



JEB TYRIE, Bridge Petroleum



BRUCE ROBERTSON, Weatherford

A new era of innovative thinking

IAN LEWIS, Contributing Editor

The industry's efforts to cut costs, reduce working times and improve efficiency have paid off handsomely over the last five years, making previously uneconomic fields viable and boosting the life and output of existing fields. The wealth of real-life case studies outlined at SPE Offshore Europe have highlighted that this work continues apace.

Wednesday's sessions on Smarter and More Effective Field Development were a case in point, covering themes as varied as subsea operating envelope review, marginal field hydrate formation, field redevelopment planning and dynamic wellbore modelling.

The North Sea industry has benefited greatly from innovative analytical approaches to field life extension, an good example of which is Bridge Petroleum's proposed Galapagos field redevelopment of the abandoned North West Hutton field and the adjacent Darwin discovery, some 130 km northeast of the Shetland Islands. The development could hold around 900 MMbbl of oil in place, of which the company hopes to recover around 40%.

Drawing up the redevelopment plan involved several multi-disciplinary teams, whose work included analysis of 20 years of production data from 52 wells, to identify production behaviour and confirm the target providing the basis selecting the development concept. This involved using gas-lifted production wells, with pressure maintenance through water injection.

A reference case of an FPSO with four subsea drill centres and horizontal wells completed with in-flow control devices and gas lift was used to devise an initial techno-economic model. The initial idea was for an FPSO capable of handling 90,000 bpd. However, improved understanding of the reservoir and flow control

valve (FCV) behaviour through extensive modelling and testing revealed that the project was only likely to require one with about half the capacity.

As Jeb Tyrie, Head of Technical at Bridge told the session: "We realised we were going to need a smaller boat!" The intensive optimisation of this development built on FCV, resulted in increased oil recovery, and drastically reduced both water injection and production with the net result that the required facilities could be shrunk.

Cutting completion times. Step changes have also been made in reducing the time needed for well completions. Typically, offshore completions are carried out over two or three trips which routinely take 8–10 days or more to deploy. Faced with costly day rates for high-specification rigs capable of drilling in deep water, Shell wanted to look at how completion times could be cut on its Bonga field, 120 km off the Nigerian coast in up to 1,500 m of water. Weatherford worked with Shell Nigeria Exploration & Production Company to come up with a single-trip, interventionless, sand control completion system and successfully install it. This involved the first full-system approach to the application of radio frequency identification (RFID) enabled tools in such a project.

Bruce Robertson, Weatherford's Geozone Technical Sales Manager, explained that the system was tested and evolved through a number of iterations in an onshore trial well environment leading to its first successful deployment in 2018. That resulted in an average completion installation time of five days, compared to the average of 10 days for deploying multi-trip completions at Bonga.

He said this single trip set-up was not applicable in all scenarios, notably at shallower depths, and it costs more than the conventional approach, but that this would be outweighed by the savings on rig hire through a shorter deployment.

Democratising data. Making complex data more accessible through easy-to-use visualisation tools has been a major theme at Offshore Europe, reflecting recent advances in know-how and computing power.

At another African project, Total E&P's Kaombo field in Angola's prolific deepwater Block 32, the wide range of often-complex reservoir conditions and the large subsea production system—with flowline lengths up to 25 km—called for an innovative approach to handling and interpreting large amounts of data.

Total's Julien Rolland told delegates how an in-house team went about developing a visual decision-making tool for the operator to handle normal and unplanned operations of the subsea system. The team developed operating maps and envelopes that enabled a wide pool of users to analyse flow assurance more easily than standard studies, he said.

The method is specifically adapted to complex economical and technical environments, with a focus on tightly defining the design margins of subsea assets. The tool helped efforts to broaden access to data across disciplines at the Kaombo project, as well as bridging the gap between project/development phase and operations.

"The data is accessible to everyone. Not only the specialists can talk about these sometimes-difficult topics, but everybody can use the tool—management, decision-makers, offshore people can check wherever they operate," Rolland said. •

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SCHEDULE OF SESSIONS AND SPECIAL EVENTS

FRIDAY, 6 SEPTEMBER 2019

- 09:00-12:00 **Beach Clean at the River Don**
- Field excursion to the River Don to help protect the environment and track pollution.
 - Register at the SPE Volunteer Page or email yp@spe.org.
- 09:30-13:00 **OPITO's Energise Your Future**
- Students will take part in interactive STEM challenges hosted by Shell. (Invite only)
- 10:00-12:00 **Late Life Management of Subsea Systems**
- Session will focus on maximising economic recovery and extending the life of operations of mature underwater UK assets.
 - Session Chair:** Neil Gordon, Subsea UK
 - Presentations by BHGE, EAME, EC-OG, Expro, PanGeo Subsea, STATS Group, 3D at Depth and Viper Innovations
- 10:00-12:00 **Security Issues in the Digital World**
- It is vital that the upstream industry introduce security barriers to eliminate weaknesses in the flow of digital data from drilling and production operations.
 - Session Manager:** Simon Bittleston, Schlumberger
 - Presentations by ABB, BP, Saudi Aramco and Schlumberger
- 10:00-12:00 **Integrated Technologies**
- Integrating technologies from different platforms, sourced through varied suppliers, is the key to success of this initiative.
 - Session Managers/Moderators:** Colette Cohen, OGTC; and Jim Lenton, Worley
 - Presentations by Babcocks, Bain and Co, BP and Robertson Group.
- 10:00-12:00 **Subsea Flow Assurance**
- Subsea production systems are increasing step-outs from gathering and processing facilities, generating challenges and opportunities to develop strategies to minimise risk and maximise production.
 - Chairpersons:** Drummond Lawson, Subsea Technologies Ltd.; and Colin McKinnon, Wood
 - Presentations by London South Bank University, TechnipFMC, Total and Wintershall Norge
- 10:00-12:00 **Technologies for a Mature Basin**
- As a mature basin, the North Sea is driving several specific techniques to ensure it remains competitive in today's market.
 - Chairpersons:** Grant Affleck, Weatherford; and Rebecca Allison, OGTC
 - Presentations by BHGE, Chevron, O&G Technology Centre, Robert Gordon University, Total, Tullow Oil and Weatherford



A good-sized crowd was on hand to attend the WellCONTAINED open house at the firm's Montrose facility during SPE Offshore Europe 2019. Image: Wild Well Control.

Wild Well Control hosts WellCONTAINED open house at Montrose facility

WILD WELL CONTROL

Wild Well Control, a developer of well control and emergency response services, and well control engineering and training, hosted a WellCONTAINED open house at its Montrose facility during SPE Offshore Europe on 5 September.

Wild Well equipment developed by the company, which is a Superior Energy Services subsidiary, was on display. Engineers and operations personnel were also onsite to discuss response capabilities.

Wild Well, a primary responder for international well blowouts, highlighted the recently completed expansion of the WellCONTAINED response facility and

its expanded capabilities. The open house included an assembled 15K 18¾ inch stack, as well as the new, regional 10K ¾ inch stack. Shears, dispersant equipment and additional ancillary equipment were also on display.

WellCONTAINED services include contingency planning and response from Source Control Emergency Response Planning (SCERP) through field deployment of one of its capping stacks to a subsea uncontrolled well. Wild Well has three response packages that are at a ready-to-deploy state in Aberdeen and Singapore. ●

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Get smart

IAN LEWIS, Contributing Editor

If you are looking for big data that could enable smarter operations, then the North Sea oil sector has amassed plenty over the decades, covering everything from field data to supply chain logistics. But a lot of it is scattered far and wide, and the industry has traditionally been reluctant to share. Now pressure is building for data to be pooled much more extensively, allowing the latest analytical tools to add value for all.

There was no shortage of examples of what the oil industry risks missing out on at Wednesday afternoon's "Smarter Innovations, Smarter Basin" session in the Decom Theatre, at the heart of a

bustling exhibition hall. Presentations on smart-mapping of cities, the ability to share data securely in the health sector, and even how the preparedness of an anti-perspirant manufacturer to share sensitive data eventually made it a fortune. They all had elements that could be adapted to add value in the oil and gas industry. In short, the message was that the industry has nothing to fear from a greater willingness to share data and, indeed, could gain enormously from it.

The Aberdeen-based Oil and Gas Technology Centre is at the forefront of the effort to provide the industry with the means to share data effectively. "We

have to work together to make this 'smart basin' a reality," said Stephen Ashley, the OGTC's Digital Transformation Solution Centre manager.

The OGTC has created a UK Hub Project, intended to provide a digital data exchange to transform the supply chain procurement process and become the single, online source of technical equipment information for the UK oil and gas industry. Data held there will provide the ability to recreate all North Sea facilities digitally with 3D representations of topsides, floating and subsea facilities, and to incorporate seabed bathymetry.

The OGTC is also seeking to create a "data trust," which involves creating a legal and governance framework designed to make the oil industry, eager not to lose its competitive edge, more comfortable with sharing project ideas. The Oil and Gas Authority also has adopted big data techniques to do its economic modelling. Simon James, the OGA's chief information officer, said the authority had built the largest oil and gas economic model ever built on the Palantir platform, covering virtually every element of UK North infrastructure.

Visualising dataSea. One key to better use of big data is to make it easier for humans to interpret. People are good at handling and interpreting large amounts of data, but it needs to be in the right format, which usually means converting into

a visual format, such as maps and graphs to make trends more readily discernible, Joel Mills, the chief executive of the Norwegian-based Offshore Simulation Centre, told delegates.

He illustrated this by showing how combining data covering a plethora of aspects of life in the Norwegian city of Ålesund could be combined into easy-to-absorb dynamic graphics to show where investment and efforts could be best targeted to produce the biggest improvements in services, traffic flows and other aspects of daily life.

Mills' company applies these kinds of techniques to the simulator at the UK's new National Decommissioning Centre (NDC) in Aberdeen, due to come online later this year, which is capable of using data drawn from the industry and other institutions to simulate a range of conditions and events in the North Sea.

Richard Neilson of the University of Aberdeen, who is NDC director, explained that the simulator would enable the impact of new technologies, that could cut costs and improve efficiency for North Sea operations, to be accurately modelled. That should mean that ideas can be turned into practical solutions much faster—vital for a decommissioning industry that has no time to lose. The Decommissioning Centre also offers hyperbaric testing, an indoor immersion tank, an industrial laser, a supercomputer and advanced workshops to help find those solutions. ●



JOEL MILLS, Offshore Simulation Centre



STEPHEN ASHLEY, OGTC

Big finds, big challenges ahead for Guyana

CRAIG GUTHRIE, Contributing Editor

Guyana expects more big finds as early as this week, and the small South American country is working hard to establish a stable governance and economic framework for the huge investment expected as a result of such discoveries, the country's chief investment official said at Offshore Europe 2019.

"There's been some big discoveries,

and by next Friday, we will be announcing another one," said Owen Verway, CEO of the Guyana Office for Investment, adding that he couldn't give more details at this stage. "We are one of the hottest destinations for the oil and gas industry right now and that is set to continue."

On 24 August, Eco Atlantic spudded the Joe-1 exploration well in the same

Orinduik Block offshore Guyana, saying results could be known in around three weeks. Earlier this month, Tullow Oil announced that the Jethro-1 well it operates with Eco Atlantic in the same block has been found to hold more than 100 MMbbl.

ExxonMobil and partners have also already made 13 discoveries totaling around 5.5 Bboe off the coast of the country since 2015. The oil finds are expected to have a major impact on the country of just 770,000, amid ongoing political uncertainty. In December, the David Granger administration suffered a vote of no-confidence, and while this is likely to trigger an election later this year, for now the process has been stalled by an appeals process.

"GDP is going to be doubling in a matter of 17 months. I don't believe another country in the world has experienced that speed of growth in the last century," said Verway. In 2018 the country's GDP grew 3.4% to \$3.6 billion, according to the World Bank. "There is a tsunami of cash investment coming into the economy, a huge increase in disposable income created by business activity," added Verway.

To mitigate the chances of suffering under the resource curse that has affected other oil-rich countries, he noted that the nation's energy officials are meeting regularly with officials from Scotland and the Canadian province of Newfoundland and Labrador to discuss policy, regulation, enforcement and development. "There is a draft of the local content policy that will hopefully be finalized by

November, and a sovereign wealth fund draft that should be enacted very soon after parliament is formed," said Verway.

Commonwealth spirit. Greg Quinn, British High Commissioner to Guyana, said that British investors, in particular, should look at the country's potential. "On the fundamentals, Guyana is not only the only English-speaking South American country, it also has an English-language common law system," said Quinn. "The courts system is, therefore, very familiar to British companies."

He added that while there is bureaucracy and other issues around ease of doing business, for example electricity supply, that as a Commonwealth country, it shares a lot of values seen in the UK. "As a place for the British to work and do business, it will feel very familiar, apart from the sunny weather."

Lack of data. Verway said that the process of legislating for the expected oil boom would benefit greatly from more detailed economic analysis of every financial sector being available. "Decision-makers need some critical analysis and projections to seize the strategic opportunities."

He cited the Tullow discovery as an example of where there was a need for a value-chain analysis that could inform stakeholders. "How have situations like this played out in Scotland, in Newfoundland or in Houston? What is the investment required and the returns? That level of analysis still hasn't been conducted." ●



GREG QUINN, British High Commissioner to Guyana



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Award to inspire next generation of HSE leaders

Nominations are now open for the "2020 IOGP Outstanding Young Professional Award," hosted by the International Association of Oil & Gas Producers (IOGP) in association with the biennial SPE Health, Safety, Environment and Sustainability Conference.

"Our industry needs competent and confident leaders for decades to come," said Gordon Ballard, executive director of IOGP. "This award aims to inspire the next generation. We want to recognize their efforts to promote safe, responsible and sustainable exploration and production operations."

Now in its third year, the award celebrates the achievements of an individual with fewer than 10 years of professional E&P experience. The winner must demonstrate professional accomplishments and evidence of outstanding talent, dedication and leadership working in at least one aspect of health, safety, security, the environment sustainability and/or social responsibility.

IOGP is looking to senior members of the industry to nominate young professionals, who meet the award criteria. Nominees must:

- Be well-respected and in good standing within the community.
- Serve as a role model for other young professionals.
- Demonstrate noteworthy professional and personal achievement.
- Demonstrate commitment to excellence and proven leadership.
- Exhibit expertise, passion and the ability to inspire others.

A special awards committee will announce the winner at the SPE International Conference and Exhibition on Health, Safety, Environment, and Sustainability in Bogotá, Colombia, March 17–19 2020.

The winner will receive:

- Outstanding Young Professional Award certificate and trophy
- Complimentary registration to the 2020 SPE Health, Safety, Environment and Sustainability Conference
- Two-year membership to SPE
- An invitation to join the Award & YP Committees for the 2022 Conference
- Recognition on the IOGP website and newsletter

- Recognition on the SPE Conference website

Award selection process. The Award Committee, consisting of SPE members, other prominent industry figures and IOGP officials, will select final candidates in December 2019. These candidates will then be asked to prepare a short

video presentation in time for a final round of judging in January 2020. The winner will be notified towards the end of January 2020.

The International Association of Oil & Gas Producers (IOGP) is the voice of the global upstream industry. Oil and gas continue to provide a significant proportion of the world's energy to meet grow-

ing demands for heat, light and transport.

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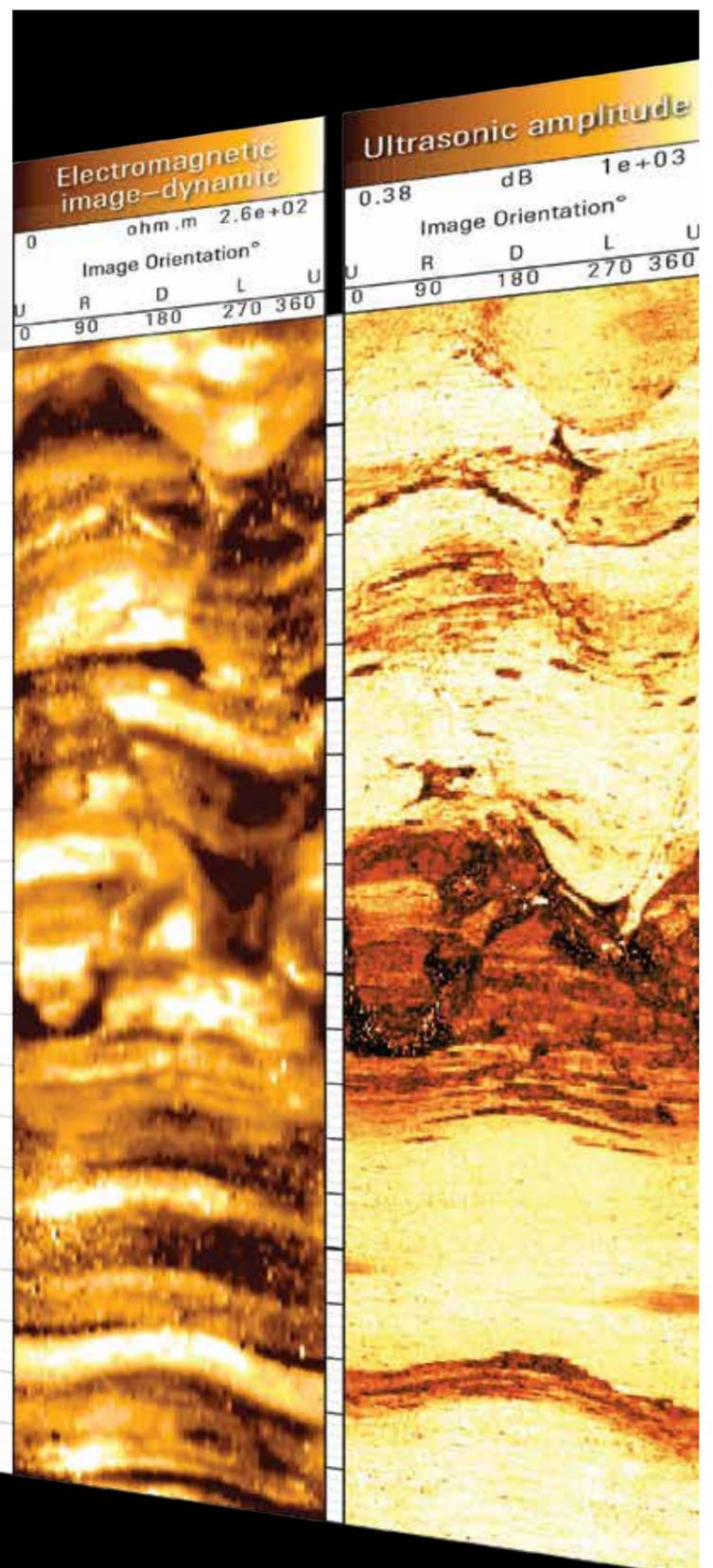
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The 2020 IOGP Outstanding Young Professional Award will be selected in January.

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Schlumberger

Weatherford's Clegg says Magnus tool is proving its worth

KURT ABRAHAM, Editor



JOHN CLEGG, Weatherford Fellow, Drilling

Weatherford's John Clegg, who spent the previous three years as the firm's director of Research, Development and Engineering, was recently honored with a new title in the company. He is now known as "Weatherford Fellow, Drilling," a first-of-its kind honor and title within the firm. Now based in the UK, Clegg is effectively Weatherford's subject matter expert in drilling.

The status of Magnus. In the new role, Clegg is carrying forth a number of messages about his company's products, particularly the Magnus rotary steerable system, which was commercialized earlier this year. And introduction of the tool is going well. "We just launched it in Europe, and we have just drilled our first well here," says Clegg. "We've also done a lot of work in the Middle East. We've had really good results in Kuwait, the UAE and Saudi Arabia. So, we've taken the basic Magnus tool outside of North America. It has been flawless so far, in Kuwait. And we've had some very good results in UAE and Saudi. We're also still pretty much flawless in Mexico. I think we've drilled nearly 70,000 ft there, with over 98% operational efficiency. So, it's working really, really well.

Since the initial commercialization, Clegg said that Weatherford has intro-

duced the 9½-in. Magnus tool, which is for a 12¼-in. hole. And so far, that version has been running in the U.S., particularly in the SCOOP area of Oklahoma. "There's a lot of vertical control work there," noted Clegg, "and they were at about 98.5% efficiency with 19 runs, 18 of those flawless."

SCOOP work and elsewhere. The 9½-in. tool is working very well in the SCOOP, said Clegg. "It's difficult drilling," explained Clegg. "There are a lot of trips for bit failures. But so far, only one minor issue with Magnus. So, I think MTBF is over 2,000 hrs, so far. This is enabling them to drill those difficult vertical sections a lot faster and effective than what was being done with steerable methods."

He says that this version of the tool will work its way out of North America soon. In addition, Weatherford just completed its first couple of 11-in. tools, for hole sizes between 16 in. and 17.5 in. "And that's likely the first tool that would come to the North Sea," elaborated Clegg. "I can't guarantee that, because it depends on what the applications are and where the tools go. But I'd say, most likely, the first job in the North Sea with Magnus will be in a larger hole size. So, probably the 11-in. tool, and that's going to be in the early part of next year."

Usage in Europe. Clegg says he sees the tool seeing extensive use throughout the North Sea region, once some initial field trials are finished onshore Europe. "The first onshore run in Europe, the first deployment, is actually in Central Europe. And we've drilled that section to TD. So, our first job in Europe is a success. They're laying down the BHA, as we speak.

But yes, we see it being used extensively throughout the region. We're keen to get it into the North Sea and build on some of the success that we've had in the region with our LWD.

Design benefits. Clegg says that the Magnus tool was designed with a few things in mind, because work on it was started after the late-2014 industry downturn. "Pricing was poor, and nobody had

any money," Clegg remembers. "So, we obviously designed it for reliability. And it has three steering pads on the outside. We designed it, so that all three of those pads would be independent of each other while working in tandem with each other. And that achieves a couple of things. First, it gives you more reliability, because in the unlikely event that one of them was to fail, you could still drill with the other two. You could still steer the well and drill a lateral with the other two. If one of the pads fails, we can still land the well."

He says the other thing the design gives drilling personnel is more control over direction. "It means that we can turn the tool off and not have it steering when we don't want it to steer," explains Clegg. "Which means that we control it perfectly straight, if we want to drill perfectly straight, or with a combination of steering and switched-off, we can drill a perfect hole. And it also means that by being able to switch them off, we can do things like drilling out casing and reaming, and operations where you really wouldn't want a rotary steerable to be pushing or tilting the bit."

Furthermore, notes Clegg, "when you can switch all the pads off individually, or collapse about a quarter-inch on the gauge—we see that as a big benefit. That was something that a lot of operators came and asked us for. They said, we like the rotary steerables on the market, but we'd love one where you can switch off, when you don't need it, and effectively not have it there. That was one of the things we did with Magnus."

Easier repairs. The Weatherford Fellow points out that Magnus is easier to repair. "You don't have to fly it to another country or continent, or a big repair shop with big test machines and stuff like that," he explains. "It's designed so that all of the wear parts and erosion parts are contained in three modules. And they can be removed and replaced in just a few hours, sometimes at the drilling site. I have been there when we've done it in about three hours. And then, you can return the unit to service. You can either dismantle and

repair those modules, or you can send them back, and they're FedEx package-sized, so it's easy to ship them around the world.

"And so, the asset stays in service," he continues, "which helps with the economics. It's a big driver for economics and rotary steerables, and it makes it much easier to operate in locations where you might otherwise think twice about rotary steerables, because of the cost of setting up a repair location. If you already have a workshop with an overhead crane and a breakout machine, then the cost of our repair location setup is basically a tool chest. It's a few thousand dollars."

Other benefits. Clegg says Weatherford made Magnus "very, very slick, because, as people are drilling minimum stress wells (as in the Middle East), and getting more and more issues with stuck pipe, and all rotary steerables have a lot of stuff in them—sensors electronics, mechanisms, things like that—and so, because of the lack of real estate, it makes them fat; they get big. Particularly if you have a drive shaft and non-rotating sleeve, you've got to have a drive shaft big enough to take torque to the bit, and then there are bearings and then a sleeve outside of it. That makes it very, very big. And we didn't want to do that, because if you design a tool like that, you're designing a tool that's going to get stuck. And so, we deliberately designed it as slick as possible. So it's as slim as possible—everything rotates, there's no drive shaft, no bearings to worry about. And all stabilization is under-gauge."

Clegg says the other thing that Weatherford thought about, when designing Magnus, was to make it compatible with the high torque and speed coming out of modern top drives and motors. "It's another reason why we chose not to have a non-rotating sleeve and drive shaft, because by making it a single-piece construction, the whole construction can take the torque. So, you've got more diameter to take the torque to bit. We expect torque available to the bit to continue to improve, to increase. ●

UNIQUE GROUP'S £MULTI-MILLION INVESTMENT REFLECTS EUROPEAN GROWTH PLANS

Unique Group, a leading integrated subsea and offshore solution provider, continues to implement its ambitious UK and European growth plans, via a £multi-million investment programme. Reflecting an



MATTHEW GORDON, Regional Vice President, Unique Group

increased demand across solutions and support services, the company's regional development strategy has included the recent expansion of its Aberdeen and Werkendam (Netherlands) facilities.

Appointed in May 2019, Matthew Gordon, Regional Vice President for UK and Europe, oversees Unique Group's UK and European expansion. "So far, 2019 has seen Unique Group embark upon a period of significant growth in our UK and European business, with particular reference to our subsea survey, and buoyancy & ballast capabilities," said Gordon. "This includes upgrading our Aberdeen premises by around 50% to facilitate our ever-extending survey capabilities, whilst our Netherlands-based SPHL (Self-Propelled Hyperbaric Lifeboats) facility has expanded to meet growing client demand for our specialist hyperbaric products."

Almost a year after the company acquired Aberdeen-headquartered Water Weights, Unique Group's Buoyancy & Ballast division has also announced renewal of an annual load-testing equipment contract with a leading crane services provider in Aberdeen,

whilst confirming it has added 110-t Water Weight bags to the equipment available for sale or rental via the upgraded Aberdeen facility.

Gordon continued, "The multi-million-pound investment in our assets, technology, people and facilities is a clear reflection of market demand for our products and services, as well as our own confidence in, and commitment to, the offshore energy market of the North Sea and beyond. We have seen a growing requirement for our technical capabilities and services in the Scandinavian region, which is another key focus area for us."

Known for its innovative diving and hyperbaric technology, Unique also confirmed its position as market leader in the production of self-propelled hyperbaric lifeboats (SPHLs), having manufactured a global record of 77 SPHLs, since production began in 2007. Mandatory onboard all dive support vessels, hyperbaric rescue facilities, such as SPHLs, are used during emergency evacuation of the mother ship, rescuing divers and securing them safely in a pressure chamber to avoid any interference with the saturation/decompression procedure. ●



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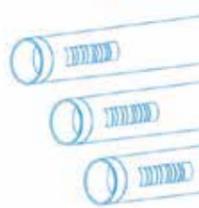
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AI-enabled offshore safety solution monitors a rig's high-risk zone

SEADRILL LIMITED

Seadrill Limited has introduced Vision IQ for offshore drilling rigs, a next-generation AI-enabled safety technology, which monitors and provides advanced warning of potential risks in the area of highest risk, called the red zone. The red zone is the area of the rig floor, where heavy drilling equipment operates and the risk of injury is highest, **FIG. 1**. Seadrill plans to make the technology behind Vision IQ available to peers as part of its commitment to driving safety in the industry. Some features and deployment include:

- Vision IQ was piloted on a Seadrill drilling rig under contract offshore, in the U.S. Gulf of Mexico, with an international oil company.
- It will be deployed on 12 rigs by the end of 2020.

- An automated safety process to identify offshore workers in the red zone and eliminate human error.
- Vision IQ is a non-exclusive solution developed by the Marsden Group, a global technology company, in conjunction with Seadrill.

A pioneering safety system, Vision IQ combines artificial intelligence (AI), laser imaging, detection and ranging (LiDAR) and advanced edge computing technology to ensure safer and more efficient operations in the red zone for all of Seadrill's offshore rigs and drillships. Comparable to the use in autonomous vehicles, LiDAR technology surrounds the red zone of the rig to create a dynamically monitored environment,

while Vision IQ's advanced AI technology allows real time monitoring of the red zone, using 3D visualisations, **FIG. 2**.

This holistic view enables users to pinpoint the exact position of crew members on the rig floor in relation to moving heavy equipment and provide advanced warning of potential hazards, thereby limiting scope for human error. Vision IQ is precisely engineered for offshore drilling and can be integrated into the rig's anti-collision system, creating a more unified, seamless approach to safety.

The introduction of Vision IQ is a significant step forward in improving offshore workers' safety. For this reason, Seadrill has committed to voluntarily share the technology behind Vision IQ with its peers in the industry. The importance of Vision IQ in revolutionising the industry cannot be understated.

How red zone management works.

The Vision IQ red zone management system feeds live 3D imagery to red zone owners. The system can be installed

for constant monitoring of permanent red zones, such as the drill floor, or at temporary sites on the vessel. Wireless connectivity gives the Vision IQ system true versatility and manoeuvrability onboard and allows owners full vision of critical safety areas.

Red zone management in action.

Seadrill red zone management monitors display a live feed from the system locally or remotely, and alarm warnings are sounded, when a hazardous situation is identified. Onboard systems can be set to automatically shut down equipment, making red zone areas even safer, while at the same time drilling operations can continue efficiently when warnings are immediately heeded and acted upon. The management system is fully portable and can be installed in any area of the vessel, where risk of injury or equipment damage is high, reducing the risk of incidents and mitigating potential downtime.

Seadrill CEO Anton Dibowitz said, "the introduction of Vision IQ is a major advancement in ensuring worker safety and improving the environment for our offshore crews. The safety of our people and our operation is fundamental, it is the cornerstone of our business. Vision IQ will help transform red zone management.

We have committed to sharing this technology with the wider industry, as it is the right thing to do, given the significant safety benefit it provides. Vision IQ also supports Seadrill's sustainable business approach, as safety is at the heart of our culture and will deliver a safer operation for our customers." ●



FIG. 1. Virtual outline of red zone, where heavy drilling equipment operates, and the risk of injury is highest. Image: Seadrill Limited.



FIG. 2. LiDAR creates a dynamically monitored environment, while Vision IQ enables real-time monitoring of the red zone using 3D visualisations. Image: Seadrill Limited.

SCHLUMBERGER TO DEPLOY DELFI ENVIRONMENT ENTERPRISE-WIDE FOR WOODSIDE

SCHLUMBERGER

An enterprise-wide deployment of the DELFI* cognitive E&P environment was



FIG. 1. DELFI leverages E&P domain software expertise and digital technologies to improve operational efficiency and deliver optimal production.

announced recently by Schlumberger, via a seven-year technology collaboration with Woodside Energy. Woodside will leverage this secure cloud-based software environment to increase consistency, reduce study cycle time and foster innovation in its subsurface characterization and development activities.

The DELFI environment delivers extensive integration and connectivity across E&P domains from planning to operations, built around openness and extensibility. The environment leverages 40 years of E&P domain software expertise and digital technologies, including security, analytics, machine learning and high-performance computing to improve

operational efficiency and deliver optimal production, **FIG. 1**.

"The DELFI environment will help Woodside meet their ambitious corporate goals by enabling their teams to collaborate seamlessly and work on the leading E&P software platforms and the new native solutions for the DELFI environment. Woodside will also be adding their own intellectual property and workflows to achieve accelerated innovation," said Trygve Randen, president, software integrated solutions, Schlumberger.

Shaun Gregory, chief technology officer and executive V.P., exploration, Woodside Energy, added, "Woodside pioneered the Australian LNG industry more

than 30 years ago, and now we are taking steps to lead the E&P industry's digital transformation. Enterprise deployment of the DELFI environment will help us achieve our growth strategy by reducing time to final investment decision and lowering technical unit costs."

The seven-year technology collaboration will give 200 global petrotechnical users at Woodside full access to the DELFI environment, including the Petro-technical Suite, the Planning Suite and the developer capability for further collaborative innovation projects. The data management and transition services provided will enable successful deployment. ●

*Mark of Schlumberger.

Norway and UK lead subsea market with wave of greenfield projects

HENNING BJØRVIK, Product Manager-SubseaCube, Rystad Energy

The subsea market in Norway and the UK is set to take off, buoyed by a tide of new greenfield projects. Subsea tree installations in the North Sea are poised to rise rapidly during the next three years, driven by a rising number of greenfield subsea projects in Norwegian and British waters that are expected to materialize through 2021. Reported and forecasted data show that the number of projects committed to, since the uptick started in 2017, is already fairly high. Rystad Energy expects to see FIDs increase further in 2020 and 2021.

Subsea tie-back wave. Of the offshore projects in Norway and the UK that we expect will be committed to over the next three years, as many as 67% will be subsea tie-backs. Prior to the downturn that hit the market four years ago, the historical average of subsea tie-back projects committed to each year (from 2000 through 2014) was only 47% of offshore projects. This shift in market share demonstrates a greater preference by E&Ps for subsea tie-back solutions in Norway and the UK, post-downturn. The trend fits well with the overall direction we observe in offshore developments, which shows increasing numbers of scaled-down projects, phased solutions and accelerated developments. These options typically improve the break-even price of the projects, but they do not optimize a project's net present value (NPV).

Clearly, the expected rise in greenfield spending by E&Ps on subsea equipment and installation over the next five years is driving the recovery of the entire subsea market in Norway and the UK. The annual growth of the subsea greenfield market is predicted to be as high as 21% from 2018 to 2023. This growth rate drops to 12%, when brownfield, exploration and decommissioning work within the subsea market are included.

Greenfield growth in Norway and the UK is expected to be much higher than what we predict for the global market during the same period. Rystad Energy forecasts that the global market will grow 16% annually during the same time-frame. The oilfield service sector faces a long road ahead before it will return to 2014 levels, yet the subsea market in Norway and the UK could achieve full recovery as soon as 2023. This is years ahead of the expected recovery for the subsea market globally, which is not anticipated until 2026, at the earliest.

Subsea greenfield expenditure in Norway and the UK (FIG. 1), having bottomed out at approximately \$1.6 billion in 2017, showed strong recovery in 2018, with a 23% year-on-year increase. The picture is less rosy for the global subsea greenfield market. Rystad Energy sees that market bottoming out during 2019 at slightly above \$10 billion, a decrease of around 9% from 2018.

Despite a sluggish global market, we expect subsea tie-back projects to account for the vast majority of greenfield subsea spending growth by E&Ps during the next five years. This forecast is supported by the encouraging number of subsea tie-back projects expected to

be committed to over the next three years in Norway and the UK, as well as those committed to during 2017 and 2018. Some years could even see subsea tie-back projects account for over 80% of greenfield subsea spending.

Rystad Energy continuously collects and combines data from thousands of available sources and uses these to build up, adjust, and calibrate its own outside-in perspective on the industry. Main sources are governmental databases and archives, company presentations, professional and scientific reports, and media, as well as user feedback. The aim is for multiple sources for each datapoint. Proprietary rules and calibration are used to fill and forecast data. ●

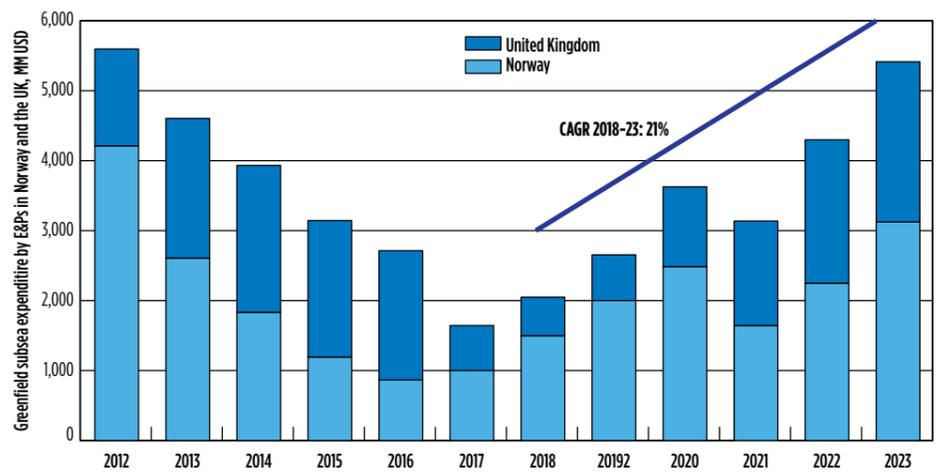
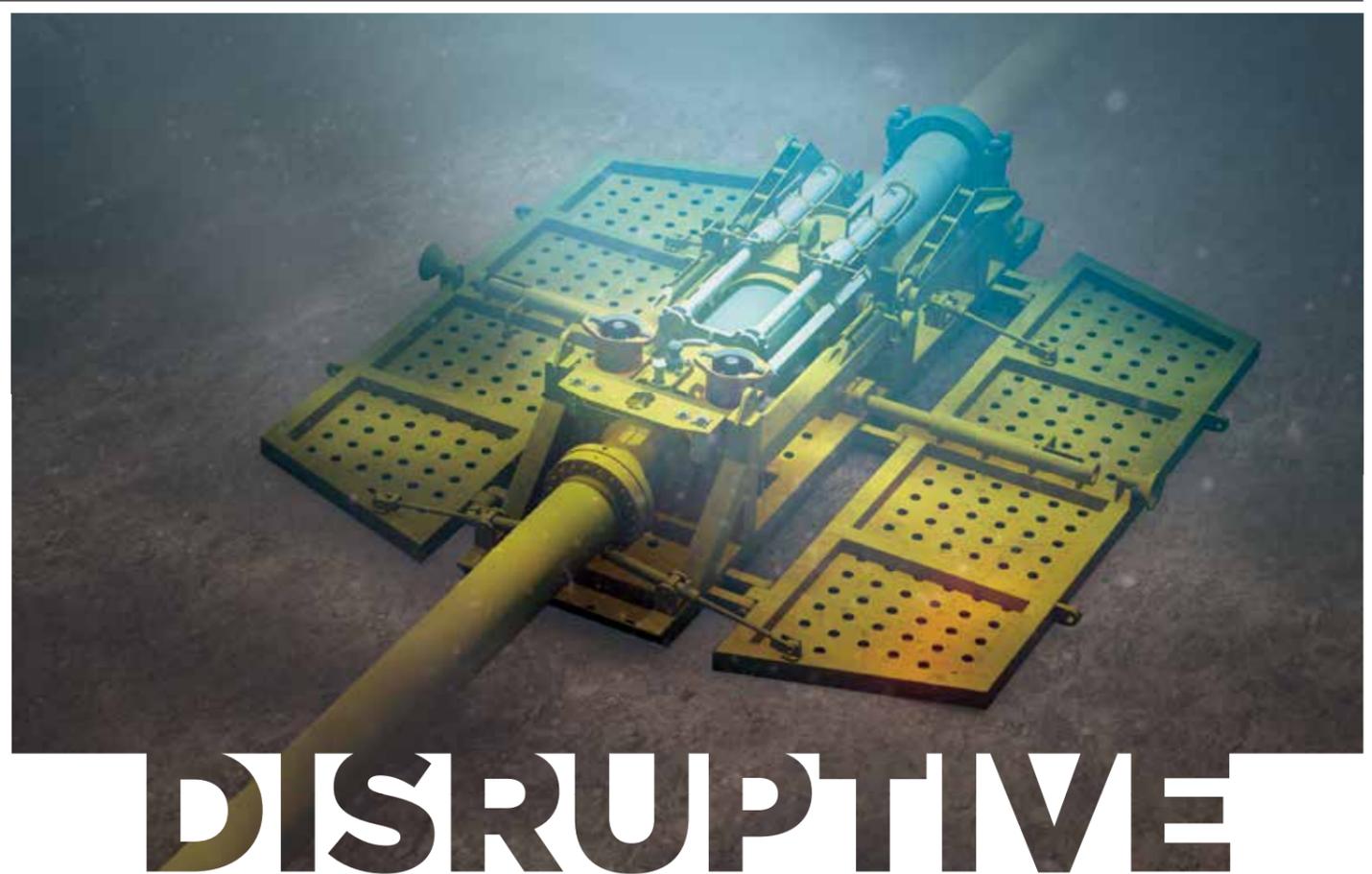


FIG. 1. Greenfield subsea expenditure by E&Ps in Norway and the UK. Chart: Rystad Energy.



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Subsea 7 integrates engineering talent from beyond oil and gas

SUBSEA 7

With activity in the North Sea increasing steadily, recruiting HR talent is back on the agenda. Experienced engineers from all disciplines are being encouraged to forge a new career in the subsea sector, and bring fresh insight, ingenuity and innovation to North Sea operations. Subsea 7, a global leader in the delivery of offshore projects and services, is inviting applications to its successful Engineering Conversion Programme.

A new career. Since 2005, the programme has provided a unique opportunity for engineers from aerospace to automotive, and onshore construction to ex-military/forces, to begin a new and exciting subsea career. More than 70 engineers have gone through the programme.

The intensive programme delivers a mix of classroom-based internal training and external activities, with Subsea 7 site and vessel visits, visits to subcontractors and offshore survival training. It transforms ingrained skills to suit a range of live projects,

ranging from inspection, repair and maintenance (IRM) to major engineering, procurement, installation and construction (EPIC) developments. The ongoing training, development and mentoring provide an in-depth introduction to subsea engineering across the energy lifecycle.

Tom McNamee, Business Unit Engineering Resource Manager with Subsea 7 (FIG. 1), said the programme fully equips entrants to hit the ground running. "It is a real job. Successful participants will already have an engineering background, and embody the right behaviours and attitude to adapt to the demands and diversity of subsea work."

"What this programme offers is a supportive, professional and effective way to quickly fill any knowledge gaps, to ensure each candidate's transition is as straightforward as possible. The support and encouragement the programme gives, continues throughout their career with Subsea 7."

According to Oil & Gas UK, global energy demand is increasing and, by 2035, will have grown 30%. The growing need

for energy, from all sources, and the importance of digitalisation, will place continued pressure on traditional methods of recruitment. The Engineering Conversion Programme complements these methods by casting the net for new recruits, far beyond the confines of oil, gas and renewables.

Career transition and long-term progression.

"Since the programme started, conversion engineers have worked their way right up to senior engineering management levels and into project management," added McNamee. "It is a programme which has transformed lives and given engineers without typical academic and work backgrounds the opportunity to grow and develop their talents in what is for many, an unknown and unfamiliar sector. We, as a business, also learn from their experiences and skillsets gained in other industries."

In his early engineering career, Paul Kelly (FIG. 2) product-engineered petrol pumps for forecourts and, having gone through the conversion programme 11

years ago, is now a project engineering manager. "The best thing about the programme is the smooth transition from one engineering discipline to another. You receive a thorough understanding of the technical, commercial and safety aspects of working in the subsea sector, plus form working relationships with colleagues and peers across the business."

"It was the professionalism within the energy industry that brought me here but what's kept me at Subsea 7 is the diversity of projects, the people and my evolving role within the company."

Rachel Souter (FIG. 2) recently completed the programme. She previously worked at a paper mill in Aberdeen, and was the first and only woman in the company's 300-year history to work as a machine technician. "It's great to see both men and women in engineering play an important role in Subsea 7's success. I enjoy being part of a diverse team, and I'm currently working on a North Sea IRM project that's been a good match for my skills and experience."

"I think the most important thing about the conversion programme, is that it widens your industry knowledge in preparation for the job you are about to do. For those looking for a career change, the subsea sector has it all. Just go for it."

Upbeat for the upturn. Subsea 7 is leading the charge to entice and invest in its engineering talent, now and in the future. In Aberdeen alone, there are more than 25 vacancies across a range of roles. "The past few years have been difficult for everyone in the industry, but we're feeling positive and looking forward," said McNamee. "The conversion programme will once again make a difference and we expect a great deal of interest. Unlike other initiatives of its kind, this really puts the onus on the individual to be involved and helps them to quickly become part of our subsea family." ●



FIG. 1. Tom McNamee. "Our recruiting programme quickly fills a candidate's knowledge gaps, to ensure the transition is as straightforward as possible."



FIG. 2. Paul Kelly and Rachel Souter are now working in the subsea sector after starting their engineering careers in different industries.

Gyrodata announces release of Quest GWD tool for surveys in real time

GYRODATA

Yesterday, 5 September, Gyrodata Incorporated released a new gyro-while-drilling (GWD) tool during SPE Offshore Europe 2019. The Quest™ GWD system (FIG. 1) provides all-attitude, high-accuracy, high-performance surveys in real-time as drilling progresses.

The Quest™ GWD is the second release that utilizes Gyrodata's innovative SPEAR solid-state technology. This ground-breaking technology reduces gyro surveying time and the error of ellipse for increased speed, precision, efficiency, accuracy and reliability. This improved accuracy helps operators avoid lease lines, mitigates frac hits and enhances ability to hit hydrocarbon-rich target zones.

Performance characteristics. The solid-state sensor package is not affected by shock and vibration or magnetic interference. As a result, drillers can safely



FIG. 1. The Quest™ GWD (gyro-while-drilling) tool is the second release that uses the firm's SPEAR solid-state technology.

steer around existing steel casing and magnetic anomalies. The Quest™ GWD also improves the ellipse of uncertainty by up to 154%, compared to competing MEMS GWD systems, while being nearly three times faster to perform surveys. Additionally, the Quest™ GWD's efficient Coriolis Vibratory Gyro assures precise wellbore guidance for collision avoidance and trajectory placement.

The tool provides continuous inclination and tool face from vertical while sliding, as well as full surveys on demand. Overall, the Quest™ GWD tool also offers operators shorter surveying time, greater transparency and improved decision making, which allows them to reach survey-reliability goals cost-effectively.

Gyrodata was founded in 1980, in Houston, Texas, by a team of industry veterans, who recognized a gap in the market for reliable, accurate surveying technologies. Gyrodata's products and services portfolio enables its clients to maximize hydrocarbon recovery and optimize an asset's lifecycle cost. With approximately 1,000 employees in over 50 countries, the company is now one of the world's leading providers of technologies and differentiated services to the energy industry. Our most important asset is our people, and we have an extraordinary team of committed individuals located around the world. Our team is what makes us unique. Defining and embracing our vision, values and behaviors is the foundation for our culture. ●

Smarter subsea standardisation attractive to operators

TOM BRYCE, Marketing Director Enpro Subsea

The ongoing need to standardise and streamline projects remains high on the agenda for operators around the world. Standardising complex subsea hardware reduces project costs and delivers increased efficiencies. While organisations have made important in-roads, low-cost standardised hardware continues to elude both the operators and the supply chain.

There have been numerous global, regional, industry and operator-led initiatives to standardise specifications, interfaces, materials and even T&Cs, to reduce project costs and time to delivery. Some of these have been successful; others less so. The subsea industry has reacted, with all major OEM subsea production systems (SPS) providers now marketing their own leaner, lighter, fast-track hardware.

One of the challenges is that procurement decisions for this subsea hardware are typically made by operators at the early stages of projects. These specifications are often compromised, due to limited well data and a lack of visibility regarding production development challenges.

In the past, the functional design specification for trees may have started off as a simple low-cost “standard” product, but prudent development strategy mandated that some of the extras, add-ons, redundancies and contingencies get added back into the simple specification. With the best of intentions, what started off as “stan-

ard” becomes “special,” and what started off as a 10-month delivery has doubled to 20 months, pushing respective budgets and schedules to the right. Worse still, the “special” then gets rebranded as the new “client standard” and is adopted across multiple fields and assets as a “can do everything” specification.

Production-enhancing technologies. Until recently, it wasn’t apparent how projects could ensure both future-proof production-enhancing contingency solutions *and* a low-cost, simplified, standard subsea infrastructure. With this double-edged challenge in mind, we developed our patented Flow Access Module (FAM) technology.

Since the first FAMs were deployed in the Gulf of Mexico during 2016, more than 60 have been adopted globally. The benefits of a new “smarter standardisation” strategy are being adopted by both majors and independents.

FAM is an enhanced subsea architecture that enables capital-efficient flexible field development. It allows operators to integrate project-specific enhanced production technologies onto standard and stock subsea hardware. It consists of a FAM “hub,” which creates an enhanced production “USB port” within the jumper envelope and a FAM peripheral module that houses the enhanced production hardware. This

enables a range of production-enhancing technologies—flow measurement, flow assurance, HIPPs, fluid intervention, subsea boosting and data acquisition. These are all easily installed and changed out at any stage throughout life of field.

Therefore, in addition to the low-cost, lightweight, small footprint and faster delivery advantages offered by the OEM SPS manufacturers, FAM delivers

enhanced production opportunities and life of field flexibility. The range of solutions which can be deployed is significant, **FIG. 1**.

FAM technology aligns with the drive for standardisation to enable fast track, capital efficient field development. Operators no longer need to decide between fast oil faster, capital efficiency, or maximum recovery—they can have the best solution for all three. ●

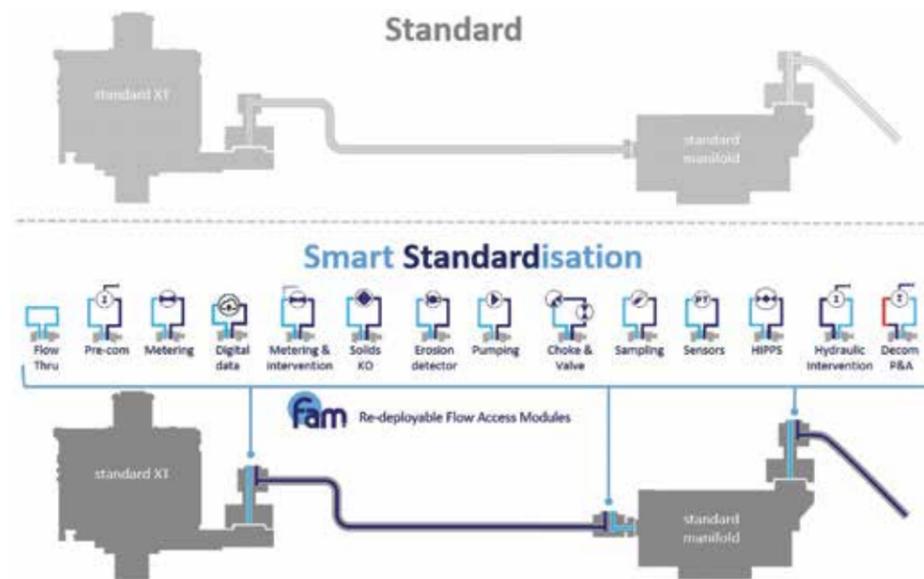


FIG. 1. Range of enhanced production FAM solutions that can be delivered using the FAM-enabled enhanced architecture. The top image shows typical subsea production hardware, versus a FAM-enabled tie-back in the bottom image.

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Araujo sees standardization, digitalization refining subsea practices further

Interview with **LUIS ARAUJO**, CEO, Aker Solutions

Luis Araujo was named CEO in July 2014 after joining Aker Solutions in 2011 as president for the company's Brazilian operations. He has more than 30 years of oil and gas industry experience, including senior posts at GE, Wellstream, ABB and FMC Technologies. He holds a BEng degree in mechanical engineering from Gama Filho University in Brazil and an MBA from the University of Edinburgh in Scotland. Recently, in a Q-and-A session, he offered his views on a variety of subsea technology issues.

OE: How is the industry progressing in its efforts to make subsea increasingly competitive?

Araujo: Worldwide, EPC suppliers are manufacturing standardized subsea equipment that is smaller, lower-cost, and simpler to ensure predictable quality and repeatable volume. We believe the key is to standardize and re-use as much of the delivery as possible, but to allow some limited ability to configure and tailor to field needs. We are working on how to use standardization to also improve total field efficiency and accelerated delivery

with, for example, automated engineering software, configurable product platforms and standardized subsea hardware components. We can automate more of our execution chain and reduce project engineering lead times, because equipment is standard, yet the design is still configurable, using a suite of standard components. For example, our vertical subsea tree is standardized but can be configured through the flow control module to match field requirements. Our control module is standard but can be configured at a software level. These allow the same products to be used globally by the same customers.

OE: What's coming next to prevent the cost inflation we've seen in previous years?

Araujo: I think the real cost-saving potential comes from early involvement in a project, when a supplier can take an integrated approach to the field design, and subsea production is viewed as part of a complete optimized system. We have examples, such as [Equinor's] Johan Castberg, where we were able to reduce the development cost 50% by simplifying challenging requirements and using our standard systems and products.

In addition, digitally-enabled front-end engineering design enables the rapid development of field concepts, with options to optimize for schedule, cost, production or carbon efficiency. Changes to the subsea system are seen in the context of corresponding efficiencies in topside facilities and wider infrastructure to ensure the most efficient design possible. An integrated view of the subsea and topside system is not only a one-off capex saving, it ensures that operationally, through the life, you have the optimal field solution.

Rapidly trialing multiple scenarios of a full-field system allows every aspect of a design to be challenged, which provides increased optionality for customers until the best result is found, and we can ensure that systems are scalable throughout the

life of the field. We call this approach Intelligent Subsea.

OE: Can you give an example of this intelligent approach?

Araujo: Our system thinking approach helped maximize production, reduce operating costs, increase safety, and reduce the carbon footprint of operations on Åsgard field. Since 2015, our innovative, unmanned, all-electric subsea gas compression technology has run at 99% efficiency, and will enable the recovery of an additional 306 MMboe. Production is radically increased by moving gas compression facilities from a traditional topside platform to the seabed, where it is closer to the wellhead, meaning there is a lower pressure drop in the pipeline downstream.

The next-generation system on Jansz-10, offshore Australia, will safely reduce capex and installation costs by cutting size and weight 50%, compared to the first-generation technology used on Åsgard.

OE: How is digitalization changing subsea developments?

Araujo: I mentioned already that digitalization can support smarter front-end engineering design, but it also supports digitalized and automated execution, and makes our service offerings more efficient and cost-effective. For example, our Field-Modeler and Subsea Configurator applications developed by our software house, ix3, can reduce timelines to perform subsea feasibility and conceptual layouts by 75%. These apps work together with other automation tools to help engineers' decision-making, reducing timelines from months to minutes.

Digital technologies can also help extend field life through enhanced recovery and predictive maintenance. For example, we recently undertook condition monitoring for a subsea facility, which had a problem with hydraulic pressure in the control system, and the customer couldn't establish the root cause. Their intention was to hire

in a vessel and ROV to investigate the field, but we were able to provide real-time data streams to our subject matter experts, and could quickly narrow the area for inspection, saving days of vessel and ROV time, and saving millions of dollars.

OE: How are you collaborating with others in the industry to develop subsea technology?

Araujo: Partnerships and collaborations are central to our way of working. A major part of our technology development is taking place within these partnerships.

Our collaboration focuses on two areas: technology alliances and execution alliances. For example, we have worked with ABB on subsea electrification for multiple projects, including the Åsgard subsea compression. More recently our power, control and process control solutions developed with ABB allow ultra-long tie-backs, even up to 600 km, which gives the flexibility to remove the need for production platforms and significantly lowers capex and opex. We are working with smaller companies, as well, such as Airborne and FSubsea, finding innovative ways to bring our individual technologies to market quicker in joint offerings. It is part of our responsibility to be a supporter of innovation and to accelerate it across our industry.

OE: The industry is under increasing pressure to demonstrate how it is reducing carbon. How are you addressing this at Aker Solutions?

Araujo: We are working on the decarbonization of oil and gas assets through initiatives, such as the low-carbon greenfield Clair South study we are doing for BP, and our new Key Environmental Performance Indicators. Having recently won the Twence waste-to-energy CCUS contract, we see rising interest in our Just Catch modular CCUS technology. We are also continuing to pursue opportunities in the offshore floating wind sector through our investment in Principle Power. ●



LUIS ARAUJO, CEO, Aker Solutions

LUNDIN STRIKES OIL DISCOVERY AT GODDO PROSPECT IN NORWEGIAN NORTH SEA

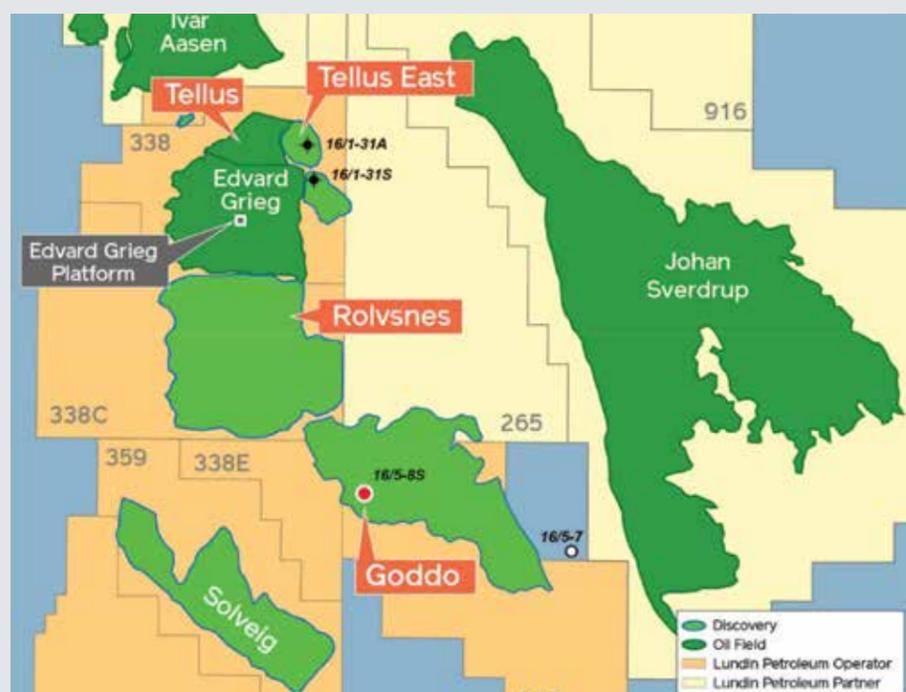


FIG. 1. Location of Lundin's Goddo discovery in the Utsira High area of the Norwegian North Sea. Image: Lundin Petroleum AB.

Lundin Petroleum AB recently announced that its wholly owned subsidiary, Lundin Norway AS, has hit an oil discovery at exploration well 16/5-8s, targeting the Goddo prospect in PL815, **FIG. 1**. This is approximately 14 km south of Edvard Grieg field in the Norwegian North Sea. The main objective of the well was to prove oil in porous basement, similar to what is found in the Rolvsnes discovery to the northwest.

Preliminary resources. The well encountered weathered and fractured basement in an estimated gross oil column of 20 m. Extensive coring and data acquisition were performed, and the reservoir displays similar characteristics to those found at Rolvsnes, but the two discoveries are not connected. The preliminary gross resources from this well are estimated to be between 1.0 MMboe and 10.0 MMboe, however, there is clear upside potential in the larger Goddo area and surrounding prospective basement.

Strategy, moving forward. The forward appraisal and commercialisation strategy for the Utsira High basement play will be based on evaluation of the production performance from the Rolvsnes extended well test, where production is set to commence in mid-2021, as well as the information collected at Goddo and surrounding well data. Two horizontal wells in the northern part of Edvard Grieg field already have production contribution from basement, and the Tellus East discovery announced earlier this year has similar reservoir to Rolvsnes and Goddo and will be produced as part of a future Edvard Grieg infill programme.

The Goddo well was drilled by the *Leiv Eiriksson* semisubmersible drilling rig. Lundin Norway is the operator of PL815, with a 60% working interest. Partners include Concedo and Petoro, with 20% interest, each. The *Leiv Eiriksson* rig will now be used by operator ConocoPhillips Skandinavia for a three well exploration campaign to the north of Utsira High. Lundin Petroleum has a 20% working interest in two of these wells: Enniberg and Hasselbank, both located in PL917, due to spud in fourth-quarter 2019. ●

Amplus Energy awarded major contract for Angolan marginal field work

AMPLUS ENERGY SERVICES

Aberdeen-based floating production solutions specialist, Amplus Energy Services, has been awarded a multi-million-dollar contract to re-evaluate the development of marginal fields in Angola. The aim of the contract is to develop economically viable field development solutions for a major operator in Angola.

The six-month project will be managed by Amplus Energy Services from its Aberdeen headquarters, and it could provide strategic learnings for North Sea marginal field development.

Amplus will work in partnership with TechnipFMC and Halliburton to support the work on the project, while local support in Angola will be provided by Amplus Energy Services' partner in that country, Prodiaman Oil Services SA.

community with a due diligence tool to evaluate reserves prior to full-field sanction. In addition, the VPU's contracting strategy reduces major up-front financial commitments to production facilities on "risky" reserves, and the vessel is a cost-effective option for replacement of aging infrastructure. Also, dual-fuel engines offer reduced fuel consumption, and the VPU also eliminates costs of the moorings, their installation and ultimate removal.

Formed in 2008 and based in Bridge of Don, Aberdeen, Amplus Energy Services aims to build a world-class fleet of VPUs that will service the needs of the oil and gas industry worldwide.

Additional information can be found at www.amplus-energy.com.



FIG. 1. The Amplus Versatile Production Unit offers fit-for-purpose, cost-effective production facilities. Image: Amplus Energy Services.

Lessons applicable to the North Sea.

Ian Herd, managing director of Amplus Energy Services, said, "We are developing an excellent reputation as a company that can turn previously uneconomic oil and gas reserves into financially viable resources. The lessons learned from this latest contract award will not only be strategically key for marginal field developments in Angola, but also in the North Sea, where there are more than 200 discoveries still to be developed, with several billion barrels of oil available for recovery."

"As a mature basin," continued Herd, "most of the UK Continental Shelf's remaining reserves are contained within marginal fields. Amplus Energy Services' ongoing North Sea Production Club initiative, which is designed to make even the smallest fields economically viable, has been pivotal in helping [us] secure the marginal field development study contract in Angola."

The Amplus Versatile Production Unit (VPU, FIG. 1) is the key to offering clients, safe, fit-for-purpose and extremely cost-effective production facilities. The VPU can support a wide range of production capacities. The vessel operates on dynamic positioning (DP) and is fitted with a disconnectable turret buoy, which gives the VPU unrivalled safety performance, operational efficiency and mobility to move field to field, if required.

The VPU's ability to sit directly above the subsea production facilities reduces cost in every aspect of a marginal field development.

Technical benefits. Among the technical benefits of the VPU are that it utilises proven FPSO and DP vessel technology, minimises seabed infrastructure, and allows reusability of SURF (Subsea Umbilicals Risers Flowlines) and SPS Wellheads. In addition, knuckle-boom cranes offer increased operability, allowing loading and offloading of supply vessels in higher sea states, and the VPU modular system facilitates the installation and removal of additional process modules.

Financial benefits. Among the VPU's financial benefits are that it reduces front-end and tail-end capital requirements, enables early revenue stream for clients, assists in self-funding the project development via a high-value production component, and provides the financial

FRIDAY

TODAY'S CONFERENCE HIGHLIGHTS

INTEGRATED TECHNOLOGIES, 10AM-12PM, CONFERENCE ROOM 2A

COLETTE COHEN, CEO, OGTC

JIM LENTON, MD Integrated Solutions, Worley

ROB HOUSTON, Project General Manager, BP

MALCOM LEE, Group Head of Technology & Innovation, Babcocks

PETER PARRY, PARTNER, Bain and Co

JOHN SIMPSON, Head of Digital Construction, Robertson Group

SECURITY ISSUES IN THE DIGITAL WORLD, 10AM-12PM, CONFERENCE ROOM 2B

TROY STEWART, Global Service Manager, ABB

MARIO CHIOCK, Fellow for IT Security, Schlumberger

BEN DICKINSON, Global Cyber security Lead Oil, Gas & Chemicals, ABB

EMILIE HUDSON, Project Manager, BP

RAED SHAIKH, Division Head Information Security, Saudi Aramco

LATE LIFE MANAGEMENT OF SUBSEA SYSTEMS, 10AM-12PM, LATE LIFE & DECOMMISSIONING ZONE - EXHIBITION, HALL 1

NEIL GORDON, Subsea UK

PAUL SLORACH, EC-OG

JULIAN RICHARDS, 3D at Depth

MOYA CAHILL, PanGeo Subsea

ROMAIN CHAMBAULT, Director Europe - Oilfield Equipment, Baker Hughes GE

DALE MILLWARD, Technical Advisor, STATS Group

DONALD HORSFALL, Subsea Sales Manager, Expro

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WE LOOK FORWARD TO WELCOMING YOU BACK THEN!



Mercury contamination: Extremely hazardous, yet solvable

MRT SYSTEM

Mercury is a natural component of our planet. However, it can be lethal and lead to major consequences if not handled correctly, **FIG. 1**. The best-known example is Minamata in Japan, where thousands of people in the 1950s became victims of severe mercury poisoning, caused by negligence. We know that the metal needs to be handled wisely, not only to protect employees in the industry but also to minimise environmental consequences. The question is, how do we achieve this?

Patrick Strandqvist, COO and a mercury recovery expert at MRT System, explains that a proven distillation technique for extracting mercury already exists. It not only safeguards the work environment for employees and the surrounding environment but also helps companies to comply with sustainability ambitions and the UN's sustainability goals. Another important aspect is that there are financial gains for companies using the technique.

"So far, we have supplied 150 distillers, and we would dare to say that distillation is the cleanest, most reliable and environmentally friendly technique on the market," says Strandqvist. "The good thing about the technique is that, with tailored solutions, it can be used for small- and large-scale extraction—from bulbs and batteries to large amounts of contaminated material."

Distillation involves heating to 700°C, causing the mercury to be evaporated and extracted from the processed material. The mercury condenses and becomes 99.9999% pure. Cleaning takes place in an entirely closed system, using automatic processes that minimise human error. For large volumes, the system can operate 24/7.

What can the oil and gas industry do? The concentration of mercury is relatively low in oil and gas operations, as far as crudes are concerned. The database

of industry association IPIECA shows that 64% of the world's crudes have mercury levels of 2 wt ppb or less, although a small fraction, 3%, have mercury levels above 100 wt ppb.

As long as oil and gas remain in the ground, mercury is not a major concern. However, when handled, mercury is released from both the crude and the surrounding ground, becoming more concentrated and in need of disposal. This means that final products, sludge and lubricators must be cleaned to avoid the need for disposal in their entirety. The same applies to pipes, hoses, containers, filters and other equipment, which also require decontamination. After recovery, the separated mercury can be encapsulated and transported to disposal. The alternative is to send all the contaminated material to disposal.

"An example from another industry shows that 200 tonnes of bulbs can be reduced to 1 litre of pure mercury. If we

compare the cost of sending 200 tonnes of contaminated waste or 15 kg of mercury to disposal, you quickly realise that there are large profits to be made," says Strandqvist.

One of the experts who has utilized distillation solutions for 25 years is Sören Potrykus, at metal recycling company GMR. "Although there is a clear political ambition to reduce the occurrence of mercury, it will take many years before we can stop worrying about managing the waste. Waste contaminated with mercury, from natural gas production for example, will be an important issue for at least the next 20 years. GMR has been using distillation from MRT System for more than 25 years without problems or major incidents. It feels safe."

Mercury's Chernobyl. "The Minamata disaster was mercury's Chernobyl, and I hope and wish that nothing like that ever happens again," adds Strandqvist. "Exposure to mercury can, among other things, cause damage to the brain, heart, kidneys, lungs and immune system. We need to deal with hazardous waste in a proper way—not only because the law requires us to, or because there is money to be earned, but also because it feels better."

Approximately 109 countries have signed up to the legally binding UN Convention named from the Minamata disaster. These countries are carrying out national implementation plans to limit, or eliminate, the release and use of mercury, as well as dealing with mercury waste in a safe manner. Clearly, this situation affects the oil and gas industry. ●



FIG. 1. Mercury is a natural component, but it can be lethal if not handled correctly.



MRT System COO Patrick Strandqvist

Advanced materials help to offset low prices, boost profitability

HYPERION MATERIALS & TECHNOLOGIES

Manufacturers provide expertise to improve downhole tools and optimize efficiency and productivity. Oil and gas producers are facing a challenging economic climate, brought on by low prices, global trade tensions and a forecast that predicts more of the same. To combat this trend and maintain profitability, producers are focusing on boosting efficiency and performance, and they are finding

solutions by collaborating with advanced materials providers to improve exploration and production equipment.

"The reliability and performance of downhole tools has a major impact on enhancing productivity and efficiency," said Prasad K.V.D., product manager for Hyperion Materials & Technologies, a global company with more than 60 years of experience manufacturing

tungsten carbide, synthetic diamond and cubic boron nitride materials. "As service providers try to drill wells faster and pump fluids at higher pressures, we partner with them to develop a wide range of high-performance components and sub-assemblies that solve these challenges in drilling, well completion and flow control," **FIG. 1**.

Simply put, when companies invest in developing tools made of harder, more corrosive-resistant materials, they experience less time on well sites, put wells into production sooner and, ultimately, spend less money to extract more resources. As a result, many of the largest producers are achieving record production—and record earnings.

Tailor-made solutions. While advanced materials are a component of that success, the driver is the expertise that manufacturers provide to solve specific problems with tailor-made solutions. K.V.D. said a recent example at Hyperion was developing diamond-faced carbide valve and seat sub-assemblies for a

major service provider's advanced rotary steerable system (RSS), a type of tool used in directional drilling. The upgrades enabled the customer to deliver more precision, speed and accuracy, which are essential for drilling longer laterals in a shorter time and at optimum cost.

From Sept. 3 to 6, Hyperion will be showcasing products and solutions at SPE Offshore Europe 2019 in Aberdeen. Specifically, Hyperion will feature its expanding oil and gas portfolio, which includes a new, high-performance tungsten carbide grade called DZ07.

"We developed DZ07 after careful consideration of customer inputs, as they wanted a better balance of mechanical properties without compromising corrosion resistance," said Ram Raghavan, Business Development Leader of Hyperion's Oil & Gas business. "DZ07 grade was tested in severe accelerated conditions, and it outperformed the incumbent grades. This new grade, with its superior properties, will offer enhanced performance, particularly suited for demanding conditions of the future." ●



FIG. 1. An automatic inflow control device (AICD, left) and drilling nozzles (right) are just two examples of devices made of advanced materials and offered by Hyperion. Image: Hyperion Materials and Technologies.

Digitalization will demand a mindset shift: Shell

CRAIG GUTHRIE, Contributing Editor

The future success of digitalization depends on companies' ability to force through fundamental changes in their approach to projects, attendees heard yesterday at SPE Offshore Europe 2019.

Firms need to ensure foundational elements are in place before launching digitalization initiatives, such as strong data strategy and governance, as well as improved data platforms and connectivity, experts from Shell, BP and Equinor said on Wednesday. "It may make people uncomfortable, but these foundational elements are not negotiable," said Rami Alieh, GM Digitalisation Upstream, Shell, comparing the inevitability of the change to paying personal taxes.

The World Economic Forum has estimated that digitalization represents a more than \$1 trillion opportunity for the oil and gas industry. Alieh added that by ensuring these foundational elements are in place, firms can develop the "transformational" products that are required.

People power. "Look at predictive maintenance, look at machine vision and look at machine learning. Or look at putting iPads in the hands of our workforce to increase our productivity. There are key products that we're going to roll out, and we're going to roll them out in a sustainable and replicable manner."

Success also depends on combining the best attributes of data and human resources, he added. "Digital transformation is just another wave that we're facing that again highlights our two most important assets: our people, and our data," said Alieh. "These two constants will remain even after digitalization. Data's importance is just going to increase, but our people continue to be the key asset. Combining those two together makes us powerful. It makes us capable of leading, not just embracing, but leading the journey leading the transformation."

Rob Kelly, head of upstream digital, BP, said that "probably six years ago, if you raised the word data

in a BP senior leadership meeting, everybody would have yawned and fallen asleep. But now data is just so, so important."

Not an easy ride. Other speakers echoed the sentiment that the industry faces unique challenges. "As individuals, we have become so digitalized that we don't even use the word anymore," said John Lervik, Chief Executive Officer, Cognite. "Companies like Amazon, Netflix, Spotify and Google have made a 'digital twin' of me, but our industry's need to create digital representations of physical assets is a much more complex task."

He added that it was vital that companies focus on enabling data flow between applications, so that it is

possible to both visualize and optimize the industry.

"AI, of course, is the Holy Grail for many things. [Currently] there's very few examples of how data-science based optimization is working, but with AI, we can really start to optimize more complex processes. Physics-based AI can really transform how we operate in oil and gas industry".

Rohit Singh, Digital Programme Manager, Equinor, said that in his company over the past 10 years, even the very top tiers had concluded that digitalization had to be the foundation of a majority of its future work. "We are looking at completely new types of businesses and completely changing the economics of what we're doing," said Singh. ●



JOHN LERVIK, Cognite



RAMI ALIEH, Shell

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Ampelmann performs cargo lifts for Apache North Sea

ERIKKA ASKELAND, Contributing Editor



Ampelmann has carried out its first cargo lift for Apache North Sea.

Dutch offshore access provider Ampelmann has carried out its first cargo lift in the oil and gas sector.

The Delft-based company, which specialises in offshore “walk to work” and cargo lift systems, was hired to complete a 30-day campaign transferring people and cargo to platforms operated by Apache North Sea.

Working for Norwegian vessel firm, Olympic Subsea, Ampelmann deployed its E1000 people and cargo transfer system on the Olympic Delta inspection, maintenance and repair vessel.

Logistics. Over the course of the campaign, the E1000 enabled more than 1,925 safe personnel transfers and 354

lifts, transferring 118 tonnes of cargo to two single point mooring platforms, SPM2 and SPM3, a short distance from the Beryl Alpha platform. The system supported critical maintenance work on SPM3 and provided significant benefit to Apache during the helideck refurbishment on SPM2. The system was installed on a 12.1-m pedestal and operated at a height of nearly 40 m above sea level.

The Ampelmann E1000 is the proven market solution for safely transferring personnel as well as cargo up to one tonne in high sea states. Changing from people to cargo transfer mode is made simply by the push of a button.

Results. Ampelmann said it has safely transferred more than eight million kilograms of cargo in the offshore wind sector and is keen to expand this service more for oil and gas customers.

Lorenz Nehring, Business Development Manager, UK & Norway, at Ampelmann, said: “The use of the E1000 at SPM2 and 3 has showcased how innovations can transform the way we work. The trust that Apache put in our onshore and offshore teams has paid off, and we are pleased to have safely delivered this project.”

Ampelmann designs and delivers transfer solutions to the offshore energy industries globally. It has a track record of more than 5.5 million safe people transfers, over 12 million kg cargo transfers and operates in Europe, Africa, Asia Pacific, the Americas and the Middle East.

The company currently maintains a fleet of 60 operational systems used for transferring crews and cargo to offshore structures. Its solutions are tailored to the needs of different market segments, sea states, cargo and crew loads.

Ampelmann has been exhibiting at SPE Offshore Europe 2019 at booth 3G60, Hall 3, P&J Live in Aberdeen. The company also has hosted a Walk to Work Lounge together with partners, including Scottish ship repair specialist Dales Marine, Port of Blyth-based engineering company Osbit and marine services provider Pacc Offshore Services (Posh). ●

2019 HIGHLIGHTS

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ENGENIOUS ZONE - HALL 1 - NEW FOR 2019



After the success of ENGenious 2018, we are proud to introduce the ENGenious zone at OE. Tying in perfectly with OE's 2019 focus on data analytics, machine learning and artificial intelligence, 'ENGenious at OE' provides innovators with a platform to demonstrate their capabilities before ENGenious returns in 2020.



ENERGY TRANSITION HUB - HALL 1 - NEW FOR 2019

New for 2019 is the Energy Transition Hub, where operators, associations and technology companies will share insight's over the course of the event. They will highlight the efforts they are making to prepare the oil & gas sector for transition to a lower carbon future, with less environmental impact.

STARTUP VILLAGE - HALL 1 - NEW FOR 2019



StartUp Village 2019

The StartUp Village is a new feature at OE19. It is a zone that will allow new UK and International start-up companies to showcase their latest technologies, products and solutions launched, and make these innovations easy to find for our visitors.

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All attendees to SPE Offshore Europe are invited to attend the free of charge conference, themed 'Breakthrough to Excellence - Our License to Operate.'

MICHAEL BORRELL CHAIR, SPE OFFSHORE EUROPE 2019

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STEPHEN HOLTZ SPE OFFSHORE EUROPE 2019 TECHNICAL COMMITTEE CHAIR

The 70+ technical presentations will address key disciplines including Data Analytics, New Technology for Late Life Development, Subsea Technology, Process Safety Management plus many more.



LATE LIFE AND DECOMMISSIONING ZONE - HALL 1



Late Life & Decommissioning Zone

Our highly popular Late Life & Decommissioning Zone will return in 2019. This free-to-attend zone includes decommissioning technology and a conference theatre programme created with the industry's key associations.

For help, visit any of our information points or tweet us using #AskOE

NEPTUNE ENERGY COMPLETES ACQUISITION OF GERMAN INTERESTS

Neptune Energy announced earlier this week that it has completed the acquisition of interests in certain oil and gas fields in Emsland and the Grafschaft Bentheim region in Germany from Wintershall Dea.

The agreement increases Neptune's existing interest in the Bramberge, Meppen and Annaveen oil fields, located in the Emsland region, and in various gas fields in the Grafschaft Bentheim region. This increased interest adds approximately 600 barrels of oil equivalent (boe) of daily net production to Neptune's production in Germany—an increase of around five percent. ●

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Carbon capture and storage and hydrogen scheme starts with a small Acorn in Aberdeen

ERIKKA ASKELAND, Contributing Editor

Listeners at a session on decarbonisation of the energy system heard how a mighty oak of carbon capture and hydrogen production could grow from a small acorn currently based in Aberdeenshire.

The partners. Pale Blue Dot energy is working with a range of partners across academia and the oil and gas industry to deliver Acorn, a project which comprises three prongs. One is Acorn CCS, a full-chain industrial carbon capture and storage (CCS) project. Acorn Hydrogen is looking at developing hydrogen production from natural gas alongside the CCS activity. The third is the Aberdeen Vision Project, which will research the opportunity of co-mingling hydrogen into the gas grid and consider potential regional applications for hydrogen in heat and transport.

Led by Pale Blue Dot Energy, the CCS project recently secured £4.8million from the UK Government's £26million CCUS Innovation fund to carry out detailed design and move the project closer to realisation by 2023/2024.

How it will work. The plan involves capturing CO₂ from existing emissions at the St. Fergus gas terminal, then transported offshore and injected deep underground for permanent sequestration. The Acorn CCS project will re-use existing North Sea pipelines to reduce project costs and make best use of redundant infrastructure. Last year, the Oil and Gas Authority (OGA) made Pale Blue Dot the first recipient of a carbon dioxide (CO₂) appraisal and storage licence, an important step to help develop one of the UK's first CO₂ transportation and storage networks.

It is envisaged the project could capture about 200,000T/y of CO₂. Additional CO₂ sources can be added, including Peterhead Power station, ship import

via Peterhead Harbour and transport via existing pipeline from industrial and power sources in Central Scotland.

Last year, Acorn also became the first-ever CCS project to receive funding under the European Commission's Connecting Europe Facility. This funding was matched by both the UK and Scottish Governments, along with Pale Blue Dot Energy and Total E&P UK.

David Mackinnon, Head of Technology Innovation for Acorn partner Total UK, told an audience at a session at Offshore Europe on decarbonisation that the CCS project was more advanced than the hydrogen strands but that there was progress for both. He said: "This first phase is about getting it right and disseminating that through the rest of the country and the EU. It is also about making sure we have confidence of government and our stakeholders to invest and build out the solution. That confidence comes through efficiency, leveraging the best of technology to do that, and ensuring we have a fit-for-purpose capex solution."

Pale Blue Dot is working with gas network company SGN and National Grid Transmission to assess the potential for early adoption of the technology in Scotland.

Greater complexity. Mackinnon said the project to inject energy to the grid was longer-term than CCS because of complexity. "There is more complexity around hydrogen in terms of its energy density. In terms of infrastructure, it potentially needs to be increased capacity. This is why government is finding this at the moment. If there was an easy answer, it would be done," he said.

"The gas system in the UK carries about five times as much energy as the electrical system. If you want to have electric cars and everything, you need five times as much grid system, just to stand still where we are today."

He said the success of the project would start being seen when the CCS project reached scale. "There are a range of ongoing projects in Scotland around CCS, hydrogen and renewables. Policy is changing. That is relevant for everyone." ●



DAVID MACKINNON, Head of Technology Innovation for Acorn partner Total UK

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Cities partnership delegation visits EOWDC windfarm

ERIKKA ASKELAND, Contributing Editor

A delegation from across the world took a special trip to view up close the European Offshore Wind Deployment Centre (EOWDC, FIG. 1) off the coast of Aberdeen, as part of a programme of activity taking place around SPE Offshore Europe 2019.

Around 150 people, including members of the World Energy Cities Partnership (WECP), boarded a ferry to take a tour of the £300-million windfarm about 2 mi out to sea. The demonstration facility is the culmination of 15 years of partnership between Aberdeen Renewable Energy Group (AREG), a membership organisation comprising industry and local government, and Vattenfall, the Swedish-owned energy company.

The 11 turbines that tower 110 m over the waterline are part of a €3million scientific research programme designed to help further understanding of the environmental impacts of offshore wind. As the delegates viewed the turbines from the top deck of a ferry, Mike Harden, operations and maintenance manager, Vattenfall, described some of the ground-breaking technology that has gone into the development and construction of the project.

He said, “These 11 turbines running at full power generate enough heat and power for 800,000 homes. That represents about 75% of Aberdeen’s power consumption. It delivers annual production of approximately 312 Gw and annual CO₂ displacement of 134,128 tonnes. To put that into perspective, it is the equivalent of removing 736,000 cars off the roads of Britain.

“We are using revolutionary suction bucket foundations. One of the benefits of that is that it has much less impact on marine life. Traditionally, wind farms use monopiles, which make noise on the seabed when knocked into the ground. The



FIG. 1. A half-dozen of the 11 turbines in the EOWDC windfarm installation. Image: Richard Crighton.

suction buckets are completely silent. They are filled with water, and when on the seabed, the water is extracted, which pulls the suction bucket into the seabed.

“We are looking at scour protection, which is what we put over our cables to prevent wear and tear prolonging the life of the turbine. We are also looking at innovative blade technology. We are monitoring the size of rain droplets. Once they hit a certain size and certain speed, we tether the blades in, all automatically using computer algorithms. We have invested £3 million in a bird collision and avoidance scheme.”

WECP AGM. Aberdeen was selected to host the prestigious World Energy Cities Partnership (WECP) AGM to coincide with SPE Offshore Europe 2019. The

event attracts mayors and their delegations, which include senior players in key global oil and gas markets, to attend a four-day programme of events and business networking in the city. The WECP connects 19 cities which are recognised as energy capitals, from Calgary to Kuala Lumpur and Stavanger to Cape Town. WECP member cities seek and develop opportunities to learn, exchange and engage in activities that strengthen multilateral ties.

Peter Tipler, renewables director, Xodus Group, which co-sponsored the trip with AREG, said, “It is no longer in the global energy industry you can look at oil and gas in a silo and renewables in a silo. Both have to understand each other’s perspective and skills. That is what we

see going on in the World Energy Cities Partnership. We see people sharing their ideas across the world, driving decision-making, skill sets and technology across the globe.

Working together. “That is one of the key things. When it comes to delivering a responsible energy future together, we have to all talk to each other. The boxes we have ticked already include the technology, the skills, the motivation. What we need is a gathering of momentum around the world, and that is what the World Energy Cities Partnership can deliver.”

The Lord Provost of Aberdeen, Barney Crockett, Vice-President of WECP, said, “Renewable energy is no longer seen as an alternative or future energy. It has become a mainstream energy source and Aberdeen’s oil and gas, and energy supply chain are playing a key role in energy transition towards a lower carbon energy system.

“I am pleased that AREG is a key sponsor of the WECP AGM and able to offer representatives from the partnership cities the chance to visit the European Offshore Wind Deployment Centre (EOWDC) just off the Aberdeen coast. It will give delegates the opportunity to learn from the industry experts, exchange experiences and offer the potential to develop new business opportunities around energy and renewables.”

Morag McCorkindale, team leader international trade and investment, at Aberdeen City Council and a co-founder of AREG, said, “Fifteen years in development, three years in court, two changes of ownership and five Scottish government terms. One sweep of the blade powers a home for a day. It is a tribute to the human persistence and creativity it persists, and I’d like to think, only in Aberdeen.” ●

Global start-up partnership launches at OE19

Offshore Europe provided the launch venue for Tech Xchange, a unique partnership between Aberdeen, Houston and Perth, Australia, to provide global market-access and investment opportunities for start-ups.



Left to right, **MIRANDA TAYLOR**, Chief Executive, NERA; **DAVID MILLAR**, Technology Accelerator Director, Oil & Gas Technology Centre; and **ROMA SHARP**, SME Engagement Manager, Station Houston

The partnership. The venture brings together the Oil & Gas Technology Centre’s TechX, Station Houston and National Energy Resources Australia (NERA) to link three global energy ecosystems and accelerate international growth for technology innovators and start-ups.

Leveraging the Tech Xchange ecosystem on a global platform, the programme will facilitate access to the market, including field trials, customer validation and analysis. It will also increase exposure to early stage investment markets, which is critical for fast-growing high-potential businesses.

The plan forward. Through using the extensive networks of the three partners to make more and better investor connections, a unique service has been created that will provide a collaborative environment to help nurture ideas and businesses. The partnership kicked off at OE with a tour of key players in the region’s start-up ecosystem, stopping at the OGTC, Elevator and ONE Codebase, and meeting with industry experts and influencers.

Start-ups have been put through their paces at the new OE Start-up Village—Powered by TechX. Alongside mentors from the North East ecosystem, these emerging companies have been battling their way through the ‘Pitch Pit’ to showcase their technologies, including innovative heat to electricity generation, wind power generation and autonomous underwater inspection drones.

David Millar, TechX Director at the OGTC, said this

was another part of TechX designed to make it one of the world’s most sought-after technology accelerators.

“We’re already delivering a world-class programme, TechX Pioneers, which in the space of one year has already created nine new jobs and raised over £1m of additional investment to help commercialise new technologies,” he said.

“This is only the beginning—it’s already proven to be a successful partnership, and we will continue to work with the global teams to promote cross-industry investment opportunities for our start-ups,” he added.

Four of Australia’s energy innovators have been able to take this opportunity to create international connections for growth this week at OE. “They’re ready to show the world what they, and indeed Australia, have to offer the international oil and gas industry,” Miranda Taylor, NERA’s Chief Executive, said

Perth-based NERA is the only industry-led research and knowledge organisation for Australia’s energy resources industries, which aims to help unlock more than \$10 billion of new value for the Australian economy. Station Houston aims to transform Houston into a world-leading hub for technology innovation and entrepreneurship.

“What Tech Xchange will provide to the global market is exactly what Station Houston is doing within Houston’s tech and entrepreneurial ecosystem,” said Gabriella Rowe, the organisation’s Chief Executive. ●

SCENES FROM OFFSHORE EUROPE 2019



Crowds listen intently at the popular Decom Theater.



A discussion group debates the optimization of reservoir performance.



Students are suited up for action at the Shell stand.



An attendant gets a VR experience provided by ABB.



Sizing up the merits of equipment on display.



The World Energy Cities Partnership tours the EOWDC wind farm.

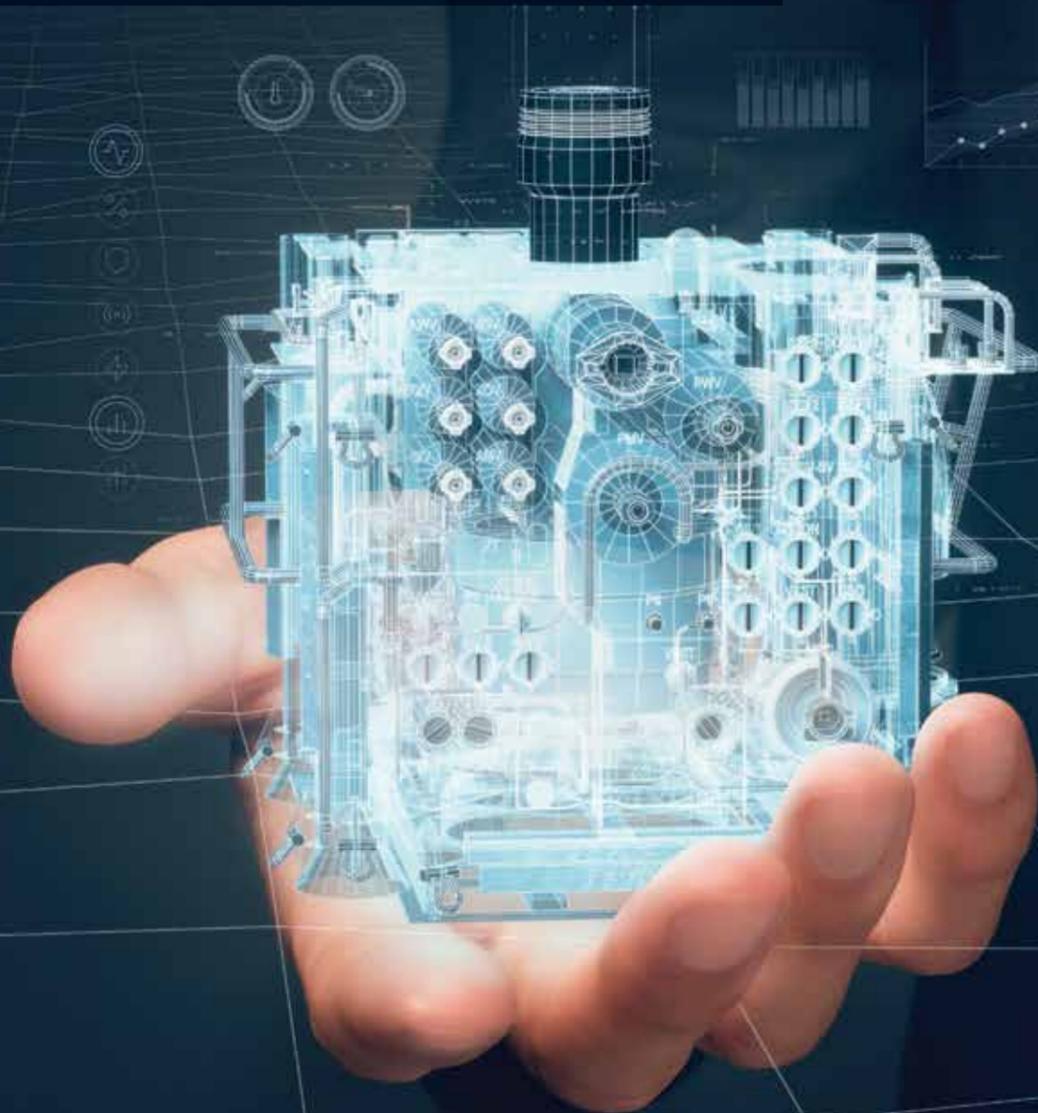


Abstract shapes and bright colors showcase the Balmoral stand.



Lord Provost of Aberdeen, Councilorr Barney Crockett.

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