OFFSHORE ENERGY REPORTER

April 2015 WorldEnergyNews.com

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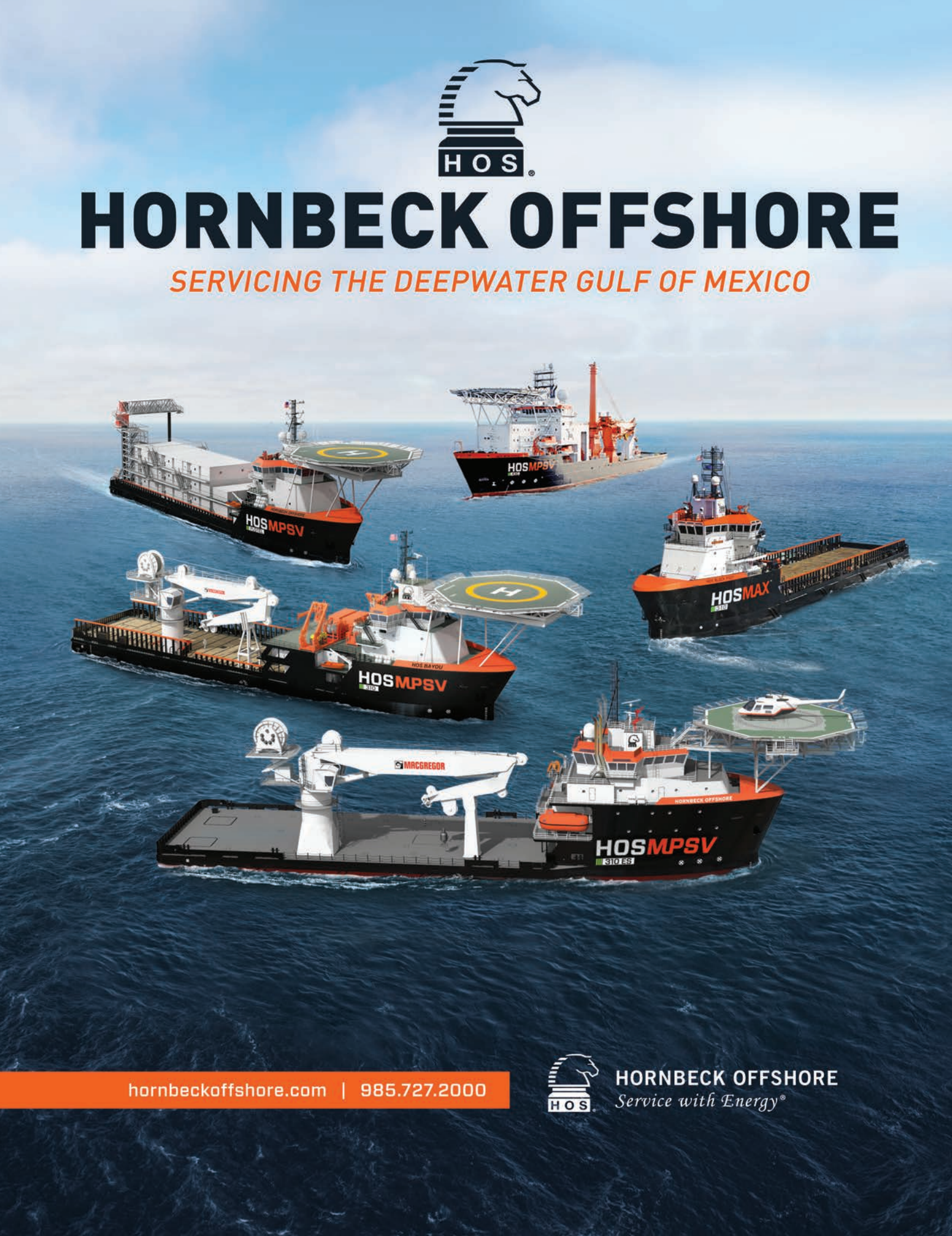
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ON THE COVER

Safe, efficient offshore operations is the focus of the futuristic oX bridge concept from Rolls-Royce.
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(Photo courtesy Rolls-Royce)

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"The offshore community suffers, on both an industry-wide and personal level, by having limited access to the modern standards of connectivity.

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Contributors

William Stoichevski

After honing the media campaign of Norwegian green group Bellona (current fuels advisors to the European Commission), William Stoichevski began working for the Associated Press in Oslo. In 2003, he left the AP to oversee and write for a number of print and electronic energy industry publications in the Norwegian capital. He has written thousands of offshore-focused reports from his North Sea vantage point. Hard-to-match access has granted him interviews with hundreds of industry captains andorks in Oslo. He started writing for *Maritime Reporter & Engineering News* in 2014 & *Offshore Engineering Reporter* in 2015.

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Editorial

Welcome to Offshore Engineeing Reporter

EIA's Short Term Energy Outlook forecasts that the recent trends in the U.S. petroleum market will continue into 2015. Our forecasts expect domestic crude production to average 9.42 million barrels per day (10% above 2014), and net imports as a share of domestic consumption to be 21%. Recent declines in crude prices may affect our outlook.

- Adam Sieminski, Administrator, EIA, U.S. DOE

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OFFSHORE ENGINEERING REPORTER is published 6 times a year by New Wave Media. Periodicals Postage paid at New York, NY and additional mailing offices.

"Dramatic" is an understatement to aptly describe the energy price plunge of 2H 2014. While there are precious few outside the inner circle of political and corporate leaders who can within reason predict energy pricing for the coming five years, the sustained low energy pricing level is sure to have a immediate and sustained impact on the people and companies that serve this market.

Regardless of the market conditions or direction, *Offshore Engineering Reporter* is the new voice for and about the global offshore engineering market.

While the *OER* name may be new, its heritage in the world of B2B publishing has a long and distinguished history. Published by New Wave Media (New York, NY), *OER* is the latest addition to a growing family of print and electronic titles serving the global commerical maritime, subsea, offshore and energy markets.

The Grande Dame of this publishing family is *Maritime Reporter & Engineering News*, the world's largest circulation marine industry B2B publication, established in 1939 and entering its 76th year in continuous operation in 2015.

The philosophy behind *OER* is simple and consistent with its publishing pedigree: deliver insightful features, data, news and analysis to the largest independently audited cirulation of executives with decision making responsiblity and buying power.

In addition to the print title, *OER* is supported online and electronically at *www.WorldEnergyNews.com* with a corresponding family of electronic media to serve most any need or taste. We, like our readers, are global and mobile, and whether you choose to receive your information in print, online, via your tablet or other mobile device, we will work 365/24/7 to ensure that your first stop for offshore engineering information is *Offshore Engineering Reporter*.

Gregory R. Trauthwein,
Editorial Director & Associate Publisher

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Quotable

"The offshore community suffers, on both an industry-wide and personal level, by having limited access to the modern standards of connectivity that we all take for granted on land."

Frode Støldal, CEO, MCP

"BOEM is taking an important step to better preserve the 'polluter pays' principle of the Oil Pollution Act."

BOEM Acting Director Walter Cruickshank on new Limits of Liability for Oil Spills from Offshore Facilities

"Our economy will not prosper as long as it is monopolized (by the government). The economy must be rid of monopoly and see competition."

Hassan Rouhani, Iranian President

"Many of the technology building blocks that will control the ships of the future are already available today, but there is still work to be done to develop marine solutions from them."

Oskar Levander, Rolls-Royce

[in brief]

Gulfaks Rimfaks Valley

Statoil and its partners have decided to develop the Rutil discovery located in the Gullfaks Rimfaks valley in the North Sea. Providing close to 80 million barrels of oil equivalent, the development will extend the lifetime of the Gullfaks A platform. “Statoil is currently implementing a major improvement effort to reduce costs and increase profitability to secure longterm activity and value creation on the NCS,” underlines Aasheim.

Sudan to Drill “Hundreds”

Sudan’s oil minister says the country will drill more than 250 wells in the coming year, aiming to boost its energy reserves by 65.4 million barrels of oil and 300 billion cubic feet of gas, state media reported.

When South Sudan seceded in 2011, it took with it three-quarters of the former unified country’s oil wealth, estimated at 5 billion barrels of proven reserves by the U.S. Energy Information Administration.

Photo Harald Pettersen - Statoil

[case study]

RRC Robotica

IMR & Offshore Support Specialist

RRC Robótica Submarina is a local company that was established nine years ago, following the increase in the Brazilian market’s demand for subsea support services using ROVs. With the growth of the ROV market, RRC reviewed its growth strategy and started to focus on ROV operations. RRC is one of the only Brazilian companies in the Work Class ROV support, operations and training market. The company started operations focusing on the training and consulting segments, later expanding its businesses to leasing and selling of imported subsea tools, simulation and modeling of subsea operations, practical training with subsea equipment and professional ROV operations simulators.

In 2004, the company was established to form and provide qualification for ROV pilots. In 2007 the company saw the need to increase its infrastructure. RRC moved from the building where it had first been established to an area of 2,000 square meters at Granja dos Cavaleiros. By 2008 RRC had established an international partnership with Perry Slingsby Systems, of the Triton Group, now F-E-T (Forum Energy Technologies), and brought to Brazil the quality of Perry Slingsby Systems’ technology with the sales and leasing of subsea tools, as well as technology to manufacture custom-made tools. In a cooperation agreement, RRC validated its simulation laboratory with CENPES (Petrobras Research Venter), creating the Simulations Technical School, thus ensuring compliance with the requirements for analysis of operations of ROV and subsea equipment. A partnership with Vmax, another Triton Group company, allowed the installation in Brazil of a third ROV simulator, which consolidated it as the only ROV operations simulation laboratory with such infrastructure in Latin America. In 2010 RRC finally entered the ROV operation market. RRC was awarded with two 10-year contracts for ROV operations from client Lu-

[in numbers]

WTI Crude Oil Future Prices

$52.69/bbl

down $2.04 from week earlier

down $42.75 from year earlier

Crude Oil Inventories

385.5 mmbbl

down1.8 mmbbl from week earlier

up24.9 mmbbl from year earlier

Courtesy RRC

patech, worth $61 million, to provide support to light work over operations, subsea construction; survey operations; drilling and completion of wells. RRC also become the only Brazilian company to provide offshore training certified by the IMCA.

The company really took off in 2011, when the Bravante Group acquired 70% of the company shares, which allowed Bravante to enter the huge and challenging ROV operation market in Brazil and abroad, with income estimated at $50 million per year from 2013. Keeping innovation in mind and seeking to reach new markets, in 2012 RRC started to developing computer-based tools and technologies for the training and monitoring of offshore pollution response operations. RRC invested $1.2 million in R&D for the development of an advanced maintenance system, to allow for equipment maintenance training in a virtual environment, using state-of-the-art technology for man-machine integration. Finally, in the same year RRC was awarded a GLOBAL BID contract for the operation of 24 ROV systems, becoming the third largest ROV operator in Brazil. With an operations base in Macaé-RJ, and a robust infrastructure, with mechanical, electric and hydraulic workshops, as well as state-of-the-art equipment and modern facilities, RRC, s planning to increase its position in the Brazilian IMR market, through its ROV operations experience.

53%

Linn Energy LLC cut its 2015 capital budget by 53% to $730 million, joining other oil and gas producers in reducing expenditure in response to falling oil prices.

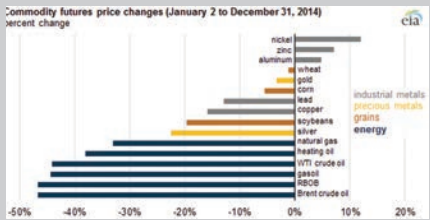
[insights]

News Flash!

In Commodity Comparison, Oil had a Very Bad 2014

Energy had larger price declines than most nonenergy commodities

The first eight months of 2014 were much like 2013, as energy commodities remained in a relatively stable price range. During the last four months of 2014, however, crude oil and petroleum product prices fell dramatically, and ended the year with the largest price drops of all major commodities in the S&P Goldman Sachs Commodity Index (GSCI). Prices for nickel, zinc and aluminum were among the few commodities that increased in 2014, while the prices of crude oil, petroleum products, natural gas, grains and other metals declined. In 2014, the energy component of the GSCI fell 43% from the start of the year. The S&P GSCI precious metals, industrial metals and grains indices declined only 6%, 8% and 8%, respectively, over the same period. Price movements in major commodity groups often move together when there are strong underlying trends in global economic growth.



Source: U.S. Energy Information Administration, based on Bloomberg

Five Minutes with

Frode Støldal, CEO, MCP

Answering the Call

There's a digital disconnect offshore. The communication standards we take for granted on land are cut adrift at sea, hampering data transfer for businesses while severing individuals' lifelines to social media networks. What's to 'like' about that? Frode Støldal, CEO of MCP, has had enough.

By D. Dexter

"We think it's time for a new mobile communications reality," says a steely eyed Frode Støldal from his seat at the Offshore Technology Days conference in Bergen, Norway.

"The offshore community suffers, on both an industry-wide and personal level, by having limited access to the modern standards of connectivity that we all take for granted on land. The result is business processes that don't enjoy the levels of efficiency, speed and accuracy they could with higher performance data connections, and crews that don't 'feel at home' when they're at sea. This impacts upon satisfaction and retention levels. "We can change that," he argues, slowing his pace to emphasize every word as he adds: "good communication unlocks potential."

…And Støldal, it seems from his meeting with Offshore Engineering Reporter, believes his firm has the key.

Faster, Further, First

Maritime Communication Partner (MCP) is currently known for its mobile services and solutions in the cruise and ferry segments, where the business, headquartered in Norway with an additional office in Fort Lauderdale, Florida, has a 12-year track record of 'at sea' expertise under its belt.

Owned by Norwegian telecoms giant Telenor, MCP operates a proprietary mobile network – CellAtSea – that last year connected some 16 million users, enabled by a collection of over 330 international roaming agreements.

It's established, financially strong (with Telenor providing the investment muscle) and hungry for fresh opportunities. Offshore, it appears, is now the main item on the menu.

MCP's plan is simple, yet technologically challenging. It aims to roll out LTE base stations in the North Sea, creating a 4G network across the entire Norwegian Continental Shelf (NCS) – the first offshore network of this kind, on this scale, anywhere.

In theory this will connect all operating vessels, platforms and rigs on the NCS to high-speed, reliable 4G mobile services. Offshore crews, workers and businesses will, for the first time, be able to enjoy levels of connectivity directly comparable to those on land.

"MCP and Telenor see offshore as a real 'greenfield' opportunity," Støldal explains, using telecoms terminology for a completely new development market – something that, in an increasingly connected world, is a rarity.

"I've been involved in the roll out of 4G on land in Norway (he was formerly Telenor Norway CTO) and the speed

Offshore comms is a focus for MCP

and capacity of the networks is revolutionary. 4G enables and enhances innovation, and the offshore community, the eco-system that serves it, and all additional maritime traffic will benefit hugely from that.

"Of course it's ambitious, and a substantial investment in spectrums and infrastructure," he concedes, "but the market demand is definitely there."

Platform for Success?

The scale of those ambitions is seen in the network infrastructure required.

To deliver Støldal's "new mobile communications reality" MCP must install a latticework of 4G base stations and control systems across the entire territory, situating the technology on existing offshore infrastructure, such as oil and gas platforms. This will facilitate high capacity networks (which can be closed/internal for companies transferring business critical information) close to installations and activity hubs, while quality, real-time broadband services can be pushed further to the very remotest parts of operating fields.

"This isn't a completely new proposition for us though," the MCP chief is quick to impart, stating that the firm already operates a GSM (2G) service on the NCS, connecting offshore vessels for firms such as Subsea7, Gulf Offshore and DeepOcean.

But GSM isn't 4G. Surely that incurs new agreements, new technology and a new installation strategy?

"Yes," Støldal admits, "there will be a greater need for new infrastructure, but that's already started moving."

Originally, he explains, MCP had planned to begin LTE roll out in 2015. However, the industry appeal of the service has fast-tracked initial agreements, with the first 4G base station being installed – potentially as you read this – on Shell's Draugen platform, 150 km off the coast of Kristiansund. All work there should be finalised before the end of 2014.

"They (the owners) see the benefits," Støldal opines, "and that openness, that appreciation of the potential here, will help us as we build the network."

Money Talks

But are those benefits worth the costs?

Readers will be able to appreciate that modern business processes and technology will perform better with better channels of data exchange – working together across secure, reliable networks for improved efficiencies and understanding. Similarly, everyone can relate to enhanced personal quality of life through better connectivity, especially if you're reading this online.

However, the words 'mobile at sea' have the ability to strike fear into any cost conscious service consumer. Prices often have a reputation for being on the vertigo-inducing side of high. So, will this service be any different?

Støldal smiles. It's too early, he intimates, to give away exact details of the pricing structure, but it will be in keeping with standard Telenor mobile roaming costs, which, he says, are "very competitive" (Telenor's website shows packages such as Feriesurf EU, which allows 40mb of data a day for $4.38).

"If you compare it to the cost of using satellite services," he continues, "which is the current standard, it's a significant price reduction … just a fraction of the cost. That will enable companies to rely more on communication, data transfer etc., meaning, for example, they could carry out tasks onshore in the future that have to be done offshore today. There's huge efficiencies there.

"I think customers will see the value in that, don't you?"

On the subject of rolling out 4G beyond the NCS, Støldal is equally enthusiastic, yet coy.

"If you look at our position in cruise and ferry we're a global business," he states, "and of course we'd like to emulate that in the offshore market. And I think we can. But this is the first project of its kind and we're going to take it step by step to ensure everything is in place and the service is of the optimal quality.

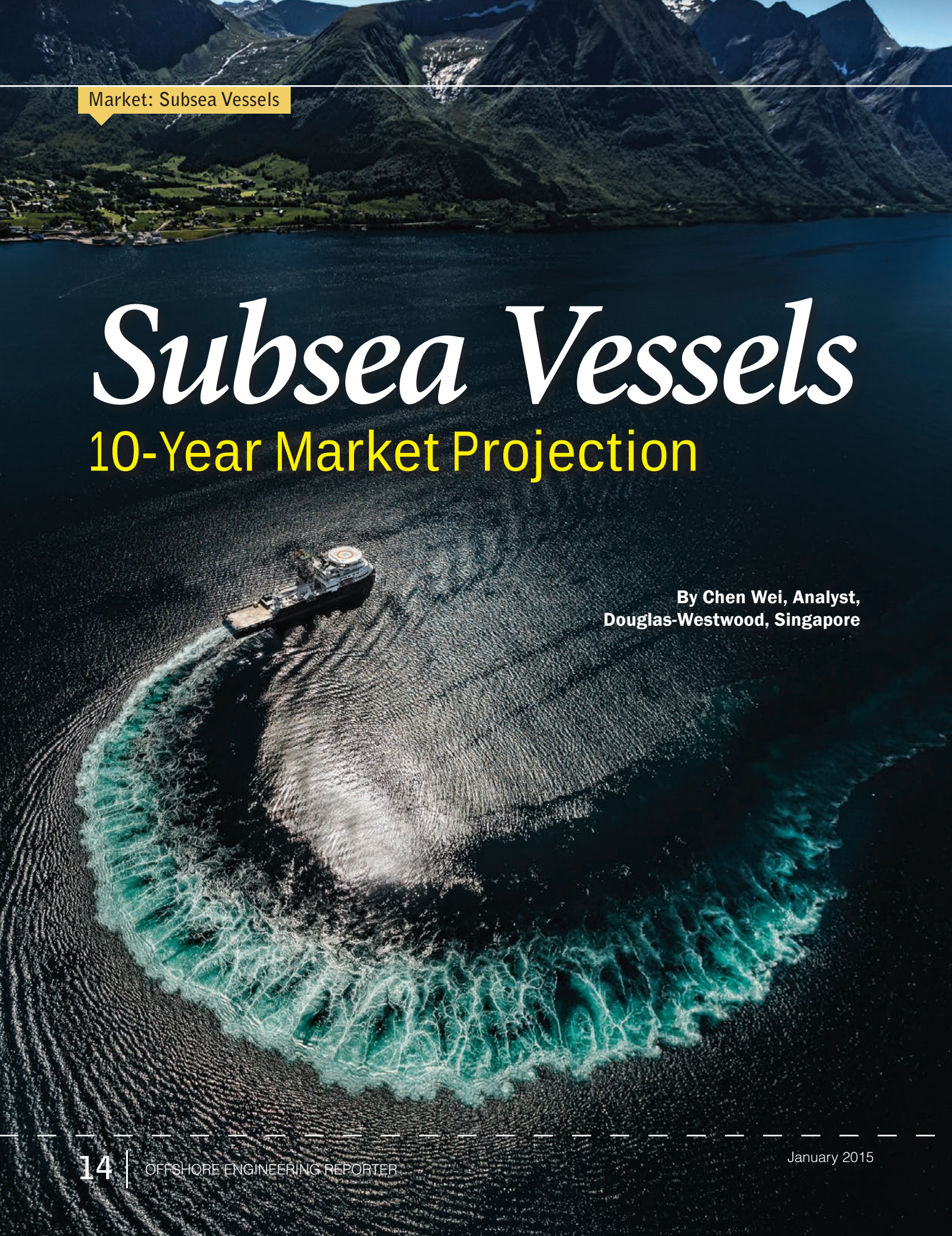
"After that," he exhales with a smile, "well, we'll see …"

MCP Fast Facts

- Established in 2002
- HQ in Arendal, Norway
- Owned by Telenor
- Building offshore proposition but already well-established in cruise and ferry segments.
- Currently has 16 GSM (2G) installations in the North Sea
- MCP's CellAtSea network recorded 16 million users in 2013
- In the same year data traffic over the network grew by 105%

Subsea Vessels

10-Year Market Projection



By Chen Wei, Analyst,
Douglas-Westwood, Singapore

Over the next five years $122 billion is projected to be spent on global subsea vessel operations – an increase of 64% compared to the previous five year period.

This growth will be driven not only by volumes of work but also by the growing usage of higher-end vessels able to cope with increasingly harsh operating conditions and evolving customer requirements with regards to safety and operational efficiency.

Field development activities, including SURF installation and light/medium construction, will account for 40% of forecast expenditure. Given the prevalence of high value assets such as Reel-lay, Flex-lay and larger MSVs this segment is the most cost-intensive in the subsea vessel industry; accounting for just 35% of anticipated vessel days over the next five years. The field development market will enjoy the fastest growth profile driven primarily by continued pre-salt developments in Brazil, revitalized activity in the Gulf of Guinea and the emergence of East Africa, with these regions accounting for 48% of projected global spend. Longer term, pre-salt potential in the Gulf of Mexico, signaled by PEMEX's recent Vasto prospect, could see the region become a major buyer of subsea vessel services.

The installation, repair & maintenance (IRM) of existing infrastructure will account for 42% of total vessel operational day requirements, the largest of all market segments. However, a tendency to use smaller vessels and long-term contracting leads to only 39% of projected spend. Unlike field development the IRM market is less associated with deepwater/subsea and is driven by conventional, shallow water infrastructure. Asia and North America will dominate global IRM requirements accounting for 46% of projected expenditure. The former in particular is becoming an increasingly attractive market to international contractors as local operators turn to more modern DSV/MSV assets to improve operational efficiency.

Construction of export pipelines and international trunklines, including supporting DSV and MSV activity, will account for 19% of projected spend over the period. Total volumes of activity are expected to be sustained at around current levels with the Middle East and Asia retaining a combined 66% share of the market. Geopolitical uncertainty in Europe is currently threatening the viability of high profile trunklines such as Gazprom's South Stream project which could impact anticipated demand for both dedicated pipe layers and support vessels.

Subsea well intervention is the smallest market segment covered in DW's definition of subsea vessel services, accounting for just 5% of forecast spend. Aimed at providing a cost competitive means of improving productivity from ageing subsea wells, this had previously been seen as a game changer for the subsea market but a hesitance to adopt new technology by operators has seen subsea well intervention fall out of focus in recent years, a fact compounded by Total's recent cancellation of a contract with Aker Oilfield Services in June 2014. A glance at activity globally.

Africa

Africa will remain a strong contributor towards subsea vessel demand, accounting for 16% of the global vessel operations expenditure at $19.8bn over the 2015-2019 period.

Asia

The majority of subsea developments in Asia are located in shallow waters but this is expected to move continuously towards water depths beyond 1,000m over the next five years.

Australasia

Subsea vessel demand in the region will be largely driven by shallow water LNG developments in Western Australia from fields in the Bonaporte, Browse and Canarvon basins. Vessel requirement is also anticipated to increase by 54% as compared to the 2010-2014 period.

Eastern Europe & FSU

The majority of EE&FSU regional developments are shallow water-focused with increasing deepwater projects coming online through the forecast period in the Caspian Sea.

(Continued on page 34)

FLNG Prelude

Courtesy of its investment in the world's first Floating liquid natural gas (FLNG) facility, a structure which is longer than four football fields, as heavy as 6 Nimitz-class aircraft carriers and almost as tall as the Taipei 101 skyscraper, costing an estimated $11 to $13 billion and essentially turning the maritime and energy world's upside down, Royal Dutch Shell PLC earns a much deserved spot on the OER100.

As Shell moves the LNG processing out to sea, it incorporates more than its fair share of subsea technologies.

FLNG Prelude will measure at 488 x 74 m, and it will clock in at 600,000 tons when fully ballasted. The FLNG facility, which is under construction at the Samsung Heavy Industries shipyard in South Korea, will be the largest object ever floated on the ocean. Designed to last 50 years, withstand level 5 cyclone winds and liquefy gas to minus 162 degrees Celsius, it is scheduled to go into service in 2017, spending the next 25 years tapping the Prelude and Concerto gas fields in the Caswell sub-basin of the northern Browse Basin, about 200 km off the coast of Broome, Western Australia. Once in place, it is expected to produce 3.6 MMt/a of LNG, 0.4 MMt/a of LPG and 1.3 MMt/a of gas condensate annually, enough gas to fuel Hong Kong for a year.

Some observers scoff at the idea of using a hugely expensive facility to extract gas from small fields. But one of the beauties of FLNG facilities is that they are mobile and can flit from gas field to gas field, servicing one or many wells at the same time, while pipelines to onshore processing plants are essential tied to one field.

Once its targeted field is sucked dry – the expensive pipeline has no further use. The plant can still receive LNG for processing, of course, but at that point it's coming in on tankers from various distances and the facility will have to be able to accommodate those ships and the necessary offloading process.

Knowing where the gas is, and getting to it, however, are two different things. There are many so called "stranded" deepwater gas reserves that have been considered either too small in terms of likely productivity or too far out, to tap into in an economical manner. Factors such as geographical proximity, slowing oil production rates, technological advancement, abundant supply and unprecedented demand growth in Asia point towards a locus of FLNG development in Australian waters, according to Murray Dormer, an analyst with Douglas-Westwood. Douglas-Westwood expects the market for construction of FLNG vessels to increase from $3.7B in the period 2007-2013 to $64.4B over 2014-2020, according to its report, "World FLNG Forecast."

As its name implies, the Prelude won't be alone for long. Nor will it remain the world's largest floating offshore facility. There are at least three other similar projects following in its wake. One of these, from Exxon, and others in the planning stages at Shell, will pump up the size equation even more. Competitors include:

- **Exxon** in partnership with BHP Billiton is looking to install what would be the world's largest FLNG - a 495 meters (1,624 feet) long facility - in its Scarborough gas field off the Australian coast. Design specs call for it to produce an estimated 6 million to 7 million mt/year of LNG from five trains, and to hold 10 storage tanks with a capacity of 380,000 cubic meters.
- **Malaysia's PETRONAS** plans to launch an FLNG plant in 2015, and has already announced plans for a second FLNG plant. It's PFLNG 1 is expected to be the first such facility in operation, beating Prelude by two years. It will be 365 meters long, about 60 meters wide, weigh approximately 125,000t when fully loaded and is expected to produce 1.5 million tonnes of LNG per year.
- **GDF Suez** of France and Santos, which are looking to put an FLNG plant in the the Bonaparte project off northern Australia.

Before Shell can hope to reap FLNG's many anticipated advantages, it must

Shell will eliminate the need for some components by extending eight 1-m diameter pipes down 50m to pump frigid seawater to help cool the gas – 50,000 cu. m./hr.

first surmount some very big challenges, not the least of which is force-fitting an entire LNG processing plant onto what some have likened as a "barge" in the middle of the ocean.

Shell had to find a way to adapt its shore-based technology for a much smaller, floating platform. This was solved in part by stacking components on deck vertically to save space.

A related solution kills two birds with one stone. Shell plans to eliminate the need for some components on deck by extending eight 1-meter-diameter pipes to a depth of 150 meters, in order to pump frigid seawater up to help cool the gas – 50 million liters (50,000 cubic meters an hour.)

Among other challenges, there's the fact that Prelude will be sitting out in the middle of nowhere in cyclone alley central. Shell has no intentions of untethering the facility every time a bad wind blows and towing it to shore. Instead, a number of factors are supposed to ensure that Prelude sits tight in savage seas. First there is its sheer size and weight. But more important, Gilmour claims Prelude's mooring system can stay on station even in the face of a category 5 hurricane.

Four groups of mooring lines will be attached to the world's largest (93 meters) mooring turret on one end, anchoring the facility, via connections to suction pile anchors, to the ocean floor on the other. The swiveling turret turns slowly with the wind, reducing the impact of water and weather conditions.

Meanwhile, the offloading of LNG onto an LNG carrier required the design of a special loading arm system with swivel joints and quick connect/disconnect flanges, capable of offloading both LNG and LPG.

(Image: Rolls-Royce)

The Future Bridge

For decades the maritime industry has long-theorized of emulating the "airline model" in uniformity and technical capability of its own ship and boat integrated bridge platform. But the term "integrated bridge" itself is somewhat of a question, as there are as many definitions as there are current 'solutions.'

Enter Rolls-Royce and the VTT Technical Research Center of Finland which together have launched a ship intelligence system that it believes could be the next major transition for the shipping, able to gather, process and reasonably present increasing amounts of complex and high-level data from onboard systems to manage propulsion, navigation and potentially lead to autonomous vessels. The latest vision of Ship Intelligence – a futuristic ship's bridge concept – could become reality by 2025.

Rolls-Royce worked with VTT's researchers and Aalto University to develop the new bridge, known as the

Subsea Laser Scanning

Fugro expanded its services for the offshore oil and gas sector with the addition of high resolution subsea laser scanning specialist technology that can be applied to a wide range of subsea services including metrology, field mapping, structure mapping, change detection and integrity management. Fugro's Marine Construction Survey group recently used subsea laser scanning in a number of projects in the Gulf of Mexico, including metrology and asset mapping. With subsea laser scanning, companies have an opportunity to gather high resolution 3D point clouds of subsea assets which are used to obtain accurate point-to-point measurements.

Future Operator Experience Concept or 'oX' for short. It offers the crew smart workstations that automatically recognize individuals when they walk into the bridge, and adjust to their own preferences. The windows of the bridge serve as augmented reality displays of the vessel's surroundings, including visualization of potential hazards that would otherwise be invisible to the human eye. The system can, for example, pinpoint sea ice or tug boats and other craft that may not be visible to the crew, especially given limited sight lines on the world's largest containerships, for example.

"We are entering a truly exciting period in the history of shipping, where technology, and in particular the smart use of Big Data is going to drive the next generation of ships," said Mikael Makinen, President of Rolls-Royce – Marine. "Over the next 10 to 20 years we believe ship intelligence is going to be the driving force that will determine the future of our industry, the type of ships at sea, and the competence levels required from tomorrow's seafarers."

"With the demands of environmental legislation and rising operating costs, ships are going to become more complex. Add to that the fact that skilled crews are already in short supply, then we see a distinct gap opening up between the complexity of ships and the competency of the people who will crew them. That will cause real problems for the industry, and we believe it is ship intelligence, that will fill that gap."

The oX concept, has been developed by studying user experience on ships today, and will transform the operating environment for crews on board large cargo ships and platform supply vessels. Using advanced 3D animation to illustrate just what could be achieved in the next decade, the new concept will use the latest digital techniques to create a safer and more energy efficient ship operations.

Rolls-Royce's Unified Bridge system recently entered service on the vessel Stril Luna, representing a new ergonomic approach to all the activity required on the bridge of a ship, coordinating the operation of on-board equipment ranging from engines to propulsion and cargo handling.

The remote monitoring of equipment on board ships is also advancing, and Rolls-Royce has control centers in Alesund, Norway, and Rauma, Finland, where many ships and thrusters are already monitored in real-time in operation around the world. "Many of the technology building blocks that will control the ships of the future are already available today, but there is still work to be done to develop marine solutions from them," said Oskar Levander.

Subsea Processing

Boosting and Gas Compression Enabled through HV Wet Mate Connectors and Penetrators

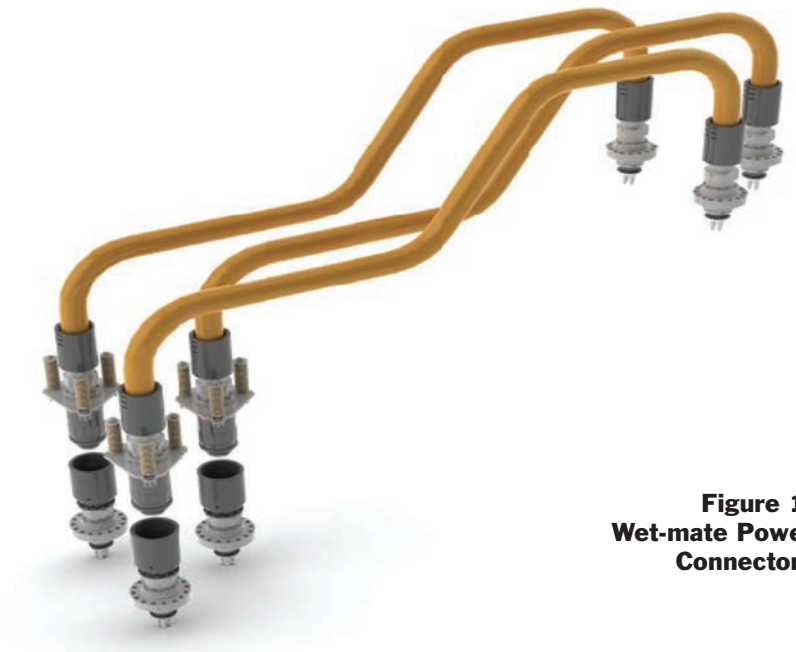
Offshore drilling activity continues to migrate into deeper waters, especially with new oil and gas discoveries happening in smaller reservoirs located in deeper waters. Making these discoveries commercially viable relies on not only revenue from high oil and gas prices but also on reducing operating expenses (OPEX) and capital expenditures (CAPEX). Oil and gas producers are now looking at new technologies to produce effectively these high-pressure, complex reservoirs. Technologies such as subsea boosting and subsea gas compression allow subsea processing of hydrocarbons to change the economics of deepwater production.

Processing the hydrocarbons on the seabed has several advantages:

- Saving the multibillion dollar cost of building a new platform by providing tiebacks to shore or existing facilities
- Enhancing oil/gas recovery rates to increase the income per CAPEX dollar
- Enabling future access to reserves that are currently inaccessible due to hazards like icebergs and hurricanes
- Increasing operational safety and reducing risks

The deeper the well is, the more potential energy is required to reach the host platform at the surface. Subsea boosting increases the flowrate of the oil or gas to the surface by reducing the back pressure on the well, and therefore increases the recovery factor of the reservoir. For oil, pumping can be used, while natural gases are boosted by compression. Another technique, which can be used in combination with pumping, is to separate the water and oil/gas, injecting the water back into the reservoir to limit pressure drops in the well. This not only saves energy (of getting the water to the topside facility and down again into the well), it also saves a lot of space and weight on the heavily crowded topside facilities.

Moving processing from the platform or shorelines to the seabed creates challenges in the design and deployment of the processing equipment. A limiting factor is the weight of such equipment, especially in deep waters. Weight (and size) issues require that the equipment is designed in a modular fashion.



[photo: TE Connectivity / DEUTSCH connectors]

Figure 1: Wet-mate Power Connectors

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