

energize

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oil & gas

Offshore Challenges

norway Set for a Second Boom

simulation Virtual Experience for Safer Structures

due diligence Looking for Hidden Risks

Topside troubles? Talk to Tore

Has an M.Sc. in marine hydrodynamics

Has developed extensive experience in Europe, China, southeast Asia and at home in the Norwegian fields

Is an authority on finite element analysis of structures, motions and wave loads

Takes part in the annual Birkebeiner ski marathon, covering the 54km from Rena to Lillehammer in the company of 16,000 others

Tore is a Senior Principal Engineer who specialises in mating topsides with their marine underpinnings. Whether the donated vessel's a retired supertanker or a completely new build, he knows how to align it perfectly with its production partner.

Based in our Norwegian offices, Tore applies his 20 years of experience to projects anywhere from Singapore to Svalbard. He knows plenty about asset sustainability too. Platforms aren't cheap, and our clients rely on Tore to get the utmost levels of safety, efficiency and service from them.

Tore is one of the thousands of dedicated experts our clients count on every day

Learn more about him here www.gl-nobledenton.com/Tore

To Our Readers



Pekka Paasivaara

No industry is as hotly debated and so at odds with its own goals as the global energy sector. But with energy diversification, sustainability of supply and higher safety standards moving up the agenda, what are the implications for civilisation and who will pay the price? “Confronting Energy Paradoxes” is the motto of the 2012 Offshore Northern Seas fair in Stavanger, a top industry event where decision-makers will seek to reconcile their conflicting objectives and define their course of action.

With hydrocarbons still accounting for 85 per cent of the world’s energy consumption, oil and gas will be indispensable for decades to come. New discoveries in Norway are revitalising the country’s energy sector. Read in “Set for a Second Boom” how GL Noble Denton’s local experts support customers in the shipping and petroleum industries (p. 8).

Making things happen: The delivery of the world’s largest offshore service vessel “Pacific Orca” marks a milestone for the industry. GL Noble Denton undertook parts of the engineering and design work. The project has been an excellent opportunity for the GL Group to demonstrate its expertise as a single-source service provider in the maritime, renewable energy and offshore oil and gas sectors (p.12).

Innovative solutions are in high demand, especially so in the gas sector. As a bridging energy resource with relatively low emission levels, natural gas is moving centre stage. Gaps in the supply chain can be closed by moving gas processing and storage facilities offshore. Read about floating LNG operations on page 20. Leading-edge computer-based simulation is another fascinating technology employed to enhance the integrity of all offshore structures. Virtualisation specialists from GL subsidiary FutureShip provide an overview (p. 14).

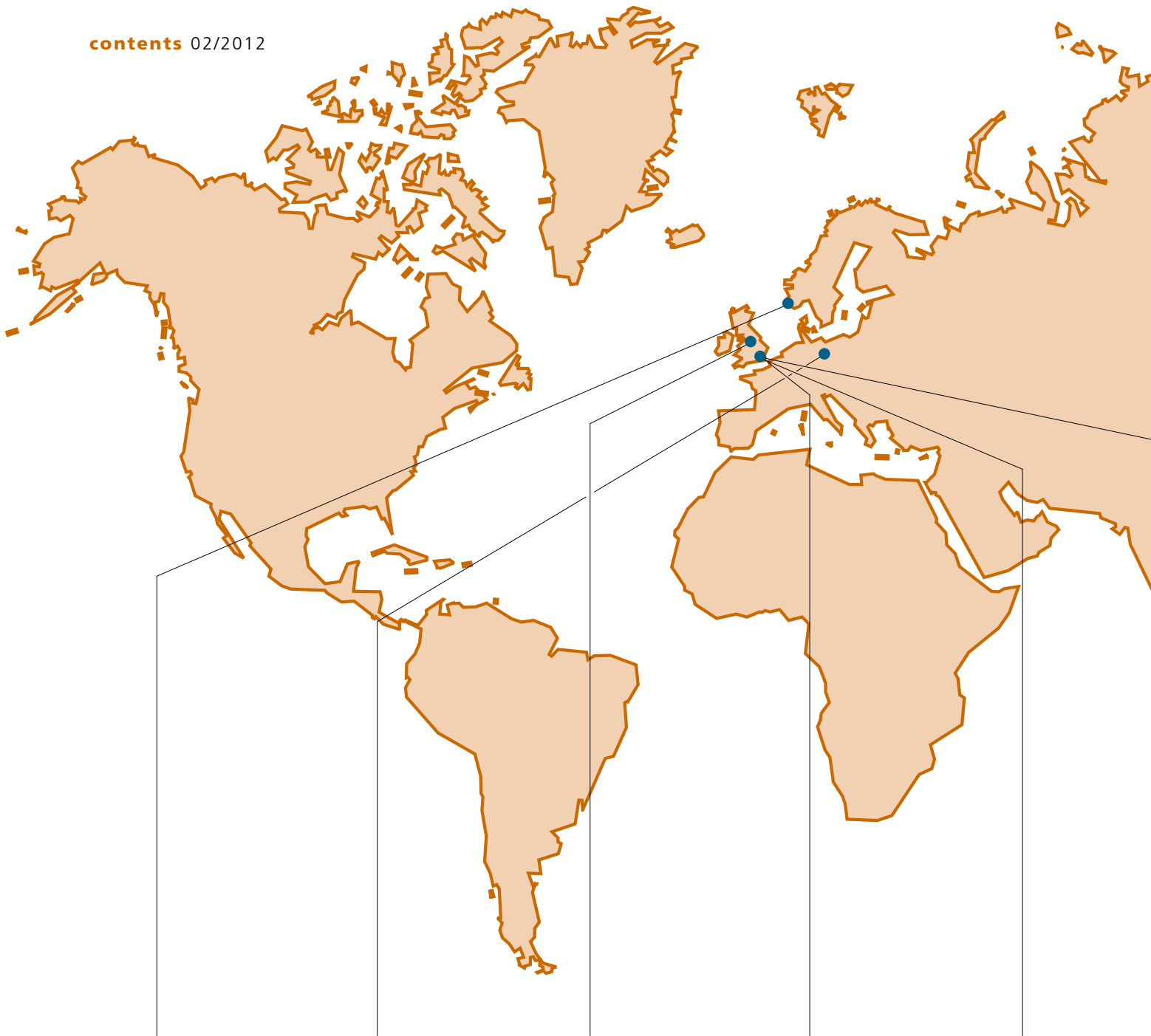
Complex offshore projects harbour potential risks in all project phases – risks that neither operators nor investors may be able to identify. “Knowing Where to Look” describes how due-diligence analytics experts from GL Noble Denton uncover hidden hazards (p. 32). But one of the most dangerous risk factors is man himself. Analyses performed by GL Noble Denton’s Applied Psychology & Human Factors Group show that a positive safety culture makes a big difference for occupational and environmental safety (p. 28).

Yours sincerely,



Pekka Paasivaara

Member of the Executive Board, GL Group



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GL Noble Denton in Brief

- GL Noble Denton is a **TECHNICAL ADVISOR AND TRUSTED PARTNER** for the oil and gas industry.
- The Oil & Gas business segment of the GL Group helps to design, build, install and operate onshore, maritime and offshore oil and gas assets to ensure **SAFETY, SUSTAINABILITY AND SUPERIOR VALUE**.
- GL Noble Denton is the **MERGER BETWEEN GERMANISCHER LLOYD'S OIL & GAS BUSINESS AND NOBLE DENTON**, a premier provider of life-cycle marine and offshore engineering services. Since January 2010, they have been offering their services as GL Noble Denton.

GL Noble Denton is a full-service provider with broad upstream and midstream competence **FOR THE COMPLETE ASSET LIFECYCLE**.

GL Noble Denton combines excellent engineering and analytical skills with operational experience of offshore, maritime and onshore oil and gas assets. The Oil & Gas business segment of GL employs **MORE THAN 3,000 ENGINEERS AND EXPERTS IN 80 COUNTRIES**.

We have strong expertise in complex oil and gas assets such as MODUs, FPSOs, pipelines, subsea systems, OSVs – and assurance, asset integrity, safety and risk, marine operations, project management and software services to match. The scope of technical services includes safety, integrity, reliability and performance management.

GL Noble Denton is **A TRULY INDEPENDENT ADVISOR** without any vested interest in selling a design, installation, fabrication or equipment.

GL Noble Denton services oil and gas clients in onshore production, onshore pipelines, storage, import terminals, LNG, refineries and petrochemicals, distribution networks as well as mobile offshore drilling units, mobile offshore production units, fixed platforms, subsea, risers and flow lines, offshore support vessels, tankers and shipping, and offshore pipelines. We oversee and support the full lifecycle of an asset from project concept to decommissioning. The business segment has **A GLOBAL REACH IN THE OIL AND GAS CENTRES** of the world.

GL Noble Denton
www.gl-nobledenton.com



offshore



The demand for engineering services, technical assurance and consulting in the offshore sector is rising. GL Noble Denton supports oil and gas companies with its high-performance spectrum.





Production.
The Norwegian offshore market is the world's largest.

Set for a Second Boom

With its latest licensing round, Norway shows that it intends to maintain its benchmark position in the offshore oil and gas industry. At ONS 2012, industry players will discuss the opportunities

The Norwegian Ministry of Petroleum and Energy has opened 86 new blocks in the Norwegian and Barents Sea. This announcement forms the basis for awarding new production licences before summer 2013. Minister of Petroleum and Energy Ola Borten Moe expects a record-breaking response. "The twenty-second licensing round is a new, important step in our efforts to facilitate long-term activity in Norway's most important industry," he says. The resulting opportunities will be among the hot topics discussed at this year's Offshore Northern Seas (ONS) exhibition in Stavanger in late August.

"Norway's oil and gas industry is considered ready for a second boom, which will continue for the next 20 years," says Tore Lea, GL Noble Denton's Managing Director Norway. He expects more exploration, more field development projects based on a series of new discoveries in ▶

ABSTRACT

- New discoveries, more exploration and increasing investments safeguard Norway's position as international energy major
- Norway's infrastructure, supply and support industry, and fiscal incentives attract investors and operators

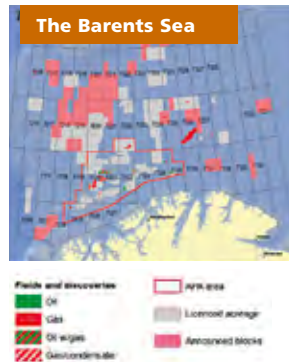
The oil and gas sector is Norway's most important industry.

Ola Borten Moe,
Minister of Petroleum
and Energy



Photo: Dreamstime/Gigi1807

Photo: Berit Roald/Scampix



Boom. Norway's offshore market expects large discoveries in the Norwegian Sea and the Barents Sea. 86 new blocks have been opened.

▷ mature as well as in frontier areas, with increased investments (see interview next page). In its "FACTS 2012 – The Norwegian Petroleum Sector" paper, the Norwegian government is cautiously optimistic, assuming that petroleum production will remain relatively stable over the next few years. While the production of oil and other liquids are likely to see a gradual decline, gas is expected to safeguard Norway's position as an international energy major. Norway is currently the world's second largest gas exporter.

Just how big Norway's influence is could be seen when the oil price rose sharply this summer in response to the Norwegian oil workers' strike. After the strike was ended by the government on 9 July, the price of August Brent crude futures for immediately dropped by as much as 2.1 per cent on the ICE Futures Europe exchange after it had well passed the 100 US dollar mark, Bloomberg reports.

Attracting Investments

Following decisive government intervention to settle the dispute and avert a complete production shut-down, Norway is now back to business as usual. "The activity level on the continental shelf is at an all-time high. The Norwegian offshore market is the world's largest. One of last year's biggest oil discoveries in the world was made in the North Sea," Ola Borten Moe said at this year's Oslo Energy Forum. Norwegian production has not even peaked yet. "During the past 40 years, we have extracted around 40 per cent of the expected recoverable resources," the government says in "FACTS 2012".

But it is not just what's hidden beneath the surface that makes Norway one of the big players. In the course of the past 40 years, the country got the necessary infrastructure and a supply and support industry in place, attracting many international investors and operators. Apart from companies such as Eni, Total, Shell, ConocoPhillips and ExxonMobil – all working in partnership with state-owned Statoil – Russia's largest private oil company LUKOIL likewise formed alliances with three major Norwegian oil companies recently to obtain licences for offshore projects. They all profit from Norway's state subsidy of oil and gas exploration introduced in 2005, which reimburses 78 per cent of the exploration costs. In addition, taxation on oil activities has been lowered, attracting additional international investment in Norway's oil and gas sectors, as the Energy Information Administration notes.

Such fiscal incentives are what many long for on the other side of the North Sea. When 30 senior players in the UK energy sector were brought together by GL Noble Denton for an exclusive round-table discussion in London ear-

GL Noble Denton in Norway

GL Noble Denton has been serving the shipping and oil industry in Norway from locations in **OSLO, STAVANGER AND BREVIK** for many years. The Stavanger location offers GL Noble Denton a presence in Norway's oil capital and expertise on projects from the wellhead to engineering and operation of installed infrastructure. This includes dynamic positioning and marine operations consultancy, design and integrity assurance services for offshore assets, and asset performance and optimisation. The Brevik office is GL Noble Denton's competence centre for general design and FPSOs. GL Noble Denton employs a staff of 50 in Norway and is set to grow.

Photo: Dreamstime/Nightman

“Challenging Projects”

Arctic exploration, mature field development, lack of experienced personnel – there are many topics to be discussed at ONS 2012 in Stavanger. energize spoke with Tore Lea, GL Noble Denton’s Managing Director Norway, about the trends and prospects of the Norwegian oil and gas industry

Tore Lea. After completing his master’s degree at the Norwegian Institute of Technology, Tore Lea joined Statoil, where he worked for about 20 years in a variety of management positions. Before joining GL Noble Denton in 2010, he built up two newly established smaller companies.



lier this year, one thing became clear: Although the British government’s 2012 Budget announcement promised tax relief to certain North Sea operations, the UK still has a long way to go if it is to compete with the progress being made in Norway.

“In Norway, the great majority of exploration costs are funded by the government, giving operators the encouragement they need to develop robust operations in the North Sea,” said a strategy director for a leading European gas company. “The UK government would never get away with funding operators at this level because of EU regulation and monopoly laws. Norway’s position outside Europe means that it can offer all the incentives it likes without other countries objecting.” Other executives at the roundtable event concurred, suggesting that the incentives being offered by Norway could have an adverse effect on the UK oil and gas industry in other areas. A member of the oil and gas division of a leading UK bank said: “Oil and gas professionals will move to those areas where the economic conditions are most favourable.”

For the time being, “those areas” can only be Norway, offering stability, predictability and continuity to the long-term and capital-intensive oil and gas industry. **AMO**

ENERGIZE: What does it mean for GL Noble Denton to be attending the ONS in Stavanger?

TORE LEA: It gives GL Noble Denton a chance to market its services and capabilities amongst all the players in a growing oil and gas market, and it is acknowledged to be one of the most interesting events in the world. ONS provides an excellent opportunity to meet key industry representatives.

ENERGIZE: What important trends are currently being discussed across the industry?

LEA: Norway’s oil and gas industry is generally expected to see a second boom during the next 20 years, with more exploration, more field development projects, and increased investment activity. Important trends over the last couple of years included many large discoveries in the most mature regions of the North Sea, and further discoveries in the frontier areas of the Barents Sea. The opening of the zone once disputed between Russia and Norway for oil and gas exploration is also an important topic.

ENERGIZE: Norway has seen 40 successful years of oil and gas exploration. Will the country be able to continue along the same lines?

LEA: As oil and gas companies in Norway continue to explore and find more hydrocarbon deposits, activities and investments will grow, and demand for services will

increase. Incentive models for newcomers have increased the number of oil companies in Norway significantly. In addition, Norway has a mature oil and gas industry with an existing infrastructure as well as new installations. Oil companies are moving into technically more challenging projects in deeper water, in Arctic regions, and in mature reservoirs. All these activities boost diversification, specialisation and competence. The biggest challenge will be to recruit enough experienced personnel.

ENERGIZE: How does GL Noble Denton support customers operating on the Norwegian continental shelf?

LEA: Our services in this region mainly focus on consulting work for oil and gas companies and design of floating structures. Our main projects in Norway are basic design and FEED studies related to FSOs and FPSOs in addition to studies and consultancy work. In Brevik, GL Noble Denton runs its global centre for floater design. We also have people performing marine consultancy, vessel assurance and dynamic positioning work. Generally we benefit from the GL Group’s wide offshore experience, which enables us to compete in the Norwegian market on projects that we would not be able to handle if we had to rely exclusively on our staff from Norway, but we also have a clear strategy to grow our local organisational footprint in Norway.

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Facts "Pacific Orca"

- Delivery: July 2012
- Operator: DONG Energy
- Length: 161 m
- Breadth: 49 m
- Depth: 10.4 m
- Installing capacity: 12 units of 3.6 MW design

Wind turbine installation is a highly specialised activity requiring custom-built ships: aptly called wind turbine installation ships (WTIS). energize spoke with Jan Schreiber, GL's new Ship Type Expert for Offshore Service and Working Vessels, about pioneering projects, newly developed rules and future challenges.

ENERGIZE: Recently, the wind turbine installation ship "Pacific Orca" was delivered by Samsung Heavy Industries to Swire Pacific Offshore Operations. What makes this ship special?

JAN SCHREIBER: First of all, she is the largest wind farm installation ship ever built, with a length of 161 metres, a breadth of 49 metres and a depth of 10.4 metres. Her capacity is enormous: she is capable of carrying and installing up to twelve wind turbine units of the 3.6 MW class. Furthermore, the Pacific Orca can install foundations and erect turbines in water depths of up to 60 metres. Looking at future projects, this WTIS will also be able to install very large wind turbines with a rated output of 10 MW. Another impressive feature is the ship's ability to lift herself up to

17 metres above sea level. This minimises the impact of waves and wind during installation operations.

ENERGIZE: How did GL contribute to this project?

SCHREIBER: This was a truly collaborative project involving several business segments of the GL Group. Our colleagues from GL Noble Denton undertook the engineering and design work for the legs, spud-cans and the jacking system, including FMEA, as well as integration of these components into the ship's hull. They also provided the shipyard consultancy and site-specific assessment services. FutureShip, a GL company, carried out the global strength and fatigue analyses for the ship afloat and was responsible for owner consultancy. And GL as a classification society conducted the in-place analysis in jacked-up mode and provides the classification services for the "Pacific Orca".

ENERGIZE: Did GL have to develop a new set of classification rules specifically for this special ship type?

SCHREIBER: Yes. GL had published new rules for Hull Structures of offshore service vessels as early as 2010. These rules have recently been supplemented by a set of classification rules for crew boats and offshore wind farm service craft. This was done to consolidate all relevant GL rules, inter-

ABSTRACT

- "Pacific Orca" is the largest WTIS ever built
- GL Noble Denton undertook key engineering and design work for the project

Where It All Comes Together

A growing offshore installation market boosts the demand for innovative offshore service vessels. The delivery of the third-generation OSV "Pacific Orca" marks a new milestone for the industry

national codes and recommendations applicable to the classification of crew boats into one coherent framework. Using this compendium, designers developing vessels for the needs of their clients will be able to rely on one single collection of rules and guidelines with full confidence that their design will comply with classification requirements.

ENERGIZE: Are these rules being applied in any current projects as yet?

SCHREIBER: Just recently we announced that the new "WindServer" wind farm service trimarans designed by Fjellstrand for World Marine Offshore will be classed by GL. This project comprises two 30 m and four 25 m ships. Their de-

signer improved access to offshore installations in difficult weather conditions, enhanced the fuel efficiency, reduced the running costs and ensured the safety of the personnel on board, all pursuant to GL's rules. The boats will have a service speed of 25 knots and the capacity to carry 25 and 12 service personnel, respectively. The trimarans are scheduled to go into service as early as March 2013. □ SGG



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Joint Forces

On 27 July Swire Pacific Offshore Operations took delivery of "PACIFIC ORCA", the company's first and also the world's largest wind turbine installation ship from Samsung Heavy Industries in Geoje, South Korea. The vessel will be put into service for Danish utility company DONG Energy. The GL Group's combined ex-

pertise in the maritime, renewable energy as well as offshore oil and gas sectors provided a single source for all of the "Pacific Orca's" engineering and assurance needs – including engineering analyses of its hull and jacking system, failure mode analysis of its jacking system and newbuilding classification services.

The Power of Virtualisation

It used to be trial and error and a good deal of guesswork. Today, powerful hardware and software enable engineers to simulate extreme scenarios to ensure the integrity of offshore structures

Traditionally, the design and operation of ships and offshore structures were based on experience. This is still true to some extent, but we increasingly rely on “virtual experience” gained from computer-based simulations. Thanks to advances in computer hardware and software technology, the scope and depth of these simulations expanded vastly over the past decade. Today, engineers can draw on a wide range of applications for design as well as decision support. Simulations can be used to minimise the environmental impact of ships and offshore structures, ensure high availability and confirm compliance with regulations. Furthermore, it allows bolder,

innovative designs and procedures without exposing people or assets to risks.

ABSTRACT

- Advanced simulation technology offers a broad choice of scenarios for design analyses
- Virtualisation-based studies are a highly complex expert skill
- Modern offshore engineering relies heavily on simulation

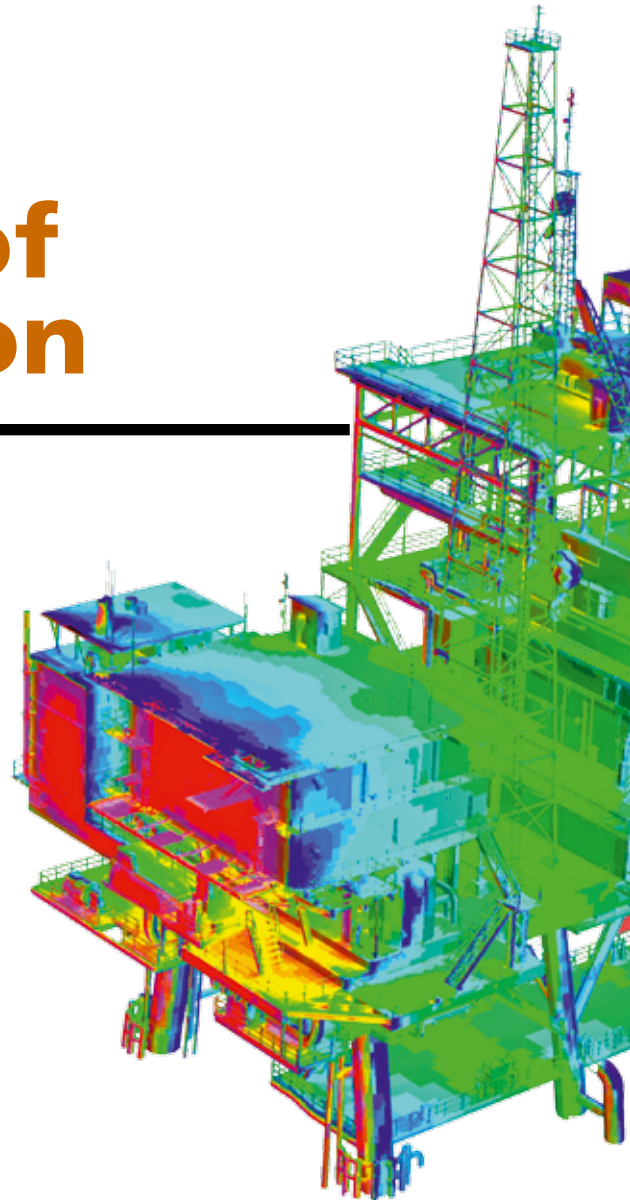
the contrary, the evolution of virtualisation goes hand in hand with an increase in complexity. As more factors come into play and the level of sophistication rises, the expertise required to produce meaningful results with simulation applications grows proportionately.

Studying Structural Integrity

But that does not mean simulation has become a tool for everyone. On

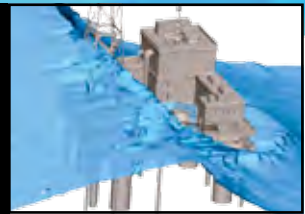
Accidents such as the “Exxon Valdez” oil spill and the “Deepwater Horizon” disaster have changed the way the offshore industry assesses risk. Beyond the physical damage and loss of assets, companies may face liability claims, criminal prosecution, damage to their reputation and possible loss of business. Regulation bodies and classification societies have responded to major incidents by imposing tighter rules and restrictions. Technical, environmental and occupational safety have moved centre stage.

Simulation is a powerful tool to ensure structural resilience and safe operation. It enables engineers to check de-





CFD. Computational fluid dynamics is invaluable for predicting loads on offshore structures.



sign strength under a wide variety of conditions, including rare events and worst-case scenarios such as the highest wave to be expected in a particular region within 100 years. Risk-based design has become a buzzword in the industry. In general, simulation experts will proceed along client specifications or common industry practice.

Since load assumptions are usually the most significant uncertainty in structural assessment, the actual structural analysis is often preceded by a series of case-specific simulations to determine load distributions. These include long-term wave load distributions for fatigue analysis, extreme wave scenarios, and impact loads associated with slamming and sloshing. For specific applications, in particular ship springing and whipping as well as sloshing in tanks with very flexible membranes, it is even possible to account for the effect of the structural response on fluid dynamics.

Strength analysis is a mature discipline applied widely in the design of offshore structures. For elastic analyses of components of ships, offshore structures and subsystems, such as gearboxes, engines, cranes, risers, pipelines, etc., finite element analysis (FEA) is a common global strength assessment method. Offshore platforms and floating production, storage and offloading vessels (FPSO) require additional, more sophisticated analyses to establish their ▶

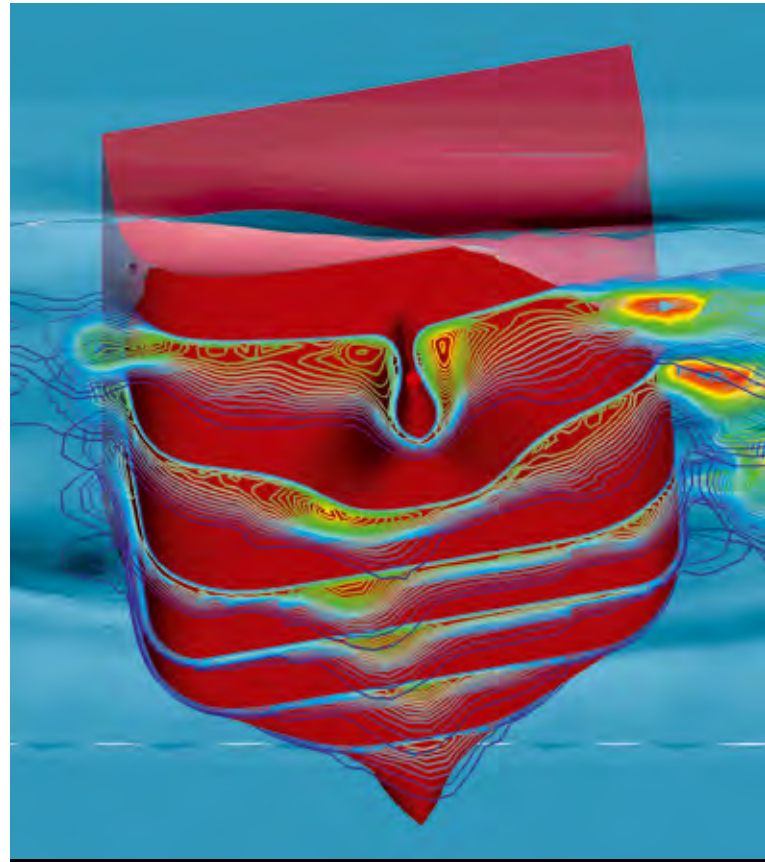
offshore simulations

▷ material fatigue strength and collision resistance, an especially important aspect for the prevention of oil spills. Germanischer Lloyd, an early adopter of simulation techniques in this field, was the first classification society to issue a standard for evaluation and approval of innovative tanker design and construction methods employing simulation. Collision analysis is standard practice today for ships bearing the COLL class notation as well as offshore wind farms subject to specific collision-safety rules.

Simulation technology and more powerful computers have spawned a wide range of applications and fields of study that used to be out of reach, too costly or not sufficiently accurate in the past. Many modern operational guidelines and accident response procedures depend on enhanced simulation techniques. In particular, computational fluid dynamics (CFD) simulations are extremely helpful in studying the consequences of specific types of accidents and identifying the best response strategies.

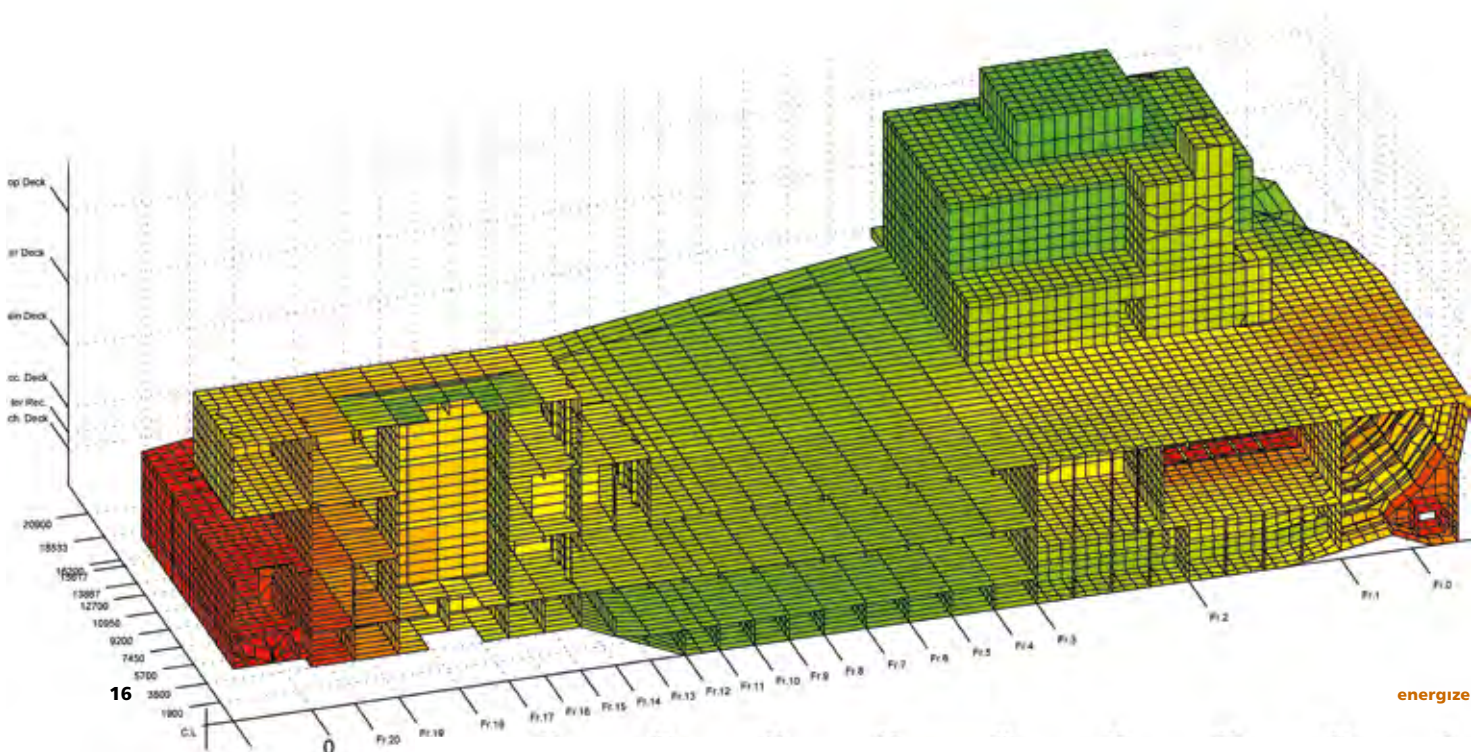
Towing Damaged Structures

Following a collision, it is often necessary to tow a damaged structure to a repair site. Typically, the initial accident



Structural Strength. CFD simulations give load histories for fatigue strength analyses on bilge keels (above).

Vibration. Structure-borne noise analysis for a jack-up structure in transit (below) avoids problems during operation.



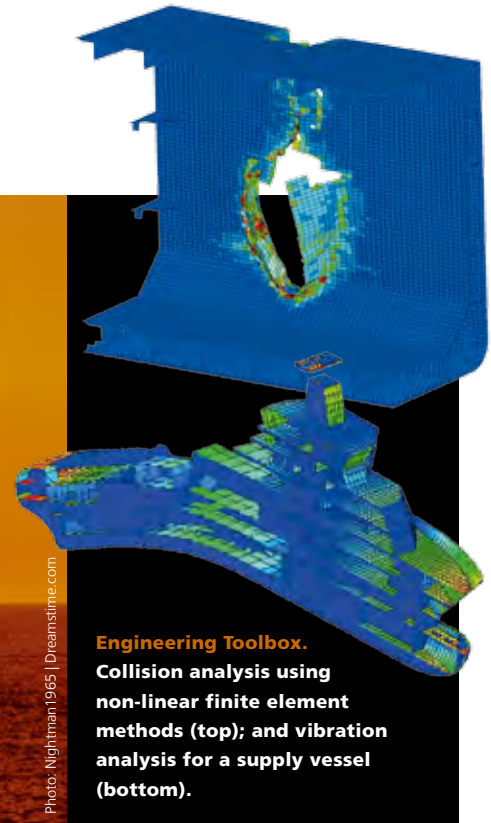


Photo: Nighthman1965 | Dreamstime.com

Engineering Toolbox.
Collision analysis using non-linear finite element methods (top); and vibration analysis for a supply vessel (bottom).

will impair the strength of the structure but may also affect residual freeboard and stability. All this needs to be accounted for when preparing for towage. CFD simulations of towed systems manoeuvring in waves provide an excellent method for understanding the navigational implications, and finite elements analysis simulations can be applied to determine stress distributions in the damaged structure, giving due consideration to the actual condition of the hull, including the degree of corrosion.

Predicting Oil Spills and Gas Dispersion

CFD can be used to simulate the complex flow behaviours of interacting fluids which differ in density and viscosity, such as oil and water in the case of an oil spill. Where waves or sloshing come into play, air may be included in the simulation as well. The same techniques and software applications can be used to study gas dispersion, such as gas leaks in closed spaces or the behaviour of smoke near crew quarters or helidecks on a drilling platform. Factors such as thermal processes, including buoyancy, and the

extreme temperatures or flow speeds typically associated with explosions can all be accounted for.

Understanding Fires

Fire simulations involve additional complexities. So-called zone models are employed to subdivide the areas under investigation into individual zones characterised by uniform conditions. This approach makes it easier to examine time-dependent scenarios. Additional CFD models can yield detailed information about fire growth, temperatures, heat fluxes and concentrations of chemicals.

Improving Availability

Apart from disaster prevention and accident response, ensuring the availability of offshore structures is a key concern for operators and other stakeholders, especially in view of the exorbitant cost of downtime this industry must cope with. There are three categories of ensuring availability of offshore structures: designing for availability, which ▷

FLUID.
In physics, any liquid or gas deforming continually under applied shear stress.

▷ mainly addresses system robustness; Monitoring for availability, a discipline focused on condition-based maintenance to avoid downtime; and troubleshooting, the rapid identification and elimination of failures during operation. Simulation plays a crucial role in all three categories.

Designing for availability is a concept not only applied during the design stage of offshore systems and subsystems but also in the development of operational procedures, which play a key role in ensuring availability. Failure

FMEA.
Analyses and classifies possible failure modes within a system to optimise system design.

mode and effects analysis (FMEA) is a common formal risk assessment method used to determine, in combination with seakeeping simulations, important parameters such as operational limits (mainly sea conditions) for installation, maintenance and operation of offshore installations and supply ships. Modern CFD simulation applications are even capable of representing waves for analysis.

Determining the fatigue life of offshore structures is another critical area where FEA simulations have become indispensable. By assessing critical aspects of structural strength during the design stage, engineers can detect and correct potential weak spots early, thereby avoiding costly changes at a later time. Similar analyses are highly recommended for offshore structures when planning to exceed the original design life.

Monitoring for availability as part of a condition-based maintenance strategy means keeping track of the degradation of specific system elements to predict and plan their replacement as precisely as possible and avoid unscheduled

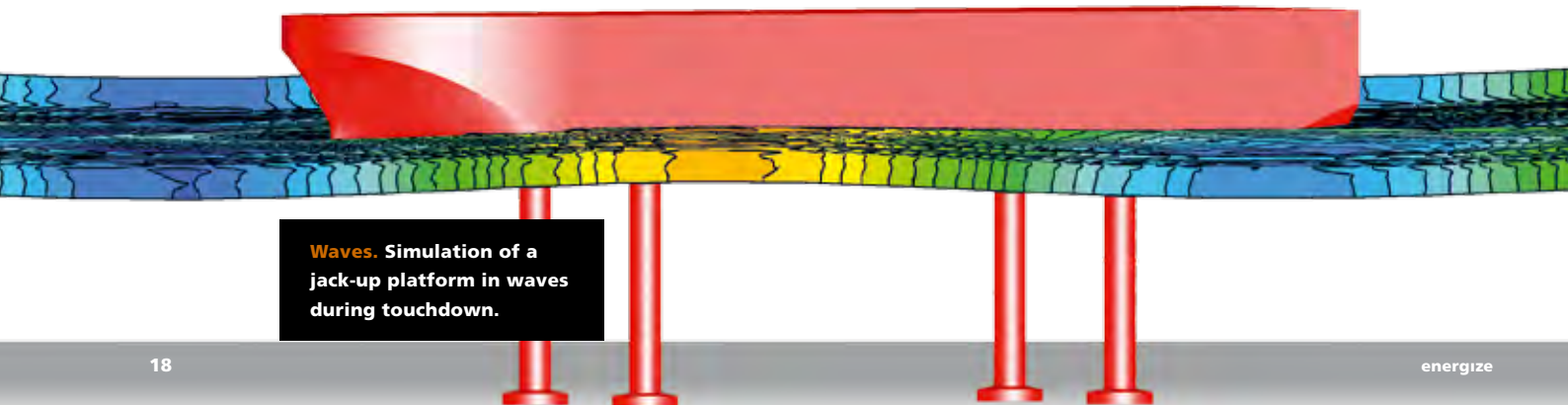
downtime. In an environment as conducive to corrosion as sea water, this approach is sometimes more economical than designing structures for complete avoidance of replacements. Increasingly, engineers combine traditional hull condition monitoring with structural FEA models to assess the residual strength of partially corroded structures. This combined approach makes it possible to reuse data models while cutting response times as well as costs for the user. The results form the basis for defining risk-based inspection schemes.

Troubleshooting maritime structures frequently means identifying the causes of vibration. Alternating flows or vortices occurring behind a local structure, typically an appendage or hull opening, may cause vibrations. On complex systems such as ships or FPSOs, such vortex-induced vibrations are difficult to analyse. CFD and vibration analysis techniques can save both time and costs when conducting these investigations.

Ensuring Compliance

The offshore industry, in particular the oil and gas sector, is under close scrutiny by authorities and pressure groups alike. High-profile accidents invariably lead to additional regulations. In this environment, simulations play a vital role, especially so in the design and approval phase. Today, simulations are widely accepted by national authorities as “engineering proof of compliance”.

International regulations addressing occupational health and safety, such as the ILO’s 2006 Maritime Labour Convention, limit the permissible exposure of on-board



Waves. Simulation of a jack-up platform in waves during touchdown.



Hot Blast. Temperature distribution in supersonic gas leak. Real-life fire testing (below) supplies vital data for simulation.

personnel to noise and vibration. Three-dimensional finite element analysis, the current standard choice for maritime vibration analysis, has its limitations when analysing structure-borne noise. Statistical energy analysis (SEA) is more efficient because it relies on averaged data over a frequency band.

Simulation complexity increases significantly when human behaviour must be accounted for, e.g. in evacuation simulations. This requires discrete event simulation (DES) techniques. Germanischer Lloyd and TraffGo have developed the evacuation simulation application AENEAS which represents the ship or offshore habitat as a simplified grid of different types of “cells” (accessible floor, doors, stairs, obstacles/walls). Humans are represented by simple “expert systems”, so-called intelligent agents. AENEAS enables yards, operators and authorities to ensure compliance with IMO MSC.1/Circ.1238.

Enabling Innovative Designs and Procedures

Facing numerous new technical challenges, the offshore industry has been under increased pressure to innovate. Innovation unlocks new riches but also involves the risks associated with venturing into technologically unknown territory. Whenever we leave our “comfort zone” of experience moving to new designs or procedures, simulations give us most valuable insight and “virtual experience”, ensuring that envisioned concepts are not only feasible but also efficient and safe. This approach applies to installations, individual equipment and procedures alike.

For example, modern design practice employs CFD and formal optimisation to derive optimum hull shapes as well as platform and appendage designs. OSVs (offshore supply vessels) are good candidates for formal hull optimisation, but fuel efficiency, stability, and seakeeping must be reflected in the optimisation model to find good trade-offs.

Tools and Know-how

As all these examples demonstrate that advanced simulation applications and techniques are a powerful set of tools for engineers to understand and predict the properties and behaviour of complex offshore structures and ships operating in the challenging maritime environment, and to design equipment for high reliability and availability in an efficient and cost-saving manner. However, working with these modelling tools requires specific expertise to find the right balance between level of detail and resources, and to unlock the full potential of virtualisation. **VB/RVA**



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FLNG – Is the Future Afloat?

As natural gas moves centre stage in the global energy theatre, innovative technologies are closing the remaining gaps in the supply chain from the borehole to the consumer. Moving certain processes offshore is one of these approaches

When space is limited, gas fields are small or the political situation is difficult, building a conventional natural gas processing facility on shore may not be advisable. Luckily, there is always the option of simply putting the equipment on some kind of ship and anchoring it where it is needed. Floating LNG technology (FLNG) is a collective term for this concept.

ABSTRACT

- Floating LNG operations is a reliable alternative to conventional natural gas processing facilities on shore
- GL Noble Denton has been involved in more than 20 offshore LNG projects

GL Noble Denton FLNG expert David Haynes explains: “The term FLNG covers essentially two different types of unit. Some work much in the same manner as an FPSO, extracting, processing, liquefying and transferring LNG, while others, so-called floating storage and regasification units or FSRUs, receive LNG from tankers and prepare and transfer the gas for onshore use.” GL Noble Denton brings a depth of experience

to FLNG, having worked on more than 20 offshore LNG projects, Haynes emphasises.

Cost-Effective Alternative

FLNG units offer distinctive advantages, pose special challenges and are designed to meet specific niches within the LNG industry, explains Haynes. “FSRUs are being considered in areas where setting up land-based transfer facilities would be too costly. LNG tankers can be converted, or units purpose-built, as a cost-effective alternative to a land-based terminal.” These projects can be up and running much more quickly than onshore terminals. However, due to the limited space available on board (130,000 to 180,000 m³), offshore units are best suited to smaller solutions where land is at a premium, local ability to develop the needed onshore infrastructure is lacking, a short-term solution is needed to increase seasonal demand, or permitting and consent processes are difficult. Both converted FSRU vessels and purpose-built units are already in operation in the US, Brazil, the UK, Kuwait and Argentina, with two dozen or more new units set to come online in the next few years.

Some estimates project that by 2015 some ten per cent of the global regasification market will be met by FSRUs. GL Noble Denton has been involved in a number of projects already, including a national oil company tender for a floating import terminal, two floating import terminal feasibility design studies, and a quantitative risk assessment at the FEED stage for a floating liquefaction project. Whereas FSRUs are an established technology, the next step for the FLNG industry lies in the development of FLNG facilities,



Höegh LNG. Three FSRUs with a storage capacity of 170,000 m³ will be delivered in 2014.

Photo: Höegh LNG

says Haynes, and after a long research and development period, the first of these ground-breaking designs are soon to be constructed.

These units are designed to enable the industry to tap into natural gas fields previously considered uneconomic to develop with conventional technology due to their remote location, small size, or environmental significance – so-called “stranded” gas fields. Shell’s massive Prelude FLNG, for example, is being designed for operation at the Prelude and Concerto fields, the three-trillion-cubic-foot discovery some 200 kilometres off the coast of Western Australia. The Prelude FLNG unit will be the largest floating offshore facility ever built.

Projects such as this require a tremendous amount of expertise to ensure that the projects are constructed on time and to budget, and that they will operate safely. GL Noble Denton is currently working on a floating LNG construction project, undertaking due diligence work and a 35,000-man-hour pre-FEED study looking at everything from the well heads to subsea work through topside work, the hull, offloading and logistics, explains Haynes. “We did that totally in house, a breadth of expertise that very few firms have,” he notes. Several other projects are also in the pipeline.

Safe Transfer

Operating offshore brings its own practical challenges when working with LNG. As Haynes notes: “Our work focuses on topics such as what must happen if an LNG spill occurs, the amount of space required for installation and equipment, and the required level of fire protection.”

One of the key challenges in the more widespread use of FLNG is in moving LNG from one vessel to another, Haynes says. As LNG is cooled to –162 degrees Celsius for transport, ensuring safe vessel-to-vessel transfer is essential. Some systems use fixed arms to connect the vessels, others flexible hoses. Vessels are typically brought alongside for the process. This works well for port-based FSRU units, explains

FEED.

The objective of a front-end engineering design study is to detail the design, develop the project execution philosophy and establish a more accurate cost estimate.



Photo: Shell

Development. Shell plans to moor the Prelude FLNG off the Australian coast at the Prelude gas field for 25 years.

Haynes, as FSRUs are moored in areas where the weather and wave conditions are relatively benign. Heavier weather conditions, however, could be disruptive to transfers, especially in more remote areas where FLNG plants might be sited.

Tandem offloading, where vessels line up stern to bow, would allow vessels to keep more distance between them and more easily cope with greater wave heights. This limits the risk of collision between the two vessels, enhancing safety but at the cost of some energy efficiency. “These systems have been designed to FEED level, but as yet we have not seen a project where this has been implemented. However, we estimate the technique could allow operations in waves of 4.5 to 5 metres, which would cover the vast majority of operating conditions,” explains Haynes. “But there remains a good deal of testing to be done. We have been involved in several projects examining LNG transfer between vessels and at our GL Noble Denton test facility at Spadeadam we have been working on LNG transfer hoses.”

Beyond the questions and the challenges, the next few years will see the birth of some of the largest, most ambitious and technically challenging offshore projects ever undertaken. GL Noble Denton and David Haynes will be right there, helping to ensure their efficiency, safety and reliability, to meet the world’s growing energy needs. □ SSP/SA



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integrity






GL Noble Denton provides engineering expertise, domain knowledge and many years experience in upstream, midstream and downstream oil and gas, petrochemicals, and power generation to develop holistic lifecycle-orientated asset integrity management solutions for their clients.

Software for Successful Networks

Gas pipeline operators face daunting challenges when it comes to managing risk and finances, planning upgrades and designing and maintaining new infrastructures. Pipeline management software is a big help if you choose the right solution

 Gas distribution and transmission companies hold valuable assets within their control. Yet, optimising value from those assets is rarely a simple exercise. Safety and environmental concerns, corrosion in ageing pipelines, increased industry regulations and the need to ensure the security of supply have all led to a greater focus on risk management as the industry has evolved. Within this framework, the creation of value and the management of finances has become a constant challenge: business continuity and safety have to take prominence over cost savings if distribution and transmission pipeline operators are to fulfil their delivery and regulatory obligations to customers and the public at large. But, without making those cost savings, it can be difficult to maintain assets and plan upgrades effectively.

ABSTRACT


- Planning and operating gas networks is an extremely complex task
- SynerGEE is a powerful pipeline simulation tool

Of course, opportunities do exist for gas network and pipeline operators to optimise networks for greater financial return. These opportunities include making decisions about when to undertake upgrade or maintenance work; controlling pressure management for the optimal transfer of gas; and making choices about which pipeline diameter

to use on new constructions. These may seem to be minor considerations, but in reality they can have a major impact – positive or negative – on an operator's balance sheet. However, to maximise advantage, gas network and pipeline operators need access to tools that will enable them to take a more strategic approach to network management – an industry-leading modelling system, such as GL Noble Denton's gas distribution and transmission software SynerGEE Gas. It supports operators from conceptual design to decommission planning and every stage in between, providing them with the tools and techniques needed to address security concerns while also optimising and operating efficiencies. Used by many of the world's major gas distribution and transmission companies, SynerGEE Gas combines an industry-leading design modelling tool and a cutting-edge geographic information system (GIS) to enable operators to monitor their current networks and model the impact of any additional design and/or maintenance work.

Safety First

Take the UK's existing gas distribution network as an example. Much of this network comprises decades-old iron



Network Upgrade.
The scenario modelling tools in SynerGEE Gas enable pipeline operators to identify the most suitable pipe diameter for maximum efficiency and minimum cost.



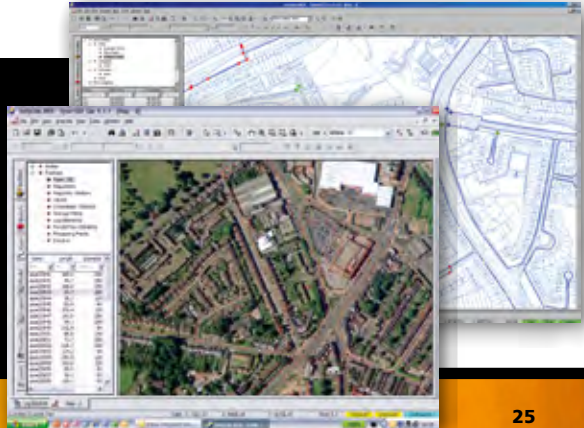
pipelines, many of which are at risk of corrosion and leaks. Upgrading these pipelines takes time and resources, and it can be difficult for a pipeline operator, without the right technology, to identify those pipes which are at most risk, and to track and control the volume of leakage. SynerGEE Gas includes state-of-the-art safety prediction and measurement features, so that operators can predict the likely lifecycle of their pipeline assets, control leaks in line with statutory regulations, and prioritise upgrade maintenance accordingly.

The software's pressure modelling tool also enables operators to develop an optimal pressure management strategy to minimise leaks and, therefore, the cost of repair and disruption. If you need to transfer gas from A to B with a final pressure at a certain level, SynerGEE Gas will enable you to identify quickly how best to do that at the minimum cost and with the minimal risk of leakage. Similarly, the software provides the tools for superior reinforcement and

replacement scenario modelling. Given the age of pipelines in the network or the pressure they are under, when will the pipes most likely need to be replaced, checked or upgraded? How will the network fare in the next winter – are the current pipelines robust enough? What will be the impact of any outages or any new customers added to the network?

Finding the Balance

If an operator can see, for example, that they will need to replace or repair a certain pipeline in the next three to four years, SynerGEE Gas's modelling tool will also help them to identify the best time to do that work. It helps identify the best case scenario, in terms of risk, cost and usage, for each maintenance and upgrade requirement. You don't want to invest too early, but you also don't want to wait too long, and you want to minimise the risk of outage to your customers. SynerGEE Gas's prediction and modelling software enables network operators to find the right ▶



Advanced Modelling.
SynerGEE's Area Isolation Module and Model Builder.

▷ balance by planning future work at the best time for their businesses and customers.

Ensuring Security of Supply

Careful planning is also required if operators are to minimise the disruption caused by upgrades to the public and to their own businesses. UK gas distribution network operators, for example, are currently undertaking a 30-year programme to replace more than 90,000 kilometres of iron gas mains around the country with polyethylene pipes that are more resistant to corrosion. It's a necessary process, but without careful planning it could cause major disruptions to services and inconvenience to the public at large.

A number of technologies exist to enable network operators to speed up the process of upgrades and to avoid having to dig up vast swathes of busy city streets. Inserting the new plastic pipe inside the existing iron main is an obvious example. However, the impact of such approaches on network operators should not be underestimated; after all, the use of a smaller pipe diameter will have a future impact on how much gas that operator will be able to transmit through the pipeline, so operators need to consider the impact on the businesses and consumers that use their network.

Complexity.
Advanced software such as SynerGEE helps operators avoid costly errors in their planning and development work.



Photo: iStockphoto/George Clerk

Software.
A SynerGEE Gas user models a new gas distribution network design on the screen. The drawing was generated by the software and is being used to check network data.



SynerGEE Gas's modelling software will enable operators to measure that impact and to model transmission strategies to assess how to make up that decrease in gas capacity elsewhere. Similarly, the Area Isolation Module (AIM) allows operators to plan for a number of business-impacting scenarios; for example, what if you need to shut off one area of the network for maintenance work? The module will track the impact of that on the network as a whole and enable you to manage any issues or risks by minimising disruption accordingly. By linking to the software's Customer Management Module (CMM), it will also set out who is affected, what kind of business and by how much, thereby enabling operators to plan a response and/or forewarn their valuable customers of any disruption to the network.

Furthermore, the CMM enables operators to drill down in great detail to track exact peaks and dips in usage, to use that insight to assess when best to undertake work to minimise disruption – and, just as importantly, to forecast future demand. After all, there's little point spending time and money on an upgrade if you haven't also considered the likely future demand on the network. The current network design or pipeline diameter might be adequate today, but what about in five or ten years' time? You want

SynerGEE Gas in Brief

- ❑ **DEVELOP GREATER OPERATIONAL EFFICIENCY:** software that identifies, predicts and helps you to address an asset's operational challenges.
- ❑ **REDUCE MAJOR ACCIDENT RISK:** make sure your operations teams have the tools and information they need to manage risk and safety.
- ❑ **ACCESS STATE-OF-THE-ART TECHNOLOGY:** software that is fully compatible with other industry tools and benefits from major R&D investment and regular design upgrades in line with industry trends.
- ❑ **REALISE YOUR ASSETS' FULL POTENTIAL:** software that tests your assets and tells you if they are performing safely and at optimum capacity.
- ❑ **ACHIEVE SECURITY AND CONTINUITY OF SUPPLY:** optimising gas distribution networks to provide continuity of supply and match time-varying demand.

to meet your customers' current demands in the most cost-effective way today, but clearly it won't prove cost-effective if you have to upgrade those pipes again in ten year's time to meet increases in demand. The modelling tools in SynerGEE Gas and its modules enable operators to plan for the future and to measure the impact of any changes or new contracts on the flow network and capacity.

Planning for the Future

But, what if as well as controlling an existing pipeline, you also want to construct an entirely new one? Many of SynerGEE Gas's customers undertake such design and development projects which may not yet have a city gas network in place. The software's modelling functionality enables operators to identify and budget for costs associated with building and then maintaining a city gas infrastructure; for example, by identifying the best pipe diameter to meet planned and future needs for the network, thereby ensuring maximum efficiency at minimum cost.

GL Noble Denton fully supports the needs of the customers that use SynerGEE Gas to ensure that they can make full use of the software. It's a world-leading product, backed by a major investment in research and development,

and provided with high levels of technical support and regular annual user group conferences.

Data is crucial to the optimal management of any gas pipeline network. That's why SynerGEE Gas and its accompanying modules have been developed to enable gas pipeline operators to measure the usage of their system, to monitor and control the risk of damage or leakage, and to plan appropriately for any upgrade or construction work. By allowing them to test and monitor the required improvements on the software, it also provides operators with an important testing environment before work begins. It's better to model and trial on the system, rather than in the live environment, so that you can identify the best approach for your business and avoid costly disruptions or mistakes before any money is spent. ❑ JS

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NETWORK MODELS may include pipes, regulators, valves, compressors, storage fields and production wells.



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Psychology Meets Industrial Safety

A dedicated GL Noble Denton research unit that studies human factors is driving a positive safety culture. The results help to improve a company's safety record

In March 2005 the BP Texas City refinery suffered one of the most serious workplace accidents of the past two decades, resulting in 15 deaths, more than 170 injuries, and significant economic (and reputational) losses. Furthermore, it transpired that the BP Texas City refinery had experienced four other fatal safety incidents in 2004 and 2005. In the BP US Refineries Independent Safety Review ("Baker panel report") a corporate safety culture that tolerated serious and longstanding deviations from good safety practice was cited as a key causal factor.

ABSTRACT

- Research demonstrates a clear link between a strong safety culture and a lower accident rate
- Psychologists study people's attitudes and performance to develop practical answers to complex risk issues

The concept of safety culture is therefore not a new one to the oil and gas industry. Many definitions of safety culture exist, but one of the most widely used definitions is the one developed by the Advisory Committee on the Safety of Nuclear Installations (ACSN): "The safety culture of an organisation is the product of individual and group values, attitudes, perceptions, competencies and patterns of behaviour that determine the commitment to, and the style and proficiency of, an organisation's health and safety management."

Tragically, over the past four decades the Texas City accident has not been an isolated case. More high-profile disasters have thrust the safety and environmental reputation of the global oil and gas industry into the spotlight. Indeed,

just five incidents alone have accounted for over 700 fatalities: Texas City, Flixborough, San Juanico, Piper Alpha, and more recently Deepwater Horizon. Many of these disasters were blamed on safety failings related to improper use of equipment, neglecting procedures, poor record keeping, inadequately trained personnel and a poor safety culture.

Collective Views

The real work on improving safety culture goes on in the "hearts and minds" of individuals and thus becomes a psychological challenge for health and safety managers. Research has demonstrated a clear link between a strong safety culture and lower accident and injury incident rates. Definitions of what constitute a safety culture vary, and measuring or quantifying safety culture can be problematic. GL Noble Denton defines it as being the "collective views of the workforce in relation to their values, attitudes and behaviours towards safety".



BP Texas City. Fire-extinguishing operations after the explosion in March 2005. The refinery is the third-largest in the US and capable of processing about 460,000 barrels of crude oil each day.



Scrabble. A reliable safety culture helps to reduce workplace accidents.

Recognising the necessity to address this topic scientifically, GL Noble Denton's Applied Psychology & Human Factors Group set out to understand safety culture, how to measure it and how to work with companies to create a sustainable culture of safety. The result is a new tool, the Safety Culture PROFILER.

Based in London, this highly qualified group works closely with clients to understand the psychological aspects of safety and risk in the workplace. "Through studying people's attitudes and performance, psychologists can develop practical answers to complex risk and people issues," says Natasha Perry, GL Noble Denton's Applied Psychology and Human Factors Group Manager.

Perry's team of three occupational psychologists combine many years' experience in the oil and gas and similar high-hazard industries, as well as first-hand knowledge of running safety culture surveys.

HUMAN FACTORS. Human error is estimated to be responsible for over 80 per cent of workplace incidents.

"We have combined this experience to create PROFILER and deliver a comprehensive service with the added benefit of workshops to complement the survey," she says. "Organisations involved in high-hazard industries understand that a strong safety culture can be the difference between whether people do, or do not, comply with the safety management system in place," she says. "A weak safety culture can account for why people still take risks, despite there being clear procedures and rules." John Tse, team member and lead researcher in developing the survey and brand identity, says: "By carrying out PROFILER surveys, we can identify problems before they become reality. These so-called leading indicators allow us to spot weak areas before they become a problem."

PROFILER methodically records an impression of a company's safety culture at a particular point in time. Through regular reappraisals and benchmarking, ▶



integrity safety culture

► changes in workforce attitudes can be captured and analysed to identify appropriate measures to improve safety initiatives. Examples of systemic organisational weaknesses include lack of supervision, ill-defined roles and responsibilities, inadequate training and poor leadership and safety communications.

“Having a regular assessment of a company’s safety culture and taking action as a consequence of the results will signal to staff that senior management are taking the issue seriously, and that this is not simply a form-filling or box-ticking exercise,” says Perry.

Clear Identification

Many managers are reluctant to fully engage with the process of developing a safety culture, allowing both human and technical weaknesses to fester and grow. It can be too easy to become distracted by immediate, day to-day issues, rather than working to create a less tangible concept such as safety culture. However, armed with a PROFILER report, an organisation can more easily assess how they are managing company safety culture. Furthermore, the PROFILER enables clear identification of potential “weak spots” in organisational safety culture, and the team offers practical help to support managers in improving on these areas.

PROFILER was developed by thoroughly researching the various different safety culture models and measures on the market, identifying the similarities and gaps and then developing one model that included all of the key safety culture factors in one comprehensive and cost-effective service. “It’s important to understand what people actually do in safety-related activities,” says Tse, “rather than what they say they do. Workers might be reluctant to offer honest answers about some safety practices for fear of reprisals, but our PROFILER service ensures all survey responses are completely confidential. The anonymity of the process allows us to gather more honest and less biased data. The survey is conducted at all levels of a company and includes



PROFILER.
Ten key factors determine the safety culture of a company. Safety culture originated after the Chernobyl disaster brought attention to the relevance of managerial and human factors for safety performance.

understanding aspects of an organisation’s operating procedures, management systems, communications and workflow systems.”

Based on academic research, practical experience and previous case studies, the 10 PROFILER target areas have been defined (see illustration left). “Our Safe-

ty Culture PROFILER survey is based on ten key factors that represent safety culture, each of which can be measured by collecting workforce views,” says Tse. “This is carried out by using our specially developed survey, and supplemented by facilitated workshops.” There are typically 46 questions on a PROFILER survey. “We have written the questions in such a way that they are suitable for any oil and gas company. We can add a number of additional questions if a client has a particular issue to understand or resolve. However, keeping the same questions enables effective benchmarking data to be developed from survey responses collected, which in the future we will be able to offer clients as a way of comparing their safety performance with their peers,” says Tse.

Tse continued: “The survey can be completed online, in hard copy or in a combination of both. Clients do not see individual responses, and all completed questionnaires are kept anonymous. The variety of survey formats are provided to ensure that diverse, geographically fragmented workforces, for example those with personnel working offshore, can easily access and complete the survey. Respondents generally have around two to three weeks to complete the survey.”

Benchmarking Data

Typically, it takes around 15 to 20 minutes to complete a survey, with respondents agreeing or disagreeing with safety culture statements on a sliding scale. “In order to make the survey bespoke to our clients’ needs, we work with the client to ensure the questions are appropriate so that workers can identify with the survey and therefore

**Pressure.
Working at
industry
plants is
attended
by risks.**

answer it as reliably as possible," says Tse. Once staff have completed the survey, a series of workshops are run to add qualitative or anecdotal evidence into the mix. This information adds to the rich data necessary for a full safety culture assessment. Other safety culture assessment techniques tend to rely on a single data gathering method, for example a survey, interview or workshop. PROFILER, on the other hand, combines all these techniques for a thorough overview, "enabling us to calibrate the findings and corroborate the evidence," adds Perry.

In addition, many of the existing measures focus on a single sector (i.e. energy, rail or aviation) whereas PROFILER can be used cross-sector for a greater gathering of benchmarking data. "This gives clients the opportunity to compare themselves against other organisations, both within their own industries and outside," says Perry.

A percentage score quantifies respondents' attitudes towards safety. Areas that are weaker can then provide information for decisions on where attention needs to be focused to drive forward improvements in safety and ultimately safety culture. "Repeat surveying of the workforce

can then show where progress has been made," says Tse. A Safety Culture PROFILER survey should ideally be repeated annually so that "changes in performance and attitudes can be measured and benchmarked. Using PROFILER, we give companies the tools and intelligence to make safety investment decisions and enhance their safety culture," adds Perry.

Creating a sustainable safety culture is one of the most important issues oil and gas companies face today. Keeping workers safe and reputations intact is a central theme for companies operating in such high-risk and hazardous environments. Using PROFILER will help to establish a sustainable safety culture throughout any organisation. **□ BMM**



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Knowing Where to Look

Due diligence means scrutinising every detail of a project so the stakeholders can be confident in their decision-making. GL Noble Denton's experts know exactly where to look for hidden risks. John Tate explains what they do and how they do it

Today's energy projects rely on the interaction of a multitude of highly specialised firms working in concert, and the use of extremely sophisticated models and equipment. The sheer complexity of this environment makes it difficult for investors and owners to understand all the implications and risks of a given project. This is where "due diligence" comes into play: independent experts identify commercial, legal, insurance and technical risks at every stage of the project lifecycle and give advice on how to mitigate and control them.

GL Noble Denton has provided technical due diligence

expertise for numerous projects covering all major offshore oil and gas asset types, including drilling, construction, field development, production and support. "It is a fundamental part of project financing and development – especially for offshore

oil and gas projects which are technically sophisticated," says John Tate, GL Noble Denton's Director for Due Diligence. "In a market with an increasing number of players, we can help protect our clients' interests as well as assist them in selecting the best partners for their project."

Significant Savings

"When we act as an appointed independent engineer or technical advisor undertaking technical due diligence, we are expected to offer opinions on how to mitigate risks and, in some cases, to monitor project implementation. Advising as to the appropriate controls and/or contingency allowance is also a key part of this work," says Tate.

Delays can spell disaster for a project, with charter rates running to hundreds of thousands of dollars per day, not to mention no-show and downtime penalties. The cost of technical due diligence is a tiny fraction of the total project cost, but one which can result in significant savings.

ABSTRACT

- Investors and owners must fully understand the risks involved in a project before making a financial commitment
- Technical due diligence scrutinises every aspect of the project lifecycle



“As the technical challenges of oil and gas exploration and extraction in remote areas increase, so do the attendant risks. The entry of new players into the market and the increased focus on project and environmental risks from financiers, the public and regulatory bodies means that an independent assessment of risk factors is more essential than ever,” explains Tate.

The technical due diligence process generally begins with a review of the project background, using GL Noble Denton’s global experience with local concerns, such as the requirements for development on the Norwegian shelf, and operations offshore Brazil or West Africa. The asset requirements involved and the operational area(s) proposed are examined carefully. In many cases this will include confirmation of the local meteorological and oceanographic (metocean) data and the geotechnical conditions. The proposed unit design parameters, completeness of the specifications, and the equipment suppliers are also reviewed.

“In the oil and gas sector, the bulk of new projects are still predominantly in the ‘Golden Triangle’ of the Gulf of

Golden Triangle.
Most new projects take place in the Gulf of Mexico and off-shore Brazil and West Africa.

Mexico, Brazil and West Africa,” says Tate. But key smaller developments are taking place globally. Increasingly there is a demand for local involvement in projects, for example local contractors, operators and suppliers. “Local experience among project participants is ever more important. We review the arrangements, capability, experience and track record of the participants as they relate specifically to the project concerned,” says Tate.

Contract and Charter Review

All contracts are reviewed to confirm that they are consistent with the main contract and that interface and communication issues with contractors and suppliers are adequately addressed. Key aspects include pricing, payment terms, bank guarantees, liquidated damages, incentives/bonuses, rights of ownership and assignment, step-in and termination rights, insurances and warranty conditions.

Charter review is very similar to contract review, particularly in relation to penalties, drop-dead dates and ▶

integrity due diligence

▷ termination requirements. It is important that the charter specification mirrors the contract specification requirements along with any local specific rules or recommendations. This can be achieved through a “gap analysis”.

All insurances have to be scrutinised, also to make sure they are in line with industry expectations for the values involved. A review of procurement procedures verifies fulfilment of specification requirements and adequate handling of delivery, insurance, and health and safety issues. Strategic parts for maintenance must be identified, and the sourcing, storage levels and security requirements for critical spares examined.

Design Phase

In the design phase, GL Noble Denton seeks to confirm that the designers involved at each stage are capable and experienced and that wherever possible the same design software is used throughout the process. A design package review ensures that the expected specialist reviews and reports have been carried out.

Planning and Schedule

“The project schedule is reviewed against industry expectations and experience,” Tate explains. “We independently monitor project progress and check on important issues such as inspection integrity, contract variations, costs and permissible delays.”

Construction

Since most assets are no longer built by a single entity in a single location, the review process generally requires a physical audit of yard facilities, subcontractors, the build methodology and the commissioning and trial arrangements. “We check whether the builder has experience with similar projects and a positive delivery track record. “Yard security is also an important issue,” says Tate. “In examining operational risks, an area of focus is the crewing requirement relative to the operator’s total manpower pool,”

Photo: Dreamstime/Dmitrybizon



DUE DILIGENCE analyses the commercial, legal, insurance or technical implications of any project in any industry to enable well-informed decisions.

notes the technical due diligence expert, “as for specialised vessels there is often a dearth of properly experienced and qualified personnel.”

CAPEX/OPEX

“The prime concern here is that all areas have been adequately defined and quantified,” explains Tate. “We look at which items are fixed-cost and which are variable. Contingencies must adequately reflect these situations.”

The project’s operating assumptions are compared against those expected of the industry in terms of the utilisation level, crew training costs, spares, and maintenance regime. “GL Noble Denton can also provide technical input for the financial model of any project to allow various scenarios to be run,” Tate adds.

“Technical due diligence covers almost the entire spectrum of expertise we have within our organisation. From our offices in Houston, London, Norway and Singapore, we can offer our clients not only an impartial set of eyes with which to examine a project, but a sounding board for ideas and, where necessary, a hammer to support appropriate initiatives and help push them through.” □ SA



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Summary of Experience and Sample Projects



SeaDragon

2 x 6th Generation
(Russia/UK), Moss Maritime CS50 Mk II design

- ❑ FEED study review
- ❑ Specification review
- ❑ Project structure review
- ❑ Yard audits
- ❑ Contract reviews
- ❑ Charter reviews
- ❑ Insurance review
- ❑ CAPEX/OPEX Advice
- ❑ Technical input to financial model
- ❑ Equipment residual-value Advice
- ❑ O&M contractor review

Transocean and others

2 x new-build
6th generation drillships

- ❑ Construction advice
- ❑ Shipyard evaluation
- ❑ Fitness-for-purpose assessment
- ❑ Cost/schedule assessment



Petromena

3 x 6th Generation
(China/Singapore), Friede Goldman ExD design

- ❑ Project structure review
- ❑ Yard audits
- ❑ Progress review
- ❑ Charter reviews
- ❑ O&M contractor review
- ❑ OPEX advice (Finance from delivery only)

TECSO Drilling Canadian shipyard acquisition

- ❑ Technical advisors
- ❑ Roadshow presentations
- ❑ Evaluation of shipyard
- ❑ Design assessment of proposed new-builds
- ❑ Contract evaluation
- ❑ Support for future construction



Sea Wolf & KSAM

2 + 1 x Friede Goldman
Super M2 design
(UAE)

- ❑ Yard audits
- ❑ Yard financial status review
- ❑ Milestone valuations
- ❑ Milestone confirmations

Jordbær/Knarr New-build FPSO

- ❑ Supply partner review
- ❑ Flag issues
- ❑ Contracts review
- ❑ Process system review
- ❑ Turret and swivel review
- ❑ OFE/BFE issues
- ❑ Design/Engineering
- ❑ NORSOK/BG standards
- ❑ Verification of readiness
- ❑ Working environment and design
- ❑ Interface, risk and control
- ❑ CAPEX
- ❑ Operating assumptions
- ❑ Transport and installation



MPF

1 x DP3 deepwater
drilling unit (China/Spain)

- ❑ Project structure Review
- ❑ Yard audits
- ❑ Design review
- ❑ Specification review
- ❑ Execution plan review
- ❑ Equipment residual-value advice
- ❑ Progress review
- ❑ Milestone confirmations

Petroserv

1 x new drillship

- ❑ Construction advice
- ❑ Evaluation of shipyards
- ❑ Fitness-for-purpose assessment
- ❑ Comparison of rig specifications against requirements
- ❑ Evaluation of owner's team
- ❑ Cost/schedule assessment



Sapura 2500

1 x 2,500 t Derrick/
pipelay barge
(Singapore)

Schahin Multiple new-build drillships and semi-submersibles

- ❑ Evaluation of charter and service agreement terms and conditions
- ❑ New-build design assessment
- ❑ Detailed yard assessment
- ❑ Assistance with roadshow and commercial
- ❑ Evaluation of project risk
- ❑ Cost/schedule assessment
- ❑ Ongoing regular audit throughout construction
- ❑ Annual audit throughout charter



projects in brief

CER Developing Key Aspects of a New Irish Petroleum Safety Framework

aberdeen The Irish Commission for Energy Regulation (CER) has selected GL Noble Denton to support the detailed development of the new Petroleum Safety Framework (PSF) for Ireland. Dr John Morgan, GL Noble Denton's Head of Consulting and Compliance, said: "I am delighted that the CER has taken the decision to continue working with GL Noble Denton to further develop its PSF Framework."

The framework will be based on the CER's approval of safety cases, which show how petroleum undertakings will ensure that the risk associated with their operations is reduced to as low as reasonably practicable (ALARP).

The framework will apply to drilling, production and other operations.

As the CER's independent technical advisor, GL Noble Denton will draft a series of documents for the Petroleum Safety Framework, defining what oil and gas operators must do to comply with Irish Petroleum Safety Act 2010 and how the CER will regulate them.

GL Noble Denton will work alongside the CER to develop key aspects of the PSF, including documents that define the required safety cases, ALARP demonstrations and compliance assurance methods. It will also help to ensure that the PSF meets the expectations of the Irish government and people.



Ireland.
Working on a new Petroleum Safety Framework.

Photo: Dreamstime/Fanbros



Photo: Dreamstime/Dmitrymik

National Grid On-Going Commitment Rewarded

london GL Noble Denton has been successful in securing another term as a framework service provider to National Grid. The three-year agreement (with an option for a further two years) will support 27 service areas covering a vast array of engineering consultancy services for Gas transmission, Gas distribution, metering and

software. "We are delighted with this outcome," said Martin Layfield, GL Noble Denton's Head of Business Development, UK. "Our tender efforts and subsequent positive discussions to reach this achievement demonstrate our on-going commitment to National Grid." As National Grid enters a new regulatory era, GL Noble Denton is well placed to support this transition, given its knowledge of their business and assets, unrivalled gas asset experience and customer centricity.

Pipelines.
GL Noble Denton will support energy utility National Grid.

HOS Selected for Dynamic Positioning Quality Assurance Contract

houston Hornbeck Offshore Services (HOS) has selected GL Noble Denton to undertake dynamic positioning (DP) assurance services across the company's technologically advanced fleet of vessels. GL Noble Denton's team of DP engineers will support HOS to further develop internal dynamic positioning operating standards across 55 DP-capable offshore service vessels and a fleet of new-build platform service vessels that will be delivered in the second quarter of 2013.

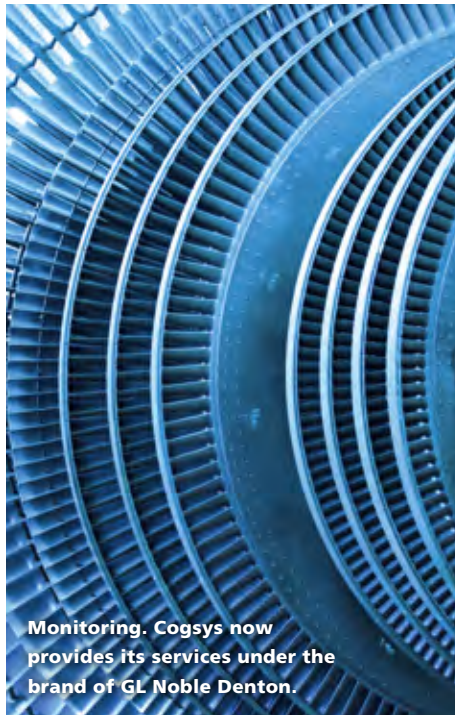
DP is a computer-controlled system that automatically maintains a vessel's position and heading. In addition to developing a robust set of DP operating standards in conjunction with HOS, GL Noble Denton's Houston-based marine warranty engineers and assurance team will provide the Hornbeck fleet with a major package of failure mode and effects analyses (FMEA), proving trials, annual DP trials, and capability analyses.

Carl Annessa, HOS Chief Operating Officer, said: "GL Noble Denton is widely regarded as a thought leader in this sector, and we are pleased to partner with them to maintain our position as the premier operator of DP-equipped offshore petroleum support and service vessels." GL Noble Denton's Craig Reid, added: "We are delighted that GL Noble Denton has been selected to help HOS achieve their goals."

DP. Offshore supply vessel "HOS Coral".



Photo: Hornbeck Offshore Services



Monitoring. Cogsys now provides its services under the brand of GL Noble Denton.

Photo: Dreamstime/Photosoup

Cogsys New Division of GL Noble Denton

warrington For more than two decades, UK company Cogsys Ltd has provided rotating machinery condition and emissions monitoring solutions to some of the oil, gas and power generation industries' best-known companies. Since June, Cogsys has been delivering the highest levels of service in this crucial field under the name of GL Noble Denton.

Cogsys has become the Rotating Machinery Solutions division of GL Noble Denton and will continue to work from its offices in Warrington, UK.

Cogsys has been part of the GL Group for the past five years. The change in name reinforces Cogsys' membership in GL Noble Denton's team of more than 3,000 experts who help to plan, design and develop, operate and optimise, and assure oil and gas assets.

IGEM Carbon Capture and Storage Is Imperative to UK Gas Strategy

london Carbon capture and storage techniques will become imperative to UK energy generation as gas becomes the country's energy game-changer, according to Arthur Stoddart, Executive Vice President at GL Noble Denton.

Speaking at the Sir Denis Rooke Lecture of the Institution of Gas Engineers

& Managers (IGEM) Stoddart suggested that there has been a fundamental shift in sentiment on gas in the UK over recent years. "The government's strategy has swayed to herald natural gas as 'destination fuel' for the country's carbon plan this year. And there are good reasons to be optimistic for this: there



Guest Speaker. Arthur Stoddart.

are plentiful resources, production is inexpensive and Europe is slowly moving towards an integrated gas market," said Stoddart at the annual event.

dates

Conferences & Fairs

SEPTEMBER

04. – 05.09.2012

IGEM Annual Conference 2012

Nottingham, UK



Flagship Event. Energising the future of gas.

18. – 19.09.2012

13th Annual FPSO Asia 2012

Singapore



Offshore. FPSO units in focus.

OCTOBER

08. – 11.10.2012

Gastech 2012

London, UK



Networking. The natural gas industry's premier event.

09. – 10.10.2012

DP Conference 2012

Houston, USA



Houston. Covering the latest changes in DP.

23. – 26.10.2012

30th International North Sea Flow Measurement Workshop

St Andrews, UK



North Sea. Premier world flow metering event.

NOVEMBER

11. – 14.11.2012

15th ADIPEC 2012

Abu Dhabi, UAE



ADIPEC. Abu Dhabi National Exhibition Centre.

27. – 30.11.2012

OSEA 2012

Singapore



Venue. Solutions for both up- and downstream.

IMPRINT

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People with pipeline issues talk to Dave

Cuts costs by designing keyhole surgery for pipelines that's seven times faster

Sits on international committees to develop industry standards

Is the trouble-shooter of choice for some of our largest clients across the world

Builds sets and paints scenery for amateur dramatics

Dave is a significant asset to our team of global senior scientists. With more than two decades of experience in gas distribution, he solves some of the world's biggest network problems. That's why, as with many of our people, clients invariably ask for him by name.

Dave is modest about the innovation awards his team has won for GL Noble Denton and our partner companies; particularly in developing faster, safer, and less costly ways of drilling into live gas mains. The public doesn't know it, but Dave's work saves them weeks of highway disruption.

Dave is one of the thousands of dedicated experts our clients count on every day

Learn more about him here www.gl-nobledenton.com/Dave

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