Required reading for the Global Oil & Gas Industry since 1975

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Seismic market expands

page 30

Ocean renewables: Energy nirvana?

page 40

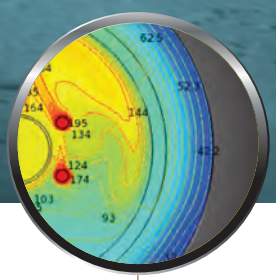
Offshore Engineer • FEBRUARY 2013

How do you know your offshore pipeline coatings will perform long term?

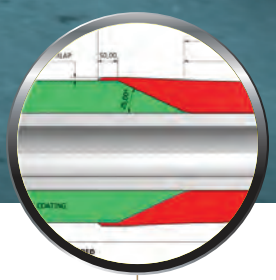
Here's one indication.

COMPLETE COATING ASSURANCE

SHAWCOR TO BE SURE



Engineering Services ▶



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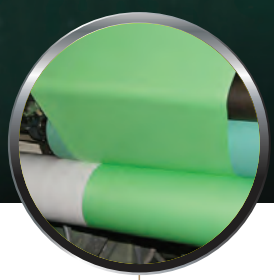
Coating System Validation ▶

Logistics Management ▶



Pipe Coating Application ▶

Field Joint Coating

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Contents

ON THE COVER

DONG Energy, E.On, and Masdar in December installed the 175th and last turbine at the 630MW, first phase of the UK's London Array Offshore Wind Farm in the outer Thames estuary. Credit: London Array Ltd.

Cover Story

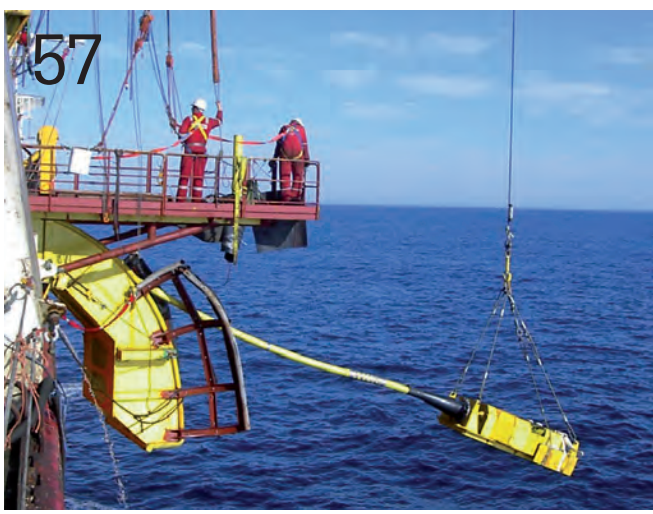
Our crowning glory?

Offshore energy means more than just oil and gas. But is it an energy nirvana or a cult of false hope? Bruce Nichols looks at the progress that the marine renewables industry has made and the hurdles it has to overcome.

Expert Access

A Streamlined Approach to Tubular Management

Join us 26 February at 11:00 CST for a Live Presentation and Q&A session on the importance of handling tubulars in an efficient and effective way to minimize their impact on offshore personnel and equipment. See page 90 for more information.



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Volume 38 Number 2

Departments & Columns

FMC Technologies

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LNG grows in importance

How new onshore field discoveries rich in natural gas and condensate in the Australasian region are giving rise to increased investment in coastal LNG facilities.

Online Exclusive

People

US Interior Secretary resigns

Ken Salazar to leave DOI at the end of March

What's trending

GE forms subsea JV

GE Oil & Gas forms Angolan subsea equipment joint venture with GLS Holdings SA

Go to OEDIGITAL and cast your vote on this month's question

Expert Access

A Streamlined Approach to Tubular Management

Tuesday February 26, 2013 11:00AM CST

Join **Aaron Sinnott** of Weatherford for a Live Presentation and Q&A session on the importance of handling tubulars in an efficient and effective way to minimize their impact on offshore personnel and equipment.

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INCEPTION

THE BEGINNING OF AN IDEA

Where in the World is OE?

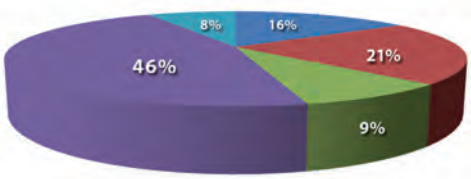
Good question! If you didn't know, ***OE*** is a global magazine serving the industry since 1975. You can imagine that during that time frame the magazine has made its way all over the world. Featured on this month's Inception page is a dedicated reader. While traveling throughout Beijing, China, Kiki Richards carried ***OE*** and chronicled the magazine's historical journey. With the launch of the new ***OE***, we wonder where you might take the magazine. Maybe it's a conference you're attending or exhibiting. You might decide to take ***OE*** offshore, on a job, or on a long flight, to keep up-to-date on relevant industry information. Wherever you take ***OE***, take a picture.

Send us a picture of yourself with ***OE*** and a brief description of your location. If we publish your photo in the magazine, we will send you a $100 American Express Gift Card compliments of our editorial staff. You can email marketing@atcomedia.com or post photos on our Facebook page.

Voices

Large and in charge. As technology progresses, so do the challenges that come with keeping up with the changes. *OE* reached out to a cross-section of industry experts to tackle the question: "How well-equipped is the offshore industry to handle massive data flows?" Here's what they had to say.

In January's poll, *OE* readers were asked: "What's the biggest challenge facing the global offshore oil and gas industry in 2013?" A breakdown of the responses indicated the following.



Available human resources
46%

Global economy
21%

Government regulations
16%

Safety/security
9%

Other
8%

Go to WWW.OEDIGITAL.COM and give us your opinion on massive data flows.

"Global oil and gas companies are moving into new geographies and deeper water, fueling new challenges in optimizing production with access to skilled resources. **Digital oil fields of the future create massive data flows**; however the value is adding business context to this data and enabling business decisions. Technologies including data visualization, decision support, and remote collaboration centers are critical in combining data from various production assets and aligning with downstream requirements, suppliers and service providers."

Tracey Haslam, Vice President of strategic markets, Honeywell

"Big data in the offshore industry has been historically handled by physical handoff of data storage devices. This high-speed flow of big data will require innovative solutions to last century's problems. Today, the offshore industry is making vital shifts in technology as it pertains to moving large data sets. The ability to analyze these data sets with greater detail in a shorter timeframe will help to decrease risk and reduce costs for finding and producing oil and gas offshore. **High-bandwidth and low-latency communication links are critical** to this paradigm shift in the offshore industry."

Keith Johnson, President Energy Solutions, Harris CapRock Communications

"In the exploration space, the offshore industry is very **well equipped to the handle massive amounts of data** involved. However, in the production space, ARC sees a transition from traditional SCADA to remote operations management. This is partly as a result of the increased data, but also because of the move toward a more collaborative environment between onshore and offshore operations."

Dave Woll, Vice President Consulting, ARC Advisory Group

"In many ways, the energy industry is better equipped for big data than many industries because exploration and production decisions have always been based on analyzing large quantities of diverse data. Where the industry can focus in the future is on **integrating across business processes** and adapting to the greater scale of data – including new data types – to maximize business benefits."

Ali Ferling, Managing Director of Worldwide Oil & Gas, Microsoft Corp

"The offshore industry's move to high bandwidth, highly reliable communications systems like undersea fiber optics has been 'deliberate'. Where such systems have been deployed (North Sea, Campos Basin, Gulf of Mexico), the operators are well positioned to meet rapidly growing requirements for operations, reservoir monitoring, environmental observing, and other yet-to-be envisioned uses of these data superpipelines. From an oceanographic perspective, access to bandwidth and power in offshore communications infrastructure would open a wide range of research possibilities that can serve both the individual operator and the common good."

Rob Munier, Vice President for Marine Operations, Woods Hole Oceanographic Institution

"There's **a lot of hype** around 'big data'. Cell phone companies handle massive streams. Our big data is seismic and fiber optic and we're doing fine; moving data is not a barrier. How quickly we are able to advance is a function of storage technology. The cost of storage is not dropping fast enough."

Scott Meyers, General Manager of IT Innovation, Shell Global Solutions

"The main concern today is on land, where **software and interpretation packages continue to struggle** keeping up with data loads, modeling and real-time feedback. While the streaming in my opinion has largely been solved, we too often find that the benefit of this information in real-time is somewhat negated through the lack of older, slower software modeling packages that do not know how to handle so much data. In a world where we are trying to reduce the manned population offshore, we have to maintain our focus on both the speed and volume of data flows from offshore, coupled with up-to-date modeling, and interpretative software on land in the office."

Etienne Roux, Managing Director, Empirica

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Colloquy

Nina M Rach

Energy and innovation intersect in the cloud

"Innovation isn't about new products, it's about changing behavior," explains Tom Koulopoulos, author of eight business books on the intersection of business and technology, including *Cloud Surfing* (2012) and *The Innovation Zone* (2011).

The cloud is more than a simple network of computers, he says. Its the beginning of an era that focuses on the innovation of "behavioral business models," and Koulopoulos positions it as the "killer app" for doing business in real-time. Innovation will accelerate in the cloud, facilitated by cloud-based idea platforms. Cloud sourcing creates a "new type of elastic organization" that can handle volatility and uncertainty – cloud computing is on the rise because it enables mobility and networking. Public cloud offerings offer benefits (reduced costs, increased business agility), but being connected carries risks (security, outages, regulatory hurdles).

Innovation Summit

In early January, Royal Dutch Shell hosted a two-day Innovation Summit at its recently expanded Houston Technology Center, which brought together Shell technology leaders and experts from other sectors to explore how collaboration can generate innovative thinking.

Shell's Matthias Bichsel, projects & technology director, said we need "competitive energy innovation . . . to deliver more affordable energy with less environmental stress." Bichsel pointed out that Shell is the only international oil company in *MIT Technology Review*'s list of the world's most innovative companies,

> Innovation will accelerate in the cloud, facilitated by cloud-based idea platforms.

and spends "over a billion dollars a year on researching and developing new technologies – more than any of our peers."

Peter Diamandis, chairman and CEO of the X PRIZE Foundation, said that real innovation comes from absolute persistence, tied to passion, a sense of purpose, a mission in life to make things happen, and an inner belief that it's do-able. X PRIZE looks at market failures, then partners with companies to launch incentive competitions. "You can incentivize non-traditional plays and come up with unexpected success." He pointed out that BP's oil spill cleanup rate, following the *Deepwater Horizon* disaster in the Gulf of Mexico in April 2010, was the same as Exxon's rate after the *Valdez* ran aground in Prince William Sound, March 1989 (1100 gal/min). What it would take to increase our cleaning capability to 2500 gal/min? In an incentive competition, seven of 10 teams doubled the rate to 2200 gal/min, and the winning team showed a 600-fold increase.

Diamandis said the current rate of innovation growth is unfathomable – most of today's technologies didn't exist 10 years ago. He characterized a 'magical partnership' as having a cross-pollination of ideas, bringing together government, corporate, and philanthropic strengths.

Shell's Gerald Schotman, executive vice president of innovation and research & development, and chief technology officer, said: "Differentiation is not the hardware, but how you process and use all this data. It's how you filter it, to visualize better." He used Shell's GameChanger program as an example. The program turns creative ideas into innovations, and invests in novel, early stage ideas to get them to "proof of concept."

Ubiquitous iPads facilitated audience responses to questions posed intermittently throughout the summit, taking the pulse of participants. When asked "In the next 30 years, where do you think the most meaningful

solutions to societies' greatest challenges will come from?," 46% of attendees chose private sector; 38% chose entrepreneurs & others; 13% academia; and only 3% government.

Energy Forum

Microsoft Corp hosted its 10th Global Energy Forum in late January, where oil & gas industry clients presented case studies of sophisticated, enterprise-wide technology solutions. More than 700 people attended GEF2013, from 134 companies – oil and gas majors, independents, drilling services, petrochemical, EPIC, and technology service providers.

The company is getting deeper into the energy industry, said Microsoft's Ali Ferling, managing director, worldwide oil & gas and mining, citing remote access and mobility as key factors in developing "connected experiences." Ferling projects US$40 trillion in oil and gas investments between now and 2035, with China driving 40% of the increase. He noted that cyber security is a large concern and refered to the company's white paper (updated last month) that addresses alignment of interests, situation awareness, and the need to define "risk-based strategies and policies that range from the protection of the entire supply chain to a sustained investment in innovation."

> The shift to cloud-based services is underway, and the economics are overwhelming.

The shift to cloud-based services is underway, particularly at smaller companies, and the economics are overwhelming, Ferling said.

Large companies are adjusting their business models, complimenting in-house services (storage, test evnironments) with web-based services. But smaller companies are able to make decisions faster and leap straight to the cloud, said Adam Hems, industry technology strategist in Microsoft's worldwide oil & gas, whereas larger companies are using aspects of the cloud to run their operations more efficiently. Renting compute power capacity is cheaper and more efficient than growing internal data centers, for instance.

Chevron's William Gilmore discussed development of the company's new PetroTechnical Portal, being rolled out to its business units. The focus was to improve engineering team productivity by integrating data, automating information collection, and archiving. Engineering staff typically spend one-third to two-thirds of their time working on data, Gilmore said. Streamlining

data access frees them to work on analytics and modeling with inherently higher value. The industry's quickly increasing staff of Gen-Y 'Millennials' represents a crew change that requires us to capture, store, and transfer knowledge more efficiently.

Shell's Adrian Estala, asset & information risk architect lead, discussed how the company has developed a flexible system to provide real-time, secure information access for partners, clients, and customers. He stressed the importance of a positive end-user experience and secure access through an authentication workflow and architecture design. Using Microsoft and Covisint solutions, Shell assigns specific roles to an individual and defines application access based on these roles. David Miller, Covisint's chief security officer, discussed cloud engagement and collaboration, stressing that "when different organizations use common systems, stronger security is imperative."

ExxonMobil's Bret McKee, information and knowledge management (IM/KM) lead, talked about information management and collaboration for capital projects, saying that it's important to share information in every direction, at all levels, throughout the upstream asset lifecycle. The company identified a business need to move toward a matrix organization plan, and is developing a new campus in The Woodlands, Texas. He recognized that the company doesn't "have a whole lot of collaboration with third parties," but is working toward internal collaboration. He outlined new IM strategies "to connect people to the information," which will be the foundation for the company's next KM initiative to develop best practices, expertise location, and social networks.

> Cloud computing, social networks, and other emerging technologies are changing the dialog.

Marathon's Thomas Sneed, vice president and chief information officer, delivered a closing keynote, reiterating that information technology is today's business enabler and accelerator. Next-gen staffers bring an expectation of cutting-edge technology to the workplace and embrace the new digital oilfield. They demand mobility and convenient access to functionality. Cloud computing, social networks, and other emerging technologies are changing the dialog between IT and technology teams.

All these show that industry will power progress through collaboration. OE

Ebb & Flow

Neil Gordon, Subsea UK

Subsea sets sights on skills

One of the fastest-growing sectors in recent years, the subsea industry is set to continue on its upward curve in 2013. Having demonstrated high growth through the recession, the subsea sector is enjoying a positive long-term outlook with the global market predicted to increase by 100% over the next five years to US$70 billion.

The subsea sector has successfully capitalized on a range of challenges by expanding into new frontiers with deeper and more complex wells, and continues to show significant future growth potential. It is also one of the fastest-growing sectors in the UK – capturing over a third of the global market. The challenge that the subsea sector in the UK faces is to not only retain that market share, but to steadily increase it.

While the north-east of Scotland will remain a recognized subsea center of excellence, with the highest concentration of subsea companies in the UK, other regions throughout the UK are increasing their subsea engineering and manufacturing capabilities. It is this nationally connected supply chain that is the key to the industry's success. The North Sea has become a recognized test bed and seat of learning for subsea technology and expertise and 2013 will see unprecedented levels of subsea activity in this mature province.

Although the industry must continue to exploit overseas markets, there is still considerable scope in the North Sea. Even as we now pass the half-way point of the UKCS' life expectancy, recent E&A and E&P activity underline that there is significant life left. The sector will undoubtedly face many more challenges over the coming years.

Focus has begun to shift to other areas of the industry; integrity management has seen strong growth, particularly as we look at extending the life of already matured assets. Order books for main contractors' vessel activity are healthy for the next two years and the export market continues to be very strong. Many companies are exporting in excess of 80% of their turnover and Subsea UK is working in partnership with UK Trade & Industry and Scottish Development International to help firms both export to and exploit established and emerging foreign markets.

> A recent survey of members revealed the industry could require a further 10,000 people.

Looking forward, it is expected that firms will move increasingly into deepwater territories, over 500m and, in many cases, up to 3000m. While there are considerable risks inherent in exploring and extracting at these depths, huge financial returns are possible, as this is where the large fields are situated.

With the continuing growth however, comes the challenge of attracting and retaining new talent. A recent survey of Subsea UK members revealed that the industry could require a further 10,000 people over the next year.

Realistically, it will take longer to build this increase into the sector.

Government is increasingly realizing the economic benefit the industry brings in terms of jobs and investment, such as the 'Skills Development Scotland' funding recently secured by Subsea UK. Members will be able to develop initiatives which will push for the recruitment and development of experienced personnel via transitional and conversion training programs.

This will ensure that the industry not only addresses the acute skills shortage in the short-term, but that we establish a sustainable pipeline of skilled workers guaranteeing the long-term health of the UK subsea industry. OE

Following 20 years' international management experience, **Neil Gordon** *was appointed chief executive of Subsea UK in 2011. Prior to this, he spent four years managing the National Hyperbaric Centre where he oversaw saturation diving operations and hyperbaric weld trials. Gordon trained as a commercial diver, working in Norway and the UK on construction projects, pipeline surveys, welding and inspection.*

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Global Briefs

A Chevron joins Kitimat LNG

US supermajor Chevron has purchased both EOG Resources and Encana's stake in the two-train Kitimat LNG facility and its associated Pacific Trail pipeline. Under a new agreement, Chevron and Apache will each hold 50% interest in the venture. Kitimat LNG will be built in Bish Cove, 400 miles north of Vancouver.

B Espirito Santo farm-in

Statoil picked up 25% interest in Petrobras' Espirito Santos license BM-ES-22A, paying mining firm Vale SA US$40 million in cash. The sale relieves Vale from $80 million in previous committed expenditures while Petrobras remains license operator with 75% equity interest. The BM-ES-22A license neighbors the Indra discovery in license BM-ES-32, of which Statoil holds 40% interest. Statoil plans to participate in an exploration well later this year.

C Yitzhak extension

Israel has extended for six months Adira Energy's drilling contract for the shallow water Yitzhak prospect. Adira CEO Jeffrey E Walter said the extension will allow the company time to obtain a drilling rig while it focuses on drilling activities on the nearby Gabriella license. Yitzhak is 17km off the Israeli coast.

D PXP off to Morocco

Houston-based Plains Exploration & Production (PXP) will pay US$15 million for 52% operating interest in Australia-based Pura Vida Energy's 2.7 million acre Mazagan permit off Morocco. Additionally, PXP will fund 100% of the costs of drilling and operating two exploration wells up to a maximum of $215 million. The first well, targeting the Toubkal prospect, is expected to be drilled next year. Estimates place Mazagan's prospective recoverable oil resources at 7 billion barrels.

E Chinese duo

CNOOC commenced production at two South China Sea oil fields, Panyu and Liuhua. CNOOC serves as operator for both fields, situated in water depths ranging from 100m to 268m in the Pearl River Mouth Basin. Liuhua 4-1 and Panyu 4-2/51 are expected to hit peak production this year and next, respectively. Lihua 4-1 is a subsea development consisting of one production manifold and eight production wells, produced through the FPS *Nanhai Tiao Zhan* and then pumped to the FPSO *Nanhai Sheng Li*. The Panyu field development 'adjustment project' is based on two fixed platforms 11 miles apart with an FPSO moored between them.

F Probing French Guiana

Shell spudded its French Guiana prospect, GM-ES-3, the second of a four-well program. The well will target the Priodontes prospect, providing critical geological data. Shell operates the field with 45%; its partners include Total (25%), Tullow (27.5%), Wessex Exploration (1.25%), and Northern Petroleum (1.25%).

G Wildcat roars

Panoro has struck oil at its wildcat well, Dussafu Torue Marin-1, off Gabon. The well, drilled by Saipem's semisubmersible *Scarabeo 3*, found 13m of pay in a 22m oil column in the Gamba formation and 38m of pay within stacked reservoirs of the Dentale formation. Dussafu Marin is operated by Harvest Dussafu, an affiliate of Harvest Natural Resources. Panoro Energy holds a 33.33% stake.

H Skarv start-up

BP is celebrating production from the Skarv field in the Norwegian Sea. CEO Bob Dudley called the start-up a "key operational milestone" for the supermajor. The Skarv development includes an FPSO (*pictured*), five subsea drilling templates, and a 26in diameter, 80km-long gas export line connecting to the Gassled transport system. BP expects Skarv to hit peak production of 165,000boe/d by year-end.

I Balai bonanza

BC Petroleum (a ROC, Dialog Group and Petronas venture) discovered 87m of hydrocarbon pay in multiple zones of the Balai-2 well off east Malaysia. Drilled to 2266m TD, Balai-2 targeted a shallow carbonate reservoir and a deeper series of stacked sandstone reservoirs. The sandstone contains an estimated 47m of net hydrocarbon pay with seven hydrocarbon-bearing reservoirs in a total interval thickness of 310m. The secondary limestone target contains 40m of gas pay with one hydrocarbon-bearing reservoir in a total interval thickness of 830m. Balai-2 has been cased and completed for extended well testing.

J Line 60 work

Pemex awarded Subsea 7 a US$140 million contract for its Line 60 project in the Bay of Campeche.

Subsea 7 will provide engineering, fabrication, and installation of a 16km-long pipeline, two slug catchers, and two cantilever structures. Offshore operations are underway.

Ogna wildcat spudded

Lundin Petroleum spud its Ogna exploration well, in PL453S, off Norway. Drilled by the *Maersk Guardian*, the wildcat will target hydrocarbons in the upper to middle Jurassic reservoirs of the Ogna prospect, located 65km northeast of BP's Ula field in the southern North Sea. Ogna is estimated to contain unrisked, gross, prospective resources of 156mmboe.

Contract Briefs

Dolphin Drilling and Petrobras have agreed to a one-year contract extension for the semisubmersible *Borgny Dolphin*. The contract, worth US$90 million, extends its deployment until September 2014.

GDF Suex E&P UK picked Technip to provide installation services at its Juliet field project in the UK North Sea. The contract covers the tie-back to the Pickerill A platform and includes the installation of a 12in diameter, 22km-long rigid flowline, one 22km-long static controls umbilical, one 12in diameter riser and one 16in J-tube assembly, as well as a 100-tonne manifold.

FMC Technologies has won a US$114 million subsea equipment order from LLOG Exploration. The supply contract calls for the delivery of nine subsea trees, four subsea manifolds, five multiphase meters and associated topside control systems, and subsea distribution systems to LLOG's Delta House project in the Mississippi Canyon area of the US Gulf.

Dana Petroleum has chosen Subsea 7 to provide subsea EPIC services for the company's Western Isles development project. The US$300 million contract calls for the engineering, procurement, construction and installation of two 2.5km-long pipeline bundles and one 11km-long gas export pipeline. Offshore work is slated to begin next year.

GDF Suez and APGDC have awarded WorleyParsons a pre-feed study for their Andhra Pradesh FLNG terminal off India. The study will assess floating terminal options including marine jetty configurations with FSRUs. The contract's scope includes the subsea pipeline and onshore receiving facility design.

McDermott International has received a US$230 million turnkey contract for Pemex's Litoral production platform. Scope includes FEED design, detailed engineering, procurement, fabrication, loadout, transport, installation, hook-up, commissioning and start-up of an eight-legged 1800-tonne jacket and 4500-tonne topsides together with 2000 tons of tripods, bridges and piles. Full project completion is slated for 2Q 2015.

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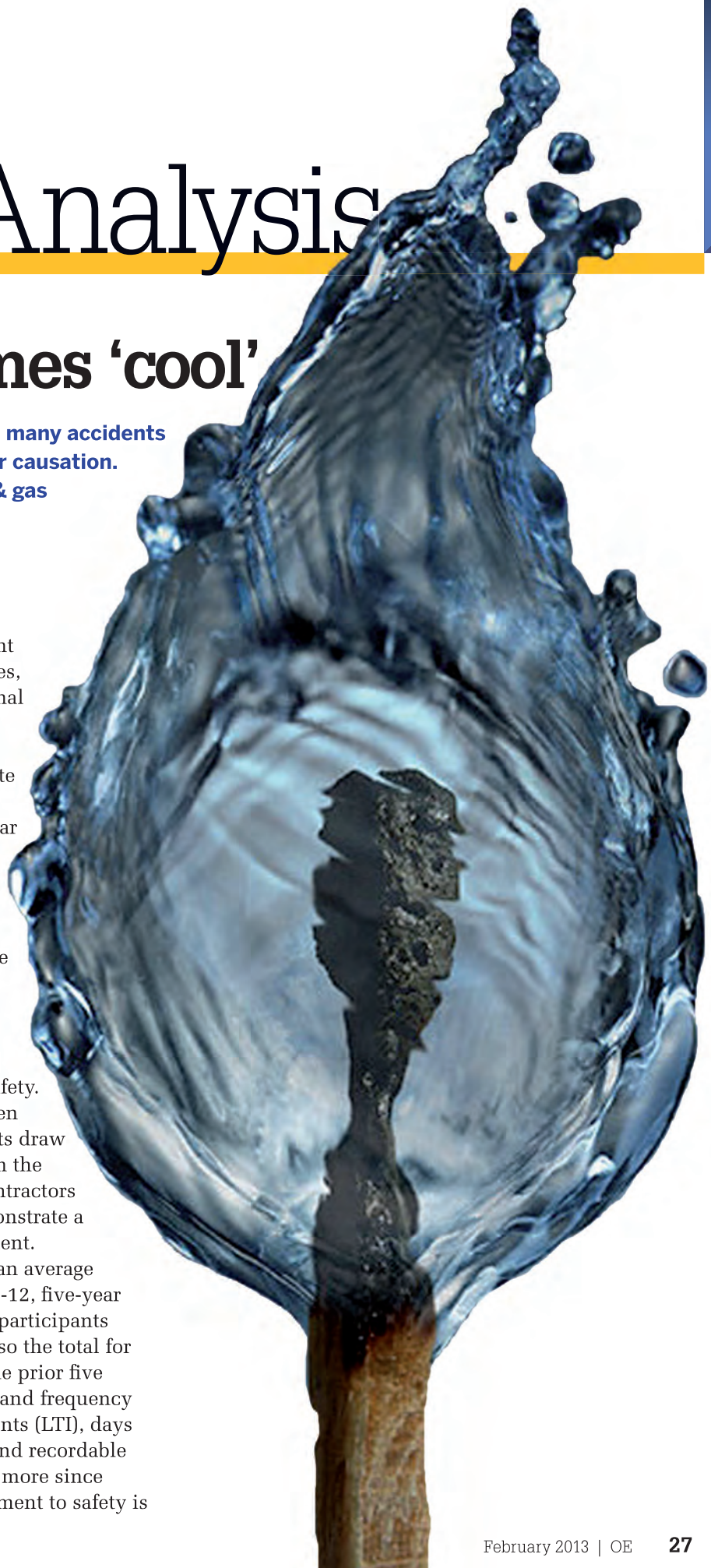


Safety becomes 'cool'

Offshore work can be dangerous and many accidents have a strong human element in their causation. Victor Schmidt explains why the oil & gas industry must constantly adapt and adjust its work practices and tools to improve worker safety.

Mass media headlines shine a bright light on industry accidents, equipment failures, and fatalities. Incidents draw international attention because of their severity, and because of the global profile of the companies that build, service and operate offshore facilities. Although major incidents are rare, they can be spectacular when they occur.

Safety onboard rigs is a rising issue for another reason – the 'great crew change' is bringing a new generation of workers into the business, who will have to learn and follow the best operating practices that their predecessors have developed through years of experience. New workers and new technologies will further refine and improve workplace safety.

The offshore oil & gas business has been getting safer, even as significant incidents draw media attention. Statistics available from the International Association of Drilling Contractors (IADC) Incident Statistics Program demonstrate a steadily improving workplace environment.

The program shows that staff worked an average 452.98 million hours/year over the 2008-12, five-year period. Through 3Q 2012, IADC survey participants reported 424,624,752.36 hours worked, so the total for 2012 will likely exceed the average of the prior five years. Both incident rate/200,000 hours and frequency rate/1,000,000 hours for lost time incidents (LTI), days away restricted or transferred (DART), and recordable events (RCRD) have dropped by 45% or more since 2008 (*see chart*). The industry's commitment to safety is

IADC Incident Statistics Program – five-year summary report.

	TYPE	2012‡	2011	2010	2009	2008	% drop - five years
Incident rate	LTI:	0.26	0.36	0.39	0.37	0.49	46.90
	DART:	0.54	0.69	0.76	0.71	0.98	44.90
	RCRD:	0.91	1.23	1.33	1.23	1.82	50.00
Frequency rate	LTI:	1.30	1.79	1.95	1.88	2.44	46.70
	DART:	2.69	3.45	3.80	3.57	4.91	45.10
	RCRD:	4.56	6.13	6.66	6.17	9.11	49.90
Manhours (millions)		424.62	504.34	459.39	422.07	454.47	
# participants		n/a	107	111	117	105	

Source: IADC http://www.iadc.org/wp-content/uploads/2011/04/2012-Q3-Five-Year-Summary-Report.pdf
‡ 2012 statistics are for through 3Q

Abbreviations:
DART = LTI (days) + Restricted or Transfer
INCD = Incident Rate (200,000 manhours)
LTI INCD = (LTIs + FTLs) * 200,000/total manhours
DART INCD = (RWTCs + LTIs + FTLs) * 200,000/total manhours
RCRD INCD = (MTOs + RWTCs + LTIs + FTLs) * 200,000/total manhours
LTI FREQ = (LTIs + FTLs) * 1,000,000/total manhours
DART FREQ = (RWTCs + LTIs + FTLs) * 1,000,000/total manhours

FTL Fatality
FREQ Frequency Rate (1,000,000 manhours)
LTI Lost Time Incident
MTO Medical Treatment Only
RCRD Recordable (total)
RWTC Restricted Work or Transfer Case

clear from these statistics, and is showing continued improvement.

Room to improve

Still, there is always more that can be done. Work practices continue to evolve with new tools and practices overcoming the shortcomings of established equipment and methods. The real key to improvement is how quickly work practice and equipment are replaced by evolving 'best practice' to supplant less-safe approaches with established work patterns.

The industry is notoriously slow to apply improved methods unless driven by outside events or regulation; witness the recent safety activity generated by the high-profile Macondo event. Established practices develop their own inertia, once operational procedures and proficiency are in place. It is easy for supervisors to manage, monitor and control the flow of work, even with permit delays and other regulation. But cultural inertia should not put lives at risk when improved tools and methods reduce risk with minimal cost.

Hot work

An example of glacial response is 'hot work', activities that require high heat, open flame, generate sparks, or produce hot metal surfaces that can ignite hydrocarbon vapors. Work practices have been developed to regulate and permit such work, contain the hot elements, minimize hydrocarbon vapors in the work area, and shield workers from serious harm. Yet, incidents continue to happen.

Joseph R Hurt, IADC VP onshore operations, provides recent statistics on hot work. "We do not have our data completed for 2012, but in 2011 we had 2934 recordable incidents. Of these there were 30 injuries to welders, and of them four were from heat sources. There were a total of 23 incidents where workers were burned from some source, but only the four welder burns were due to flame or heat from burning. Other incidents involved steam hoses, hot engines, or other equipment. Five of the incidents were to workers on offshore rigs. Three of the five were to welders working on South American offshore rigs," notes Hurt.

COURTESY GREENPEACE

The explosion and fire last November on a platform in the US Gulf of Mexico's West Delta block 32 (*pictured left*) emphasizes the point. Twenty-two construction workers were on the shut-in platform; nine were injured and three were killed in the incident. Early reports placed the cause as a worker cutting through a tank's pipeline with a gas torch. A review is underway to determine the specific cause, but the Bureau of Safety & Environment Enforcement (BSEE) requested that the operator, Black Elk Energy,


TFT-PNEUMATIC

Spark-less cutting tools are available to eliminate fires from hot work.

cease all 'hot work' on its facilities until safety improvements are made.

This event might have been avoided if a change in standard methods and tools was in place. What if hot work had been kept to a minimum by a simple change in the tools used? How much time, money and heartache could be saved by eliminating the need for hot work permits, risk evaluations, special habitats, and fireguards?

Step change?

A proven tool exists that eliminates the need for a hot work permit, yet has cutoff and grinding capability. It produces filings whose temperature 30-60°C (86-140°F) is well below the ignition point of any stray hydrocarbon gases on production platforms or drilling rigs.

Manufactured by TFT-Pneumatic Industrial Tools, the system (*pictured above*) changes the hot-work game by replacing the industry standard, high-speed grinder with a lower-speed tool that uses a proprietary, tungsten carbide-based cutting wheel to shear metal, rather than striking steel with a whirling stone wheel that throws high-temperature sparks.

The tool is already established and working daily in the North Sea. It comes with multiple attachments for different tasks, is driven by compressed air, and requires no specialized training other than to change out its working parts. The cultural change needed for implementation is minimal. There is one drawback, the initial cost is high; but the savings in time, money and life are irreplaceable.

Perhaps it is time for the industry to implement a new 'best practice' that changes the game for hot work. OE

Quick stats

OE's at-a-glance guide to offshore hydrocarbon reserves and key offshore infrastructure globally is updated monthly using data from leading energy analysts Infield Systems (www.infield.com).

New discoveries announced

Depth range	2010	2011	2012	2013
Shallow (<500m)	93	104	64	1
Deep (500-1500m)	29	24	19	0
Ultradeep (>1500m)	32	20	34	1
Total	154	148	117	2

Note: Operators do not announce discovery dates at the time of discovery, so totals for previous years continue to change.

Reserves in the Golden Triangle

by water depth 2013-17

Water depth	Field numbers	Liquid reserves (mmbbl)	Gas reserves (bcf)
Brazil			
Shallow	33	3909.25	2180.00
Deep	18	3810.00	2505.00
Ultradeep	41	14,491.20	21,220.00
United States			
Shallow	18	64.65	1153.50
Deep	29	2732.37	3050.78
Ultradeep	26	3596.75	4060.00
West Africa			
Shallow	169	3836.60	20,272.81
Deep	52	8290.00	12,640.00
Ultradeep	19	2885.00	3390.00
	405	**43,615.82**	**70,472.09**
(last month)	(407)	(43,734.82)	(82,087.09)

Greenfield reserves

2013-17

Water depth	Field numbers	Liquid reserves (mmbbl)	Gas reserves (bcf)
Shallow (last month)	1369 (1367)	81,089.90 (81,068.74)	840,408.05 (853,004.33)
Deep (last month)	187 (189)	18,796.24 (19,036.24)	111,621.48 (111,716.48)
Ultradeep (last month)	106 (107)	21,661.95 (21,676.95)	67,237.00 (70,487.00)
Total	**1662**	**121,548.09**	**1,019,266.53**

Pipelines

(operational and 2012 onwards)

	(km)	(last month)
<8in		
Operational/ installed	41,195	(40,910)
Planned/ possible	23,014	(22,616)
	64,209	(64,020)
8-16in		
Operational/ installed	87,446	(65,255)
Planned/ possible	47,828	(47,441)
	123,965	(123,707)
>16in		
Operational/ installed	87,446	(85,935)
Planned/ possible	47,828	(48,773)
	135,274	(135,118)

Production systems worldwide

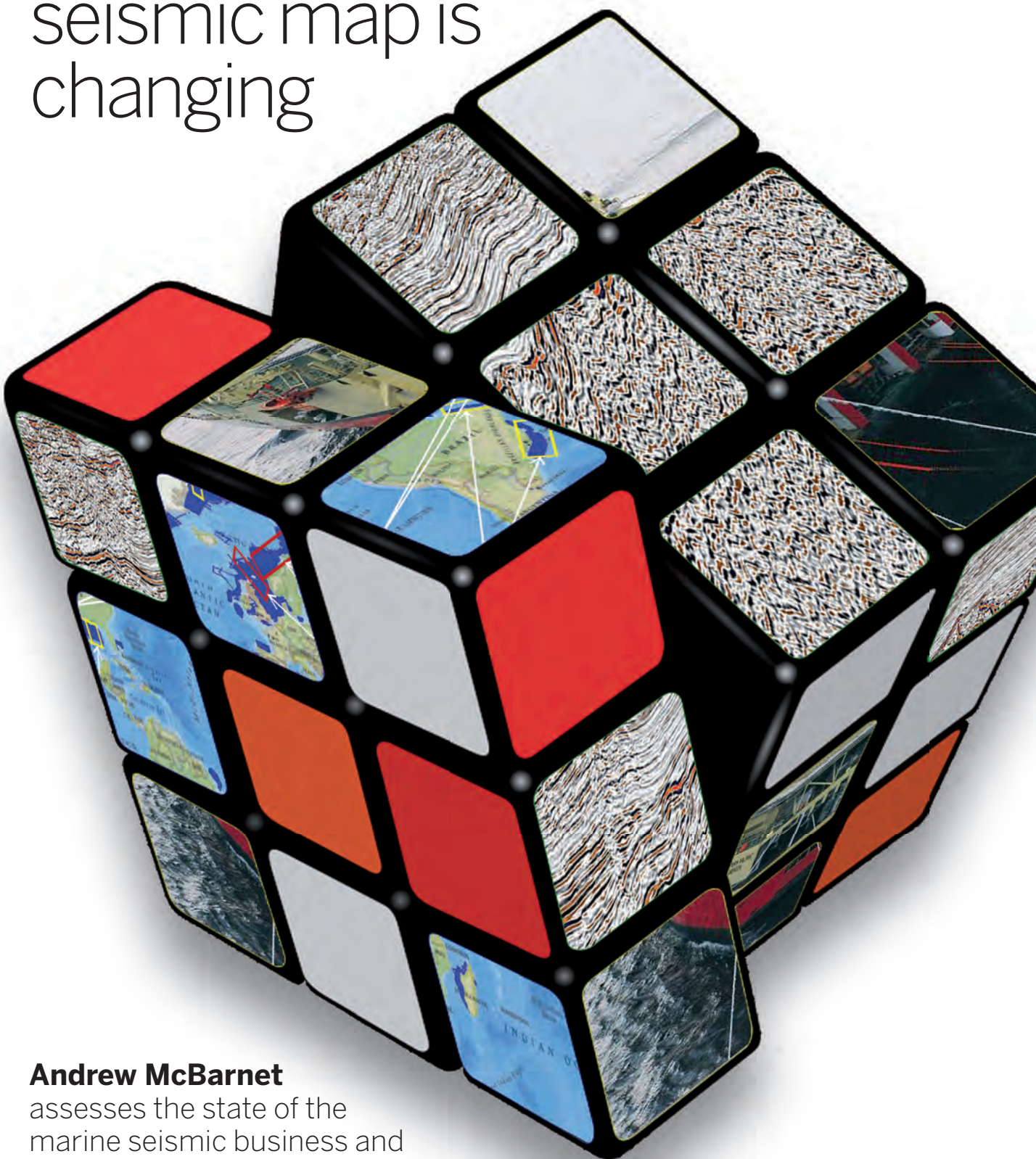
(operational and 2013 onwards)

Floaters		(last month)
Operational	267	(265)
Under development	45	(42)
Planned/possible	325	(316)
	637	(636)
Fixed platforms		
Operational	9806	(9763)
Under development	147	(153)
Planned/possible	1480	(1486)
	11,433	(11,418)
Subsea wells		
Operational	4329	(4301)
Under development	413	(407)
Planned/possible	5915	(5799)
	10,657	(10,660)

Global offshore reserves (mmboe) onstream by water depth

	2011	2012	2013	2014	2015	2016	2017
Shallow (last month)	10,310.41 (10,380.86)	9770.68 (10,415.50)	71,093.27 (70,813.34)	34,546.21 (34,943.15)	38,629.13 (40,923.08)	29,615.11 (30,028.02)	55,732.55 (55,109.50)
Deep (last month)	1316.73 (1316.73)	2618.75 (2618.75)	4039.46 (4039.46)	6362.53 (6518.12)	5793.08 (6124.80)	6448.96 (6627.05)	15,864.92 (15,456.26)
Ultradeep (last month)	119.94 (35.26)	1515.62 (1686.30)	2674.60 (2636.00)	2936.68 (2682.61)	3143.82 (3143.82)	7018.35 (11,515.05)	17,751.44 (14,135.35)
Total	11,827.09	13,905.05	77,488.80	43,845.43	47,566.03	43,082.41	89,348.92

How the seismic map is changing



Andrew McBarnet
assesses the state of the marine seismic business and where it is going in 2013.

Rarely, if ever, can the marine seismic business have been so busy in so many places around the world. Demand for surveys is nearly at an almost all-time high, being stimulated by increased spending by the big oil companies and the emergence of a number of new plays which have been overlooked in the past. Another highlight in this climate is the rise in the number of multi-client surveys targeting the hot plays.

The trends for 2013 are clear from a series of presentations in January by the main marine seismic players. The most optimistic assessment comes from Dolphin Geophysical citing SEB Enskilda Equity Research. It makes the assumption that the historically high correlation between seismic spending and E&P spending will continue. On this basis, seismic spending in 2012, which was up 19%, will grow by another 18% this year with nearly two-thirds accounted for by marine seismic (*see Table*). It also estimates an average price of US$115/bo in 2013 ($113/bo in 2012), which is said to provide a healthy margin over oil company estimated budgeting price of $83 per barrel.

The bigger picture put forward by Petroleum Geo-Services (PGS) is based on a range of sources (BP, IHS CERA, Wood Mackenzie, IEA and Pareto Securities) and suggests that increased non-OECD transport and industrial demand for oil between now and 2030 will be more than offset by efficiency gains and substitutions. It states that incremental world demand for oil is likely to exceed by 0.9%/year production from existing resources which are set to decline over time. Furthermore, new tight oil is not expected to contribute significantly to make up the shortfall. The unsurprising conclusion, that the decline in existing oil production is the biggest challenge in meeting future energy demand, has a silver lining for the marine seismic business: it can expect strong and sustained future demand.

The economic indices do not necessarily guarantee untroubled waters ahead for the seismic business. Starting point for any analysis must be consideration of the capacity of the marine seismic fleet to meet likely demand for seismic services.

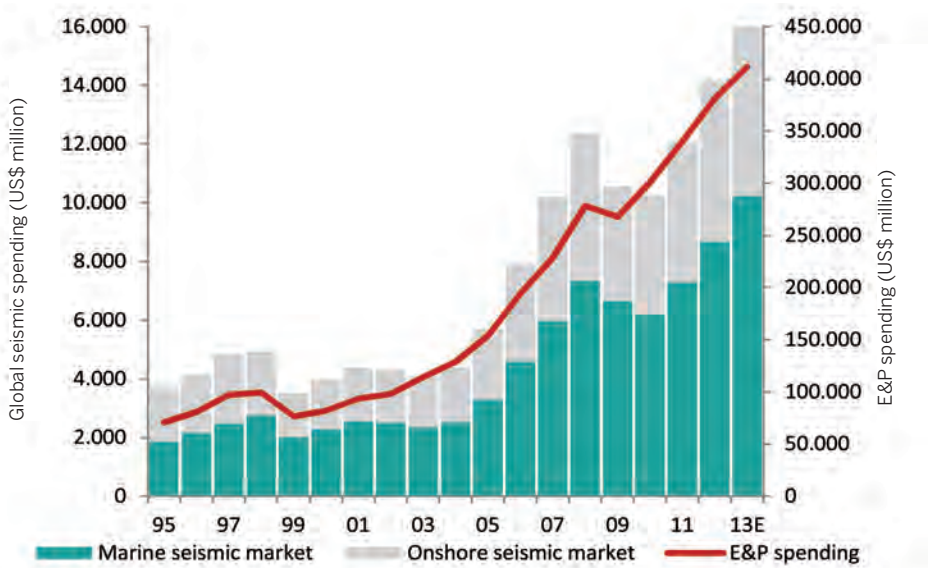
Economic balance

The perennial worry is that the balance between available vessels and the amount of work on offer will alter, as has happened so many times in the past. In this context, it is worth observing that according to PGS calculations, demand for 3D seismic from 2006 to the end of 2012 has grown by approximately 120% measured by square km. That is a hefty increase, but it has not translated into a bonanza for the major players. A two-year boom came to an abrupt halt at the end of 2008 as a result of a drop in oil company spending and the introduction of too many vessels into the market.

Vessels

Currently, vessel supply/demand balance seems likely to remain more stable than it has for a number of years. There are only seven new 3D vessels expected to enter the market over the next two years – two Titan class Ramforms for PGS (18-24 streamers), two Sanco newbuilds for Dolphin (12-16 streamers), two Amazon class for WesternGeco (14-18 streamers), and one for Sinopec (eight streamers). PGS shows this as an increase in the 3D streamer count of 5% in 2013, 2% in 2014, and 7% in 2015. Lead time for newbuilds is usually at least two years; so that, even if more vessels are announced, they will be unlikely to affect the overall balance for some time, especially if companies retire some of their inefficient, non-economic units – of which there are quite a few.

The two companies most likely to be looking to increase their capacity are Polarcus and Dolphin (*OE* last month) because neither are big enough on their own to cover business opportunities in every region of the world. Polarcus confirmed in January that a second vessel, *Polarcus Samur*, would be chartered out on long term contract, in this case to the Turkish oil company TPAO. The issue for seismic contractors is to make some real money from their fleet investment. Anecdotally, companies are still finding pricing for tenders very competitive. Dolphin is suggesting that the day rate for high-end 3D seismic vessels could rise from $220,000-280,000/day in 2012 to $280,000-330,000/day.



The seismic market is expected to grow by 18% over this year.

Source: Dolphin Group/SEB Enskilda Equity Research.

However, most companies are concerned about building backlog for their fleets, which often means adding work at a less than ideal price. No substantial increases are expected until vessel availability is more obviously limited than it is today.

In the short term the acquisition of Fugro's fleet of seven seismic vessels by CGGVeritas seems likely to depress prices. Before the end of last December, in a statement to reassure shareholders about the sale of its Geoscience division to the French company, Fugro management admitted that oil company client concern about the deal had affected the marketing of its seismic vessels. This means that CGGVeritas is inheriting a fleet that is seriously short of work. Altogether it will have 15 high-end 3D vessels and five mid-capacity 3D vessels plus two 2D vessels to manage, so expect them to be extremely competitive about winning orders. It could well be that the company – expected to rebrand itself back to its old Compagnie General de Geophysique (CGG) name – will opt to unload some capacity, and who knows, Dolphin could be a potential taker in its bid to grow.

In its outlook for 2013, Dolphin refers to the need for more consolidation, and summarizes by stating that it will continue an opportunistic approach to further develop "through a mix of consolidation and organic growth in all business segments". Reading between the lines this implies that not only would the company look at appropriate vessels to acquire, but might also contemplate a merger. It's hard to imagine WesternGeco, PGS or CGGVeritas wanting to take on Dolphin: they are engaged in their own fleet building/renewal programs linked to their proprietary technologies. This leaves Polarcus as the only other merger option. Many people were surprised by CGGVeritas making the move for Fugro, so the idea of Dolphin and Polarcus combining cannot be entirely ruled out even if the short histories, vessel inventory and management styles of the two organizations are very different.

Multi-client surveys

A conclusion that all the global players in the marine seismic market have come to is that the conditions favor increased emphasis on multi-client surveys.

This is partly economics.

Contractors have the cash and the confidence to take on the element of risk involved. If pre-funded, these surveys are potentially very profitable, especially with data library sales which can constitute a positive on the balance sheet by earning revenue for quite a few years. Dolphin is hoping for 50% pre-funding of 2D projects and 85% for 3D multi-client with a sales ratio of between 1.8 and 2.4 times the investment costs.

A combined portfolio of contract and multi-client surveys is regarded as the way to improve margins and fleet utilization. PGS, for example, says it is increasing its cash investment in multi-client from $280-300 million in 2012 (with 150% pre-funding) to an estimated $300-350 million this year (with 110% or more pre-funding). It says that approximately 40% of its 2013 active fleet capacity will be used for multi-client surveys. Industry-wide, at least 30% of all surveys are multi-client, although Polarcus puts the figure nearer 50% as a proportion of offshore seismic E&P spend. Last year, Polarcus had 9% of its fleet engaged on multi-client work but expects to increase this to 20% by 2015.

The consummate artist when it comes to multi-client surveying is TGS. It has no fleet of its own and essentially identifies survey targets, sells the project to oil company customers, and then contracts vessels and crew to carry out the surveys on short-term charters: as a result the company is invariably a client or partner of a seismic contractor. For 2013, TGS has already booked *Geco Eagle* (WesternGeco) for work to

POLARCUS

Turkish delight: *Polarcus Samur* joining Turkish company on long-term contract.

the end of April offshore Angola, *Geo Caribbean* (Fugro) for the Gulf of Mexico at least until the end of June, and *Akademik Shatskiy* for offshore Colombia in the early part of this year. For the upcoming North Sea season, TGS has contracted Dolphin's newbuild 16-streamer *Sanco Swift* for three months from July, as well as vessels from CGGVeritas and Fugro.

With this business model eliminating the cost of full-time operation of seismic vessels, TGS has proved extraordinarily successful. It has almost completely avoiding the roller coaster, cyclical revenues of marine seismic contractors. In the last 10 years, the company has grown its revenues sevenfold, from $124 million in 2001, to a record $931 million in 2012, a compound annual growth rate of 22%. The vast proportion of TGS' revenues come from marine seismic data sales, although the company has made efforts in recent years to diversify, notably with its digital well log business and lately, multi-client onshore seismic surveys following the acquisition of Canadian company Arcis Seismic Solutions.

TGS' full year revenues for 2012 were 53% up on 2011, suggesting the global spread of seismic exploration survey opportunities. Successful multi-client surveys are most often the outcome of accurately anticipating licensing rounds around the world. The majority of TGS surveys are 2D seismic over large offshore areas that enable oil company customers to evaluate the prospectivity of blocks when they come up for bid. The most profitable surveys are 3D multi-client: they are more expensive to put together but provide a much better return, which is why the major players are seeking out more of the business for themselves.

Aggressive marketing of multi-client studies can be expected to help drive the marine seismic business in 2013. At the same time, the map of prospective offshore seismic areas of the world has been subject to some unexpected additions in the last two or three years, even if the North Sea and Gulf of Mexico still generate the most seismic business.

Anticipated events

Starting in the South American region, who could have anticipated that PGS would be deploying the *Ramform Vanguard* to carry out a huge 15,550 sq km multi-client survey offshore Uruguay to cover blocks 6, 11, 12 and 15, which were awarded in the 2012 second licensing round? The company is said to be working closely with state agency ANCAP and block operators to improve the collective understanding of the regional geology. PGS also has the *Ramform Sterling* and *Ramform Challenger* working off the Falkland Islands for Noble Energy and Falkland Oil & Gas (FOGL).

The most anticipated event in the region is the long-delayed 11th Brazilian licensing round, focusing on the equatorial margin and mature basins, which is now expected to be held in May. There are 174 blocks on offer, of which 87 are expected to be offshore, much of the acreage classified as frontier.

This is due to be followed by the pre-salt round in November. Virtually all the seismic companies have Brazilian data in their libraries. After the January announcement of the eleventh round by Brazilian president Dilma Rousseff, the multi-client specialist Spectrum was quick to announce that it had recently acquired 38,588km of long-offset seismic data in areas pertaining to the round and also had other data being reprocessed.

Caribbean, Gulf of Mexico

Exploration interest extending into the Caribbean has been transformed since the deepwater discovery of oil by Tullow Oil in the Zaedyus-1 well off French Guiana. The company

Offshore seismic demand by region

Arctic Ocean
Growing, but unlikely to be substantial in the near to medium term.

North Atlantic
Strong growth in Barents Sea and high activity in the North Sea and Norwegian Sea.

North Pacific
Some activities expected in Sakhalin as well as growth offshore China.

Mediterranean
Region still affected by recent political changes but exhibiting high interest in the eastern Mediterranean.

Gulf of Mexico
Still to return to previous levels.

Caribbean & Central America
An increasingly significant province.

Indian Ocean
High activity on the East Africa Margin and a revival offshore India.

Southeast Asia
Australian waters to remain a key market. High potential offshore Indonesia and considerable demand offshore Malaysia.

South Atlantic
West Africa margin remains a key area, with Angola a hot spot. Brazil to remain slow. Sizeable surveys in 2013 off Uruguay, the Falkland Islands, Namibia and South Africa.

Source: PGS

2013 global E&P spending

Russia +7% on 2012
2013 budget US$50.3 billion

Europe +6% on 2012
2013 budget US$47.7 billion

US +0.7% on 2012
2013 budget US$139.7 billion

Middle East +11% on 2012
2013 budget US$29.8 billion

India/Southeast Asia +11% on 2012
2013 budget US$103.7 billion

Latin America +15% on 2012
2013 budget US$72.8 billion

Africa +5% on 2012
2013 budget US$24.7 billion

Source: Data from TGS and Barclays Research (*Barclays Capital Survey*)

believes that the find goes a long way to proving an analog with the Jubilee discovery made offshore Ghana in 2007. The Caribbean and Central America now look like significant provinces with growing demand for seismic in the offing offshore French Guiana, Suriname and Guyana.

The US Gulf of Mexico is normally a major workspace for the marine seismic business especially with the promise of the deepwater presalt not yet fully delineated. In reality, the region has still not recovered completely from the interruptions caused by the Macondo disaster, but the prospect for seismic business will increase with ongoing leasing. The Western Gulf of Mexico Lease Sale 229 in November 2012 offered over 20 million acres. Thirteen companies submitted 131 bids, with Chevron making the highest offer of more than $17 million for a single tract. The sale was the first under the US government's Outer Continental Shelf Oil & Gas Leasing Program for 2012-17 (five-year program) and followed two other recent Gulf of Mexico lease sales. Central Gulf of Mexico Lease Sale 227 is scheduled for March, making 38 million acres available off Louisiana, Mississippi and Alabama.

The most significant, current, multi-client seismic survey in the Gulf of Mexico is probably 'IBALT' being undertaken by CGGVeritas. This is its first StagSeis dual-vessel, long-offset, full-azimuth multi-client survey in the Keathley Canyon area of the Gulf covering 221 blocks. The level of industry support has not been disclosed.

High latitudes

The other significant seismic interest in the Americas is eastern Canada. In November 2012 the Canada-Nova Scotia Offshore Petroleum Board (C-NSOPB) made four licence awards each to Shell and BP with exploration commitments of $31.8 million and $1049.9 million, respectively. Last month, ExxonMobil probably added some value to the acreage by confirming the go-ahead to the Hebron field offshore Newfoundland & Labrador, which could contain in excess of 700mmbo. In 2011/12, PGS and TGS carried out a 22,000km, multi-client 2D seismic survey in the region.

This summer, a great deal of seismic business will once again be focused on the northwest European continental shelf. In January, the Norwegian minister of petroleum & energy, Ola Borten Moe, announced the award of 51 production licences to 40 companies in its Awards in Pre-defined Areas (2012) program, designed to maintain interest in more mature areas. Thirty-four of the blocks are in the North Sea, 14 in the Norwegian Sea and three in the Barents Sea. In eight of the areas there is a requirement to acquire new seismic data. Meantime, seismic companies on an exclusive or contract basis continue to collect data in anticipation of the 22nd licensing round awards expected this summer. There are a total of 86 blocks or partial blocks on offer, 14 in the Norwegian Sea and 72 in the Barents Sea, which can expect to see a lot of seismic action. In addition, the Norwegian Petroleum Directorate is expected to continue its own commissioning of seismic to explore the potential of the 'Grey Zone' in the Barents Sea and Arctic Ocean between Norway and Russia, following a maritime boundary agreement between the two countries.

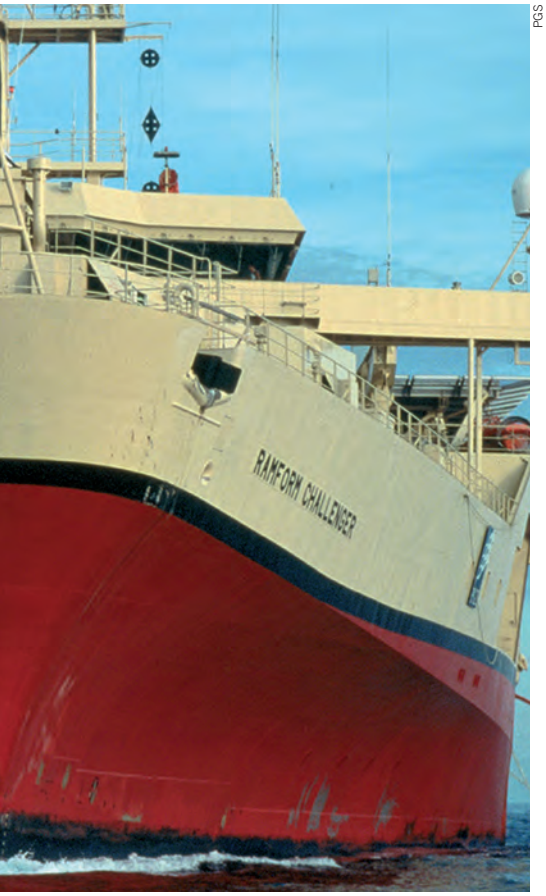
In the Arctic region, the Greenland government is in the process of awarding further licences off northeast Greenland, first to bidders from the Kanumas group of major oil companies, and then from all-comers. A total area of 49,948 sq km is being offered. It is not clear how much seismic interest will be generated by the round, given the conditions and lack of definitive oil and gas indications to date.

Ramform Challenger: booked for Falkland Islands work.

There is also the growing assumption that possible hydrocarbon finds are likely to be gas, for which the market may be restricted from such a remote and climatically unfriendly region. Meantime, Iceland has just awarded licences to Valiant Petroleum and Faroe Petroleum, in which the Norwegian state-owned Petoro AS will have 25% stakes. Again, resulting seismic operations may be rather limited.

Investor confidence

By contrast, the UK government is hoping that its extensive 27th licensing round, announced last October, offering a total of 167 blocks, will galvanize oil and gas companies into greater exploration activity. Seismic companies expect to be in the North Sea in force. According to Wood Mackenzie analysts, investor confidence in the UK sector has been restored by a measure of fiscal agreement between government and industry, as well as the high price of oil. The



PGS

company's report, published in January, warns that exploration and production performance in 2012 was poor and may serve to dampen enthusiasm, but this is not reflected in the plans already announced by seismic companies.

Mediterranean, Africa

One of the biggest surprises on the world E&P seismic activity map is the growth of interest in the eastern Mediterranean.

This was first sparked by the Leviathan gas discovery offshore Israel by Noble Energy, which Woodside Petroleum has now bought into with a 30% interest. Leviathan and associated finds represent examples in recent years where smaller independent companies have led the way in opening up new plays. This year will see the first offshore licensing round by Lebanon and the results of the second Cyprus licensing round, where Spectrum and PGS have been notably active in acquiring seismic data to meet international interest in the highly prospective deepwater Levantine basin.

Egypt offered some previously relinquished, gas-prone acreage last year, although only four blocks were taken up. Political upheaval may have had something to do with the result. Currently Ganoup El Wadi Petroleum has 20 blocks put out to international licensing some of which are in the Red Sea and the Gulf of Suez.

African hotspots

Both sides of the African continent are now exploration hotspots. The big surprise here is the emergence of gas prospects offshore Mozambique and Tanzania with finds by Anadarko, Eni, Statoil and Ophir Energy/BG among others which complement the onshore boom initiated by the original finds in Uganda and Tanzania by Tullow and Heritage Oil.

Off the west coast, Namibia may be emerging as a country of interest, certainly as far as PGS is concerned. Last November, the company signed a 10-year multi-client survey deal with NAMCOR, the national oil company, for the acquisition of both 2D and 3D multi-client seismic. Operations are to begin with a large 2D regional survey over open deepwater blocks, which will form the basis of a future licensing round.

Like most seismic companies PGS has also been active offshore Angola which remains the single most prospective area of West Africa. So has TGS, which has just begun an extension to its 12,500 sq km 3D multi-client survey off Angola which will cover 4064km over blocks 36 and 37. According to TGS, pre-salt basins along Angola's conjugate margin pre-salt basins are similar to the hydrocarbon-rich basins offshore Brazil. The same thinking has fuelled exploration interest offshore countries such as Ghana, where last month Eni added to the country's inventory of significant hydrocarbon finds with the drilling of its first appraisal well

WESTERN GECO

Seismic service off Malaysia: *Western Patriot*.

in the Sankofa East 2A block.

This year may see licensing of ultra-deepwater blocks off Liberia and next year another Sierra Leone round following its 2011/12 initiative. In January, TGS said it would be starting its 3D multi-client Sunfish survey covering 7800 sq km in the prospective Harper Basin, offshore Liberia. The survey involves the six-month charter of the 12-streamer *Polarcus Asima*.

Meantime prospects offshore South Africa have attracted the attention of ExxonMobil. The company has agreed with Impact Oil & Gas to acquire a 75% interest in Tugela South Exploration Right which covers 2.8 million acres offshore Durban with water depths extending from the coastline to some 6500ft, which may explain why it has not been an exploration target in the past. Future exploration rights cover a further 16 million acres in water depths ranging to 9800ft. In addition ExxonMobil says it has executed a technical cooperation permit with the South African government to study the exploration potential of the deepwater Durban Basin covering some 12.4 million acres.

Last November, Dolphin won a second offshore South Africa contract. It involved acquisition of around 6250km of 2D seismic for Anadarko in partnership with PetroSA using its vessel *Artemis Atlantic*.

There are some indications that the once highly active offshore India market may be reviving but a surer bet seems to be the continued healthy seismic survey activity in the waters of Southeast Asia and Australia/New Zealand. Indonesia, for example, has just launched its second bidding round with a number of offshore prospects in the mix. One seismic company with work in the region is WesternGeco. The company has been awarded by a BP subsidiary what is described as one of the largest marine seismic surveys ever offshore Indonesia covering over 9000km^2 in the new concession blocks West Aru I and II.

The Indonesian survey was mentioned during the announcement of parent company Schlumberger's latest financial results. Another survey highlighted was offshore Malaysia where WesternGeco completed for Petronas a first commercial survey using its Obliq sliding-notch broadband acquisition and imaging technique combined with Coil Shooting single-vessel, full-azimuth acquisition. The Coil Shooting method was intended to resolve illumination challenges while the Obliq technology is said to have provided greater penetration in deeper targets. The company is also carrying out a 4D seismic survey for Sarawak Shell offshore Malaysia using its *Western Patriot* vessel.

WesternGeco is believed to be focusing more attention on the Asia-Pacific market which is providing a steady source of work from a number of areas. Last December, New Zealand Petroleum & Minerals awarded 10 petroleum exploration permits which it said would represent $82 million in committed exploration spending and up to $776 million should the permits all reach their full five-year term. The blocks awarded were in the Pegasus, Great South and Taranaki Basins, and a further concession round is planned for this year as part of an annual process.

According to Deloitte Petroleum Services, the proposed May 2013 Australian Offshore Petroleum Acreage – which has still to be formally launched – includes a total of 31 blocks mainly offshore Western Australia spanning the Bonaparte, Otway, Gippsland, Browse, North Carnarvon and Perth Basins. The new acreage will help to sustain the level of seismic in the region.

Even from this broad brush picture of current marine seismic activity worldwide, it is clear that there should be plenty of opportunities for the marine seismic fleet worldwide. The scale of possible survey work can sometimes be concealed because seismic companies are quiet with regard to upcoming contracts and especially multi-client surveys.

What we can deduce is that the preconditions for steady or better marine seismic business are about as favorable as can reasonably be expected. That can't be a bad thought for the rest of the year. OE

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Bob Heath
International Technical Marketing Manager
iSeis and Seismic Source Co.

Chris Friedemann
Chief Marketing Officer
NEOS Solutions

Dave Ridyard
Executive Vice President Strategic Business Development
EMGS

David Jackson
Chief Geologist
ARKeX

Duane Dopkin
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Fredd Causevic
Vice President of Business Development
RXT

Habib Al-Khatib
Permanent Reservoir Monitoring Business Development Manager
CGGVeritas

Jim Andersen
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Joe Gagliardi
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Technical Sessions Include:

[DAY 1] Tuesday March 5, 2013

6:00 – 8:00 PM **Welcome Cocktail Reception**

[DAY 2] Wednesday March 6, 2013

8:15 – 8:30 **Opening Remarks**
*Co-Chairman **Robert Hobbs**, CEO, TGS*

8:30 – 9:00 **Keynote**
Seismic After 100 Years: What is Left To Do?
***Craig Beasley**, Chief Geophysicist and SLB Fellow, WesternGeco/ Schlumberger*

9:00 – 9:30 **Oil Company Panel**

9:30 – 11:00 **Marine Seismic**
Marine Seismic Overview
***Mike Edwards**, Regional President Marine, PGS*

Multi Client Business Model
***Rod Starr**, Sr. VP Western Hemisphere, TGS*

Under-Ice Exploration: Breaking Arctic Barriers
***Joe Gagliardi**, VP Marine, GeoVentures, ION Geophysical*

11:00 – 11:30 **Coffee & Networking Break**

11:30 – 12:30 **Offshore Technology**
Where Does 3D EM Create the Maximum Value in the E&P Workflow?
***Dave Ridyard**, Executive VP, Strategic Business Development, EMGS*

Environmental Issues
***Phil Fontana**, Chief Geophysicist, Polarcus*

12:30 – 1:30 **Awards Luncheon**
Geoscience Innovation Award
Geoscience Business Award

1:30 – 2:30 **Seabed Seismic**
Cable Solutions for Ocean Bottom Seismic
***Fredd Causevic**, VP of Business Development, RXT*

Developing Strategies for Node-Based Marine Seismic Acquisition
***Steve Mcintosh**, Director of Sales & Marketing, Fairfield Nodal*

2:30 – 3:30 **Permanent Reservoir Monitoring**
Seismic Permanent Reservoir Monitoring – Challenges, Solutions and Opportunities
***Habib Al-Khatib**, PRM Business Development Manager, CGGVeritas*

The Future of Oilfield Monitoring: How Network Infrastructure Can Combine Multidisciplinary Sensors
***Bjart Fageras**, CEO, OCTIO Group*

3:30 – 4:00 **Coffee & Networking Break**

4:00 – 5:30 **Reservoir Characterization**
The Importance of Rock Physics in Quantitative Interpretation of Geophysical Data
***Lucy MacGregor**, Chief Technology Officer, RSI*

Building the Earth Model
***Duane Dopkin**, Executive VP, Paradigm*

Well Data (TBA)

[DAY 3] Thursday March 7, 2013

8:15 – 8:30 **Opening Remarks**
*Co-Chairman **Bob Peebler**, President and CEO, The Peebler Group/Former Executive Chairman, ION Geophysical*

8:30 – 9:00 **CGGVeritas Keynote**
Perspectives on the Future of Integrated Geosciences
***Kamal al-Yahya**, Sr. VP, Geomarkets and Global Marketing, CGGVeritas*

9:00 – 10:30 **Land Seismic**
Advances in Land Seismic Acquisition: Better Data with Lower Risk
***Malcolm Lansley**, VP of Geophysics, Sercel*

Cableless Land Sciemic: Lessons for the Future from its First Decade
***Bob Heath**, International Technical Marketing Manager, i-Seis and* **Seismic Source Co.**

Enhancing Profitability with All-Optical Seismic Sensors
***Jim Anderson**, President, US Seismic*

10:30 – 11:00 **Coffee & Networking Break**

11:00 – 12:00 **Unconventionals**
Microseismic Monitoring: Where is the Value?
***Peter M. Duncan**, President & CEO, MicroSeismic, Inc.*

Unconventionals (TBA)

Unconventionals/Carbon Capture (TBA)

12:00 – 1:00 **Lunch**

1:00 – 2:00 **Potential Fields**
The Increasing use of Gravity Gradiometry in the Exploration Workflow - Examples from the Arctic, Africa and the Middle East
***David Jackson**, Chief Geologist, ARKeX*

Multi-Measurement Interpretation: An Overview of the Methodology and its Applications for Exploring and Developing Both Conventional and Unconventional Plays
***Chris Friedemann**, Chief Marketing Officer, NEOS Solutions*

2:00 – 2:15 **Coffee & Networking Break**

2:15 – 3:15 **Integration**
Advances in Integration
***Martyn Millwood Hargrave**, CEO, Ikon Sciences*

Data Integration: Giving Seismic a Helping Hand
***Richard Cooper**, Chairman & CEO, RSI*

3:15 – 3:45 **Operator Panel**

3:45 – 4:00 **Brief Wrap Up**

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OUR CROWNING GLORY?

Offshore energy means more than just oil and gas. But is it an energy nirvana or a cult of false hope? **Bruce Nichols** looks at the progress that the marine renewables industry has made, and the hurdles it has to overcome.

The latest trend in renewable energy has come to Cobscook Bay in Maine, on the US/Canada border. On the bay bottom, a turbine driven by tidal ebb and flow is generating electricity for customers onshore. The facility built, installed and run by Ocean Renewable Power (ORPC), is the first in-stream, tidal generator in North America to go commercial.

"We'll take bragging rights for the Western Hemisphere," says John Ferland, vice president of project development for ORPC, which has had its 150kW TidGen system selling power into the grid since last September and plans expansion to as much as 5MW capacity by 2017. Project cost is $20 million, including $10 million provided by the US Department of Energy (DOE).

The innovative ORPC turbine is just one example of a surge in ocean energy research and development that took off in Europe a decade ago and is spreading globally. New devices are capturing wave as well as tidal energy, and, more exotically, engineers are studying extraction of power from variations in ocean temperature and salinity.

Not that mankind is on the verge of energy nirvana, cautions Neil Kermode, director of the European Marine Energy Center in Scotland. His test facility is part of the UK's world-leading ocean energy program, but he is careful not to exaggerate growth. "Explosion is probably an overstatement," he says. "It's a bit of a mushrooming; in the dark, quite gentle, and often unexpected."

Ocean energy

Actual marine hydrokinetic power production – that's the term experts use to distinguish it from wind and more familiar, river-based, hydroelectric power – remains small relative to demand. Marine hydrokinetic power contributed about 0.1% of total world demand in 2010, representing less than 1% of all renewable output, according to the International Energy Agency.

Government support is still crucial because costs are high. ORPC, for example, gets a state-mandated US$0.215/kilowatt-hour (kWh) in Maine, compared with a state retail average of less than $0.15/kWh. Non-energy priorities like the environment, fishing and shipping must be accommodated. Steps forward currently seem to outnumber steps backward, but prototypes still fail, private investment is hesitant, and the world fiscal crisis threatens government funding.

Even boosters of ocean energy say it will take decades to unfold – the IEA sees it becoming significant in 2030 – and it won't work everywhere. The best tidal energy sites are at high latitudes, like Maine and Scotland, where tidal range can equal or exceed 20ft, compared with a foot or less at the equator. The best wave energy sites are in places with long, west-facing coasts beside broad oceans. Local power prices need to be high, as in Hawaii, where rates can reach $0.30/kWh. The continental US average is $0.12/kWh.

Still, the potential is enormous. A recent DOE study says waves and tides theoretically could provide 1420 terrawatt-hours (TWh) of electricity, a third of the 4000TWh consumed annually in the US. The

OCEAN RENEWABLE POWER

Ocean Renewable Power's tidal turbine about to be lowered into the water in Cobscook Bay near the US/Canada border in Maine. The turbine rated at 150kW has been selling power to customers onshore since last September. It is the first commercial in-stream tidal power generator in North America. Two more turbines are set to be installed this year in a project costing $20 million, half of which came from the US Department of Energy.

practically recoverable is smaller, less than 15% of consumption by 2030, when it would still be a junior partner to onshore hydropower, DOE says.

Parallel development

Since 2000, ocean energy technology has built rapidly on progress in other fields, including offshore oil and gas: the development of heavy lift vessels that can launch huge turbines; better corrosion control and coatings to keep marine life from fouling equipment; stronger, lighter construction materials from the aerospace sector; electronics and software from Silicon Valley.

"It's only recently that technology gained from offshore industries like oil and gas have evolved to the point that it's actually reasonable to think about putting these converters out in the marine environment to harness this power and realize theoretical designs," says Brian Polagye of the University of Washington, co-director of the Northwest National Marine Renewable Energy Center.

Advances in computing power and software are key to the first grid-connected wave power buoy on the US West Coast, set for launch this spring. The 'secret sauce' in Ocean Power Technologies' PB150 is its electronic brain, says Phil Hart, OPT's senior vice president. It tunes the buoy to the surrounding wave regime, maximizing power output in normal seas and survivability in rough ones.

"You're connecting a very variable input to a generator and trying to, on average, optimize generator speed and force to maximize its power output," Hart says. "The absolute key to wave energy technology, therefore, is software control theory."

Other US ocean renewable energy leaders include Verdant Power of New York, which hopes to begin installing a 30-turbine tidal system in the East River off Manhattan starting in 2014, using its fifth-generation design. In the Pacific Northwest, Snohomish Public Utility District – a big utility despite its unassuming name – has a tidal turbine plan for waters near Seattle. Columbia Power Technologies is working on a wave-power machine for the Oregon coast.

OCEAN POWER TECHNOLOBIES

Ocean Power Technologies plans to install its PB150 PowerBuoy in the Pacific Ocean offshore of Oregon this spring. The device (*seen above during a test in Scotland*) is rated at 150kW and will be the first wave-riding power-generating buoy connected to the US electric grid with plans to sell the power to onshore utilities. The device stands 9m tall out of the water, but its lower section extends 26m underwater, for a total height of 3m.

It's not all about onshore consumption. OPT is offering its autonomous wave power buoy, developed for the military, to civilian offshore interests. Scientific institutions and the oil & gas industry could load it with sensors to study marine life or guard against offshore oil well leaks. It could have helped monitor the spill from BP's Macondo well in the Gulf of Mexico in 2010, Hart says.

"The military wants to put sensors and listening devices into the ocean to detect submarines, ships, swimmers. Oil and gas applications are very similar. You can feed the umbilical and mooring down to the seabed, leave it for up to three years and use it for anything. Think of how many things you want to sense in the ocean."

The idea is not entirely new to the offshore oil & gas sector. Anadarko Petroleum has been studying the generation of power from ocean currents for several years and successfully tested a one-fifth scale device in 2011, though it has not put it to commercial use.

Overall, last year was a "banner year" for ocean energy, says Mike Reed, who runs the US Department of Energy's water power program. Since 2009, some 26 projects have received more than $100 million in funding, which must be matched with funding from other sources. Among them is a planned US test center modeled on Scotland's EMEC. The US Federal Energy Regulatory Commission (FERC) and the Bureau of Ocean Energy Management have streamlined their rules to accommodate ocean energy.

The surge in activity is due in large part to the US enacting the Energy Policy Act of 2005. Prior to that, marine hydrokinetic energy was not even listed among renewable projects eligible for federal money. The change has stirred private interest.

"When FERC opened the permitting process, it was kind of like the gold rush," Reed says, though he notes preliminary permits far outnumber actual projects. "Companies were staking out territories for future developments. To me that was a very positive indication."

The move by ORPC, OPT and others toward commercialization is a big step forward, says Chris Campbell, executive director of Marine Renewables Canada, an advocacy group that includes private, public and non-governmental organizations.

"This momentum is beginning to focus on trying to demonstrate

Offshore wind

Ocean energy is not just in the water. There's offshore wind, which tends to be steadier than onshore wind. But turbines are harder to build and maintain in a marine environment than they are on land. The Bureau of Ocean Energy Management (BOEM) estimates theoretical US offshore wind potential is four times current US power output, although practical recoverable power will be smaller.

Entrepreneurs have taken notice. One company, Boston-based Energy Management, plans to start building what likely will be the first US offshore wind farm later this year. The company envisions a 130-turbine, 468MW capacity, 65km^2 facility in Nantucket Sound and already has pre-sold three-fourths of the power.

Other companies are waiting in line, and the US Department of Energy is trying to help with challenges that include stiffer permitting requirements and higher capital and operating costs than onshore wind operations.

DOE recently awarded grants to seven projects on the Atlantic, Gulf and Pacific coasts. Among them is Seattle-based Principle Power's plan to build a truly oceanic wind machine, a floater that does not have to anchor on the bottom in coastal waters like virtually all its predecessors (*pictured above right is a prototype which has been operating offshore Portugal since October 2011*).

As with wave and tidal energy, the UK is the world leader. The world's largest offshore wind farm, the London Array, is in the outer Thames Estuary. It was declared finished in December 2012 upon installation of the 175th turbine (*pictured below*). The London Array started generating power last October and is due to be running at maximum capacity of 630MW – enough for 470,000 homes – this spring.

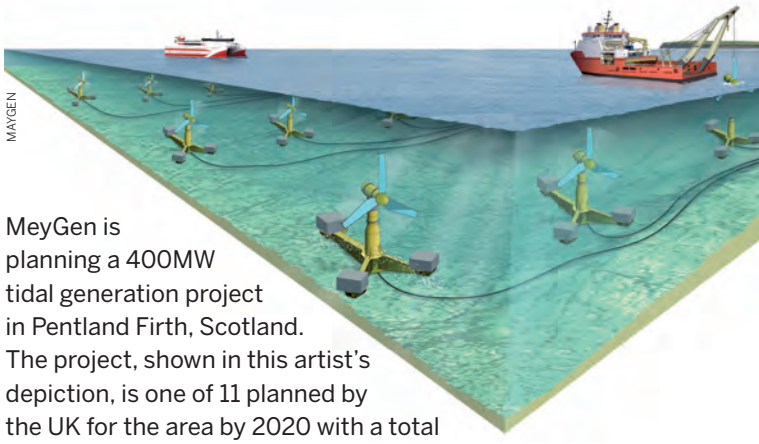
The London Array was built by UK-based E.On, Abu Dhabi's Masdar and DONG Energy, based in Denmark, the nation that pioneered offshore wind in 1991.

An even larger UK offshore wind project, Dogger Bank, is being developed in the North Sea, off the coast of Yorkshire. The ultimate goal is huge, 9.6GW, equal to nearly 10% of

UK power demand, by 2020. Cost estimates have not been disclosed.

Dogger Bank is being developed by Forewind, a consortium of UK-based SSE, Norway-based Statkraft and Statoil, and RWE npower renewables – the UK subsidiary of the German renewable energy company RWE Innogy.

"There's a lot of public support for renewable energy in the UK and for offshore wind in particular," says Lee Clarke, Forewind director and general manager. "The UK government has really got behind finding ways to exploit this fast renewable energy source off our coasts."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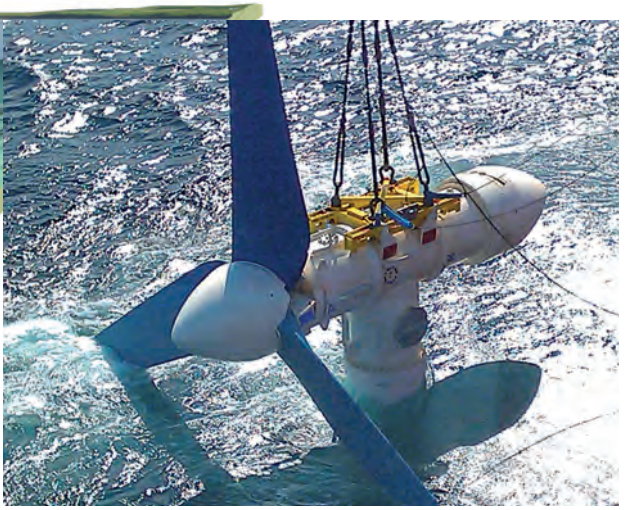


MeyGen is planning a 400MW tidal generation project in Pentland Firth, Scotland. The project, shown in this artist's depiction, is one of 11 planned by the UK for the area by 2020 with a total capacity of 1600MW (*a test turbine is pictured right*). The UK has embarked on an aggressive path to develop ocean energy and is currently the world leader in the field.

a power plant as opposed to a technology, and to my mind that is the big transition that has been happening in the last 12 to 18 months," Campbell says.

UK initiatives

US efforts remain a far cry from work in the UK, where coordination between government, industry and academia has become a motive force much stronger than often fractured US funding, permitting and development processes for ocean energy, says Polagye.

In its latest major move, the UK created two huge marine energy parks last year, one off Cornwall in the southwest and another off the north of Scotland, setting aside offshore waters for renewable energy development.

Not far from Kermode's office at EMEC, the world's largest tidal energy project is planned in Pentland Firth, one of the best sites anywhere for underwater turbines because of its dramatic tides. The UK hopes to have 1600MW of tide and wave-generated electricity operating in the Firth and around the Orkney Islands within a decade, at a cost of more than £6 billion.

'Our goal is still 2014 for installing a demonstrator array. We are hopeful of being able to build out the rest of the project before 2020,' says CEO Dan Pearson of MeyGen, which plans a 400MW installation, the largest of 11 projects given government leases in the Pentland Firth area.

Major multinational equipment manufacturers are diving in, buying or investing in startup companies in wave, tidal and other forms of ocean energy, and that's a big change, Kermode says, touting EMEC's 14 test berths and additional offshore sites where many devices can be demonstrated at the same time.

"We have been able to act as something of a shop window, which I'm sure has helped generate confidence," he says.

Within the past 18 months, Germany's Siemens has bought Marine Current Turbines. France's Alstom has taken control of Tidal Generation. French oil major Total, Swiss engineering giant ABB, US aerospace giant Lockheed Martin and Japanese industrial giants Kawasaki and Mitsui also have ventured into the sector.

Other nations are following the UK lead in ocean energy. Japan has stepped up activity in the field since its Fukushima nuclear disaster forced reevaluation of its energy supply. Australia, New Zealand, South Korea, and China, seeking alternatives to fossil fuels, are heavily engaged. In South America, energy-short Chile, with its 4300km (2700 mile), west-facing Pacific Coast, is beginning to look at opportunities.

The effort could still falter in the US, which differs in key ways. The UK is an island nation, has a stronger sense of vulnerability to high energy costs as well as wider public acceptance of climate change than the US, says Oregon State University's Belinda Batten, co-director of NNMREC with Polagye.

Generally low US electricity prices, thanks to relatively inexpensive hydropower and the boom in natural gas, is a market challenge for ocean energy, adds Damian Kunko, a Washington lobbyist for the Ocean Renewable Energy Coalition. "It's an issue of cost," he says.

Even US president Barack Obama, who has repeatedly called for renewable energy development, recommended cutting funding for water power programs by two-thirds in his 2013 budget, seeing wind power as a surer bet in a fiscally constrained world.

Optimisim

But given a growing desire for alternatives to fossil fuels and that half the US population lives near the coasts, within relatively easy reach of ocean energy, there is reason to be optimistic, according to Trey Taylor, co-founder of Verdant Power.

"It's slow going because of the economy, because of vested interests, but we're getting traction, we're making progress," Taylor says. "It is slower than we wish it would be, but it's inevitable." OE

Technology

Rube Goldberg had nothing on these guys. The American engineer, inventor and cartoonist most famous for drawing outlandish machines would have smiled at all the ideas for capturing ocean wave and tidal energy.

According to the European Marine Energy Center, there are at least eight design types for waves, and six for tides. The US Bureau of Ocean Energy Management (BOEM) counts four for waves, one for tides. All of them have been tried somewhere, by somebody.

The goal for each design is to apply Faraday's Law by moving magnets through a coil of wire to generate electricity. Power takeoffs – they can be direct, geared, or hydraulic – use wave or tidal energy to create this movement. Water is 832 times denser than air, so slower currents generate as much power as high wind speeds.

"The equipment just has to be robust," says Paul Jacobson of Electric Power Research Institute. "Water is powerful. The forces, turbulence create challenges. The ocean is corrosive. The cost of getting out there and maintaining and repairing is greater when you're working in water."

EMEC's Neil Kermode, adds: "With wave, the big challenge is making sure you can be there after the big storm. Station-keeping, making that right, is something we've yet to deal with.

"On the tidal side, it's mainly about getting the machine in the water at the start, fixing things down in tides that are pretty unrelenting."

He quoted a Marine Current Turbines engineer who said that installing its tidal turbine in Northern Ireland was "pretty much equivalent to putting a wind turbine up and it withstanding Hurricane Katrina".

Wave designs

1. Attenuator: a hinged pair of floats that ride the waves, capturing energy from the relative motion of the two floats as a wave passes. (Pelamis Wave Power)

2. Point Absorber: a floating structure with a less-buoyant base, converts the motion of the buoyant top, relative to the heavier base, into energy. (Wave Energy Technologies-New Zealand, Resolute Marine Energy, AWS Ocean Energy, Columbia Power Technologies, Ocean Power Technologies, WaveBob)

3. Rotating mass: a floating structure with a rotating internal weight that rocks on the waves and spins a generator, like a self-winding watch. (Wello Oy)

4. Oscillating Wave Surge Converter: a flap perpendicular to the waves, anchored on the bottom, that extracts energy as it moves back and forth with the waves. (Aquaramine Power, Neptune Renewable Energy)

5. Oscillating Water Column: a partially submerged hollow structure, with a column of air trapped above a column of water, when the water moves, it compresses the air, driving a turbine. (Dresser Rand, Oceanlinx, RWE, Voith)

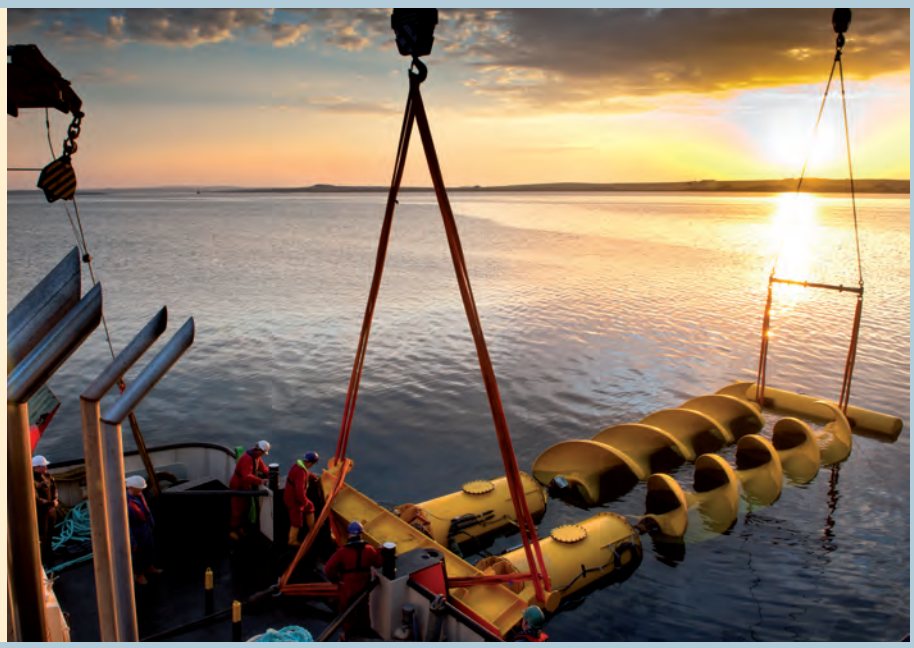
6. Overtopping Terminator Device: catches water as waves break over a storage reservoir, drains the water back into the sea through a low-head turbine. (Wave Dragon)

Tide designs

1. Horizontal Axis Turbine: like a wind turbine with blades underwater, with the axis parallel to the current; extracts energy from water as it passes. (Atlantis Resources, Hammerfest Strom, Marine Current Turbines, OpenHydro, Verdant Power)

2. Archimedes Screw: a corkscrew-shaped device that draws power as the tidal stream moves through the strakes (spiral blades), driving turbines. (Flumill)

3. Cross-flow Turbine: horizontal to the seabed, it looks like a hollow kitchen dough roller, with foils spiraling around an axle that turns a generator as water passes through. (ORPC)



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A streamlined approach to tubular management

Weatherford has been mobilizing a bucking unit equipped with torque/turn process control systems to an operator's onshore Australian support base and providing full pipe preparation. Weatherford's **Aaron Sinnott** explains how these services significantly reduced operating costs.

Until recently, most aspects of tubular handling and running preparation have been carried out on the rig floor offshore, a process that requires significant manual handling. Typically, tubulars were shipped to the rig and laid out on pipe racks while processes such as cleaning, tallying, thread inspection and drifting were carried out off line by the rig crew, before the pipe could be run in the hole. The number of personnel required to manually carry out these operations on a rig deck of limited space introduced significant risks to safety and efficiency.

While newer offshore drilling rigs are equipped with auxiliary pipe make-up stations and racking systems for offline pipe handling and preparation – which can provide major cost savings – they have lingering limitations. For example, the capacity for $13^{5}/_{8}$in diameter and larger casing that can be racked in the derrick is usually lower than the amount required for hole sections in deeper wells.

As a result, service companies that normally provide tubular running services are now assuming responsibility for all aspects of tubular management, such that there is a cohesive focus on drilling operations. In Australia for example, service providers are being called upon to deliver tubular handling and running services that reduce flat time, manual handling and environmental hazards, while improving connection integrity and the capabilities of third- and fourth-generation rigs. And it is not just operators calling for such services in that country; after the 2010 Macondo oil spill in the Gulf of Mexico, Australian regulatory agencies such as the National Offshore Petroleum Safety & Environmental Management Authority (NOPSEMA) are calling for stricter safety and environmental controls on many offshore operations, including tubular management and running.

Weatherford has advanced its tubular management services approach to answer these requirements, by shifting these processes to onshore operating bases where better control and a more automated preparation strategy can be established.

Tubular management

Tubular management services comprise several key functions that are conducted dockside, including:

Pipe cleaning. Incoming tubular joints are received and cleaned onshore, using a pressure-driven cleaning unit and then dried internally with compressed air. This helps satisfy NOPSEMA's environmental legislation that restricts the disposal of any waste into the sea, particularly around some sensitive locations such as marine parks.

Thread inspection. The thread protectors on each joint are

Expert Access

Join Aaron Sinnott of Weatherford on 26 February at 11:00 CST for a Live Presentation and Q&A session on the importance of handling tubulars in an efficient and effective way to minimize their impact on offshore personnel and equipment.

See page 90 for more information.

removed and cleaned, and then threads are steam cleaned and inspected for defects or corrosion.

Drifting. Each joint is drifted from the box end with a nylon-bodied drift of appropriate OD. If the drift passes through the joint without binding, the operator is assured that the ID of the entire joint is sufficient to allow the drill bit to efficiently pass through it downhole.

Thread lubricant. Each thread is doped such that it is ready for field running, in accordance with client requirements, prior to reinstalling the thread protectors.

Pipe tallying. Each joint is laser tallied, and the length and size data are tagged onto it, either with a stick-on printed label or laser-printed bar code applied directly to the pipe surface. This provides an extra level of assurance to the Australian operator that the pipe arriving at the rig site has been properly prepared and inspected from a quality assurance/quality control (QA/QC) perspective.

Accessory installation. If required, additional tubular accessories such as centralizers, float equipment or casing bits are installed per operator specifications.

Racking and transportation. The joints are installed in tubular transport frames or 'wine racks' for transportation to the rig. The packing order is recorded, with each joint being numbered and the pertinent data being recorded in shipping documents.

Figure 1. A Weatherford ComCAM onshore bucking system can make-up 5.5in diameter drillpipes in double or triple joints per stand, delivering substantial savings to operators in their transportation and downhole deployment costs.

A recent advancement in tubular management services is the ability to make up doubles or triples – connecting two or three joints offline and off the rig floor – with the advent of bucking machines with associated torque/turn recording systems. One example of such a machine is an automated system (*Figure 1*) comprised of:

- A hydraulically operated bucking unit with 15in-diameter pass through and a torque capability up to 160,000ft lbf.
- A skid-mounted, electrically powered hydraulic power supply unit.
- A control panel with torque process controller and torque/turn recording system.
- Two single-joint pipe racks located either side of the bucking unit.
- A hydraulically operated, inclined tip/table for moving pipe joints from the single joint pipe rack to the pipe feeding facility.
- A pipe feeding system consisting of custom designed hydraulic jack stands to move pipe horizontally in and out of the bucking unit.
- A double pipe rack to receive made-up joints from the bucking machine.

Offline benefits

The reduction in on-location, drill floor pipe handling has several advantages for an operator's commitment to safety, environmental stewardship and operational efficiency:

Improved wastewater management. Storage compounds for pipe joints must be washed off and replaced with a running compound prior to downhole deployment, which introduces challenges for the safe handling of waste fluids. Washing

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pipe offshore requires capturing the waste fluid and ensuring that it is not washed off the rig floor and into the sea. Onshore pipe cleaning, in a controlled environment, eliminates the risk of overboard discharge, significantly lowers transportation and disposal costs and allows for appropriate oil/water segregation and recycling.

Safety. In its *2011 Summary of Occupational Incidents* report for the Asia-Pacific offshore region, the International Association of Drilling Contractors found that 36% of recordable incidents occurred on the rig floor, and 10% occurred on or near the pipe deck. This comes into clearer focus when one considers that space constraints on a rig floor force many operators to stack pipe five to six joints high. Thus when preparing pipe offshore Australia, rig personnel walking on the casing are working at heights of 1.5m or higher, which increases the risk of twisted ankles or falls.

Making-up pipe onshore allows for safer handling of pipe joints, and additionally, reduces the amount of rotary table (RT) activity on the rig floor. Further safety improvements are realized by the hands-free make-up systems afforded by tubular management services. Onshore pipe preparation can be performed under more controlled environmental conditions, such as under a canopy, to protect field personnel from the risk of heat stress that is common in the Australian summer, when temperatures can reach 50°C.

Improved logistics. Preparing the pipe offshore on the rig requires that it be there five to six days prior to running in the hole to allow sufficient prep time, which introduces deck loading issues and scheduling challenges for boats and crews. Prepping the pipe onshore at the yard avoids these logistics hurdles, and less activity on the rig floor helps reduce maintenance costs associated with rig floor machinery by reducing the number of connections made-up at the rotary table and extending the operating life of rig equipment. In addition, it reduces the number of days tubular running personnel are required onboard the rig to assist with pipe preparations, providing cost savings and reducing risk, particularly during Australia's cyclone season when rig headcount should be kept to a minimum.

Further logistics and running time improvements are realized by prepping and moving doubles or triples to the rig, in a ready-to-run state. Running ready-made stands of doubles or triples also reduces running time, which translates to corresponding reductions in the amount of 'open hole' time. Further, it reduces wellbore conditioning and cleaning costs while enhancing safety, and rig time savings that reduce time to production. Similar savings are realized when shipping doubles or triples back to the shipyard for breakout into singles, rather than breaking them down on the rig. Given the high operating spread rates in Australia, even small time savings translate to significant cost savings.

Full inventory control and yard management. A subset of logistics benefits provided by tubular management services is the complete tracking of pipe inventory, down to the sequence in which it will be run in the hole. Each joint or joint multiple is tracked at every stage, from prep in the yard to downhole deployment.

Figure 2. Weatherford used the operator's operations base to prepare and make-up tubular doubles prior to deployment.

With the level of QA/QC assurance provided by this service, a reduction in contingency tubular plans bring added benefits and cost savings.

Increased accuracy of pipe preparation. The use of tubular management services onshore allows for higher technology prep options to be deployed, such as laser measurement and barcode identification of each joint or stand, and drifting and strapping machines. Offshore preparation typically translates to more manual handling and preparation techniques, such as the use of measuring tapes and manual data recording. And a reduction in wellsite handling helps protect the integrity of expensive corrosion-resistant alloy tubulars.

Integrated operations. An operator can realize significant operational efficiencies by partnering with one provider to conduct both tubular management and tubular running services. Using the same company with the same employees that are multi-skilled and experienced in the comprehensive tubular running process ensures consistency and integrity in how the tubing is handled, controlled and run, and

allows unforeseen problems with tubular management and running to be addressed quickly and correctly prior to wellsite installation.

Australian developments

Resultant improvements in rig efficiency using tubular management services have been documented in many locations, both on- and offshore. But given the high costs and risks associated with handling and deploying pipe for offshore wells, the most interest has come from offshore operators. This is certainly the case in Australia, where continued offshore E&P activity, and an increased emphasis on safe, efficient and environmentally responsible well construction operations in the last few years, has made tubular management a high priority.

A major operator working offshore in NW Australia and using a fourth-generation semisubmersible drilling rig wanted to improve its casing and tubing running efficiency by running doubles in a six-well program. The operator also wanted to improve safety and efficiency by reducing the manual handing of tubulars and bottomhole assembly (BHA) components. Previously, the operator had performed tubular preparation and make-up work on the rig floor, and was running only single joints downhole.

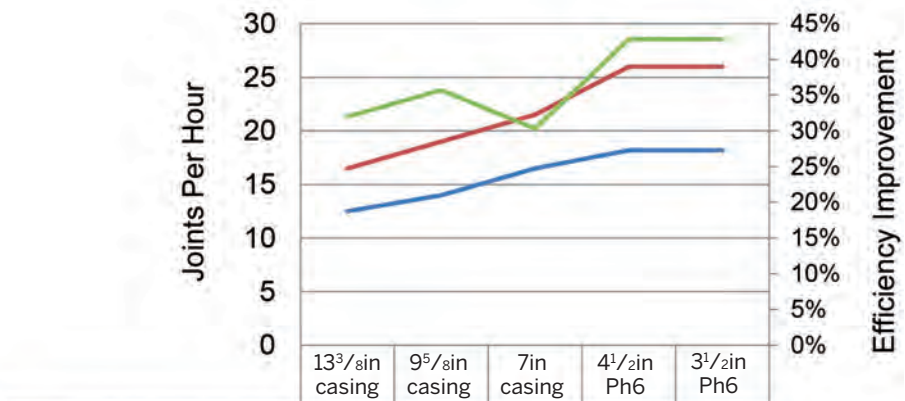
Weatherford was selected to provide management services that included mobilizing a bucking unit equipped with torque/turn process control systems to the operator's onshore support base to make doubles of 9⅝in, 7in and 4½in PH6 tubulars. The operator also required full pipe preparation and yard management services (*Figure 2*). In compliance with these requests, the tubulars were cleaned, inspected and drifted; the threads were cleaned and doped; the tubulars were bucked into doubles, laser tallied and tagged; thread protectors were re-installed; and the tubulars were racked in double wine racks. They were then trucked a short distance to the quayside, where they were shipped to the rig.

The operator conservatively estimated that, when compared with earlier operations, running doubles prepared via the company's tubular management services boosted handling efficiency by 30-43% (*Figure 3*). An average of four hours of rig time was saved on each tubular running operation by running doubles, which amounted to a total of 32 hours over the short campaign. At the hourly operating cost of US$52,000, this amounted to a savings of US$1,644,000 in operating expense, with a corresponding safety enhancement due to the reduced manual handling of the tubulars. The operator also calculated that a saving of $400,000 was achieved by preparing the pipe offsite, and eliminated the need for offshore pipe cleaning and transportation costs associated with wastewater disposal.

This same operator installed a top loading Hydraulic Mobile Bucking Unit (HMBU) on board the same rig for use in make-up and break-out of sub-assemblies such as hole openers, running tools and jetting tools for a separate six-well program. The HMBU recorded and stored the connection torque for the BHA, which improved connection reliability. In addition, by moving this activity off the critical path where it would have to be handled at the rotary table with manual tongs, the operator saved an estimated $6.9 million.

Conclusion

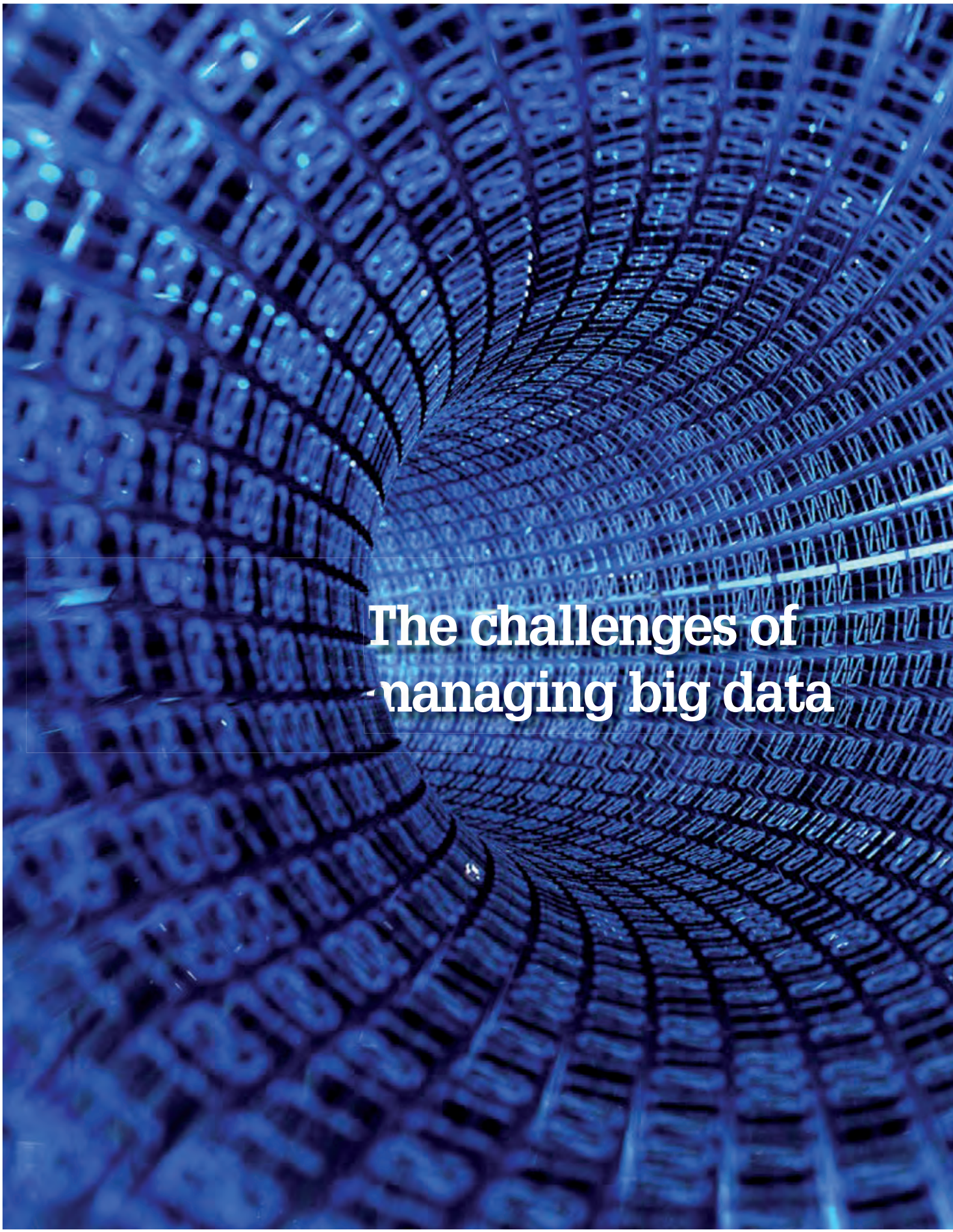
The use of tubular management services, particularly to run doubles in the well, can contribute substantially to improvements in operational efficiency and consequent cost reduction. This approach not only reduces overall operating costs, but can also have a major impact on HSE performance. It's use should be a major consideration in the planning of any drilling and completion program. The recent successful deployment of these services offshore Australia is garnering the interest of other operators. OE



	13⅜in casing	9⅝in casing	7in casing	4½in Ph6	3½in Ph6
joints per hour, singles	12.5	14	16.5	18.2	18.2
joints per hour, doubes	16.5	19	21.5	26	26
efficiency improvement	32%	36%	30%	43%	43%

Figure 3. The Australian operator was able to run between four and eight more of the double joints per hour compared to single joint runs in previous wells, and improved running efficiency by 30-43%.

Aaron Sinnott *is the global product line manager for tubular running services (TRS) at Weatherford. Sinnott has more than 20 years with the company in a range of field operations and management roles. In his last position as the regional business unit manager for TRS in the Asia-Pacific, he played a critical role in developing Total Depth services and tubular management services.*



The challenges of managing big data

The US, for the first time, is close to being independent on itself for oil and gas, notes J Michael Kuykendall, VP for global information technology at Apache. "Our technology is what is driving us there, the pressure being put more now on the communications and infrastructure that is required to make all of that happen."

While technology provides advantages in the form of near-instant access to extensive information, such knowledge can be crippling if not properly distributed and protected. The most significant communication challenge, Kuykendall says, is to manage and merge the data into significant, useable data. He was recently on a rig and saw firsthand the data overload many operators face.

"They were pulling data from everything – anything that can be measured, in perpetual motion, received a pip tag. Millions and millions of rows of data were generated just from that one platform, coming into a server. I asked: 'What are you going to do with that?' And they said: 'That's what we are trying to figure out,'" he says. "We are just a mess right now trying to manage that big data."

Everybody is "on that steep learning curve right now, trying to manage data distribution", Kuykendall adds. "It all goes back to that 28 year-old on a pumper who wants to be sitting in his room, and be able to pull out his iPhone and have access to that one little piece of data, that is gleaned from the millions of rows, that he needs."

Finding a means to turn data into meaningful information more quickly for the end user is a challenge that plagues offshore communications professionals. The answer often requires asking the right questions to determine what data is needed, when it is needed, and how the data will be used.

"It's important to get on the frontlines. Don't assume you think you know," Kuykendall says. Many businesses are now taking more of a proactive, not a reactive approach to data management, he adds.

Additionally, 24/7 video feeds are often used offshore, both for monitoring equipment as well as teleconferencing. Such use can provide substantial savings but does add another challenge.

"The sixth generation rig is a software-driven rig. More often than not something software-driven will bring it to its knees, causing downtime," notes Coy Wright, IT VP for Pacific Drilling. "We've taken the stance that IT is imperative, is critical, to avoid downtime."

As technology advances and resources become more available, companies are faced with multiple solutions to complicated offshore communication woes.

Potential solution

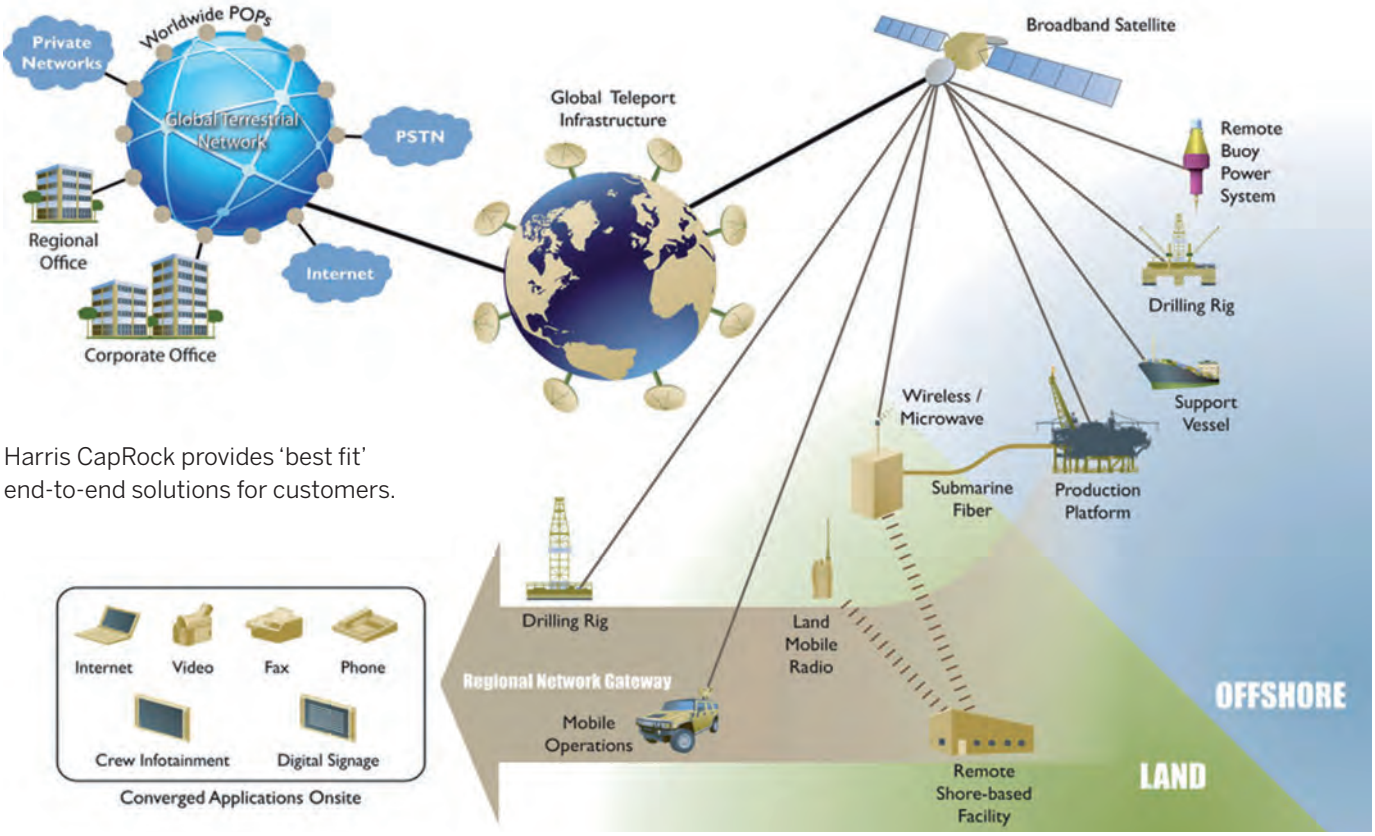
Touted by some as having the potential to change offshore communications, satellite's Ka-band is one potential solution for companies facing bandwidth issues. Though all Ka systems are more susceptible to rain fade than high throughput Ku systems, experts suggest the additional frequency may provide added value to users.

"All bands have their place and the application environment tends to determine the appropriate band, rather than a fleet operator's band of choice. It is all about the mission and the right solution for the mission profile. There will absolutely be mission profiles that need Ka, but it is not an automatic replacement," says Keith Johnson, president of energy solutions for Harris CapRock.

"Unlike cellular technology, where 4G replaces 3G and everything else before it, Ka will join other frequency bands as a tool in building a communications solution. There are cost and service trade-offs to every band," he adds.

Harris CapRock recently entered into a strategic marketing alliance focused on ultra high-speed, low latency E&P communications capabilities with O3b Energy. "O3b

Managing access to crucial data while maintaining a secure environment in the offshore communications sector can be taxing for many operators. Whether the information is moving from rig to shore, to the seabed, or to the drilling equipment, offshore communication has a host of inherent issues. **Jennifer Leahy** explores issues and innovations discussed at OilComm 2012.



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represents an interesting potential technology for our customers. It is unique in that it offers low-latency exploration and production communications capabilities that no other planned Ka system is offering. For those clients that have assets operating within their coverage area, the low latency advantages represent an exciting new capability for some applications in the oilfield, including seismic vessels and other data hungry sites and could offer better remote decision making," Johnson says.

The 'need more bandwidth' cry is nothing new for the industry, according to Shell field telecoms advisor Don Happel. "It's been growing for the last 30 years, and the carriers have to continually upgrade and push their networks."

Though some companies have opted to install efficient fiber network solutions offshore, such capital investments are cost prohibitive for many operations and applications. "The technology is there. We can have live feeds from the battlefields but it is not economical," Wright says.

Shell opted to install fiber networks when rebuilding communication networks in the Gulf of Mexico in the aftermath of hurricanes Katrina and Rita. And Happel notes Shell has invested in subsea fiber in new deepwater developments where costs can be justified in relation to the overall project development costs.

Shell's offshore microwave system was obliterated during the storms, says Rob Raleigh, subsea IM/IT manager – deepwater IM/IT – upstream Americas for Shell E&P. As such, the company started to look toward fiber as a potential strategic solution. Although fiber itself does not provide any benefit, it enables improvements to work processes and tools that can provide significant benefits, he notes.

In environments where communication options are less than optimal, companies must re-evaluate operations and tailor the data output to suit the available bandwidth.

"We struggle probably most notably with application performance over satellite networks. Even if the network is optimized, a lot of the applications the software providers are rolling out right now are not architected, and not coded, in a way that they perform well over high latency, low bandwidth environments. So we are looking at re-architecting our application platforms. There's a lot of technology that we feel like we can't look at. Based on experiences we have had, we feel it won't work well," says Rowan's VP and chief information officer Lisa Gauthier.

The human element

While offshore data management may be considered a daunting task, the human element of communication applications is becoming increasingly demanding as companies work to attract and retain skilled personnel.

In addition to the communication needed for business operations, employees also now expect access to the internet and are increasingly likely to bring their own electronic devices – known as a 'BYOD' environment. Gauthier says that crew members have expectations

and demand bandwidth while offshore. "They expect to be able to access social media, to watch the video from their child's birthday party that they missed," she says.

Providing such access creates a host of security issues, however. Employees may attempt to download illegal, copyrighted material, or otherwise compromise the network.

"Anything that touches the Shell [corporate] network has to follow our security procedures," Happel says. "We have to provide a modicum of filtering to mitigate corporate responsibility."

Shell uses a corporate network which has strict controls and filtering and offers wireless internet for employee and contractor. Initially, Happel says, Shell only provided protection on the wireless internet network from external denial of service attacks, but the company later found that it had to provide additional filtering and logging to prevent people from using bit torrent activity to potentially download copyrighted material. Published company policy also reinforces that such illicit activity is subject to reprimand up to and including dismissal, he adds.

Despite the increased availability of bandwidth, many companies still grapple with balancing business need for access with employee demands for online access. Some alter access availability based on time of day, opening the system for increased worker communications at the end of the work day and reserving the majority of bandwidth for business use during hours of operation.

"We prioritize data streams on networks. Someone doing crew e-mail is not going to get the best service as someone who is putting in a purchase request or addressing a drilling issue," Wright says.

Unreliable or insufficient access for onsite personnel can cause major headaches for business operation and drain worker morale.

"There is inherent limitation of satellite networks. In IT we understand it. But business users don't. Explaining that to the operations side is tough. When they're out there and want to do what they need to do, they don't care about that conversation. Their reality is that it is not working for them. They don't care about latency statistics," Gauthier says.

Conducting offshore business in an international environment also may pose additional problems in terms of regulatory challenges.

As a rule, the level of bureaucratic oversight is increasing globally, notes telecommunication attorney Christian Hyde, director at Hyde & Associates. "When you are using a transmitter you need a license – either the corporate user or operator. For VSATs, it's most often the end user," he notes.

Hyde recommends companies begin determining whether they need a license for offshore applications as soon as sites are identified because it can take up to six months to receive official approval in some areas of the world.

"There is no silver bullet. Don't waste your time looking for it," Hyde says.

Despite the breadth and scope of the technological improvements occurring in the offshore telecommunications sector, Shane Meche, telecommunications consultant for TEK systems and consulting full-time for a major oil company, predicts collaboration between IT and operations will be the most notable evolution as the industry looks forward.

"The work force is changing. We now have video feeds that work in a number of applications. We are dealing with better technology that will allow us to be smarter about how we do things, limit the amount of people onsite," Meche says. "In the future the focus will shift to determining what is critical, what is not critical, and how to optimise how you operate within your parameters." OE

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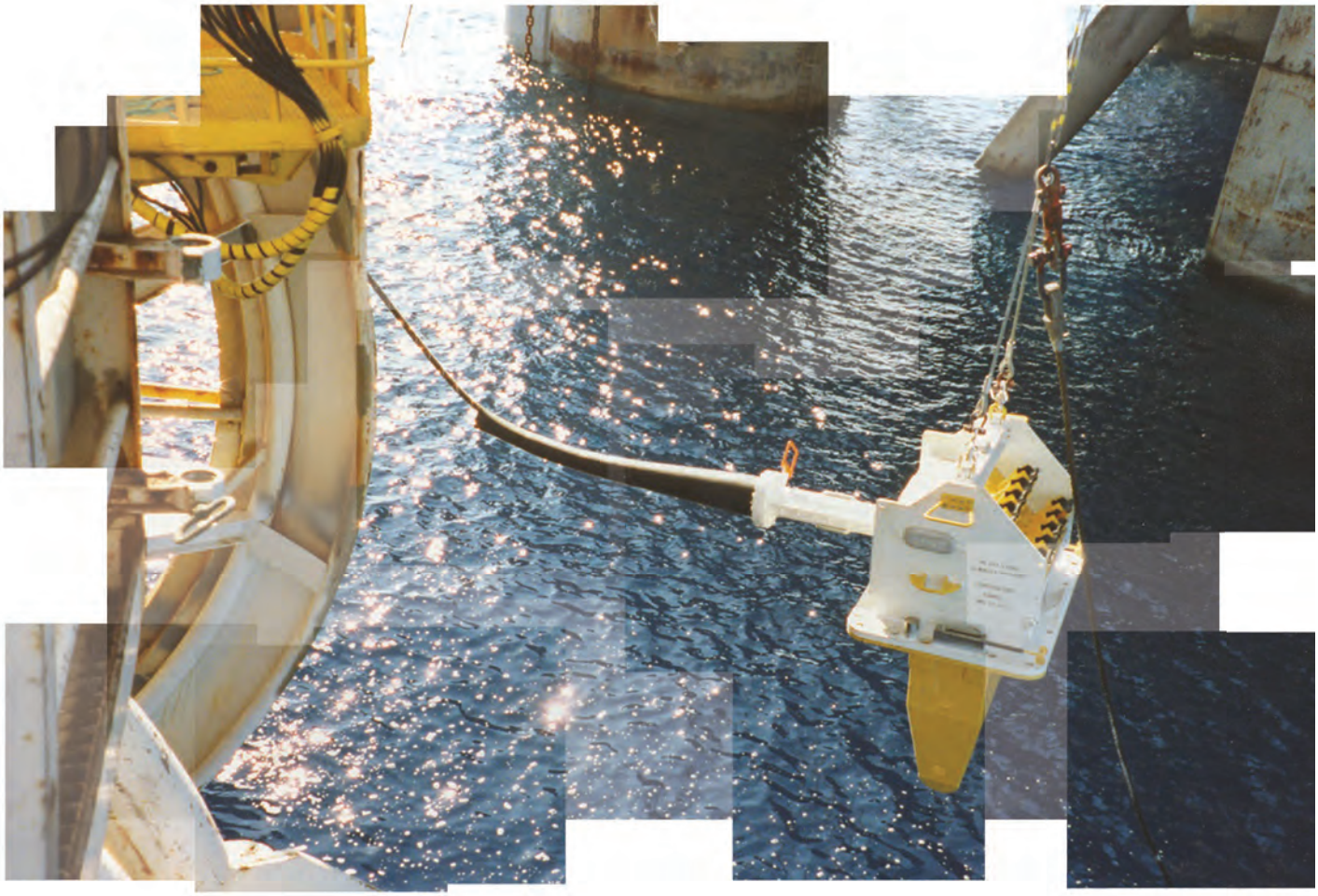


Installation initiative increases industry involvement

Umbilicals form a critical link in the recovery of hydrocarbons involving subsea production. Over the past 30 years, many umbilical systems have been installed in waters ranging from a few meters to depths exceeding 2000m. Installing umbilical products subsea presents several challenges and it is understandable that some difficulties have been encountered during past operations.

With the trend to ever deeper waters and longer tie-back distances, and with subsea production moving into increasingly hostile environments, it is likely that installation will continue to be a problem for the industry. In 2009, the Umbilical Manufacturer's Federation (UMF), in conjunction with the Society for Underwater Technology (SUT), arranged a one-day seminar/ workshop with the objective of gaining a better appreciation of the issues.

With this, the UMF aimed to develop a strategy with the ultimate goal of reducing the occurrences of umbilical installation problems.

The workshop adopted a similar format to that used for the UMF umbilical blockages initiative which was very successful and resulted in a joint industry project addressing blockage avoidance in subsea productions systems (www.basics-jip.com).

The workshop was a great success, with more than 100 attendees from operators,

As the oil & gas industry ventures into deeper waters and more extreme environments, operators, umbilical equipment designers and manufacturers, and installation companies, have been working together to ensure umbilical installation is as smooth an operation as possible. **Pat Oakley** reports.

Free span analysis

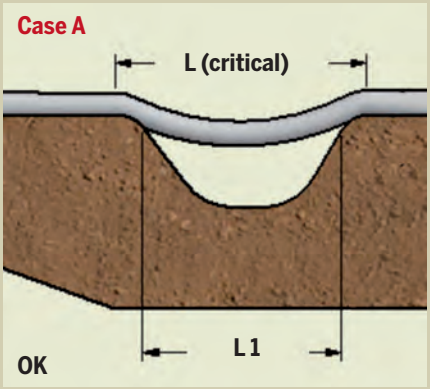
On a separate but related theme, the Umbilical Manufacturer's Federation has recently published a guidance note on the subject of free span analysis.

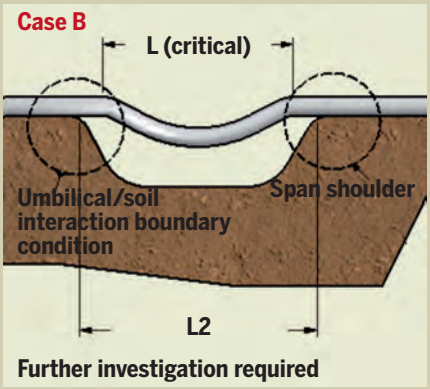
The term 'free span' is used to refer to the scenario whereby a section of installed static umbilical is unsupported along its length on the seabed for a distance, typically greater than 3m.

If the lay route includes free spans longer than the critical length then the umbilical may be subject to vortex induced vibration possibly leading to one or more of the following: fatigue, wear, curvature and infringement of local structural capacity at span shoulder.

The reasons for the umbilical being unsupported can be various, *eg* local seabed topology, scouring of the soil from underneath the umbilical, the physical configuration of the subsea terminations, spans between I-tube and seabed, and at pipeline crossings.

The guidance note describes the typical process employed when conducting free span analysis on umbilicals, and describes the primary and secondary parameters utilised in the analysis. The document is intended as a free reference source for all engineers involved in umbilical system specification, design and installation, and can be downloaded from www.umf.as/downloads





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installation companies, equipment designers and manufacturers. Morning presentations highlighted a number of significant issues in relation to umbilical installation. In the afternoon, the audience was organized into groups, each to discuss a topic arising out of the morning session. The major themes were :

- Reducing the size of subsea terminations.
- Matching vessel spreads to umbilical needs.
- Better understanding of umbilical internal behavior.
- Standards and specifications.
- Lessons learned.
- Training and awareness.

Various suggestions to improve installation activities arose from the different discussion groups including:

- Address the issue of termination size and weight by designing smaller units, relocate distribution onto subsea structures, change handling/deployment methodologies, or combinations of such actions.
- Develop best and recommended practice documents.
- Assess and revise the current standards and specifications.
- Standardize terminology throughout the industry.
- Standardize information presentation throughout the parties involved.
- Encourage development of an 'umbilicals network' that involves the entire supply chain from an early stage of a project.
- Develop a global 'lessons learned' database.
- Develop training modules to educate design and installation personnel.
- Survey/review current installation spreads to identify any shortcomings with a view to developing a specification for spreads for umbilical installation purposes.

Results

The workshop closed with strong feedback from attendees that the issues highlighted should be followed up. As a result, the UMF undertook to raise the output from the seminar with a number of major installation companies. A meeting took place with installation contractors in early 2010. The various themes raised at the previous workshop were tabled and discussed.

A considerable amount of time was spent on the subject of umbilical terminations, this being one of the major concerns of installation companies.

The general view was that terminations were too large and heavy, quite often not cylindrical, and lacked sufficient handling points. The size and weight caused problems when loading onto a vessel, and even more so when over-boarding during the installation process. This often led to increased installation time and

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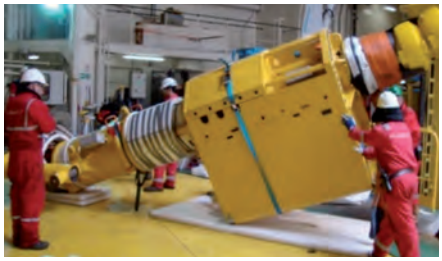

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subsequent significant weather downtime.

These factors were compounded by the fact that many installation vessels are not purpose-designed for umbilical installation and the termination handling requirements proved difficult to meet with normal crane outfitting.

Other issues relating to the design of umbilical terminations were raised. It was noted that design premises rarely address size and weight limitations, and that the design for the same number of elements varies with designer.

Termination JIP

The meeting participants observed that dealing with the issue of large terminations would require involvement by all parties, including clients, FEED contractors, control system designers, and termination designers.

It was proposed that a way forward for dealing with the issue would be a JIP drawing in all interested parties.

As a result, OTM Consulting – a company with a solid track record of successful JIP launch and management – was engaged to map industry interest in a termination JIP. Interest was strong and a JIP launch meeting took place in Aberdeen in April 2011, at which several companies confirmed their willingness to participate. As a result, the first Umbilical Termination Size Reduction JIP (UMSIRE) meeting took place in September 2011.

To date, UMSIRE has 16 member companies encompassing operators, installers, equipment designers and manufacturers.

UMSIRE membership aims to collaboratively develop a best practice document addressing the need to optimize the shape of umbilical termination assemblies (UTAs) and identify guidelines for their size and weight, thus allowing:

- Planning and consideration of installation issues at the design stage of the umbilical system resulting in UTAs to be more proportional to the umbilical size and the installation equipment capabilities.
- Evaluation of the economic and operational risks during the design phase.
- Estimation at the design stage of the final UTA size on the basis of the number of functionalities of the umbilical system

JIP progress

One year after its official launch, the JIP is well on track with the preparation of its deliverables which will clearly serve to address one of the main concerns raised by installers (further information on the UMSIRE JIP is available at www.umsire.com).

The UMF reports that further initiatives are under consideration to address a number of the other themes and issues raised at the original installation workshop. OE

The Umbilical Manufacturer's Federation

The UMF is a group of global umbilical manufacturers, founded in 2001, with the principal objectives of improving umbilical safety, reliability and standards. The UMF seeks to support the subsea oil & gas industry by various activities including umbilical related workshops, guidance notes, and joint industry projects. The UMF comprises Aker Solutions, Duco, JDR Cable Systems, Nexans, Oceaneering Umbilical Solutions and Parker Scanrope, who between them account for the majority of umbilical systems installed in subsea production systems.

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Bridon's new wire rope factory at Neptune Quay.

Additional bobbins to reel in sophisticated rope applications

UK rope manufacturer Bridon has a new state-of-the-art factory on the River Tyne, on the site of the old Swan Hunter shipyard. Bridon claims it is capable of producing the largest and most complex wire ropes in the world. Officially opened by UK minister for business & enterprise Michael Fallon, the new facility represents an investment of £30 million ($48.6 million), a third of which went toward an innovative, 24-bobbin rope-closing machine.

Speaking at the launch of the new facility last November, Bridon Group CEO Jon Templeman announced that "Bridon Neptune Quay is open for business, making the largest and most complex ropes the offshore industry has ever seen. We have worked closely with customers to understand the challenges they face in reaching greater depths in some of the toughest conditions on earth. Thanks to this collaborative approach, ropes constructed at Bridon Neptune Quay will not only be the most advanced in the world, but will also be uniquely tailored to tackle 21st century offshore challenges."

The main focus of product development at Neptune Quay will be to provide solutions for lifting, lowering and mooring that meet and exceed the stiffer challenges the oil & gas industry faces when accessing deepwater reserves. Templeman expects the ropes produced at the new plant to "expand the boundaries of the possible" across

Shipments have begun from a new UK wire rope factory built by Bridon International with future deepwater installation and lifting requirements and challenges very much in mind. **Meg Chesshyre** joined industry leaders taking an early look around the Bridon Neptune Quay facility in Newcastle.

the sector. Keeping pace with the ambitions of the oil & gas industry has been a principal motivation for the construction of the new facility as deepwater deployment moves from 300te (330 ton) in 3000m (9843ft) water depth to up to 600te at depths down to 4000m. The company is already in talks with Petrobras, which is eyeing subsalt development below 4000m. Bridon has opened up a logistical hub in Macae, Brazil, providing warehousing, distribution, and project supervision. West Africa is another developing deepwater market.

The Bridon Neptune Quay facility has the capacity to produce highly engineered ropes in package weights of 650te, with enhanced breaking loads, optimized bend fatigue performance, effective lubrication, and minimal rotation under load. It will boost Bridon's rope manufacturing capacity by at least 9000te a year.

Designed and manufactured by German engineering company Sket, the new 24-bobbin rope closer machine with up to 600te rope weight capacity is claimed to be the largest rope-making machine in the world. It can manufacture ropes up to 250mm (9.8in) in diameter. In the past, the largest closer machines have typically had only eight bobbins.

Sket also produced the new stranding machine, which winds the individual wires into strands before they are spun together by the closer machine.

Newcastle-based engineering firm Pipe Coil Technology was commissioned to deliver an innovative take-up stand. The stand takes up new ropes from the closer onto the final reels, and can either be used to move the reels along a track to the quayside or to load them onto trucks. The reels can then be taken by truck to the nearby Walker Quay, and loaded onto vessels using the quay's imposing, historic and newly refurbished 1930 Hammerhead crane. The load capacity of the crane has been increased to 325te with Newcastle City Council backing the refurbishment.

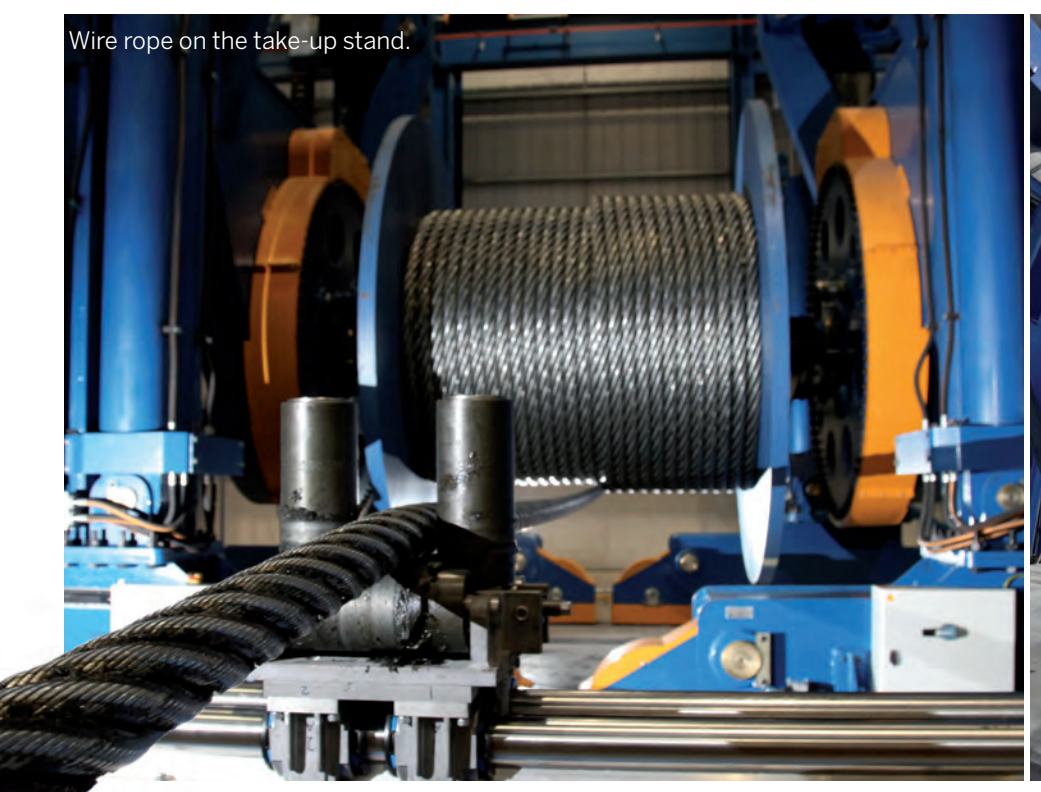
The factory's Tyneside location, along with its state-of-the-art take-up stand for lifting reels directly from dock to vessel, will help Bridon significantly improve logistics. The water depth at the quay is 8.5m.

Bridon's £30 million investment has been supported by £2.2 million from the UK's Regional Growth Fund, which estimates that the new factory will leverage additional supply chain investment into the northeast England economy.

Bridon was originally formed in 1924, through an amalgamation of wire rope producers, one of which dates back to the late 18th century. In 2008, Bridon was acquired by Melrose, a specialist manufacturing investor listed on the London Stock Exchange.

Bridon's offshore product portfolio is engineered to service operators and contractors in a wide range of applications including exploration, drilling and completion, deepwater lifting and deployment, station keeping for mobile offshore drilling units, permanent production and export mooring systems.

The company has 30 years of expertise in developing ropes and related systems for permanent moorings, starting with the Schielhallion system for BP back in 1983. The 81st system was due for



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The 24-bobbin rope closer machine.

completion last month. Fabrication of the 82nd system starts in May for a project in 2000m of water off West Africa.

"We are a niche supplier," says Newton. The new facility offers the opportunity to build longer and more complex ropes up to 600te in weight compared with the company's previous limit of 360te. The 24-bobbin closing machine enables the production of ropes with very low rotation characteristics, essential when carrying out accurate placement of heavy objects on the seabed.

"Our market is ropes for demanding and sophisticated applications – about 40% of the total rope market. This is as opposed to the remainder of the market, based in China, which manufactures straightforward industrial ropes," says Templeman. In deepwater heavy lifting there are Korean and Italian competitors, but Bridon expects to retain a market edge with its new closing machine in Newcastle.

The main customers for lifting ropes are heavy lift and underwater contractors such as Heerema,

Subsea 7 and Technip. The anchor line market is much broader. "We would only produce anchor lines where some sort of specialist input, or higher level of performance was required," explains Templeman.

Capacity increase

A 20% increase in the capacity of the closer enables the manufacture of six- and eight-strand offshore wire rope in lengths up to 7000m. Neptune Quay's manufacturing capacity is being enhanced further by the relocation of a spiral stranding machine from the company's Doncaster factory and the installation of a polymer exclusion and sheathing line. These should be operational by May.

In addition to the significant investment in Neptune Quay, Bridon has also increased wire drawing capacity at Doncaster with a new £1.75 million wire drawing machine, and is currently investing £4.6 million in the Bridon Technology Centre in Doncaster, to develop the next generation of rope solutions. The center will be inaugurated this month and operating at full capacity by March.

UK minister for business & enterprise Michael Fallon and Bridon CEO Jon Templeman at the official opening.

Current avenues of research include advanced lubricants, and hybrid ropes combining synthetic materials and steel. The integration of complex polymers and advanced materials into wire ropes will reduce compression stress. Bridon has applied for a patent for a novel extrusion process, which incorporates strakes in the sheathing to minimize vortex-induced vibration in deepwater mooring systems. The new center will also be used for rope analysis, with customers encouraged to provide feedback on rope performance and input on future requirements.

Bridon has 11 manufacturing units worldwide with four factories in the UK: a wire operation in Doncaster, fiber rope manufacturing at Coatbridge, and steel rope factories at Neptune and Willington Quays, Newcastle. It has rope factories at Gelsenkirchen, Germany; Hangzhou, China; Jakarta, Indonesia, and Auckland, New Zealand. In North America it has a rope factory in Exeter, Pennsylvania, a wire operation in Hanover, Pennsylvania, and a fabrication service center in Oakland City, Indiana. OE

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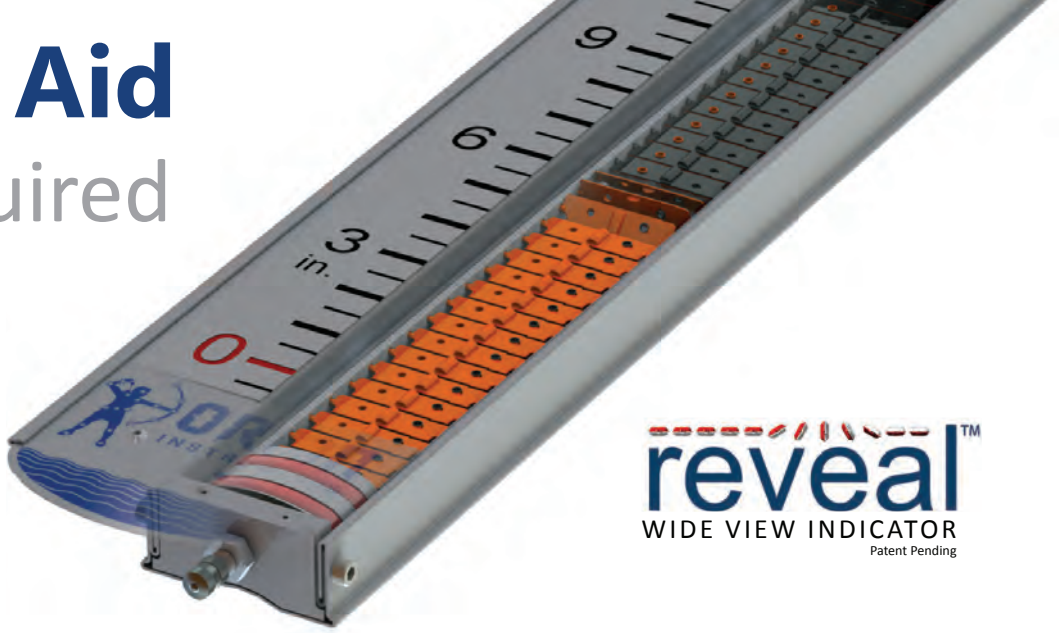

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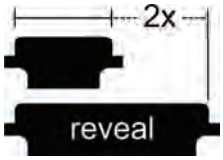

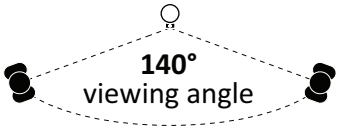

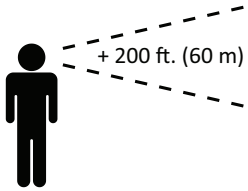

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New vessels offer enhanced capabilities

Following the delivery of its flagship combined pipelay and heavy lift vessel, *Seven Borealis*, last summer, international diving contractor Subsea 7 continues to expand its fleet. **Meg Chesshyre** takes a look at recent new vessels ordered by Subsea 7, McDermott and Ulstein to address a perceived shortage in the market.

Subsea 7's latest vessel will be the third new-build dive support vessel (DSV) to join the company's fleet in recent years, following the delivery of *Seven Atlantic* in 2010 and *Seven Havila* in 2011. The brand-new VS 4725 DSV design was created by Wärtsilä Ship Design specifically for this vessel, which will be built at the Hyundai Heavy Industries (HHI) shipyard in Korea. The contract was signed with HHI last December, and the vessel is scheduled for delivery in 2015. The vessel is intended for year-round North Sea diving operations. In customizing the design of such a complex vessel, close cooperation between Subsea 7, HHI, Drass Energy, the diving equipment supplier, and Wärtsilä was essential.

"The development of the Wärtsilä VS 4725 DSV, the development of the dive system by Drass, and the overall design and building by HHI is the result of good cooperation between all the parties involved. Wärtsilä Ship Design's willingness and ability to adapt to the specific requirements and standards needed were key considerations in the award of this contract," said Stuart Smith, vice president for technology & asset development, Subsea 7.

Subsea 7's Steve Wisely, executive VP commercial, said the new vessel

"will reinforce our leading diving capabilities with one of the world's largest DSV fleets, and enable us to continue to serve our clients in an efficient, cost-effective and safe manner on many future projects".

The new DSV will be equipped with the latest integrated diving equipment; a three-split engine and propulsion configuration ensures the highest level of redundancy. With accommodation for 110 people, the new DSV will incorporate an 18-man saturation system supplied by Drass and rated for 300m, with two moon-pool deployed, three-man diving bells and two 18-man hyperbaric lifeboats. The vessel will be powered by six main engines in three separate engine rooms designed to maximize performance in DP3. The design length is 123m (403ft), breadth 24m, depth 10.5m, and service speed 12 knots. It will have a 120 tonne (132 ton) AHC knuckle-boom main crane, a deck area of around 980 sq m (10,548 sq ft) and a 1000 tonne deck load capacity.

The company now owns the DSV *Seven Havila* (*pictured above*) outright, having acquired Havila Shipping's 50% share in the joint venture Acergy Havila last December. The JV owns the diving support vessel *Seven Havila*, built in 2010 and delivered to the JV in February 2011, when it immediately commenced a bareboat charter with Subsea 7.

The naming ceremony for the next-generation IMR and light construction vessel *Seven Viking*, built by Ulstein, took place in Stavanger at the end of January. The ship now begins a long-term charter with Subsea 7, working under contract with Statoil. Classed as 'Ice-C' by DNV, the new vessel has a crew capacity of 90, length of 106.5m, molded breadth of 24.5m and 16-knot service speed. It is co-owned by Eidesvik and Subsea 7 under the joint venture Eidesvik Seven.

Recent contract awards for the company include a US$30 million project with BP to support the redevelopment of the Schiehallion field, West of Shetland. This is part of a subsea construction, inspection, repair, and maintenance (SCIRM) frame agreement contract.

The scope of the Schiehallion project includes providing a subsea construction vessel for five months to disconnect the subsea risers, prior to the removal and replacement of the existing FPSO. The work will be engineered and managed from the company's office in Aberdeen, with offshore work due to begin early this year. Subsea 7 has been providing SCIRM services in the harsh, West of Shetland deepwater environment for more than 18 years.

BP has extended its SCIRM contract in the North Sea by five years. The extension is valued at about $300 million and will run through 2017. Under the terms of this contract, Subsea 7 will deploy the multi-purpose support vessel *Subsea Viking* to provide extensive support services, primarily for BP's operations in the Foinaven and Schiehallion fields, as well as support for BP assets in the North Sea.

Shell Upstream International Europe has awarded Subsea 7 a two-year extension on both of its underwater services contracts (USC), worth about $360 million. Under these contracts, Subsea 7 will continue to provide SCIRM services across Shell's European offshore fields and facilities. The company has worked in partnership with Shell in the North Sea since 1990. The contract extension will commence in 2014 and continue until at least 2016 with the possibility of up to a further two-year extension.

The advanced diving support vessel *Seven Atlantic* and the IMR, survey, and light construction vessel *Normand Subsea* will be dedicated to operate for Shell and managed by an onshore engineering and support team of more than 50 people. Both vessels are designed for year-round subsea operations in exposed conditions. They will provide 24-hour diving and ROV support services in the North Sea.

The *Seven Atlantic* was originally custom-built to meet Shell's advanced technical specification and began operations in 2010. One of the largest vessels of its type, *Seven Atlantic* is primarily designed for saturation and air diving support works. The *Normand Subsea* was also custom built to Shell's specification and began operations in 2009. It is a state-of-the-art, remotely-operated-vehicle support vessel designed for subsea inspection, maintenance, and repair. It carries six ROVs and a module handling system, all of which have been proven to operate simultaneously when required.

Dana Petroleum just awarded Subsea 7 a contract valued at about $300 million for the provision of subsea EPIC services in support of the Western Isles development project in the northern North Sea. The scope includes the engineering, procurement, construction, and installation of two 2.5km pipeline bundles and an 11km gas export pipeline. Engineering and project management have begun at the company's Aberdeen office, with offshore activities scheduled to start in 2014.

Chevron awarded Subsea 7 an EPCI topside contract valued at about $150 million for the development of the Lianzi field offshore the Republic of Congo and Angola. The scope of work includes a 200-tonne module hosting a high voltage generation system for the new subsea direct, electrically-heated pipeline cable; an 80-tonne flow meter deck extension, and various upgrades on the platform. Project execution will maximize the use of local personnel and resources in the Republic of Congo and Angola. Onshore fabrication will be performed in both the Republic of Congo and Angola by the company's Angolan joint venture. The offshore works, including installation, hook-up and commissioning, are scheduled for 2H 2014.

COURTESY SUBSEA 7

New combination S-lay vessel

McDermott International subsidiary, Hydro Marine Services, has signed a contract for the design and construction of a new high-specification, dynamically-positioned, combination S-lay vessel with a 2000-ton crane. Provisionally named *Derrick Lay Vessel 2000* (*DLV2000*), the vessel will be built at Keppel Singmarine in Singapore and construction is expected to take about two and a half years, beginning this quarter.

DLV2000 is the second new-build vessel under construction for the McDermott fleet. In August 2012, McDermott signed a contract to build *Lay Vessel 108*, sister ship to the recently completed subsea construction vessel the *Lay Vessel North Ocean 105*, which is under construction at Metalships & Docks yard in Vigo, Spain. *LV108* is due for delivery around 3Q 2014 (*OE* October 2012).

"*DLV2000* is expected to address a market demand we consider to be extremely robust for deepwater pipelines as well as our traditional markets," says Stephen M Johnson, chairman, president and CEO. "A combination heavy lift and deepwater S-lay pipelay vessel is an important asset for our expanding fleet, focusing on the subsea construction market."

Developed by Keppel's ship design arm, Marine Technology Development, *DLV2000* is equipped to support advanced deepwater pipelay operations in severe weather conditions that will allow pipelines to be installed at depths of up to 10,000ft. An economical vessel transit speed is expected to be 12 knots with a top speed of 14 knots. It will be able to accommodate up to 400 personnel.

Keppel Singmarine has also recently secured a contract from Australia-based Bhagwan Marine to build a catamaran air dive support vessel, designed by Incat Crowther, due for completion in 1Q 2014. The new vessel will be deployed off Western Australia to support the operations of Apache Energy. Presently, Keppel Singmarine's projects also include a multi-purpose, dive-support, construction vessel for SBM Offshore.

North Sea re-entry

Norway's Ocean Installer and McDermott last month established an exclusive alliance jointly to meet customers' increasing rigid pipelay needs in the North Sea subsea market. The alliance marks McDermott's re-entry into the North Sea and establishes Ocean Installer as a tier one North Sea contractor by adding rigid pipelay to the company's capabilities.

"We are very pleased that McDermott has chosen Ocean Installer as its partner for the development of rigid pipelay solutions in the North Sea and we look forward to advancing our capabilities further together," says Steinar Riise, CEO of Ocean Installer.

"With our expanding portfolio of deepwater subsea projects primarily in Asia-Pacific and the Gulf of Mexico, we look forward to working together with the experts at Ocean Installer to pursue subsea installation projects that support the continued development of the North Sea and further expansion of Norway's offshore energy reserves," comments McDermott's Johnson.

The agreement commits the parties to pursue exclusively and execute jointly rigid pipelay projects in the North Sea and also serves as a framework for a more permanent relationship between the two companies.

New Ulstein multi-functional offshore vessel

Island Offshore and its American partner Edison Chouest Offshore have entered into a contract with Ulstein for the delivery of a multifunctional offshore vessel based on Ulstein's proven SX121 design, with an option for an additional vessel. The vessel is prepared and tailored for the well intervention, IMR, and SURF segments, and meets the latest requirements for both well intervention and offshore construction work.

The newbuild (*Island Performer*) is scheduled for a delivery in May 2014.

The 130m-long and 25m-wide ship will have DP3 capability and will be equipped to perform subsea operations at depths down to 3000m. The vessel can be rigged for well intervention and is prepared for the laying of flexible pipes and cables on the seabed through a VLS (vertical lay system) tower. It also has room for a rotating carousel below deck with a capacity to load 2500 tons.

An active heave-compensated offshore crane with a 250-ton capacity at 14m outreach and a below-deck winch will be installed. The vessel will carry two deep-sea work ROVs – one to be launched from the starboard side and one through the vessel's moon pool. The ship is designed with a large cargo deck for equipment transport. It will be equipped with diesel-electric propulsion and three-azimuth main thrusters powered by six large generator sets, and will have a crew capacity of 130. In the event of evacuation, both the starboard and port side life boats can accommodate the entire crew.

Island Offshore currently has four vessels delivered by Ulstein in its fleet: The well stimulation vessel *Island Patriot*, the subsea construction vessel *Island Pioneer*, and the two subsea construction and intervention vessels of SX121 design, *Island Constructor* and *Island Intervention*. OE

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Natural gas lifts Australian reserves

As Australia grapples with chronic oil production decline in the face of rising imports, the buoyant gas sector offers the prospect of rising revenue from LNG export. **John Mueller** reports.

A study commissioned by the Australian Petroleum Production & Exploration Association (APPEA) prognosticates that Australia is on track to become the second largest exporter of LNG in the world, after Qatar. Currently ranked fourth worldwide for LNG exports, also trailing Indonesia and Malaysia, it is a promising counter balance to Australia's crude oil production, which has been steadily declining over the past decade, now under half of an approximate one million barrels per day domestic requirement.

Australia has widespread petroleum assets both on- and offshore, possessing close to 4 billion barrels of proven oil reserves, typically low in sulfur and wax and therefore of higher value than heavier crudes. The reserves are largely located off the coasts of Western Australia, Victoria and Northern Territory. Western Australia has around two-thirds of Australia's proven crude oil reserves, as well as three-quarters of condensate, and around half of its LPG.

The two major producing basins are the Carnarvon Basin off the northwest coast, accounting for about 70% of total liquids production, mostly exported, and the offshore Gippsland Basin in the southeast, who's output primarily is used in domestic refining.

Extensive offshore exploration continues to make discoveries with production achieved using innovative technologies, often involving floating production vessels and subsea wellheads and pipelines, and led by Woodside

Petroleum and Santos, the two largest domestic companies, and such international majors as ExxonMobil Shell, Chevron, ConocoPhillips, Total, BHP Billiton, Japex and Apache.

Principal frontier oil exploration has moved in recent years to the deepwater area of the Timor Sea, although the nearby Carnarvon Basin remains busiest in terms of overall drilling activity.

However, crude oil and natural gas liquids (NGL) production has been in steady decline, dropping from a peak of 828,000b/d in 2000 to 484,000b/d in 2011 with oil imports rising as the population of around 22 million drives consumption upward.

According to APPEA, hydrocarbon liquids production will continue to decline unless major new fields are discovered.

Increasing gas exports

Natural gas production and exports have been increasing since the mid-1990s. Output is up from 1.15tcf in 2001 to nearly 1.6tcf in 2011, and is seen likely to triple by 2020. Gas exports rose from 370bcf in 2001 to 684bcf in 2011, according to the *BP Statistical Review of World Energy*.

Proven reserves have steadily risen, from 32tcf in 1991 to over 130tcf in 2011, with technically recoverable shale gas reserves by one estimate placed at 400tcf in yet to be exploited basins.

Conventional gas is largely produced from the Carnarvon Basin, the Cooper/Eromanga Basin in central Australia, and Gippsland Basin. These three basins account for over 90% of conventional natural gas production.

Queensland and to a lesser extent New South Wales are the main sources for coal bed methane, which accounted for 13% of gas production in 2010. About half of the natural gas is converted to LNG for export.

Long term contracts are in place to supply LNG to Japan, China, South Korea and Taiwan, with spot market sales to numerous other countries. During 2011, 73% of LNG exports went to Japan.

The abundance of natural gas in Australia coupled with the energy needs of regional economies, in particular those of East Asia and most notably that of China, has underpinned the growing LNG industry and spurred a profusion of LNG project plans and proposals.

Plentiful conventional natural gas resources have been identified offshore the northern coast and Western Australia, and in eastern Australia large coal seam gas (CSG) resources have been discovered onshore in Queensland and to a lesser extent in New South Wales.

Three LNG processing plants are in operation, two onshore Western Australia, one each for the offshore North West Shelf LNG (at Karratha) and Pluto LNG projects, both in the Carnarvon Basin, and a third LNG plant in Darwin, Northern Territory, that receives gas via a 500km pipeline from the Bayu Undan field in the Timor Sea. The North West Shelf project has five trains with a total capacity of 16.3mmt/yr, Pluto 4.3mmt/yr, and Darwin 3.6mmt/yr, both from one train.

Largest resource

The North West Shelf project is a $27 billion investment in Australia's largest oil & gas resource, which accounts for about 40% of oil and gas production and has exported more than 3000 LNG cargoes since 1989. It also currently supplys around 65% of the domestic gas market in Western Australia.

Operated by a equal sharing partnership comprising Woodside Petroleum, BHP Billiton, BP, Chevron, Shell and Japan Australia LNG (MIMI), the North West Shelf project produces such fields as North Rankin, Perseus, Goodwyn, Echo/Yodel, Wanaea and Cossack, among others.

The Pluto LNG project, started up in 2Q 2012 and anticipated by 90% stakeholder and operator Woodside to output 36mmboe of gas and condensate this year, is supplied by the offshore Pluto and Xena fields, located 190km northwest of Karratha, which contain an estimated 4.8tcf of gas reserves. Gas is piped by 180km trunkline to an onshore LNG facility on the Burrup Peninsula.

The Darwin LNG plant is supplied by the ConocoPhillips operated Bayu Undan gas and condensate field within the JPDA (Joint Petroleum Development Area) of Australia and Timor Leste, via 500km subsea pipeline.

Project development

There are several substantial LNG projects at various stages of development that source gas from conventional reservoirs, defined as discrete accumulations trapped by hydrodynamic processes. Offshore Western Australia is the huge Gorgon project, due to begin in 2014/15, the Wheatstone project set for operation in 2016 and the Ichthys project, online end-2016.

A fourth groundbreaking effort underway is the Prelude LNG project.

Gorgon LNG, led by Chevron with 47.3%, partnered by Shell and ExxonMobil each holding 25%, with initial completion slated for 2014, is now estimated to cost $15 billion more, reportedly raising the total to over $50 billion. Three trains will output 15.6mmt/yr of LNG, processing gas from Greater

Production, reserves and usage

According to the *BP Statistical Review of World Energy*, Australian oil and NGL production in 2011 was 484,000b/d (175.7mm bbl/yr). Natural gas production was 4.35bcf/d (1.59tcf/yr).

Proved reserves as of end 2011 were 3.9 billion barrels of oil and 133tcf of gas.

Domestic consumption in 2011 stood at just over 1mmb/d of oil and nearly 2.5bcf/d of gas.

Gorgon fields transported by subsea pipeline to production and shipping facilities on Barrow Island.

The Wheatstone LNG project, a $29 billion Chevron-operated development located at Ashburton North, 12km west of Onslow, has a foundation phase consisting of two LNG trains with a combined capacity of 8.9mmt/yr and a domestic gas plant. First gas is expected at a rate of 433bcf/yr.

Around 80% of capacity will be fed from the Wheatstone and Iago fields, the balance supplied from the Apache and KUFPEC Julimar and Brunello fields.

The Ichthys LNG project, led by Inpex in partnership with Total, is developing a reserve of 13tcf of gas and 525 million barrels of condensate in the Ichthys field, Browse Basin, at a cost of $34 billion. Workscope entails an 889km gas pipeline together with an onshore two train 8.4mmt/yr LNG plant near Darwin, an offshore central processing facility and an FPSO vessel for condensates. The Ichthys project will also output 1.6mmt/yr of LPG and 100,000b/d of condensate at peak.

The Shell-operated $12 billion (greenfield) Prelude project is scheduled to be operational by around 2017 using a floating LNG vessel, producing the Prelude and Concerto gas and condensate fields in the Browse Basin.

The unprecedented 488m long barge-like facility with a 3.5mmt/yr LNG capacity is suited to smaller and remote offshore fields, and is able to unlock otherwise stranded gas resources. This approach is planned for a number of other developments that include Bonaparte, Sunrise and Cash-Maple FLNG projects.

The Bonaparte LNG project in the Bonaparte Gulf, a joint venture of GDF Suez and Santos, is to begin front-end engineering and design mid-2013 for a 2mmt/yr LNG development involving the Petrel, Tern and Frigate gas fields.

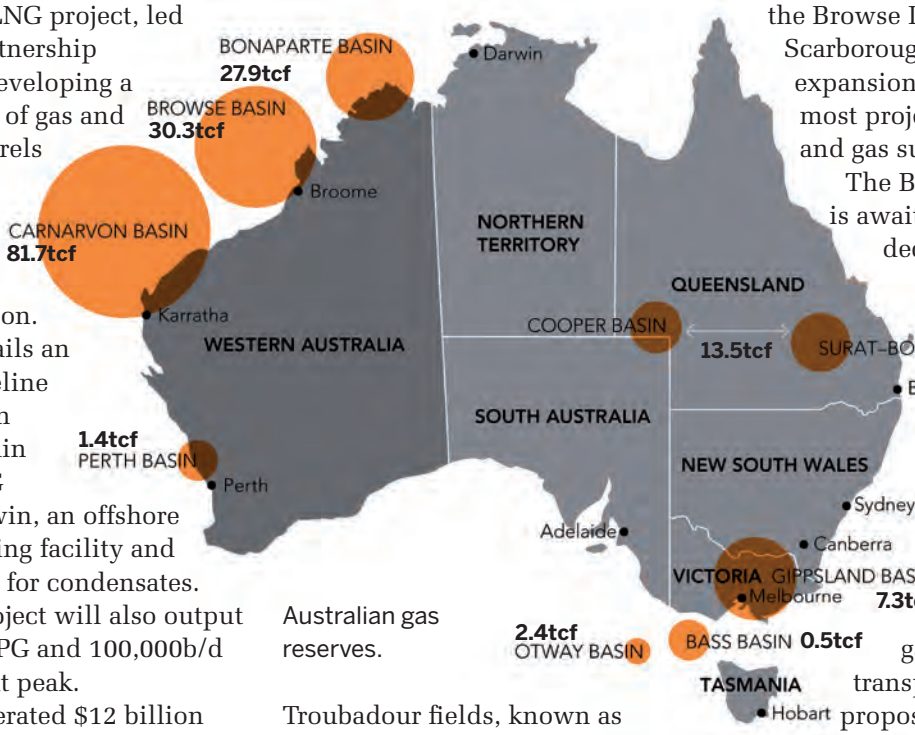
The Sunrise LNG development, which involves the Sunrise and Troubadour fields, known as Greater Sunrise, and located about 450km northwest of Darwin and 150km southeast of Timor-Leste, is in discussion phase between the two governments. Operated by Woodside in joint venture with principal partners ConocoPhillips and Shell, the fields are estimated to have a contingent resource of over 5tcf of gas and 226 million barrels of condensate.

The Cash-Maple gas field, 100% held by PTTEP and situated in the Ashmore & Cartier Islands area of the Timor Sea, is undergoing a concept study of development options, which include a possible FLNG unit. Startup of the facility is scheduled for 2016. Hoegh LNG of Norway is reported to be in final talks with PTTEP on an FLNG vessel.

Other potential conventional gas sourced LNG developments awaiting final approval include the Browse LNG project and Scarborough field with expansion train potential at most projects, if market demand and gas supply options align.

The Browse LNG project is awaiting final investment decision. Meanwhile, Woodside, operator and major equity holder, is evaluating tenders for offshore and onshore infrastructure. The Brecknock, Calliance and Torosa gas fields will have gas and condensate transported 425km to a proposed onshore 12mmt/yr LNG plant.

The Scarborough gas field project, an offshore venture of ExxonMobil and BHP Billiton, is being considered for an FLNG platform to develop the 8tcf resource. A decision is to be made later this year. OE



Australian gas reserves.

AUSTRALIAN DEPT OF RESOURCES ENERGY & TOURISM

Outlook

There is considerable potential for further development of the extensive natural gas resources in Australia, which accounted for 18.9mmt/yr of LNG in 2011.

Australia has in the region of $185 billion worth of oil projects, including those under construction and in advanced stages of planning and approval, collectively amounting to some 35% of all business investment in the country. Should all oil and gas investments be realized, they will represent more than 64% of all committed investment in Australia, according to APPEA.

Australia's stable political environment, substantial hydrocarbon reserves and proximity to Asian markets make it an attractive place for foreign investment, tempered by cost overruns and labor shortages.

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Basins bounty sought

The Taranaki Basin, located along the west coast of New Zealand's North Island, has been the principal focus of oil & gas exploration and production. It commenced with the large gas and condensate discoveries made in 1969 with the onshore Kapuni and offshore Maui fields, and continuing throughout this on- and offshore petroleum province.

Other significant hydrocarbon finds include the offshore Tui and Maari oil fields and Kupe and Pohokura gas fields.

The Maui field, formerly the premier deposit, has been in sharp decline.

The Maari and Pohokura fields contain about 49% of remaining oil and condensate reserves, Pohokura accounting for 45% of natural gas with the balance distributed over 17 other fields.

Exploration is being conducted in other basins, sub-commercial discoveries achieved in the East Coast Basin of North Island and in the Canterbury and Great South basins offshore South Island.

More than 400 wells have been drilled in the 330,000 sq km Taranaki Basin, but none beyond the marine shelf edge. New discoveries have been made at a steady rate, and new play types are still being found.

Elsewhere in New Zealand, frontier basins have yielded discoveries confirming viable petroleum systems, with many untested structures having closures greater than the Maui field.

Concerted geophysical data gathering since the mid-2000s, coupled with advancing deepwater drilling and production technology,

As oil and natural gas production continues to fluctuate at a level well below demand, **John Mueller** looks at New Zealand's growing need to aggressively explore the nation's vast and extensive offshore sedimentary basins.

Gas to the fore

Although Papua New Guinea has a strong economy resulting from exploitation of its extensive petroleum deposits and abundance of other natural resources ranging from minerals to forest products, the nation is one of the least developed countries in the Asia Pacific region.

Constrained by the remoteness of its condensate rich natural gas assets, limited domestic needs and considerable distance to overseas markets, Papua New Guinea is investing heavily in multiple LNG projects.

Papua New Guinea-based oil & gas exploration and development company Oil Search has been operating in the country since 1929, and has a portfolio including substantial joint-venture holdings in the Gulf of Papua that could bolster the PNG LNG project or alternatively become another LNG hub.

Oil Search has contracted the semisubmersible *Stena Clyde* to drill at least two wells in the Gulf of Papua, initially scheduled for late 2012, but since delayed.

The company also has an interest in the Kumul marine terminal located 40km offshore in the Gulf of Papua which receives crude oil via a 265km pipeline from its majority held Kutubu oil project, the first commercial oil development in Papua New Guinea.

The petroleum industry in Papua New Guinea is poised to yield a sharp rise in revenue with the PNG LNG project and Stanley field recovery, both online next year. PNG LNG will also provide a needed lift of 20,000b/d of condensate to the onshore Highlands oil production, which has declined by 40,000b/d from a high of 70,000b/d in 2000.

The future of LNG export and condensate production in Papua New Guinea appears bright, likely both alleviating the shortfall in domestic oil demand that stood at around 15,000b/d in 2009 and leading to an overseas market for liquid hydrocarbons.

has shifted exploration further offshore in anticipation of larger oil and gas accumulations. Sections of five offshore frontier basins: Great South, Canterbury, Raukumara, Deepwater Taranaki and Reinga, are currently licensed to major international companies.

The increasing acquisition of seismic data has prompted frontier basin exploratory efforts that have yielded several significant, albeit non-commercial deposits. These included two off the east coast of South Island in the Great South Basin, where Kawau-1A in 1977 flowed 6.8mmcf/d of gas with estimated reserves of 461bcf and in the Canterbury Basin well Galleon-1 produced 10mmcf/d of gas and 2300b/d of condensate in 1985.

There are multiple sedimentary basins with known or potential hydrocarbons onshore and underlying the extensive continental shelf of New Zealand, as well as several deepwater basins within its Exclusive Economic Zone where sovereign rights extend over more than 5.7 million sq km of seabed, a region more than 22 times greater than the land area.

GNS SCIENCE

Outlook

With Maui field output seeing a precipitous drop from a peak in 1997 and only partially compensated for with production from several other offshore Taranaki fields starting to ramp up from 2006, the pressure is on to achieve major discoveries.

Although the bigger discoveries are gas-condensate, several oil fields have been discovered. These fields and geochemical research, indicating similarity to prolific oil provinces in Southeast Asia, suggest the discovery of large oil fields is only a matter of time.

Commercial and sub-commercial discoveries, abundant potential source rocks, thick Cretaceous-Cenozoic sediments, and numerous hydrocarbon seeps and shows in exploration wells indicate widespread petroleum generation and migration.

Block awards

The tender in 4Q 2012 involved 23 blocks including 40,200sq km offshore. Five offshore exploration permits were awarded, with the remainder likely to be included in the this year's block offer.

Oil output has varied widely over the past 15 years, rising and falling year to year, from approximately 22,000b/d in 1997 to around 7000b/d in 2006 and then to around 16,500b/d in 2011, primarily from the Pohokura, Tui and Maari fields – Maui only producing about 1500b/d that year.

Gas production in 2011 averaged 395mmcf/d, mainly from Pohokura, Kapuni and Maui, all of it consumed domestically.

Proved hydrocarbon reserves are relatively modest, estimated at around 113 million barrels and about 1.2tcf of natural gas in 2011.

Hydrocarbon consumption in 2011, according to the *BP Statistical Review of World Energy*, was 148,000b/d of oil and 377mmcf/d of gas, each a decline from 2010. OE

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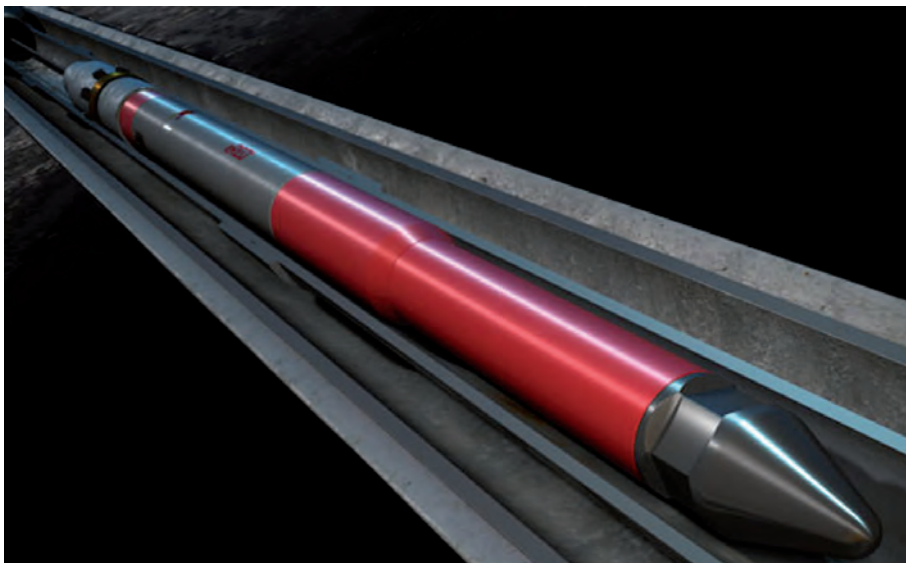
Solutions



eRed goes to Asia

Red Spider's remote open close technology, eRed, has been deployed in Malaysia and Vietnam. Working with Petronas in Malaysia, eRed removed wireline runs from completion operations, and reduced wireline interventions in a highly deviated well.

As part of a contract with Vietnamese firm Than Long JOC, Red Spider will deploy two eReds, pre-installed within a nipple profile, for testing tubing, setting production packer, flowing the well and barrier isolation.

www.redspiders.com

The right stuff

Bredero Shaw has launched a risk-reducing model for offshore pipeline coating projects called Complete Coating Assurance. The model intends to cover a project's entire lifecycle from concept to pre-feed and commissioning.

Complete Coating Assurance aims to cut project risk through the pre-designed and validated pipe and joint coating interface, which Bredero Shaw's VP of sales, marketing & business development, Gregg Johnson, said will not fail at installation. Bredero Shaw's production and delivery infrastructure, Johnson says, both reduce schedule and performance risk, respectively.

"The stakes are higher than ever, and so are the risks," Johnson said. "This model addresses the risk through product innovation, advanced technologies and deep experience."

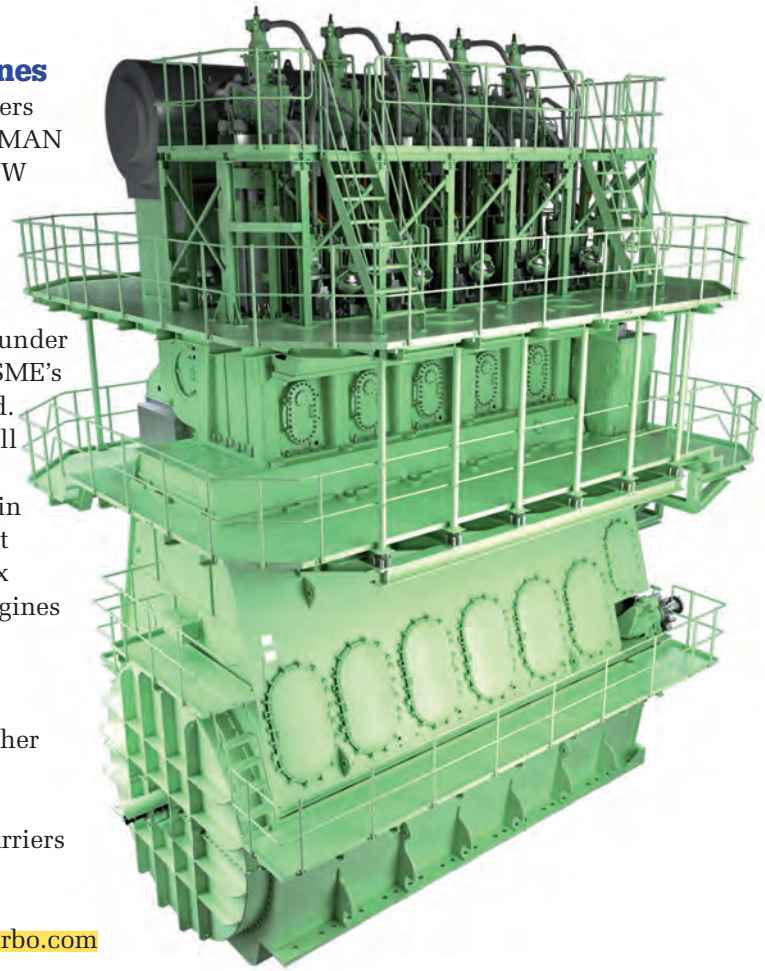
www.brederoshaw.com

Dual fuel engines

Teekay LNG Partners ordered two twin MAN Diesel & Turbo B&W ME-GI dual-fuel, two-stroke, gas-injection engines for two of its LNG carriers currently under construction at DSME's South Korean yard. The newbuilds will be equipped with M-type, ME-GI twin engines, which cut CO_2, NOx and SOx emissions. The engines are based on an ultra-long-stroke G-type concept, which enables higher propulsion plant efficiency.

Teekay's LNG carriers are scheduled for delivery 1H 2016.

www.mandieselturbo.com



Brazilian power pact

Petrobras has chosen GE Oil & Gas to power its four new FPSOs – the *P-74*, *P-75*, *P-76,* and *P-77* – bound for the Cessão Onerosa field in the Santos Basin pre-salt. GE's turbomachinery will generate primary energy for the FPSOs using gas turbines and advanced generators to move gas through pipelines via compressors and re-injecting CO_2 and natural gas back into the well to enhance oil recovery.

The contract's scope includes the supply of 16 powergen turbogenerators, eight turbo compression trains, and 32 electric motor-driven compressors for gas main, export services and CO_2 re-injection.

The contract win "demonstrated the strength of [GE's] integration," said Joao Geraldo Ferreira, president and CEO of GE Oil & Gas for Latin America.

www.ge-energy.com

SPOTLIGHT

Compact subsea LED

DeepSea Power & Light unveiled a new version of its SeaLite Sphere LED light. The 220Vac is a compact LED alternative to Halogen lights that are now available for 220-275Vac (50/60Hz) and 275-385Vdc input. DeepSea Power & Light said the SeaLite Sphere utilizes the same connectors, mounting bracket, input voltages, and dimming capabilities as the company's Halogen SeaLite products. The sphere operates in depths up to 6000m.

www.deepsea.com

Activity

Ocean Installer and **McDermott International** struck an alliance to pursue and execute North Sea rigid pipelay projects. The new partnership paves the way for a more permanent relationship. Along with Ocean Installer's expertise and North Sea organization, McDermott brings resources such as its DP2 lay vessel *North Ocean 105* (*pictured*) and new-build deepwater S-lay vessel *DLV 2000*, which will be available in 2015 and features a 2000te crane.

Carrizo Oil & Gas has agreed to sell its wholly-owned subsidiary, Carrizo UK Huntington, and its 15% interest in the North Sea Huntington field for US$184 million in cash to Calgary-based **Iona Energy**. The Houston-based explorer expects to net $116 million from the sale. E.ON Ruhrgas UK E&P operates Huntington field with 25% interest. Its partners include Premier Oil UK (40%) and Noreco (20%).

Halliburton has added remote, open-close technology specialists **Red Spider** to its Halliburton Completion Tools product service line. The Aberdeen-based Red Spider said the acquisition not only expands its geographical reach in Australasia, Brazil, Africa and the US, but also gives it access to Halliburton's facilities, operational support and logistical support.

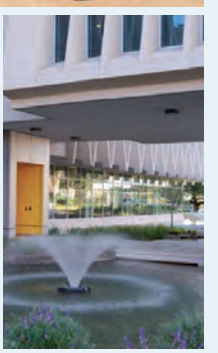
Oil Spill Response has united with Fort Lauderdale, Florida-based **Clean Caribbean & Americas** under the banner **OSRL**. The new organization will support adoption of best practices and will offer members enhanced response capability and equipment, training, consultancy, technical advice and project support. OSRL plans to open a Brazilian base later this year.

Aker Solutions acquired Canadian firm **AKCS Offshore Partner**. The

SPOTLIGHT

Technological investment will "spark new ideas"

Shell celebrated the relaunch of its Shell Technology Center Houston in January. The expanded facility contains one million square feet of laboratory and office space and houses 2000 Shell scientists and engineers, making it the largest of Shell's three worldwide technology centers. About 60% of the facility is newly built or renovated. The improvements cut CO_2 emissions by 30% and reduce energy consumption by approximately US$2 million/year. "This investment in innovation and a consistent commitment to collaboration are essential to spark new ideas and develop solutions to today's and tomorrow's energy challenges," said Matthias Bichsel, director of Projects & Technology at Royal Dutch Shell. Shell spends more than $1 billion annually on technological research and development.



company said the buyout supports planned future growth in North America as well as expansion into the St John's, Newfoundland & Labrador, and Atlantic Canada market. AKCS was formed by Aker Solutions, SNC-Lavalin and GJ Cahill & Co in 2002, to provide maintenance, modifications and operations services offshore Canada.

Aberdeen-based **EnerMech** announced plans for a new base in Bergen, Norway. The facility is part of the mechanical engineering firm's US$4.8 million investment in its Scandinavian business. "This [facility] will give us access to Norway's largest yard market and we are confident there will be a strong demand for our cranes, rental equipment, hydraulics and PPU services," said Trond Møller, EnerMech general manager in Norway.

FMC Technologies purchased 173 acres in Houston's Generation Park. The Houston-based company said the purchase affords the firm flexibility and options as it assesses its future needs in the area.

Robbins & Myers accepted **NOV**'s US$2.5 billion takeover bid. Shareholders will receive $60/share. The transaction transforms the engineered equipment and systems supply firm into a wholly-owned NOV subsidiary. The merger remains subject to approval by US and Canadian regulators.

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www.EMERGINGFPSO.com

On the Move

Brad Farnsworth joins Greene's Energy Group as chief financial officer. He comes to Greene's from NATCO Group where he served as CFO. Previously, Farnsworth was chief administrative officer at Dynegy and KN Energy. Based in Houston, he will report to CEO Bob Vilyus.

MicroSeismic has hired **Ganesh Murdeshwar** as vice president in its Calgary office. Murdeshwar will lead the sales, analysis, and operations teams. He comes to MicroSeismic from Tagle Information Technology, where he served as president and chief operating officer. Murdeshwar spent most of his career at IHS, which acquired his start-up, AccuMap.

Aquatic Engineering & Construction, an Acteon company, has appointed **Bill Smart** business development manager, North America. Smart joins Aquatic from Prime Source Packaging, where he was vice president of sales & service. Previously, he held engineering and project management positions with Oceaneering Intervention Engineering, Oil States, Unigraphics Solutions, and Global Compression Services.

Robert P Peebler has retired as Ion Geophysical's executive chairman. Former board chair **James M Lapeyre** Jr has replaced Peebler, who will remain a consultant to the company. Peebler served as president and CEO from 2003.

After 17 years at DNO International, managing director **Helge Eide** (*pictured*) has resigned his post. **Bjørn Dale** has been named interim replacement. Eide will continue to advise DNO on strategy and business development.

Stephen Lovegrove is the new permanent secretary at the UK's Department of Energy & Climate Change. Lovegrove replaces **Moira Wallace**, who left in October.

IHC Merwede has named **René Raaijmakers** (*pictured*) as offshore sales director, succeeding **Twan Voogt**. Raaijmakers is charged with all commercial activities within the offshore division. Since April 2012, he served as product director for renewables and manager of IHC Offshore Systems. Raaijmakers spent 14 years with FPSO contractor Bluewater, before founding OceanMill, which was bought out by IHC Merwede.

Thomas M Botts has joined John Wood Group's board as a non-executive director. Previously, Botts spent 35 years with Shell, beginning as a production engineer, later becoming treasurer for Shell's US activities, and global head of manufacturing.

UniversalPegasus has appointed **Terry Mienie** as business development director for the UK and international. Mienie, who joins from Penspen, will focus on growing the firm's UK subsea business.

Samsung Engineering has appointed **Michel Lainé** as chief operating officer of its newly established offshore segment. Lainé comes to Samsung from Saipem (France) where he served as chairman and CEO. His appointment underpins Samsung Engineering's bid to move into the offshore market.

Maria Lindenberg has taken over as Chevron's chief procurement officer, replacing **Leo Lonergan** who retires this month. Based in Houston, Lindenberg will head Chevron's enterprise-wide, supply-chain management activities. She joined the company in 2007 as VP of global downstream procurement before serving as general manager of supply chain management for Chevron in Luanda, Angola.

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Numerology

19 Gallons of motor gasoline obtained from one barrel of crude oil.
(Source: US Energy Information Agency)

6000 Products derived from crude oil including balloons, deodorant, denture adhesive, crayons, nail polish and credit cards.
(Source: Rankin Energy)

#1 California is the top consumer of gasoline in the US.
(Source: US Energy Information Agency)

359 The number of rigs scheduled for removal this year from the US Outer Continental Shelf.
(Source: US Bureau of Safety & Environmental)Enforcement)

40 Highest frequency, in GHz, defining the Ka band, used for communication bandwith. ▶See full story on page 52.

2,200,000 The number, measured in b/d, of LPG consumed in the US in 2011. *(Source: US Energy Information Agency)*

1179 Keystone XL pipeline, in miles, extending from Hardisty, Alberta, to Steele City, Nebraska. *(Source: TransCanada)*

24 Bobbins in a rope-closing machine at Bridon's new facility in the UK. ▶See full story on page 61.

2015 The year Subsea 7 takes delivery of a newbuild 18-person saturation diving system. ▶See full story on page 67.

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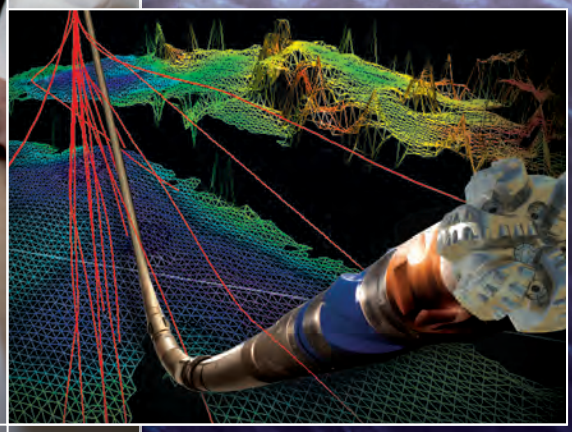

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Read the case study at
slb.com/Archer

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