots. The different service speeds were considered accordingly in the analysis. Using this basis, the installed output of our design was closer to the small Panamaxes at 36,240 kW and 23.1 knots than the larger types. This is because a slower ship does not need such a big engine and therefore has a lower price tag.

However, the main advantage is that the operating costs are much lower, corresponding to the small Panamax vessels, whereas the stowage capacity is comparable to today's 5,000-TEU class. With an average weight of ten tonnes per container, the Baby Post-Panamax is even more economical. Our ship can accommodate 3,778 TEU, whilst the big Panamax reference ship manages about 3,452 TEU. What is more, the Baby Post-Panamax only needs a quarter of the ballast water of the extremely slender types,

owing to its better stability. Through the transport costs alone, the ballast savings make an appreciable difference to the energy balance. And when the relevant IMO Convention comes into play, the water must be purified by onboard plants – several of these will be needed. So more ballast water also means a bigger energy footprint.

nonstop: What are the cost benefits?
Dr Sames: As far as the costs and also the potential earnings are concerned, the shorter Panamax ship lies at about 82 per cent of the larger reference ship. Then again, the Baby Post Panamax achieves the same earnings as the 5,100-TEU container carrier, but at 15 per cent lower expenditure. The relationship of fuel costs to cargo capacity becomes more favourable with the increase in ship's breadth. To get there, we merely threw off the constraints which the Panama Canal had placed on our thinking all those years.

nonstop: What other possibilities for efficiency enhancement do you see?
Dr Sames: The greatest savings potential is given by reducing the speed, because the fuel consumption and hence the costs increase with the number of knots. Some of the major container operators are only sailing at 20 knots now, instead of the customary 24. It may also be worthwhile including an additional ship in the loop to maintain the annual transport volume and still cut the total outlay. Ten slow ships can be much more economical than eight fast ones. This is due to the large share of the fuel costs in the overall operating costs. If you apply the lever here, you have a very powerful tool for cutting costs.

nonstop: What does the calculation look like for the Baby Post-Panamax?
Dr Sames: GL developed a computer model for optimizing fleet speeds three years ago. We applied it to our Baby Post-Panamax and plugged in various fuel prices and cargo values per container. The result: if the fuel price increases and the cargo value remains constant, slowing down is worth it. Of course, this requires more tonnage per loop.
The second driver is the cargo value.

If you are carrying high-value goods, it is better to sail faster. This is due to the capital costs of moving such a valuable cargo slowly. This aspect was integrated into our calculations, and yet we still obtained speeds lying considerably below those for which these ships had been built. According to our calculations, the greatest savings for the Baby Post-Panamax are to be had on the route East Asia – Europe at a cruising speed of 18 knots.

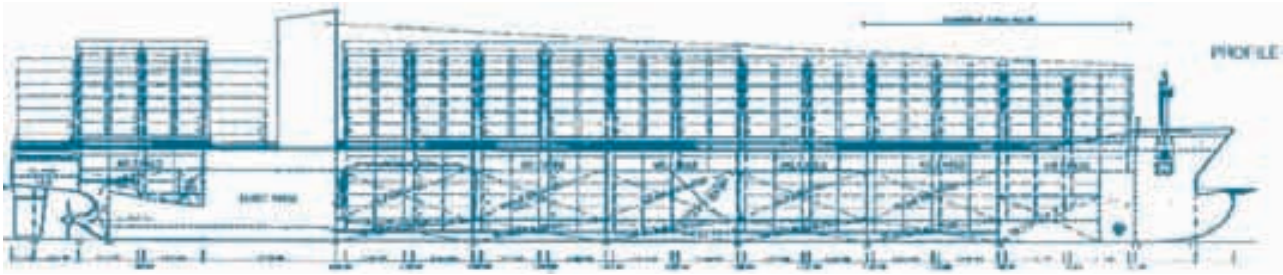
nonstop: But surely this general decrease in cruising speed and engine output will result in reduced flexibility?
Dr Sames: In our example, we used a small propulsion plant. This ship will certainly no longer be able to travel at 24 knots. But what is more important: an engine that is oversized and never really runs at its optimum operating point, just to have the option of being able to steam faster some day – or an engine that best fits the purpose?

Logistics companies agree with us: the duration of a transport is less important than having the goods arrive on schedule. Naturally, this is not true for all commodities, but certainly for most. The supply chains can indeed be slowed down – just not all at once and not everywhere. Anyone with a valuable consignment will continue to look for partners who can guarantee speedy carriage. So there will still be a market for fast containerships in future. These will perhaps no longer carry any old cargo, but only the high-value goods – while the less expensive cargo can take the slow boat. In principle, there can be one loop for express goods and another for standard transports.

nonstop: Are width and speed the only efficiency factors for the Baby Post-Panamax?
Dr Sames: These two aspects are extremely effective; all others have far less effect. Saving 30 per cent of the costs at 18 knots speed and with the same earnings scenario: it almost sounds like magic. We also asked what else could be done. A special area of interest for the GL subsidiary FutureShip is optimization software for the hull shape. An optimized hull shape from the model basin can improve fuel consumption by another five per cent. In addition, air cushion systems using air-filled chambers on the underside of the hull reduce the contact surface between hull and water.

This causes less drag, which means that less propulsive power is needed. The system was originally intended not for containerships but rather for slow and broad ships. Since the Baby Post-Panamax fits these criteria, this is a good opportunity for implementing the system. Although we have not yet planned a double-bottom design for a containership, we assumed in our thought experiment that it would work. This approach will cut the fuel costs additionally.

Abridged interview with the maritime newspaper THB.



DESIGN STUDY. The baby post-Panamax achieves the same earnings as a 5,100-TEU ship at 15 per cent lower cost.


新 扬 子 造 船
沃得重工制造 2008
NEWYANG

Striving to Be the Most Outstanding Shipyard in China

Merely a nameless, collectively-owned shipyard some five decades ago, Yangzijiang Shipbuilding (Holdings) Ltd. is now a large joint stock shipbuilding group with a Singapore listing that has taken the lead among Chinese shipbuilding enterprises. All this was accomplished within ten years

More than 600six hundred years ago, the great Chinese navigator Zheng He constructed his treasure ships in the lower reaches of Yangtze River whereupon he ventured out for his seven expeditions to the Western Ocean. Today, reviving its legacy, the Yangtze Delta has emerged as one of the top three shipbuilding bases in China. Home to six out of the top ten Chinese shipyards, the region turns out 60% of China's newbuilds and 10% of the global construction output.

Yangzijiang Shipbuilding continues a long history of shipbuilding. At the time it was established in 1956, Yangzijiang was only a small shipyard. When current Chairman Mr Ren Yuanlin took over as General Manager in 1997, the shipyard had remained dormant for decades. But under Ren's leadership, Yangzijiang Shipbuilding made an unprecedented leap forward. It now possesses two core assets on the banks of the Yangtze River – Yangzijiang Shipbuild- ➔

→ ing Ltd. on the south bank and New Yangzi Shipbuilding Ltd. on the north bank. Covering an area of 2.2 million square metres, the shipbuilding group has a 3,000-metre long wharf line and employs more than 10,000 people. Equipped with one large dry dock and five large and medium-sized slipways, it is capable of building over 1 million dwt of vessels annually. Its mainstream products range from large and medium-sized containerships and large bulk carriers to medium-sized multi-purpose ships. In an interview with *nonstop*, Chairman Ren Yuanlin retraced his company's road to success and its strategy to cope with the challenges currently facing the shipbuilding industry.

Modern Entrepreneurial Concept

Over decades, Yangzijiang Shipbuilding had accumulated considerable management expertise and a corporate culture that provided not only a solid foundation for the company's ensuing growth but also a competitive advantage. Then in 1999, Ren Yuanlin, an entrepreneur with an open mind and a pioneering spirit, transformed the enterprise into a joint stock company. Powered by an advanced enterprise concept he had introduced, Yangzijiang Shipbuilding embarked on a highly successful journey to become a veritable trailblazer amongst state-owned shipbuilding companies.

When the global shipbuilding market reached its zenith in 2007, the shipbuilder raised 5.5 billion Chinese Yuan at

SAILING. The new landmark office building in Jingjiang resembles a huge ship in the ocean.

the Singapore Exchange, the largest Chinese IPO that year at the stock exchange, in support of its new shipyard and production expansion. Content with his decision till today, Ren said, "We're one step faster than others both in making an IPO and building a new shipyard." But first and foremost the company relies on incentive mechanisms as part of its modern concept, such as granting equity interest to employees to "share the fruits of business growth with staff members" and attract and retain talented people.

No Cancellation

In the wake of the financial crisis the global shipbuilding industry has been plagued by contract cancellations. In contrast, Yangzijiang Shipbuilding had not received any cancellations at the time *nonstop* spoke with Ren, a fact he attributed to a series of measures the shipbuilder had taken: postponing the delivery of vessels, allowing shipowners to convert ship types, assisting shipowners with financing, and even lowering some prices of vessels on order. "This helps both ship owners and ourselves," Ren emphasizes. Postponing deliveries also helps the shipyards themselves by allowing them to keep producing during the shipbuilding bust. Yangzijiang Shipbuilding had taken some precautionary measures for bad times as early as the latter half of 2006 when the shipbuilding market was at its peak. This strategy is now paying off, providing the shipyard with an adequate workload.

Regarding the current market situation, Ren has arrived at an assessment of his own: "The real impact of the financial crisis on the shipbuilding industry will become evident after 2011. Due to relief policies adopted by different states, the crisis seems to have bottomed, but overcapacity in shipping and shipbuilding has not. The adjustment phase may last much longer."

Yangzijiang Shipbuilding was able to seize opportunities in several previous crises. For instance, in the 1997 Asian financial crisis, the company expanded its containership business from Southeast Asia into Europe. Following the SARS epidemic in 2003, it gained momentum during the market recovery phase, conquering a place among the top-ten Chinese shipbuilding companies by boosting its productivity rapidly.

The Goal: Being the Best

Whether or not the current financial crisis will see Yangzijiang benefiting from new opportunities is an open question: "Right now, we're going further to boost our production efficiency and on this basis, we plan to develop ship recycling, making it more environment-friendly and greener in response to government calls for a reduction of shipbuilding overcapacities and the phasing-out of outdated ship types. We are also working with consulting companies to explore our options in the offshore engineering market," said Ren. Here and there on the premises of Yangzijiang Shipbuilding you can find banners spelling out the company's slogan: "Striving to Be the Most Outstanding Shipyard in China".

The meaning of "most outstanding", in the words of Chairman Ren, is "best in quality, not necessarily biggest in size". "We also intend to achieve a leading level of per capita work efficiency in China," Ren added. Yangzijiang has made every effort to position itself accordingly. As a non-government-owned shipbuilding company, it has always maintained its focus on the main segments accounting for about 90% of the market, such as bulk carriers, containerships and oil tankers. Last year, Yangzijiang Shipbuilding set up a design centre to promote technological study and the improvement and optimization of ship types in its drive to raise product quality.

Germanischer Lloyd, a business partner of Yangzijiang Shipbuilding, has been assisting the shipyard in working towards these goals. Ren emphasized: "GL is number one in the containership market. Its design concepts and experience are the richest and are recognized worldwide. As a builder of containerships, we cooperate closely with GL and enjoy a fruitful relationship. Recently, GL relocated its plan approval office to Shanghai, which has enhanced GL's responsiveness to its clients' needs and made its services more convenient for us." Yangzijiang intends to continue its cooperation with GL in the bulk carrier and oil tanker markets, as well, Ren said.

AMBITIOUS GOAL. Chairman Ren Yuanlin (centre in front) and his team from Yangzijiang Shipbuilding.

Just last year, Yangzijiang Shipbuilding moved into its new office building in Jingjiang City on the north bank of the Yangtze river. The state-of-the-art structure looks like a huge ship in the ocean. Chairman Ren's office on the 19th floor offers a splendid view over the brand-new dock and the glistening Yangtze River in the distance. You can hear the clanking of the machines down at the docks. All this makes Ren think of those glorious shipbuilding days over 600 hundred years ago. To him, Yangzijiang Shipbuilding continues that legacy, carrying it all across the oceans and around the world. ■ LZ

VALPARAÍSO. Chile´s main port suffered only relatively minor damages due to the earthquake in February.

Photo: Bigstockphoto

Chile's Opportunities

As the last stop for ships travelling south, Chile plays a major role in international shipping. GL supports shipping operations from the country's seaports that are recovering rapidly from the recent earthquake

Atacama – the world's driest desert. Patagonia – pristine nature. Humboldt penguins. Copper. Good wines. Things that come to mind at the mention of Chile, that long and narrow-shaped country on the west coast of South America that extends across as many as 39 parallels. Shipping, however, is not something most people would spontaneously associate with Chile, which was hit hard by the 27 February earthquake and subsequent tsunami wave. Nevertheless, Gastón Boré, GL Country Manager in Chile, is confident: "Chile has plenty of potential for development. In fact, across all of Latin America there are significant opportunities for expansion."

It is Chile's unique geographic position that makes the future look bright for the country, says Boré. Facing the Pacific Ocean along 4,500 km of coastline, with strong commercial ties to Asia, the USA and Europe, the prospects of growth in the maritime trade are promising once the current downturn subsides. "For many internationally trading, GL-classed ships, the Chilean ports of Valparaíso, San Antonio and San Vicente are the last stops on their southbound journey," Boré stresses. "This usually provides longer laying time in the Chilean ports so the owners can take the opportunity to have their vessels surveyed, and there is a significant number of owners whose ships we have been surveying regularly over some years. This includes renewal surveys in the drydocks of ASMAR, one of the main yards on the Pacific coast of the American continent." This yard, however was severely damaged by the earthquake and tsunami, and will take some time to regain full operational capacity.

Surveys of the GL fleet in service (including numerous vessels of Chilean owners), and classification services for three newbuilding projects at local shipyards, carried out by four experienced surveyors, make up GL's main areas of activity in Chile, accounting for about 90 per cent of its turnover. But there are also other services to local customers, like ISO certification, some industrial inspection work, and the consulting services rendered to port facilities related to the International Ship and Port Facility Security Code. In this

SERVICES. Gastón Boré has been heading the GL Country Office in Chile since 1994. From the country's seaports (photo: floating dock shipyard Valparaíso III), he and his team ensure the safety and functional integrity of ships of any type.

Viña del Mar

Santiago de Chile

Valparaíso

Talcahuano

Lago General Carrera

Facts & Figures

The Andean nation of Chile has been a stronghold of stability in the global financial crisis.

Instead of spending the substantial earnings from copper exports in recent years, the government saved money for bad times. In early 2009, the copper stabilization fund boasted roughly 20 billion US dollars. The Chilean government had been generating budget surpluses until the advent of the crisis. The country is thus nearly debt-free and able to offer liquidity support and loans to the industry.

While the growth rate of the national economy decreased to minus 1.5 per cent in 2009 following many boom years, it is still expected to rebound in 2010 in spite of the earthquake. As an exporting nation, Chile is highly dependent on the global business cycle. With copper accounting for more than half of Chile's export volume, prices have seen a steep upswing of late, following a significant drop earlier. On the import side, machinery and vehicles are the most important products.

CHILE IN NUMBERS	
Capital	Santiago de Chile
Official Language	Spanish
Form of Government	Representative democracy
Head of State	Sebastián Piñera
Area	756,950 km²
Inhabitants	16.8 million
GDP (nom., 2009)	US$ 160.8. billion
GDP per Capita	US$ 9,525

consulting business, GL Chile enjoys about 60 per cent of the market share in local ports, developing security assessments, security plans, security audits and exercises for its clients.

Promising Projects

CSAV, one of the main Chilean shipping companies, has selected GL to class its series of five 8,000-TEU container vessels to be built at the Samsung Shipyard in Korea. In addition to this, one of the most important newbuilding projects currently underway in Chile is classed with GL. At the ASMAR shipyard, which is recovering from the damage caused by the tsunami that followed the February earthquake, a state-of-the-art research vessel is under construction for the Chilean Navy and the Undersecretary of Fisheries. Conforming to the most rigorous standards for such vessels, particularly regarding underwater noise levels, the vessel will be fitted with latest generation research equipment. By building this vessel, Chile will be able to match international research standards, which will support its national maritime sciences and add to the knowledge about the Chilean waters.

"This project is a major step ahead for both the Chilean shipping industry and the work of GL in this country," says Boré, who has been heading the GL operations in Chile from the society's national headquarters in Viña del Mar since 1994. Another GL-classed newbuilding project is a 70-metre-long ferry to be built for Lago General Carrera, a lake located high in the Andes in the border region between Argentina and Chile. What makes this project special is the fact that the components for the ship must be manufactured at the shipyard in Puerto Montt, and then transported to the construction site located about 500 km away in the Andes Mountains.

A business partner that is playing an increasingly important role for the Latin-American shipbuilding industry is the military. Germanischer Lloyd has been chosen to classify an offshore patrol vessel that is currently being built in Colombia, and there is a similar project in Argentina.

New Perspectives

In the maritime field, new perspectives will be actively promoted in the future with the new services offered by GL's Maritime Solutions, thereby widening the scope of services, and strengthening their ties with the local customers. Due to their average age, the ships of local owners are good potential beneficiaries of the services oriented to increase their energy efficiency, reducing fuel costs and environmental impact. In the area of Industrial Services, an interesting development is the increasing number of projects related to wind energy.

Once a year, GL Chile offers an event to the maritime community, where GL experts meet with customers and industry representatives for an exchange of ideas and views on the perspectives and trends in the maritime sector. "This event is beneficial for all parties involved. Here we learn firsthand about the challenges our clients must handle, and what they would like us to do for them so we can put our expertise and knowledge to work in a more focused manner. In particular, we can assure safety and quality while supporting the continued growth of the nation's shipping industry." This means that in the future, Chile will be able to rely not only on its traditional strengths, such as copper, good wines, delicious fruit and breathtaking landscapes, but also on its shipbuilding industry. ■ JH

For further information: Gastón Boré Pineda, Country Manager,
Phone: +56 32 2969153, E-Mail: gaston.bore-pineda@gl-group.com

Close Connection

The success story of modern welding began 150 years ago. Not only is this classic joining technology still going strong, it is more innovative than ever. Welding is applied in all areas of shipbuilding and civil, mechanical and process engineering. A high level of interdisciplinary competence is essential

North Atlantic: Wave after wave approaches obliquely to port. Spray covers the forebody, the wind howls, and the significant wave height is six metres. A containership of 13,000 TEU ploughs through the heavy seas. The mountains of water pass under the 350-metre-long ship, lifting it up at several points and twisting the vessel about its longitudinal axis. This causes extreme stresses to act on the top flange, especially in way of the hatch side coaming.

Change of scene: A laser welding station inside a separate dedicated workshop. The doors close before work begins. A warning light indicates that something special is about to happen here: laser hardfacing.

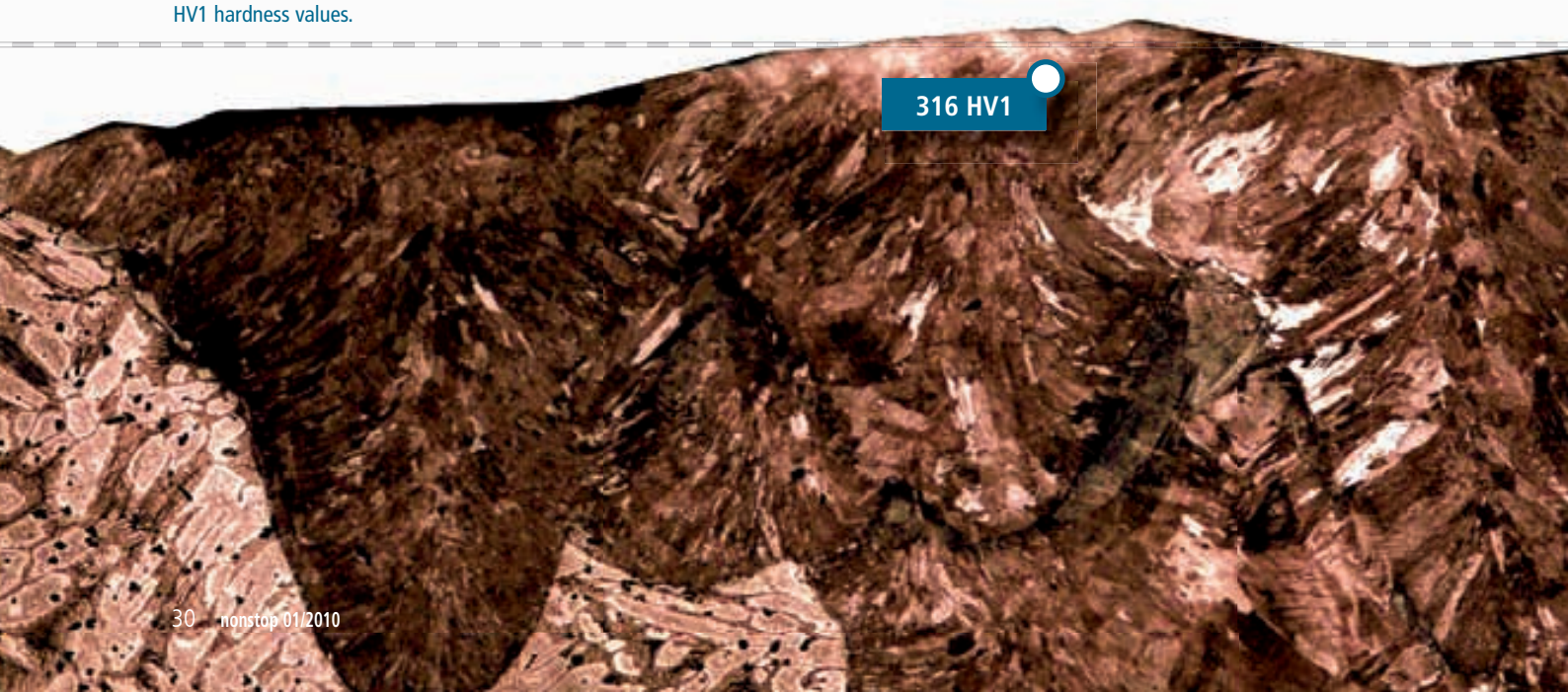
The environmental conditions at the two places could hardly be more different – and yet a common thread runs through both scenarios. On the fictitious jumbo containership as well as in the real laboratory, the focus is on welding as the most important industrial joining technology. "Welding is an interdisciplinary field," says Marcus von Busch, Head of Department Welding at Germanischer Lloyd. "It affects almost every area of industrial production, maintenance and repair. So what our customers need is interdisciplinary competence."

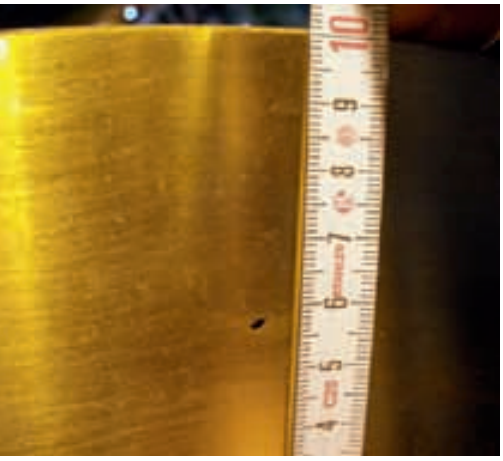
Back to our jumbo containership. The background for the advancement in welding technology offered by GL is the use of a new high-tensile shipbuilding steel – codename GL-E47EXP. This development was prompted by the exceptional growth in size of the containerships now under construction. Up to now, yards have generally used E36 or E40 shipbuilding steel. As long as the corresponding scantlings are observed, these steel grades will meet the strength requirements, but the growing size of modern ships has resulted in plate thicknesses ranging up to 100 mm. This leads to increased costs in purchasing the materials while slowing down the welding process considerably.

High-Tensile Steel for MegaBoxers

"The new GL-E47EXP is something of a quantum leap in shipbuilding," says von Busch. The novel material, which exhibits improved properties in relation to the S460 type used in steel construction, offers close to 30 per cent more strength than E36. And this offers a decisive advantage: the structural components can be made much smaller. "This pays off in material procurement," Marcus von Busch explains. He estimates the weight savings to be about one per cent. A significant cost reduction is obtained by the shorter welding time and the lower consumption of filler metal. The decreased thickness achieved by using high-strength steel reduces the weld volume, and thereby the

CLOSE-UP. Micrograph of a manual laser weld with its HV1 hardness values.





DEFECT. Laser welding is very versatile. The aim of hardfacing is to deposit wear-resistant material with high precision on specific small areas.

welding time, by ten per cent. "The initiative for developing this high-tensile steel came from Asian yards and steel manufacturers, who approached GL," says von Busch. "We then drew up an approval plan for qualification of the steel and its manufacturer." Besides the material and the steel factory, the welding contractor and its production processes are also certified by GL – after all, superior strength and favourable weldability do not necessarily go hand in hand. Despite the high strength values, GL-E47EXP lends itself well to welding, provided that certain parameters are observed closely.

First Deliveries in 2011

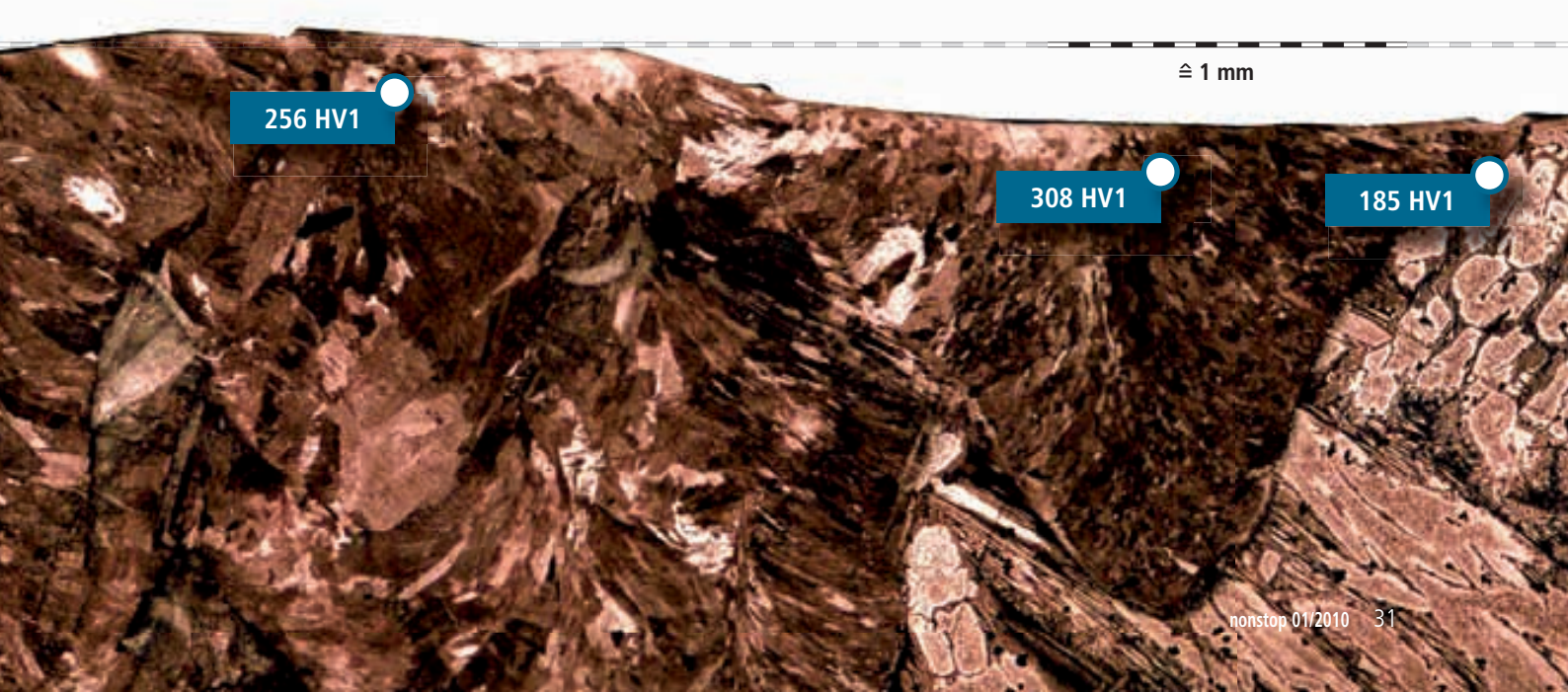
To date, few yards have shown enough confidence to work with GL-E47EXP. There are currently 20 ships in the planning stages that are to be built using this material under the supervision of GL; two of them are due for delivery during the first quarter of 2011. Each about 350 metres long, they range between 10,000 and 13,600 TEU. The weight saved by using the innovative material is between 300 and 500 tonnes.

The laser hardfacing process is of an entirely different nature. This is not about the welding technique for a new high-quality material, but the application of a whole new process: "The aim of this cladding method is to deposit wear-resistant material with high precision on specific small areas," says Norbert Worm, Laser Applications Expert with GL, "such as applying a wear-resistant layer on the pillow block of a line shaft." The same technology is used to overhaul ship propellers where cavitation has eaten holes in places already weakened. In both cases, material is deposited to even out pits and holes and build up a wear-resistant layer. Then the final dimension of the component is restored through machining or grinding.

Hardfacing Avoids Full Replacement

Hardfacing, which lays down material exactly where it is needed and thus avoids the need to replace the entire component, is not radically new – nor is the use of laser beams. The innovation consists in the combined use of laser welding and weld-deposit cladding. In joint projects with several enterprises and research institutes, Germanischer Lloyd contributes to the development of such pioneering processes. GL's focus is on certifying the process and defining the requirements the component must meet after being welded – in each case with due regard for the particular application. A test piece similar to the specific component is welded and then subjected to both destructive and non-destructive testing, which is typically done by experts from GL's own test laboratory.

Once again, the interdisciplinary nature of welding technology is evident here: the development of the certification requirements calls for the expertise of other GL specialists who themselves are no welding specialists but are in- →



CHECKING. GL welding expert Marcus von Busch examines the workmanship and condition of weld seams on board a ship.

→ timately familiar with the respective components and the loads that will act upon them. Quite frequently, further studies are necessary to verify the ability of hardfaced components to resist the vibration stresses under daily use in salt water.

Minimal Thermal Stress

The laser beam is a universal tool – this is its primary strength. A flexible optical fibre is able to transfer the laser beam over a distance of several metres. But what are the reasons for using this technically demanding laser-welding process in the first place? Its fundamental advantage lies in the low thermal loading of the component by the laser beam. At present, conventional arc welding is the preferred method for hardfacing.

However, this approach subjects the component to additional internal stresses. Workpieces can warp so badly during the welding process that none of the design dimensions remain intact. In many cases, it is necessary to preheat the component, owing to the chemical composition of the material. This can also cause the part to warp. With laser welding, on the other hand, the energy input is minimized, and so is the thermal stress for the components. "At the moment, we are involved in several laser hardfacing projects focusing on both rotationally symmetrical and cambered surfaces. The objective is to achieve a post-welding quality equal to the condition of the new component.

The added effort is well worthwhile, says GL expert Marcus von Busch. In principle, the method can be applied to all metal materials and is more economical than competing processes.

For further information: Marcus von Busch, Head of Department Welding and NDE, Phone: +49 40 36149-6141, E-Mail: marcus.von-busch@gl-group.com

LASER TECHNOLOGY

Science Fiction Come True

For many people, the word "laser" still conjures up a vision of science-fiction extravaganza – no space adventure can do without a laser gun.

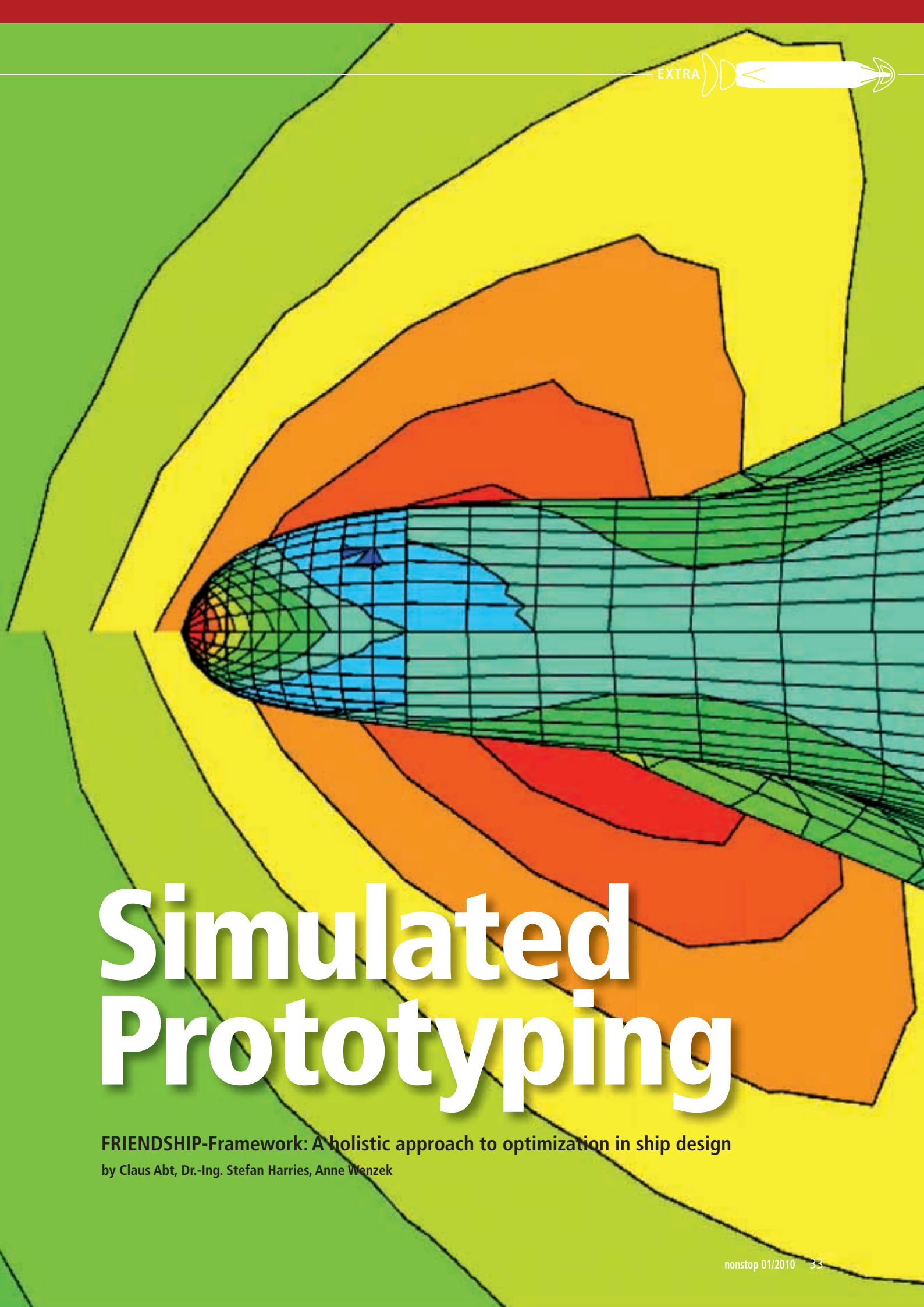
Meanwhile, Light Amplification by Stimulated Emission of Radiation – LASER for short – has become an everyday technology. This year the laser is turning 50. The high-energy beam writes labels on milk cartons, etches away the corneas of short-sighted eyes, and even cuts or welds high-tensile steel plates. Laser light is not generated merely by sharply focusing a normal light beam – rather, it consists of waves all of the same frequency, moving in step and in the same direction. Laser light always has a specific colour because it is monochromatic light. The principle of its generation: energy is added to a crystal, a gas or a liquid – the laser-active material – to "pump up" the power of the beam. A resonator in the source ensures that the beam passes through the laser-active material several times. Modern laser technology includes a large number of laser types, depending on the type of energy input and the laser-active material.

CULT. The laser is an important tool in "Star Wars" too – but with destructive effect.

EVENT

12th Symposium
"Welding in Shipbuilding and Structural Engineering" on 26 and 27 September 2011 in Hamburg

Organizers: German Welding Society (DVS), Schweißtechnische Lehr- und Versuchsanstalt Nord (SLV Nord) and Germanischer Lloyd



Simulated Prototyping

FRIENDSHIP-Framework: A holistic approach to optimization in ship design

by Claus Abt, Dr.-Ing. Stefan Harries, Anne Wenzek

Introduction: A Major Step Forward

A major advance in the quest for best practice in Computer Aided Design (CAD), and in the evolution of product development techniques in general, has been attracting growing attention among researchers and corporate decision makers alike: Integrated Simulation. In advertisements, catchwords such as Virtual Prototyping promise to reduce the number of physical prototypes, thereby lowering the development costs while boosting the advance knowledge about a new product design long before major investments are made. The benefits of Integrated Simulation are obvious. So why is it that fluid-dynamic design challenges are rarely supported by commercial solutions?

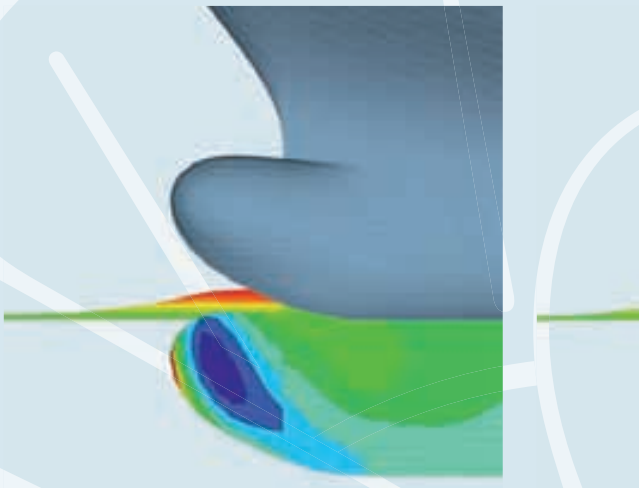
For most companies in the automotive industry, the use of CAx systems with integrated structural simulation is no longer a question of competitive advantage but a bare necessity. As for ship design, there are at least three possible explanations for the shortfall of design systems that readily integrate Computational Fluid Dynamics (CFD):

- **The response time of a CFD calculation is usually much higher than that of a structural design simulation. Today's computers are not powerful enough to allow an immediate evaluation of ad-hoc design changes.**
- **Current design and simulation programs for the marine and turbomachinery industry are fairly complex. Many companies use software developed in-house. Introducing a completely new CAE system that involves entirely new simulation methods could render established methods and the associated investments obsolete.**
- **Only slowly does the threat of global warming impact on (political) regulations , market development and overall sensitivity to the issue of energy efficiency. Recent steep fuel price increases have raised concerns about the affordability of energy, customer demands for energy efficient products have since grown.**

A fascination with high-performance design and a passion for parametric modelling, computational fluid dynamics and formal optimization were the driving forces that inspired the establishment of FRIENDSHIP SYSTEMS in 2001. In its early years, the company mainly carried out consultancy projects with a focus on shape optimization of ship hulls and other surfaces exposed to a flow

regime. Expanding the new design methodology into energy-efficient product design, the company strove for a new type of software that would allow engineers and naval architects to apply CFD technology and optimization strategies in a holistic approach. The key driver of the design process would be integrated simulation, feeding and directing the development of shapes.

Effective shape variation, streamlined preprocessing and seamless integration of simulation tools commonly used in design offices all over the world were the requirements de-



Cutting-Edge Technology

Photo: MPC

PERFORMANCE. Optimized hull shapes are the key to increased efficiency.

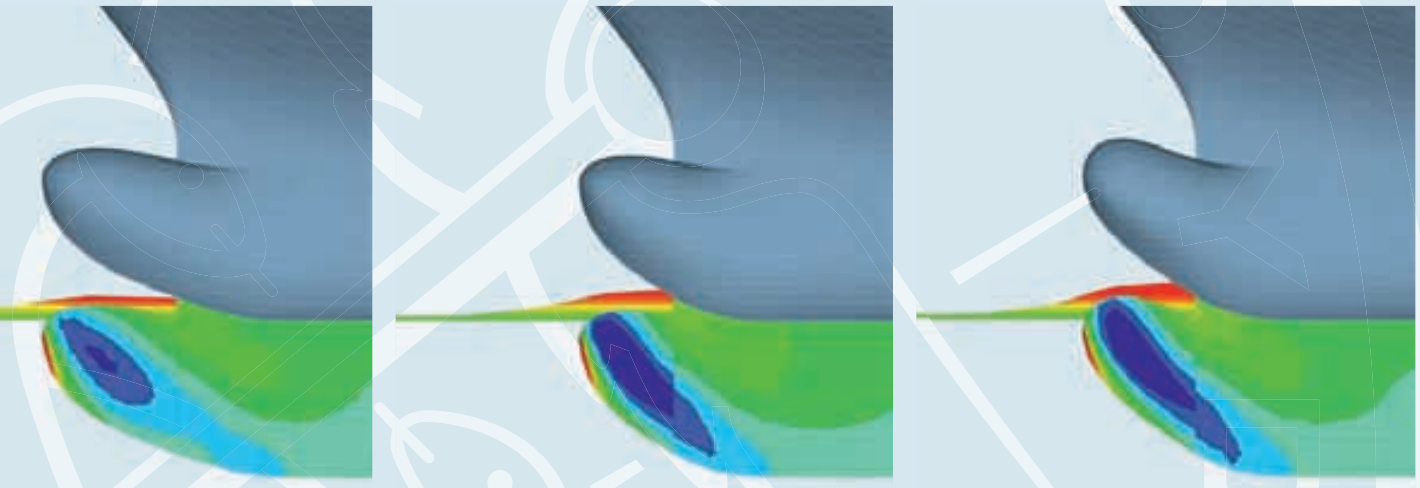
fined for the envisioned integration platform FRIENDSHIP-Framework. Today this software offers a full range of design and optimization techniques, integrating easily with the user's simulation software. All program modules combined provide an efficient environment for developing the best performing design that fulfils the defined requirements in an optimal way.

Companies that have deployed flow simulation software successfully in recent years can now easily take the next step in product development by putting their CFD software into the driver's seat. By doing so, they can rest assured they will be ready to meet the growing demand for highly efficient designs from individual customers as well as the society at large.

Cutting-Edge Technology

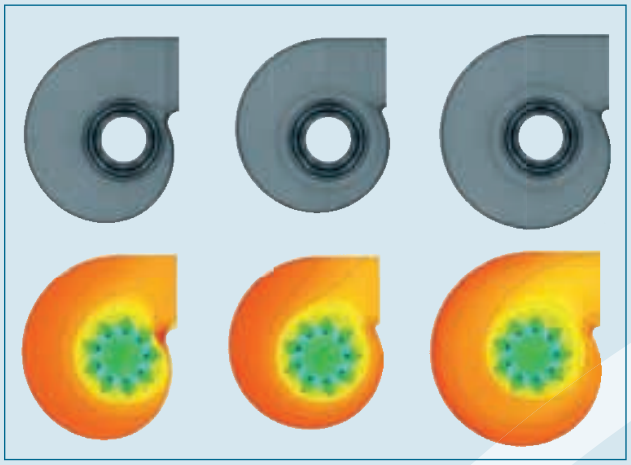
While simulation tools are quite common in the hydrodynamic analysis of ships, they continue to play a subordinate role in the design process. Modelling inside a CAD system continues to be the standard procedure. Yet, a shift towards integrated simulation appears inevitable: instead of relying on a manual process to check and compare the performance of a small number of variants, simulation-driven design guides the designer towards a superior product. Simulation becomes the new driver of the design process – controlled by the designer's knowledge and his company's accumulated expertise. This approach is the logical materialization of the popular saying that "form follows function".

The simulation-driven approach is cutting-edge technology: unlike conventional modelling, which employs hundreds of variables for geometry set-up, simulation-driven design relies on a small number of parameters only. Parameterization defines sophisticated relationships between points, curves and surfaces. Form parameters can relate to product properties and thus express product performance. A change in form parameters will consequently cause a change in performance. The designer can directly influence product performance →



NOSE. The design of the bulbous bow is an essential factor for the ship's flow behaviour.

Implementation Examples



FLOW BEHAVIOUR. Examples of mesh variants based on the parametric model, along with static pressure distributions.

➔ by defining constraints, dependencies and degrees of freedom. In a consecutive step, systematic variation will reveal where to go in the search for the best possible design. Ultimately, however, it is form optimization where simulation-driven design truly excels, with the simulation itself producing shapes rather than just evaluating them.

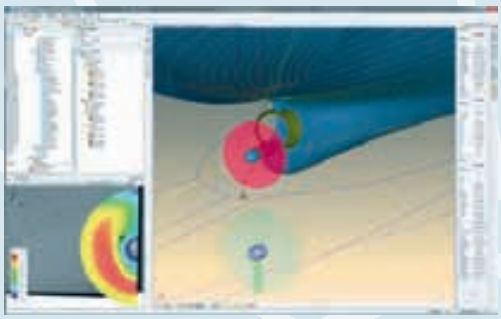
Implementation Examples

Enhanced product performance is the most desirable and tangible benefit of the simulation-based design process. Substantial improvements can be achieved by combining the main functions, CAD and CFD, and applying optimization strategies and parametric modelling. The following use cases may illustrate this:

Hull Development Case Study

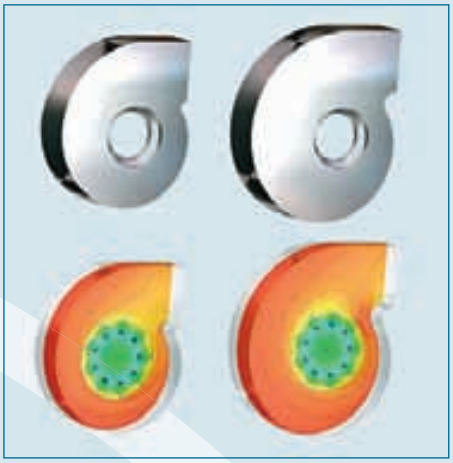
Korean shipyard DSME (Daewoo Shipbuilding & Marine Engineering) used the simulation-driven approach in optimizing its 14,000-TEU container vessel MSC Danit. The world's largest container ship was hydro-dynamically optimized in 2008 using the FRIENDSHIP-Framework and the embedded flow code SHIPFLOW by Swedish software developer FLOWTECH. The integration of this flow code into the FRIENDSHIP-Framework demonstrates how well this software system interacts with external tools. The hydrodynamic optimization of the hull shape for the vessel yielded remarkable results: wave resistance was minimized by 50 per cent (!), and propulsion performance was enhanced significantly. A few design steps led to the final, optimal design. A series of variants was numerically simulated to determine wave resistance. The examination of these variants showed that extending the parallel section of the mid-body from 5 per cent to 15 per cent of LPP would be beneficial. An additional improvement was achieved by adjusting the volume distribution at the forward perpendicular.

Based on the optimization results, a model of the optimized ship was tested in the towing tank of the ship model basin HSVA in Hamburg. The wave patterns seen in both the numerical simulations and the model tests were favourable and stable, giving the ship additional robustness. The 14,000-TEU vessel has set standards for speed, shape and stability in its class



COMPARISON. The simulation tool illustrates the hydrodynamic improvements.

Photo: DSME



EFFICIENCY. The 14,000-TEU containership MSC Danit was designed and built by Korean shipyard DSME and hydrodynamically optimized using the FRIENDSHIP-Framework.

OPTIMIZATION. Initial (l.) and optimized (r.) volute designs.

of MegaBoxers. Using FRIENDSHIP SYSTEMS' software suite improved speed performance while allowing for a higher degree of automation in the design process and speeding up hull optimization. In short, the hydro-dynamic optimization achieved:

- **a reduction in wave resistance by more than 50 per cent;**
- **better propulsive efficiency;**
- **stable wave patterns and**
- **higher robustness of the vessel.**

This use case shows that increased preproduction knowledge obtained in parameter studies and geometry evaluation directly leads to desirable results while significantly reducing the risk of expensive late changes. What is more, it leverages existing know-how and tools.

Turbomachinery Case Study

The design of a radial fan volute is a good example of the combined use of CAD and CFD technology. In this case study, geometry variation and CFD simulation were controlled by the NUMECA software product FINE™/Design3D. Modelling was done within the FRIENDSHIP-Framework, which was used solely as a geometric modelling engine in batch mode under external control. This optimization project served two purposes:

- **enhance the pressure increase between inlet and outlet**
- **optimize the overall efficiency.**

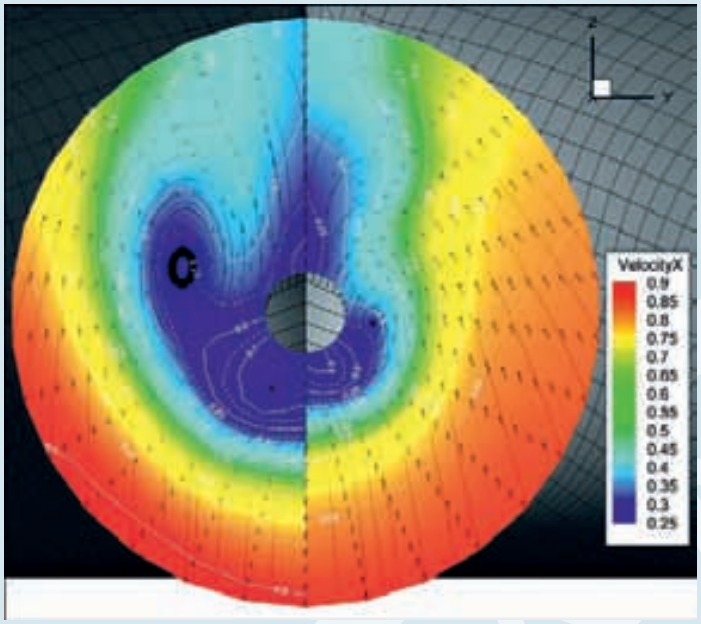
The overall computation time of a single variant was 1.1 hours on an average workstation. It included geometry and mesh generation, CFD analysis and post-processing. A total of 100 variants were created. The picture left shows three sample variants based on the parametric model with the respective generated structured meshes and static pressure distributions visualizing the influence of different geometries on flow behaviour.

The results of this optimization were very promising, highlighting the advantages of parametric models in an optimization process. Compared to the initial design, the optimized volute delivers a calculated improvement of about 30 per cent in pressure increase between the volute inlet and outlet.

Appendage Design Case Study

Key requirements in ship design optimization are an increased energy efficiency, the avoidance of excessive cavitation, and reduced pressure excitation. In this use case, a wake equalizing duct (WED) was applied to a tanker. The result was a dramatic improvement of the wake field. The geometry of the tanker was imported into the FRIENDSHIP-Framework, while the wake field was computed using the RANS solver CHAPMAN. For reusability and convenience, the WED was defined as a feature, a design entity that encapsulates complex design tasks. By bundling functionality relevant within a certain modelling context, →

Benefits



DIFFERENCE. Computed wake field of a tanker without (l.) and with (r.) a WED.

→ features achieve two objectives: they aggregate several separate design steps into one simple action; and they speed up repetitive or tedious processes. In the given case, the design parameters were:

- **inner diameter**
- **angle of outline cone**
- **angles of axes of half rings against the longitudinal planes of the ship**
- **position of the WED**
- **chord length**
- **profile section shape.**

The first four properties were defined as inputs for duct generation, while the profile was taken from a proven standard series. In addition, the generation of a surface grid was incorporated into the feature. The wake equalizing duct was added to the model, and adjusted to achieve a reasonable position and geometry. The surface grid was used to generate a component volume grid so that the viscous flow computation with a WED could be launched without involving any complicated grid generation procedures. The comparison of the tanker's wake fields with and without a wake -equalizing duct highlights the massive effect of the duct: The strong bilge vortex is minimized while the areas of low flow velocity are reduced significantly.

In generating the results, care was taken to safeguard data consistency and minimize alteration, loss or corruption of data during the geometry exchange process. This ensured both a reliable geometry development and smooth processing towards the final product.

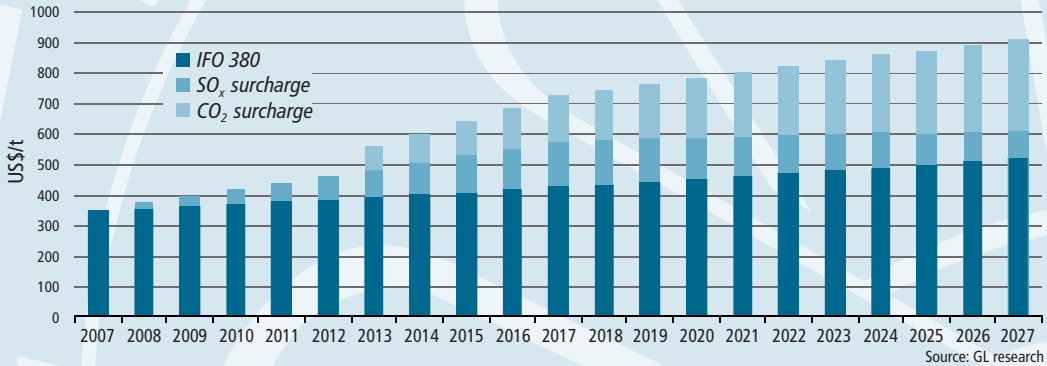
Benefits

The following key benefits can be achieved by using the FRIENDSHIP-Framework as a CAE system:

- **a time and cost-saving engineering process and an accelerated design phase**

Fuel Price Development – Need for Action

Assumptions: Inflation of 2% p.a., SO_x surcharge increasing to current price difference MDO-HFO (US$ 150/t) until 2017, CO_2 surcharge increasing to US$ 100/t (with 3t CO_2/t fuel)



Source: GL research

Future Prospects

References

- **lower design and model testing costs**
- **expanded pre-production knowledge; lower risk of late changes**
- **enhanced return on investment in CFD and other tools; integration techniques enable individual customization (e.g. XML, generic interface, COM interface).**

Shape optimization within the FRIENDSHIP-Framework will achieve, on average, fuel savings of 4 to 5 per cent.

Future Prospects

The FRIENDSHIP-Framework supports both surface engineering from scratch and (re)engineering, and the improvement of existing designs. It enables engineers to set up, analyze, vary and optimize functional surfaces in a convenient, holistic design process. These user-friendly solutions reduce workloads dramatically while minimizing design uncertainties and supporting a target-oriented, streamlined work flow. The software system serves as a unique integration platform for external tools and programs, and as a configurable workbench for naval architects. Existing investments in CFD and CAD will continue to yield their good return.

New IMO regulations and guidelines, as well as increasing demand for efficiency emphasize the growing need for optimized, compliant products. Re-engineering and re-modelling existing designs and structures are effective means of ensuring sustainability, operability and efficiency – both today and in the years to come.

References

- **Abt, C.; Harries, S.; Wunderlich, S.; Zeitz, B.:** Flexible Tool Integration for Simulation-Driven Design using XML, Generic and COM Interfaces, COMPIT 2009, Budapest.
- **Brenner, M.; Abt, C.; Harries, S.:** Feature Modeling and Simulation-Driven Design for Faster Processes and Greener Products, ICCAS 2009, Shanghai.
- **Harries, S.; Hinrichsen, H.; Hochkirch, K.:** Development and Application of a New Form Feature to Enhance the Transport Efficiency of Ships. 102. Hauptversammlung Schiffbautechnische Gesellschaft, Berlin, November 2007, STG Vol. 101.
- **Keskin, A.; Swoboda, M.; Palluch, J.; Abt, C.:** Comparison of Different Parameterization and Optimization Approaches in the Field of Aerodynamic Compressor Blade Design.
- **Lee, Y.-S.; Choi, Y-B.; Harries, S.:** DSME Sharpens Edge for 14,000 TEU Carrier, The Naval Architect, Design and Construction of Containerships, July 2008.
- **Palluch, J.; Starke, A.; Harries, S.:** Parametric Modeling for Optimal Components in Turbomachinery, World Wide Turbocharger Conference 2009, Hamburg.

BACKGROUND INFORMATION

FRIENDSHIP SYSTEMS – a Member of the GL Group

FRIENDSHIP SYSTEMS, based in Potsdam, first introduced the leading software system for the simulation-driven design of functional surfaces in August 2007. In autumn 2009, an upgrade with expanded functionality, for instance distributed computing, was released. For the SMM 2010 a new release with further enhanced user-friendliness is planned. The work focuses on developing effective, cutting-edge software solutions and providing a range of support services. The company assists customers in streamlining their internal processes, especially in the engineering workflow. Through expert-led hands-on training, both onsite and in house, engineers around the world can hone their skills in working with the software while learning about new developments and methodologies. FRIENDSHIP SYSTEMS has built an extensive knowledge database drawing on years of experience in academia, R&D, international projects and cooperations. This accumulated expertise drives the development of software solutions, delivering invaluable benefits in expediting the most effective and efficient designs.

service

Dates at a Glance

JUNE/JULY

23. – 25.06.2010
Wind Power Asia
Beijing, China
www.windpowerasia.com

23. – 26.06.2010
IGEM Annual Conference and Exhibition
Loughborough, UK
www.igem.org.uk

29. – 30.06.2010
Event & Expo BWEA Offshore Wind
Liverpool, UK
www.renewable-uk.com

JULY

07.07.2010
IAME 2010,
Lisbon, Portugal
www.iame2010.org

AUGUST

24. – 27.08.2010
Exhibition & Conference ONS
Stavanger, Norway
www.ons.no

30.08. – 01.09.2010
Windpower Brazil 2010 Conference and Exhibition
Rio de Janeiro, Brazil
www.brazilwindpower.org

SEPTEMBER

06. – 07.09.2010
FLNG Technical Masterclass Mooring systems for FLNG
Rio de Janeiro, Brazil
www.informaglobalevents.com/event/FLNGMasterclass

07. – 10.09.2010
Exhibition SMM
Hamburg, Germany
www.hamburg-messe.de/smm

07. – 08.09.2010
First global maritime environmental congress
Hamburg, Germany
▶ Lecture Dr Klein 07.09.2010, 1:45 – 3:20 p.m.: „Legislation & the regulatory environment: What is the current regulatory environment facing the maritime industry? What is on the horizon?"
www.gmec-hamburg.com

08. – 10.09.2010
FPSO Course
Rio de Janeiro, Brazil
www.informaglobalevents.com/event/fpsocourses

GL Academy

Selected seminars in 2010 (in English) – information and registration: academy@gl-group.com
held by GL Garrad Hassan – information and registration: training@garradhassan.com

JUNE

22. – 23.06.2010
Wind Farm Development
Bristol, UK

JULY

01.07.2010
Offshore Wind Farm Electrical Systems
Liverpool, UK

01. – 02.07.2010
Internal Auditor BS OHSAS 18001:2007 for Industry and Service Providers
Hamburg, Germany

03.07.2010
Introduction to GH WindFarmer
Oldenburg, Germany

05. – 09.07.2010
Lead Auditor Environmental Systems ISO 14001
Mexico, D.F., Mexico

06.07.2010
Harmonization of Safety (ISM) and Security (ISPS) Management Systems
Singapore, Singapore

11. – 12.07.2010
Application of Risk Assessment in Tanker Management and Self-Assessment (TMSA)
New Orleans, USA

14. – 15.07.2010
Shipping Basics for Banks
New York, USA

15.07.2010
Practical Aspects of Corrosion Protection for Shipping Companies and Shipyards
Vancouver, Canada

15.07.2010
Offshore Basics and Dynamic Positioning
Singapore, Singapore

21. – 22.07.2010
Internal Auditor ISM/ISO 9001: 2008 for Shipping Companies
Limassol, Cyprus

AUGUST

05.08.2010
Emergency Preparedness and Crisis Management
Piraeus, Greece

11. – 12.08.2010
Classification and Preparation of Newbuilding Surveys
Stamford (CT), USA

16. – 17.08.2010
Implementation Workshop ILO Maritime Labour Convention
Charleston, USA

17.08.2010
Managing Newbuildings
Singapore, Singapore

26.08.2010
Extended Dry Docking
Singapore, Singapore

Personalia

GL Noble Denton has appointed **Chris Harding** as the new Executive Vice President for the region Americas. As of 1 April, he will direct all business activities of GL Noble Denton in the United States and Canada, Brazil, Mexico, and Trinidad & Tobago.

Steen Brodsgaard Lund is the new Executive Vice President and Regional Manager of GL Maritime Services Asia/Pacific. In his new position, Mr Lund will be in charge of 16 countries comprising over 50 liaison offices and 600 employees.

Richard Bailey is the new Executive Vice President for the region Asia/Pacific at GL Noble Denton, effective since 1 February 2010. He directs GL Noble Denton's services in markets as diverse as Australia, Singapore, Malaysia, China, Korea, Thailand, Vietnam, Brunei, Indonesia and the Philippines.

Addresses

EGYPT
GL Garrad Hassan Egypt
Usama Said
66, Cornich El-Nile, Maadi
Zahret El-Maadi Tower
35th Floor, Apartment 2
Cairo, Egypt 11431
Phone: +20 225 287 295 / 241
Fax: +20 225 287 294
E-Mail: usama.said@gl-garradhassan.com

TRINIDAD & TOBAGO
Germanischer Lloyd Industrial Services Trinidad Ltd.
Invaders Bay Tower
Audrey Jeffers Hwy
Port of Spain, Trinidad, W.I.
Phone: +1 868 623-0428
Fax: +1 868 623-0429
E-Mail: jeff.clark@gl-group.com

SWEDEN
Germanischer Lloyd Sweden AB,
Country Office/Station Gothenburg
Hantverksvägen 15
436 33 Askim, Sweden
Phone: +46 31 7488930
Fax: +46 31 7488935
E-Mail: gl-gothenburg@gl-group.com

Photo: Dreamstime

Rules for Classification and Construction

Our latest brochures, rules, and guidelines are available on request.
Order forms are available on the Internet: www.gl-group.com > Rules & Guidelines

I – Ship Technology

Part 0 – Classification and Surveys 2010-05-01

Part 1 – Seagoing Ships

Chapter 1
Hull Structures 2010-05-01

Chapter 2
Machinery Installations 2010-05-01

Chapter 3
Electrical Installations 2010-05-01

Chapter 4
Automation 2010-05-01

Chapter 5
Structural Rules for Containerships 2010-05-01

Chapter 15
Dynamic Positioning Systems 2010-05-01

Part 6 – Offshore Service Vessels

Chapter 1
Hull Structures 2010-01-01

VI – Additional Rules and Guidelines

Part 3 – Machinery Installations

Chapter 1
Guidelines for the Use of Gas as Fuel for Ships 2010-05-01

Part 10 – Corrosion Protection

Chapter 1
Coating of Ballast Water Tanks 2010-05-01

IACS Common Structural Rules and GL Complementary Rules

Bulk Carriers

Volume 1
Common Structural Rules 2010-07-01

Volume 2
Complementary Rules 2010-05-01

Double Hull Oil Tankers

Volume 1
Common Structural Rules 2010-07-01

Volume 2
Complementary Rules 2010-05-01

CD-ROMs

GL Rules and Programs 12.0
Selected Rules & Guidelines incl. Programmed Hull Structural Rules for Specific Ship Types 2010

Poseidon ND 10.0
Strength Assessment Tool for Hull Structures of Seagoing Ships 2010

GL Noble Denton Guidelines

Reference	Title	Rev	Issue date
0009/ND	Self-Elevation Platforms – Guidelines for Elevated Operations	5	2010-03-31
0013/ND	Guidelines for Loadouts	5	2010-03-31
0015/ND	Concrete Offshore Gravity Structures – Guidelines for Approval of Construction, Towage and Installation	2	2010-03-31
0016/ND	Seabed and Sub-Seabed Data Required for Approvals of Mobile Offshore Units (MOU)	5	2010-03-31
0021/ND	Guidelines for the Approval of Towing Vessels	8	2010-03-31
0027/ND	Guidelines for Marine Lifting Operations	9	2010-03-31
0028/ND	Guidelines for the Transportation and Installation of Steel Jackets	4	2010-03-31
0029/ND	Guidelines for Pipeline Installation	0	due 2010
0030/ND	Guidelines for Marine Transportations	4	2010-03-31
0031/ND	Guidelines for Floatover Installations	0	due 2010
0032/ND	Guidelines for Moorings	0	due 2010
0033/ND	Guidelines for Installing Subsea Equipment	0	due 2010

IMPRINT

nonstop, issue No. 1/2010, June 2010 **Frequency** nonstop is published twice a year **Published by** Germanischer Lloyd Aktiengesellschaft, Hamburg **Editorial Director** Dr Olaf Mager (OM), Corporate Communications **Managing Editor** Steffi Gößling (SG) **Authors of this issue** Claus Abt (CA), Marc Beerendonk (MB), Monika Dippel (MD), Antje Fleischhauer (AF), Capt. Nigel Groves (NG), Dr Lars Grünitz (LG), Stefan Harries (SH), Janna Heuer (JH), Karen Jacka (KJ), Michael Kühnel (MK), Jörn Iken (JI), Nora Luttmer (NL), Stefanie Normann-Birkholz (SNB), Richard Palmer (PR), Heinrich Seeger (HS), Mirjam Tomé (MT), Anne Wenzek (AW), Li Zhang (LZ) **Design and Production** printprojekt, Schulterblatt 58, D-20357 Hamburg **Layout** Oliver Lohrengel **Translations** Eugen Klaußner, Andreas Kühner **Prepress** Fire Department **Printed by** Media Cologne

Enquiries to: Germanischer Lloyd AG, Corporate Communications, Brooktorkai 18, D-20457 Hamburg, Phone: +49 40 36149-7959, Fax: +49 40 36149-250, E-Mail: pr@gl-group.com

Subscription service: for address changes and orders please send an e-mail to publications@gl-group.com

news

PIPELINE SIMULATION

New Technology Award for Acknowledged Experts

Pipeline Simulation Interest Group (PSIG) has awarded its first-ever Technology Advancement Award to Dr Henry H. Rachford, Jr. and Dr Richard G. Carter of GL Noble Denton. The experts received this award for their outstanding work in the field of pipeline optimization under transient conditions.

Good reputation. The award, which was handed over at the Group's 41st annual meeting in Bonita Springs, Florida, recognizes achievements made in advancing the state-of-the-art of pipeline simulation technology. "Henry and Richard have made remarkable contributions to the technical development of pipeline simulation and I congratulate them for this recognition," said John Wishart, GL Noble Denton President. "We are honoured to have such esteemed scientific experts on the team."

HONOUR. Dr Henry H. Rachford, Jr. and Dr Richard G. Carter of GL Noble Denton receive PSIG's first-ever Technology Advancement Award.

Dr Henry H. Rachford, Jr. has had a stellar 60-year career within the petroleum and natural gas industries. In 1969 he founded DREM, Inc. with Dr Todd Dupont, a company specializing in real-time pipeline hydraulics simulation. Since 1986, when Stoner Associates purchased DREM, he has served Stoner as well as its successors Advantica and GL Noble Denton, as a principal technical adviser.

Dr Richard G. Carter is Senior Lead Research Scientist at GL Noble Denton. He has 30 years of experience in scientific computation including the past 18 years in the oil and gas industry with Stoner Associates, Advantica, and GL Noble Denton.

Large expertise. The Pipeline Simulation Interest Group, formed in 1969 as an outgrowth of an American Gas Association committee dealing with transient flow in natural gas transportation systems, is an international group of pipeline engineers conducting annual meetings, drawing approximately 150 attendees and publishing between 11 and 20 papers in its proceedings. The Technology Advancement Award was created to recognize unique and major additions in the technology of pipeline simulation. Ever since, PSIG has reflected the industry's areas of interest working on steady-state analysis, optimal design and operation and combining transient analysis with optimization.

FPSO RESEARCH FORUM

Teaming up to Overcome Engineering Challenges

Oil & gas industry experts will join to discuss "Human, System and Ageing Effects on FPSO Integrity" in autumn. The Floating Production Storage and Offloading (FPSO) Research Forum will be hosted by GL Noble Denton in Aberdeen from 11–15 October 2010.

Hand in hand. More than 150 experts are expected to meet for Joint Industry Projects' (JIPs) Steering Committee meetings and a public forum. The forum's mission is to identify the common technical issues facing those involved in designing, fabricating and operating FPSOs and to foster JIPs to tackle them for the common good of the industry.

The importance of this forum is in investigating the key human, system and ageing effects which influence FPSO integrity.

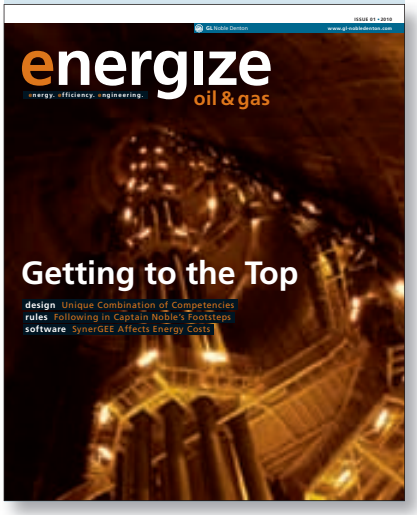
GL Noble Denton has been involved in more than 100 mobile offshore production units since the first FPSO ever built, "Petrojarl 1" in 1984, including more than 15 newbuilds, 20 conversions and 65 studies.

Full service. With experts on hull, structure, mooring, turret, marine systems, living quarters, safety and utility modules, GL Noble Denton takes on all phases of the project from conceptual and front-end engineering design through detail design to site management and asset integrity management.

INFORMATION

New GL Magazines

The growing importance of both the oil and gas business and renewable energies in the service portfolio of the GL Group is reflected in two new company magazines now being published alongside *nonstop*. With its new magazines *energize oil & gas* and *energize renewables*, GL as a technical service provider offers its customers and partners a medium closely tailored to the audiences in these key business segments. **Readers interested in subscribing are invited to send an e-mail with their contact details to publications@gl-group.com.**



Mitsubishi Power Systems

Wind Turbine – GL Issues Statement of Compliance

Mitsubishi Power Systems Europe received a Statement of Compliance from GL Renewables Certification for the A-Design Assessment of their wind turbine MWT 95/2.4 (50 Hz). The Statement of Compliance means new opportunities.

Up to standard. "Due to the long-lasting relationship between Mitsubishi Power Systems Europe and GL, we are delighted we were chosen by them to verify the design of the newly developed wind turbine. Another milestone in our cooperation," said Christian Nath, Vice President GL Renewables Certification.

CERTIFICATE. GL's Vice President Christian Nath (third from l.) handed over the Statement of Compliance to Masaaki Shibata, Mitsubishi Power Systems Europe (fourth from l.).

The statement was issued according to the International Standard IEC 61400-1 "Wind turbine generator systems – Part 1: Safety requirements", 2nd edition, and the "Guideline for the Certification of Wind Turbines", Edition 2003 with Supplement 2004, GL.

ONLINE SERVICE

New Wind Intelligence Tool

Launch in Poland: GL Garrad Hassan presented its new Online Data Management (ODM) service at EWEC 2010 in Warsaw. The new tool helps wind farm developers maximize the value of their wind resource measurement investment by enabling stable, accurate and continuous data collection and review.

The service provides 24/7 secure online access to summary statistics compiled from the data recorded, including energy estimates and other critical information pertinent to the early stages of project development. The on-site data measurements transmitted are received and processed by the automated service. The data is quality-checked, then reviewed by an experienced analyst. Recent data statistics are presented on a weekly basis.

Direct access. Routine data reviews ensure that problems with equipment are quickly identified and resolved, thereby increasing the value of the data for subsequent use in formal, bankable assessments. The ODM service also provides access to trained staff to help answer questions and provide further development services if required.

The Human Factor

Human failure – a commonplace explanation for accidents. Human Factors Engineering helps improve the interaction between humans and machines to prevent catastrophic accidents

The offshore oil and gas industry is continuously striving to make the offshore environment a safer place to work. Most serious offshore accidents (a generally accepted figure is 80 per cent) have been primarily attributed to "human error". Detailed investigations, however, indicate that human errors are most often caused by a mismatch between human and machine behaviour. The "human factor" thus needs to be given much more serious consideration to avoid accidents. The offshore industry has begun to acknowledge the role that Human Factors Engineering can play in the design of offshore facilities.

Human Factors Engineering (HFE) addresses the need for an effective interaction between humans, the technology they use and the environment in which both must operate (human-machine environment, or "ergosystem"). HFE also ensures that all factors that can influence humans and their behaviour (workplace organization, physical work environment, workspace design, job factors and individual characteristics) are taken into account to create beneficial and efficient working conditions, thus reducing the potential for human error whilst improving safety and overall system performance.

Complex Technical Systems

Unfortunately, HFE has traditionally not received the same practical emphasis as industrial engineering and occupational medicine. However, considering the advancement of technology in the 20th and 21st century, all reasonable efforts to mitigate the risks inherent in this technology should be given the same emphasis. As Jerome Lederer, a pioneer of air safety, said: "We shall continue to take risks of greater magnitude than in the past.

ENGINEER ERROR. In a startling accident at Montparnasse train station in Paris, France, in October 1895, an engine driver not only overran the buffer but also the platform, breaking through the glass wall of the station.

But the consequence of failure is becoming less permissible."

It is considered the "duty" of HFE to question engineering concepts. Wherever a task is designed, all requirements, including those relating to human performance, must be accounted for. In operator training programmes intended to minimize risk, the underlying assumptions and procedures must be challenged. Detailed investigations of serious large-scale industrial accidents – such as Three Mile Island, Bhopal, Chernobyl and Piper Alpha – have shown that so-called "human error" needs to be viewed in the wider context of the circumstances created by organizational and management structures. HFE recognizes that the causes of errors and accidents are usually to be found in the way the engineered and human systems fit together and interact. It promotes an approach in the design of systems →

A Pioneer of Air Safety

Photo: NASA

ENGINEER. J. Lederer.

Jerome Lederer (1902–2004), founder and until 1967 Head of the Flight Safety Foundation. From 1970 until 1972, Lederer was responsible for the safety of all NASA activities, including space and aircraft operations, industrial safety, fire and vehicular safety. After his retirement from NASA in 1972, he dedicated much of his time to investigations of unique and challenging safety problems, essentially HFE issues, such as substance abuse, and subtle cognitive incapacitation of pilots, cockpit boredom, and interpersonal communications.

Photo: NASA

APOLLO 17. The "Lunar Roving Vehicle" on the moon.

ACCURACY. When handling safety-critical equipment, every movement by the operator must be well controlled.

→ and equipment that minimizes the potential for human error. This is particularly important in today's complex and large-scale technological systems that confront human operators with new demands. On many occasions, the error and resultant failures can be attributed to factors such as:

- complicated operational processes,
- ineffective training,
- non-responsive managerial systems,
- non-adaptive organizational designs,
- haphazard response systems, and
- sudden environmental disturbances.

It is obvious that it would be irresponsible for the offshore oil and gas industry not to give due consideration to human performance factors in its efforts to mitigate the risks to people and assets in the offshore environment.

Understanding Human Nature

With all this in mind, GL Noble Denton has expanded its Safety and Risk services to include HFE. The company's expertise in this field covers many different industry sectors and is transferable to any domain. GL Noble Denton's head HFE specialist has over 13 years' experience in Human Factors Engineering and ergonomics. GL offers a diverse range of HFE services to the oil and gas industry:

- **Integration of HFE into traditional safety cases** – During the formal safety assessment, GL Noble Denton accounts for human factors to ensure that operators can handle "non-design" emergencies.
- **HFE hazard analysis and screening studies** – In the initial stages of a project cycle for a new facility, GL Noble Denton determines where HFE could add value by improving human efficiency or reliability and/or by reducing HSE risk during maintenance and operational tasks. The result is an HFE Issue Register.
- **HFE implementation plans** – Define the HFE organizational structure, responsibilities, scope of work, schedule and integration plan within the engineering project organization.
- **HFE design standards** – Aids for the design of hardware and software that provide quick and easy access to project-specific criteria for certain HFE design requirements.
- **Front-End Human Factors Engineering Analyses** (FEHFEA) – A high-level task analysis performed early on during FEED (Front-End Engineering Design) to "think through" the activity sequences a person would need to go through to use the equipment and to verify whether the capabilities and limitations of the persons who will operate and maintain the equipment have been accounted for.
- **Assistance with EPC contractor selection and awards** – Ensures that bidding EPC contractors include in the bid packages their own HFE Plan (HFEP) describing the scope of HFE measures, the deliverables and other relevant details. GL Noble Denton will help in the assessment of the HFE information presented in the bid packages.
- **HFE awareness training** – Specific HFE training for all

BACKGROUND

The Human Factor in Major Industrial Accidents

DEALING WITH THE CRISIS. US President Carter leaving the ill-fated Harrisburg nuclear power station.

1979: Three Mile Island Nuclear Station accident near Harrisburg, Pennsylvania. The partial core meltdown in Unit 2 resulted in the release of an estimated 43,000 curies of radioactive krypton and 20 curies of the hazardous iodine-131. Investigations indicated that mechanical failures were compounded by the initial failure of plant operators to recognize the situation due to inadequate training and ambiguous control room indicators.

1984: Union Carbide India Limited Bhopal gas tragedy in India. The plant released 42 tonnes of toxic methyl isocyanate (MIC) gas. 3,828 people died as a direct result of the disaster. By 1 December 1999, the Office of the Indian Medical Commissioner had registered 22,149 fatalities directly attributable to the disaster, with over 200,000 recorded health effects. Investigations indicated that apart from the significant safety concerns that existed at the plant, one operator had to monitor about 70 panels, indicators and controllers in the control room, and the period of safety

Photo: Dreamstime

technical personnel involved in detailed design work before the actual detailed design begins.

- **HFE specialist studies** – Valve Analysis Studies, Skid-Packaged Unit Analysis and Control Room Studies assessing these items in terms of HFE criteria.
- **Detailed control system interface design/modification** – Workload analysis: Determines optimal staffing numbers over all shifts and covers all operating modes (normal, degraded and emergency). Review of the alarm management system: alarm systems are often a contributing factor in accidents.
- **Human error analysis studies** – Identify potential operator errors during human-machine interaction in complex systems, such as control room monitoring.
- **3-D model design reviews** – Ensure efficient maintenance of equipment, safe movement of staff and equipment, sufficient clearances, safe access to critical items, adequate pathways and egresses for escape, evacuation and rescue, and other items.
- **Review of vendor packages** – Review of proposed designs for compliance with project HFE requirements, specifications and standards, and assistance in incorporating improvements to the package.
- **HFE inspections** – For details not included on drawings, GL Noble Denton HFE Consultants can audit compliance with HFE design requirements.
- **Support during the installation of "field run" equipment** – Ensures compliance with project HFE design requirements.
- **Input into critical operating procedures**, operations and maintenance documentation – Serves to identify potential human error during critical operations as a result of poorly written operating procedures.

Man as a risk factor will never be eliminated entirely but needs to be managed professionally. ■ KJ

For further information: Karen Jacka, Principle Consultant Human Factors, Phone: +603 2161 0088, E-Mail: karen-louise.jacka@gl-group.com

FURTHER HFE SERVICES BY GL NOBLE DENTON

- **Human error identification and analysis** using accepted methodologies.
- **Development of guidance documents/specifications** for various HFE and HSE activities.
- **Development and review of safety-critical procedures** to ensure effective communication of critical safety aspects; and
- **Crane cab assessments** to ensure control-movement compatibility, effective angle of sight, improved visibility and a fatigue-free operator posture.

ACCIDENT. The Chernobyl nuclear power plant.

training for workers in the MIC unit had been reduced from six months to 15 days.

1986: Chernobyl Nuclear Power Plant accident in Ukraine, then part of the Soviet Union.
To date considered the worst nuclear power plant disaster in history. 56 direct deaths were recorded, but it is estimated that there were 4,000 additional cancer deaths. The incident resulted in the evacuation and resettlement of 336,000 people. Investigations indicated that apart from inadequate safety features, an unstable reactor design and lack of containment, operators were insufficiently trained, there was a lack of communication about the emergency core cooling test that was being performed, and at the time of the incident all control had been transferred from the process computer to inadequately trained operators.

1988: Occidental Petroleum Ltd "Piper Alpha" North Sea oil production platform explosion.
The platform was destroyed, and the resulting fire killed 167 men. The world's worst offshore oil disaster to date in terms of both lives lost and impact to the industry. Investigations indicated inadequate maintenance and safety and emergency procedures, as well as poor communication relating to working permits.

FLOAT-OVER. Phases of an operation: The installation of a topside onto a pre-installed jacket by means of an installation barge.

The Magical Powers of DP

No tethers, no moorings, no tedious anchor handling: Dynamic Positioning (DP) enables float-over installations of topsides in a fraction of the usual time. With almost magical precision, the installation barge finds and maintains its position

The term "float-over" describes the installation of a topside onto a pre-installed jacket by means of an installation barge or vessel: the barge floats into the jacket slot and then transfers the load to the jacket, typically by ballasting. Once the topside rests safely on the jacket, the installation vessel exits the jacket slot.

Float-over operations are becoming more common worldwide due to limited availability of large crane vessels, high costs and the advantages of hooking up and commissioning large topsides onshore. Float-overs are usually performed by self-propelled heavy lift vessels. A key challenge in any float-over operation is the precise manoeuvring and positioning of the vessel into the jacket. The conventional approach uses a mooring spread, which requires careful planning and is associated with considerable technical cost and effort. More recently, a new method has been tried successfully in several installations: relying on the Dynamic-Positioning (DP) system of the installation vessel rather than using a mooring spread.

Eight topside float-over installation operations have been performed utilizing the DP capabilities of the COSCOL-owned vessels Tai An Kou and Kang Sheng Kou, ranging from using the DP capabilities with mooring tethers to full, un-aided DP float-overs.

Moored Float-Over Method

In a traditional float-over operation, the vessel or barge is hooked-up to a pre-installed mooring spread prior to entering the jacket. This method requires a considerable amount of preparatory work during the early stages of the project, both on the offshore site and on the float-over vessel itself. Typically it can take up to 36 hours to connect a vessel to the mooring spread and to perform the float-over operations. Additional anchor handling vessels are required to connect the vessel lines to the pre-laid moorings and to remove them once the installation has been completed.

Float-overs were initially performed onshore and then, as the technology developed, carried out offshore with barges. They have now been performed using DP with the vessel entering the jacket and holding station during weight transfer without the aid of moorings; the most recent float-over from entering to exiting the jacket was completed within three hours. Performing a DP float-over is significantly simpler than a mooring-assisted float-over, because most of the operations can be controlled and per-

formed from the bridge of the vessel. There is no need to hook up to pre-laid moorings, and therefore no additional tugs or winch operators are required. This lowers the risk and increases the safety of the operation.

Vessel preparations for a DP float-over are minimal compared to the mooring-assisted method as there are no requirements for winches and power packs to be placed on the main deck. Jacket entry aids at the stern of the vessel and surge fenders still need to be installed on the vessel, as for a mooring assisted float-over.

Since a float-over with DP requires no mooring lines to hold the vessel during the operation, field preparations are minimal, with only tidal reference gauges that need to be installed on site. Most importantly, there is no need for anchoring or pre-installed buoyed moorings as required by some field operators for conventional float-over operations. This provides significant savings for fields with subsea assets that may obstruct a mooring system.

The DP float-over method thus offers clear advantages over the traditional, mooring-assisted approach (refer to insert "Comparison Between Moored and DP Float-Overs"). After transferring the topside to the jacket, the installation vessel can depart from the field immediately. A DP float-over's simplicity is its most important factor in terms of safety and economy.

Examples of DP Float-Overs

The Bunga Raya A Topside, located in the Gulf of Thailand and operated by Talisman Malaysia, was the first to be installed from a DP vessel. As a pioneer DP installation, this project included many safeguards to recover the situation should the DP system fail. These included a full position management survey spread, motion monitoring, assisting tugs, bow and stern moorings and tethers and tether monitors as required by the client. During the planning stage, a DP-capability plot was prepared to establish that the DP system's operational limits were in excess of the environmental conditions prevailing at the installation location.

As the vessel approached the location, a number of DP-system trials and simulation manoeuvres were undertaken, which proved successful. Then the vessel was moved stern first towards the jacket in 10-metre steps. At the end of each step, the vessel was brought to a stop to allow her position to stabilize before continuing. On approaching 50 metres from the jacket, the steps were reduced to 5-metre intervals. The DP system worked well and the vessel maintained heading and did not deviate from the track by more than one metre between 250 and 50 metres from the jacket centre. The DP system proved adequate to manoeuvre a vessel from seaward towards a jacket for the installation of a topside with significant wind area in benign conditions.

The second DP installation project was the Bunga Raya E topside in February 2006. Amendments to the Bunga Raya A installation methodology were made based on the lessons learnt. The significant differences from Bunga Raya A were recorded.

During the transit and float-over operation, a Height Differential Monitoring System (HDMS) specifically developed by the DP system provider Nautronix PLC provided invaluable information on vessel movement characteristics to the marine crew, earning praise from the charterer's marine representative who commented on the cost savings compared to traditional survey methodology. This was the first-ever float-over operation carried out by a vessel relying solely on DP. All parties involved were pleased with the performance of the DP system, especially given the fact that there were only seven centimetres clearance between the side of the vessel hull and the jacket pins.

The Rong Doi project, the third DP-controlled installation, differed from Bunga Raya A in one major aspect: the jacket leg fenders were dispensed with and the final clearance between the vessel's side fendering and jacket leg reduced to 100 mm, 50 mm on either side. This installation demonstrated one of the real advantages of the DP method. With a planned installation period of 14 hours (subsequently reduced to 12 hours), the allowable reference period was only 24 hours. Despite unfavourable weather conditions, the topside was installed in less than three hours on DP alone.

A Viable Alternative

Using a DP vessel for a float-over operation is a relatively new technique and a very valuable alternative to the traditional mooring-assisted float-overs.

The additional advantages of relatively high-speed transports and shorter exposure time mean less probability for the environment to pose a threat to safety. Additionally, the cost savings are significant when compared to a lifted installation or mooring-assisted float-over. Operational experience of the vessel's DP capabilities and also the competence of the vessel crew have increased with each successive project, allowing progressive savings to be made. A further five float-over contracts have been secured for these vessels, taking advantage of their DP capabilities. ■ MB/NG/RP

For further information: Richard Palmer, Group Director, Transportation & Installation, Phone: +44 20 7812 8748, E-Mail: richard.palmer@nobledenton.com

COMPARISON BETWEEN MOORED AND DP FLOAT-OVERS

Duration. The most obvious benefit of a DP-assisted float-over operation is the reduced window required to perform the actual float-over. Without the need to connect mooring lines and make significant on-site preparations, the float-over operation itself can be performed in a much shorter timeframe, which is also beneficial with respect to costs and safety. For the vessel or barge itself, there is no need for extensive preparations such as installation of mooring equipment. Time is, however, required for a DP trial prior to entering the jacket, given the importance of a reliable DP system for the intended operation.

Costs. Costs for a DP-assisted float-over can be considerably less than a mooring-assisted operation, given the fact that no anchors, lines or winches need to be purchased or rented. Also, fewer anchor handling vessels will be required to assist during the operation.

Safety. The main benefit of a DP-assisted float-over operation lies in the reduced weather window required to perform the actual float-over operation. Also the redundancy in the vessel's dynamic positioning system should be considered, since a one-component failure cannot result in unacceptable risks for the operation.

In order to meet the safety standards, DP trials are conducted prior to entering the jacket, while also a dedicated DP-capability plot is prepared during the engineering phase of the project.

Wind of Change

The renewables sector continues to grow, offering a host of opportunities for Garrad Hassan and GL who are now ready to serve the market as one integrated technical services and consulting enterprise

On an area of approximately four square kilometres, equivalent to roughly 500 football fields, twelve wind turbines rise up from the icy waters.

150 metres in height, these structures are as tall as Cologne Cathedral. Each weighs 1,000 tonnes, or as much as 25 fully-loaded articulated trucks. The Alpha Ventus wind farm will feed at least 220 gigawatt hours of electricity into the utility grid every year, enough for 50,000 households. The commissioning celebration of Germany's first offshore wind farm in late April was a milestone, not only for its operators, E.ON, Vattenfall and EWE. It also ushered in a new era for the energy supply market.

In the coming months and years, more of these gigantic offshore power plants will be built to generate massive amounts of energy for continental power networks. Involved in nearly all larger projects are the experts of GL

PARTNERS. Pekka Paasivaara (l.), Dr Hermann J. Klein (r.), both Members of the GL Executive Board, and Dr Andrew Garrad, President GL Garrad Hassan.

Garrad Hassan. This new GL business segment was formed by merging GL's existing renewables business with British consultancy Garrad Hassan.

Perfect Partners

Garrad Hassan and GL now jointly form a leading independent, global provider of consulting, engineering, turbine design, certification, measurement, project management, strategic advice and inspection services as well as software products for the renewable energies sector. Their joint technical services portfolio covers the entire life cycle of wind, solar, marine and other renewable energy projects, both onshore and offshore, in- →

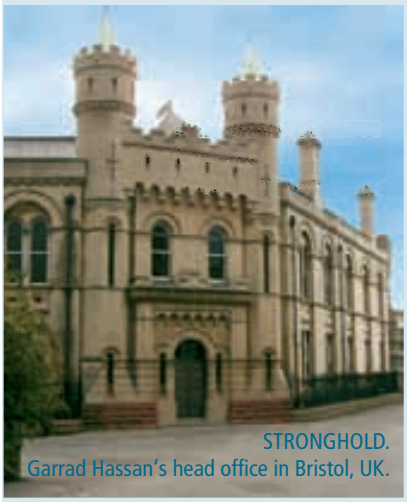
SURF. Wave and tidal stream power generating systems harness the energy of the oceans.

→ cluding the areas of safety, integrity, reliability and performance management.

"The merger of Garrad Hassan and GL is a reflection of growing customer demand for a one-stop service provider who offers solutions for challenges in technology, environmental matters and asset performance on a worldwide scale," said Pekka Paasivaara, Member of the GL Executive Board. "Together we will offer a unique level of service expertise and global presence across the whole project lifecycle."

Since April 2010 the new business segment renewables has been operating under the name of GL Garrad Hassan. It employs over 600 highly qualified engineers, technical experts and supporting staff working at 34 locations around the world. The merger follows GL's acquisition of Canadian wind energy consulting and engineering company Helimax, as well as WINDTEST, a German specialist in the field of measurements for wind turbines and wind farms. In addition, the offshore wind power expertise of Noble Denton, particularly in wind

BACKGROUND: GARRAD HASSAN



STRONGHOLD. Garrad Hassan's head office in Bristol, UK.

Leading Experts in Renewable Energy

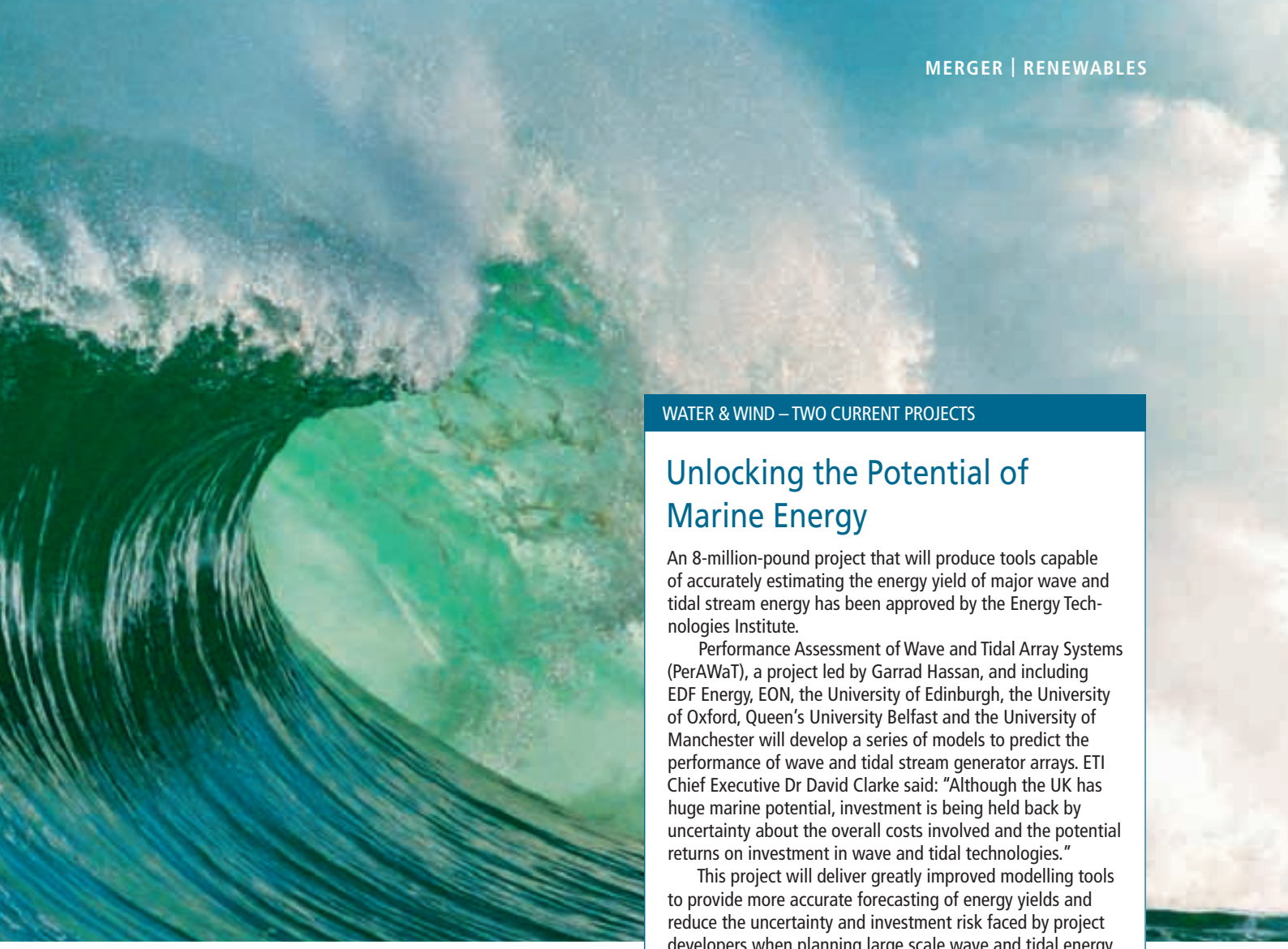
Garrad Hassan and Partners Ltd. was established in 1984. GH today employs over 360 highly skilled engineers and consultants at offices in 18 countries, serving the wind energy, marine and solar renewables industries around the world and is recognized as the leading independent authority.

The client list includes major wind turbine manufacturers, developers, banks and lenders. Garrad Hassan's expertise covers every aspect of wind energy: Garrad Hassan has acted as a banks' or owners' engineer for over 22,000 MW of operating wind farms around the world and has carried out energy assessments totalling over 100,000 MW.

The company provides due-diligence work, contract review and supervision for banks and lenders. Energy resource assessment, wind farm design and development services, onshore and offshore, are major parts of the portfolio.

For governments, the EU and NGOs, Garrad Hassan carries out analyses of energy policies, market surveys, regional resource studies, and research and development.

For manufacturers, the services include design and analysis of wind turbines, components, control systems, and software design packages as well as certification support and on-site measurements.



project management, was added to the GL Group in April 2009. GL has thus positioned itself as a full-service consultant with an expanding range of services, such as optimization of wind farm designs, performance enhancement of existing wind farms, measurement projects (covering wind resources, wind turbine performance and structural behaviour), as well as inspection and certification of turbines. Garrad Hassan contribute their comprehensive engineering and consulting expertise, along with a large array of software products and turbine design services. The merger puts GL Garrad Hassan at the forefront in the drive to develop a greener and more sustainable energy mix for the world.

Ideal Connection

"Garrad Hassan is delighted to be merging with GL. We have considered many potential partners but we have chosen GL because we share the same values of independence and technical rigour. Both companies have been working together for 25 years and hence know this combination will be successful. It brings benefits to our clients and employees alike. We are now able to provide an even more comprehensive service offering with access to more engineers, and this will enable us to enter developing markets," explained Dr Andrew Garrad, who is the President of the new combined renewables business. The fact that "renewables" not only denotes wind energy is demonstrated by the most recent marine energy project with GL Garrad Hassan as a key player (refer to insert at right). The affinity to GL and their maritime roots cannot be symbolized more aptly. ■ SG

For further information: Dr Andrew Garrad, President GL Garrad Hassan,
Phone: +44 11 79729900, E-Mail: andrew.garrad@garradhassan.com

WATER & WIND – TWO CURRENT PROJECTS

Unlocking the Potential of Marine Energy

An 8-million-pound project that will produce tools capable of accurately estimating the energy yield of major wave and tidal stream energy has been approved by the Energy Technologies Institute.

Performance Assessment of Wave and Tidal Array Systems (PerAWaT), a project led by Garrad Hassan, and including EDF Energy, EON, the University of Edinburgh, the University of Oxford, Queen's University Belfast and the University of Manchester will develop a series of models to predict the performance of wave and tidal stream generator arrays. ETI Chief Executive Dr David Clarke said: "Although the UK has huge marine potential, investment is being held back by uncertainty about the overall costs involved and the potential returns on investment in wave and tidal technologies."

This project will deliver greatly improved modelling tools to provide more accurate forecasting of energy yields and reduce the uncertainty and investment risk faced by project developers when planning large scale wave and tidal energy schemes. Garrad Hassan Marine Renewables Group Leader Dr Robert Rawlinson-Smith: "Deployment of large-scale arrays of marine energy conversion devices will only occur when project developers have sufficient confidence in the return on their investment."

Specialists Push Things Forward

Dudgeon Offshore Wind Ltd has appointed Garrad Hassan to provide continued technical support as it pushes ahead with the Dudgeon's 560-MW Round 2 project, in parallel with a planning approval process, in order to chase a 2013 commercial operation date. The Dudgeon site, which is positioned north of Cromer off the coast of Norfolk, has the potential to provide the annual electricity demands of 400,000 UK homes.

Garrad Hassan's multi-disciplinary offshore team is utilizing its many years of experience in supporting project developers, owners and investors to provide Dudgeon with advice related to the wind turbine and support structure procurement process as well as assessment of wind resource and site conditions.

PERFECT PLACE. England's eastern coast offers ideal conditions.

One-Stop-Shop Support

Badly sited or designed wind projects can have adverse social and environmental implications. GL helps clients to address these issues early in the project development phase and ensure that a project is compliant with regulatory requirements

TRANSPORT. A blade for one of the 60 wind turbines to be built at St. Joseph Wind Farm wind farn in Canada.

Environmental pollution and the emission of carbon dioxide (CO_2) due to the use of fossil fuels represent a threat to the environment, sustainable economic growth and health. Electricity generated by a wind turbine is produced without CO_2 emissions; nor does it pollute the air or water with harmful gases and materials. Indeed, wind turbines cause virtually no emissions during their operation and very little during their manufacture, installation, maintenance and decommissioning.

While this is the case, a wind energy project can potentially affect their immediate surroundings if they are not sited properly. In order to prevent environmental impacts due to the installation of wind turbines and to obtain the development consent, an Environmental Impact Assessment (EIA) has to be completed. Typically such a study will include detailed investigations of the natural and human environment, evaluate the potential effects of the wind project on the environment and the local community, and propose mitigation measures to reduce or eliminate any residual impacts. If carried out early on in the development phase, certain elements of an EIA such as constraints analysis and site screenings – which can quickly identify social or environmental critical issues – will assure the developer of a reduction of development risks. EIAs are also essential and required for on- and offshore projects. However →

CREATING AN OPTIMIZED PROJECT DESIGN

A Successful Approach

ENVIRONMENTAL/SOCIAL FEATURES
- Protected areas
- Watercourses, wetlands, water bodies
- Sensitive wildlife areas/sites
- Heritage/Archaeological sites
- Roads, trails, houses, settlements
- Communication towers, microwave links
- Permissible noise levels
- Lot lines
- Recreational areas
- Land uses
- Land owner restrictions
- Visual consideration

ENGINEERING
- Turbine selection
- Turbine layout
- Proximity to transmission lines
- Site complexity assessment
- Preliminary roads layouts, electrical network

METEOROLOGY
- Mesoscale
- Met towers

Photo: Siemens

WATER & WIND – TWO CURRENT PROJECTS

Persuasive Benefits

Maximize energy, minimize environmental and social impacts: a systemic approach optimizes wind project development

nonstop: How would you describe your systemic approach?
Patrick Henn: The systemic approach is basically a project development strategy that integrates engineering, environmental sciences and GIS to ensure that a project's design is optimized, i.e. that it maximizes energy while minimizing environmental and social impact.
nonstop: Why is the systemic approach successful in Canada?
Henn: We quickly realized a few years back that wind project development was done without considering environmental constraints, social acceptance, local zoning, etc. This generated frustration amongst developers in that – further down the development path – site constraints were reducing the amount of land available for development or, in some cases, eliminated a site altogether. The systemic approach proposes looking at siting issues early in the process to reduce the risk of surprises down the line. Additionally, integrating the environmental permitting process with the engineering of a project ensures that all elements are considered in parallel, thus creating an optimized project.
nonstop: How do your clients benefit?
Henn: Generally speaking, the systemic approach has two main benefits: Cost efficiency, as the whole project design is done "under one roof" and risk management, as our approach quickly identifies "showstoppers" or critical issues that might impact a project's design.
nonstop: How many EIAs have you conducted since you started the environmental service?
Henn: We have conducted EIAs for more than 3,500 MW of wind projects. Furthermore, if you consider the partial services such as constraints analyses, noise impact assessments, visual assessments, electromagnetic interference studies, etc. we have probably carried out such studies for more than 10,000 MW of projects.

PATRICK HENN. GL's Section Head of Environment and Permitting.

nonstop: How many EIA experts can you provide?
Henn: Our team is growing and currently includes approximately 20 in-house experts, such as environmental assessment managers, land planners, noise specialists and GIS staff. We also have a very extensive network of local specialists to address specific issues like avian fauna, bats, archaeology, etc.
nonstop: Do you think the systemic approach will be successful in Europe?
Henn: I can't see why not. Environmental and social issues are present in any jurisdiction and virtually all projects need to comply to a certain level of environmental regulation. The approach ensures these items are taken into account efficiently in the development phase of a project.

→ the potential impacts of on- and offshore wind farms are distinct given the different site conditions and environmental surroundings.

Systemic Approach

GL Garrad Hassan offers an environmental service ensuring the highest energy yield is achieved while minimizing social and environmental impact and ensuring the regulatory compliance of a renewable energy project. How is this achieved?

Through a systemic approach tried and tested in Canada by GL Garrad Hassan, an approach that integrates engineering, environmental sciences and the Geographic Information Systems (GIS) and enables all specialists to work together and create an optimized project. In essence, GL Garrad Hassan's main advantages are the following:

- **Cutting-Edge Method Ensures Highest Energy Yield**
  GL Garrad Hassan understands the interaction between environmental factors, turbine siting, and energy yield.
- **Efficiency in Project Design**
  By combining engineering with environmental sciences and GIS, GL Garrad Hassan ensures that a project is developed in a cost-efficient manner. Additionally, GL's EIA team includes local specialists that understand the local issues on a site-specific basis. These specific specialists are added to the team when required.
- **Experience**
  Former Helimax, now part of GL Garrad Hassan, has successfully completed EIAs for more than 3,500 MW of wind power projects. It has established itself as the Canadian leader in applying wind engineering expertise throughout the EIA of wind farms. With its knowledge and experience, GL Garrad Hassan can become the leading expert for EIAs of wind farms in Europe. ■ MT

For further information:
Mirjam Tomé, Environmental Impact Assessment
Phone: +49 40 36149-2748, E-Mail: mirjam.tome@gl-group.com

INTERVIEW

Efficiency Makes the Difference

Prof. Dr Karsten Runge is Managing Director of OECOS GmbH. *nonstop* spoke with him about the benefits of Environmental Impact Assessments (EIA)

KARSTEN RUNGE. Managing director of OECOS GmbH.

nonstop: How long have you been working in the field of Environmental Impact Assessments (EIA)?
Prof. Runge: I have been involved in Environmental Impact Assessment for over 20 years, whether working for the government, at the university or as a self-employed consultant, and I have prepared Environmental Impact Assessments for a large number of projects.
nonstop: Do you believe it to be useful for customers to get the full range of services from the same provider?
Runge: That depends on the customer. In my experience, large enterprises such as Vattenfall or E.ON are very interested in comprehensive solutions that allow them to deal with a single, reliable contact and minimize communication problems. As for small companies, I believe they would prefer to negotiate with each specialist separately.
I think it is very important to address both, the technical and environmental aspects concurrently. Technical solutions in particular can minimize the environmental effects while optimizing energy output.

Another key issue is the cost factor. A consistent methodology improves coordination during a project, thereby enabling an efficient overall solution. Integrated Environmental Impact Assessments are not only the best approach to minimizing the environmental impact while maximizing the energy yield. They are probably the most economical solution for the customer, as well.
nonstop: How important are EIAs?
Runge: First and foremost, an EIA serves as a basis for a well-informed environmental permitting decision. Furthermore, it is very important to emphasize the significance of EIAs publicly. The renewables industry sets a good example by undergoing a thorough EIA process to demonstrate that climate protection and the conservation of our natural environment are indeed compatible.
nonstop: Which is the most important market segment for OECOS?
Runge: The operative focus of OECOS is in the wind energy sector, both onshore and offshore.
nonstop: There has been considerable public resistance against offshore wind power. What is your conclusion?
Runge: The potential negative impact of offshore wind technology may have been overestimated during the early years of its development. Many of the expected negative effects never materialized at the offshore wind farm sites built to date.

Photo: Siemens

PROJECT MANAGEMENT

Environmental Services Include:

- full environmental permitting management
- constraints analysis and site screenings
- identification of stakeholder issues and means to obtain community acceptance
- public consultations/hearings and organization of presentations
- photomontages and zones of visual impact assessments
- noise emission and shadow effect measurements
- interference with communication systems
- navigation risk assessment
- ice-throw risk analysis
- baseline monitoring of avian fauna, bats, terrestrial fauna
- habitat assessments
- environmental impact assessments
- environmental monitoring during construction and operation

Case Study: St. Joseph Wind Farm

TYPE OF PROJECT:
Environmental Assessment
CLIENT: Pattern Energy Group/ Bowark Energy
PROVINCE: Manitoba
YEAR: 2008–2010
Complete Environmental Assessment and fatal flaw analysis according to both the Manitoba provincial requirements and the federal requirements. Furthermore, Helimax headed a multi-disciplinary team made up of internal resources and local subcontractors, and as such was responsible directly or indirectly for the overall budget management and all components of the environmental permitting process. The project will begin construction in summer 2010 and GL Garrad Hassan is managing the construction and post-construction environmental monitoring programme.

Photo: ELBE&FLUT; Source: HafenCity Hamburg GmbH

Hamburg Harbour – The Heartbeat of GL

1,600 GL staff members move to new GL Head Office in the modern HafenCity

February and March were exciting months at Germanischer Lloyd's Hamburg headquarters. With the new Head Office building at Brooktorkai 18 in Hamburg's HafenCity district completed, the time had come to say goodbye to the old work space at Vorsetzen and 13 other locations spread across the city. Now all of GL's Hamburg departments and offices, from technical assurance and engineering consulting to ship classification and training, are finally under the same roof.

Whether you are looking for maritime services, oil & gas or renewables expertise, you can find all GL business segments represented at a single location now. Designed by the architect firms gmp and Jan Störmer, GL's new home covers 45,000 square metres of office space, equivalent to seven football fields.

After several years of planning and construction, the long-awaited relocation marked a turning point for GL, opening a new chapter in the annals of the company. The designers of this modern, sophisticated working environment created optimal conditions for efficient workflows, providing numerous opportunities for enhanced interdisciplinary and interdepartmental teamwork. All this not only benefits the GL employees working here but also their growing international client base. Never before has the GL team been in a better position to address the needs of customers around the globe with unsurpassed responsiveness, flexibility and effectiveness. This is all the more important in view of the vastly expanded service portfolio resulting from the company's numerous acquisitions over the past few years.

"In its recent history, GL has evolved from a leading classification society into a globally recognized technical assurance and consultancy body for the maritime and energy industries," says Dr Joachim Segatz, Member of the GL Executive Board. "The modern architecture of the new location, and its communicative, open office landscape fulfil the needs of our growing enterprise in an ideal way."

Photo: Michael Bogumil

ACCENTS. The mainly clinker-brick façades of the buildings at Brooktorkai bear an obvious similarity to the historic Speicherstadt, with its important influence on the local setting.

The last relocation of GL's headquarters occurred more than thirty years ago. Back in 1977, the GL Head Office was moved from downtown Hamburg to the quay area. The new location in the newly-developed HafenCity, or Port City district, is an even more prominent site for the nerve centre of a global group like Germanischer Lloyd. ■ SNB

New address:

Germanischer Lloyd AG, Brooktorkai 18, 20457 Hamburg, Germany,

The telephone and fax numbers as well as e-mail addresses remain unchanged.

The global independent
technical advisor

GL Noble Denton

The holistic approach to Asset Integrity Management

Do you recognise these challenges?

Ensuring compliance to stricter safety standards, managing and verifying safety systems and reducing your operating costs? If you do, we can help.

The complete solution

At GL Noble Denton we have developed an approach to Asset Integrity Management, drawing upon our extensive experience and domain knowledge, that really does cover the complete asset lifecycle from pre-FEED, FEED, design, fabrication and construction, through to operations, maintenance and life extension to abandonment and decommissioning.

GL Noble Denton can ensure that operationally critical elements remain fit-for-purpose throughout the lifecycle of your assets.

Contact us now to learn more about how we can help you.

www.gl-nobledenton.com

Email: **glnobledenton@gl-group.com**

15823_NS_14.05.2010

GL Group
Head Office

Brooktorkai 18
20457 Hamburg
Germany

Phone: +49 40 36149-0
Fax: +49 40 36149-200
E-Mail: headoffice@gl-group.com

www.gl-group.com
www.gl-nobledenton.com
www.gl-garradhassan.com
www.gl-maritime-software.com
www.friendship-systems.com
www.futureship.net

GERMANISCHER LLOYD

Region Americas

Suite 900
5177 Richmond Avenue
Houston, TX 77056
USA

Phone: +1 713 543 4337
Fax: +1 713 543 4370
E-Mail: gl-americas@gl-group.com

Region Europe/Middle East/Africa

Brooktorkai 18
20457 Hamburg
Germany

Phone: +49 40 36149-4018
Fax: +49 40 36149-4051
E-Mail: gl-ema@gl-group.com

Region Asia/Pacific

Room 3201–3220, Shanghai Central Plaza
381, Huaihai Middle Road
Shanghai 200020
People's Republic of China

Phone: +86 21 6141 6700
Fax: +86 21 6391 5822
E-Mail: gl-asia.pacific@gl-group.com

GL NOBLE DENTON

Region Americas

Suite 900
5177 Richmond Avenue
Houston, TX 77056
USA

Phone: +1 713 586 7000
Fax: +1 713 586 7007
E-Mail: glnobledenton@gl-group.com

Region Europe

Brooktorkai 18
20457 Hamburg
Germany

Phone: +49 40 36149-7700
Fax: +49 40 36149-1781
E-Mail: glis@gl-group.com

Region Middle East/Africa

Zahret El-Maadi Tower
66, Cornich El-Nile, El-Maadi
35th Floor, Apartment 2
11431 Cairo
Arab Republic of Egypt

Phone: +20 225 287 295
Fax: +20 225 287 294
E-Mail: glnobledenton@gl-group.com

Region Asia/Pacific

Level 39, Menara Ambank
No. 8, Jalan Yap Kwan Seng
50450 Kuala Lumpur
Malaysia

Phone: +60 3 2160 1088
Fax: +60 3 2160 1099
E-Mail: glnobledenton@gl-group.com

GL GARRAD HASSAN

Region North Americas

45 Main Street
Suite 302
Peterborough, NH 03458
USA

Phone: +1 603 924 8800
Fax: +1 603 924 8805
E-Mail: info.usa@garradhassan.com

Region IEMEA

St Vincent's Works
Silverthorne Lane
Bristol, BS2 0QD
UK

Phone: +44 117 972 9900
Fax: +44 117 972 9901
E-Mail: info@garradhassan.com

Region Asia

1st Floor, 4th Cross, Sampige Road
494/11 U.P. Royal Building
Malleshwaram
Bangalore, 560003
India

Phone: +91 80 4271 7979
E-Mail: mste@gl-group.com

Region Pacific

Suite 25, Level 8
401 Docklands Drive
Docklands, Melbourne
Victoria, 3008
Australia

Phone: +61 3 9600 1993
Fax: +61 3 9602 1714
E-Mail: info.au@garradhassan.com

0E003 2010-06