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| THE OFFICIAL 2019 OFFSHORE TECHNOLOGY CONFERENCE NEWSPAPER | DAY 2

AI Promises Change ... But Also Dollars

- The next wave of offshore technology will ultimately enhance worker productivity and create the potential for a massive expansion of prosperity.

BY JOSEPH MARKMAN



Malcolm Frank

Offshore technology in 1897 was no more complex than a cable-tool rig atop a California pier jutting the length of a football field into the Pacific Ocean.

When oil was produced in the Summerland Field that year, a boom ensued, and in the next five years, 22 companies would drill 400 wells from 14 piers. Other

drilling projects would follow, but it would be another half-century before Kerr-McGee's Kermac No. 16 well was spudded 16 km (10 miles) from shore in the Gulf of Mexico—the first to drill beyond sight of land.

At the time, the \$300,000 project was the most expensive and hazardous ever undertaken, the Associated Press said in a story recounting the event. The roughnecks manning the 12-m by 21-m (40-ft by 70-ft) platform in rough seas remembered their experiences as plenty scary, too.

So to those who fear that the next wave of oil and gas technology—artificial intelligence (AI)—will bring uncertainty to the industry and devour jobs ... well, it will but get used to it. The more it is adopted, the more the industry and its workers will benefit.

"We think this is the great story of our time," said Malcolm Frank, executive vice president of strategy and marketing for Cognizant, in his keynote at OTC's opening session on Monday, May 6. AI, he said, will join the loom of the first industrial revolution, the steam engine of the second and the assembly line of the third as the engine driving the fourth industrial revolution.

"In each of them, there was a dramatic dislocation; there was concern that jobs would go away," Frank said. "In fact, the Luddites were right. They sabotaged the loom because it could do the work of 40 Luddites. But then it allowed massive economic expansion and made the pie bigger for all."

The robots, he emphasized, aren't coming. They are already here, surrounding us in the worlds of retail,

See **PROMISES** continued on page 25

Addressing Climate Change

- BP plans to develop the offshore platform of the future.

BY EMILY PATSY



Gordon Birrell

Some in the industry are finding ways offshore to produce energy smarter as oil and gas companies, large and small, are feeling the pressure to address climate change.

One global oil major, BP Plc, is "deadly serious" about reducing emissions from oil and gas production, said Gordon

Birrell, BP's COO for production, transformation and carbon, at OTC on Monday, May 6.

Last year BP set a target to keep carbon emissions flat out to 2025 even as its oil and gas output grows. Headquartered in London, the company has onshore and offshore oil and gas operations in 78 countries worldwide including a growing renewables business.

During an early morning talk at OTC on advancing the energy transition, Birrell shared some of the technologies the company currently deploys to meet its ambitious emissions target, including unveiling BP's "offshore platform of the future."

"The concept [for the offshore platform] is it will be simpler, smaller and be operated largely from onshore," he said.

Other key characteristics of BP's next-generation oil and gas platform, which is still in the early phases of development, include being partly powered by renewable energy and manned offshore with fewer, "if any," people.

"In short it will be safer, lower cost and lower emissions," he said.

An example of this concept already being deployed in the field is BP's Cypre Project offshore Trinidad and Tobago designed to commercialize the Macadamia discovery.

The Cypre Project is a new minimal equipment platform concept combining technology and improved processes to deliver a normally unmanned installation platform that BP said is simpler, safer and greener. The project is operated by BP Trinidad and Tobago, which is a partnership between BP and Repsol SA.

See **CLIMATE** continued on page 26

Golden Gala Celebrates OTC Anniversary

- Industry leaders gathered to recognize the achievements of both individuals and companies but also to raise money for a worthy charitable cause.

BY JENNIFER PRESLEY

About a thousand slices of anniversary cake were cut for guests gathered at Houston's Marriott Marquis, on Sunday, May 5, to enjoy an evening of honoring distinguished guests, giving back to a worthy cause and spending time with friends celebrating a significant OTC milestone. Attendees of the 2019 OTC Golden Anniversary Gala Dinner were welcomed by co-emcees Wafik Beydoun, chairman

of the OTC Board of Directors and fellow board member Galen Cobb of Petroleum Equipment Supplier Association.

Sylvester Turner, mayor of Houston, kicked off the event, noting that OTC is represented by "a huge gold star on the city's calendar" for the event's many contributions. He added that the city is proud to claim the title as the world's energy capital and would like to "hold onto that crown for just a little bit longer."

See **ANNIVERSARY** continued on page 25

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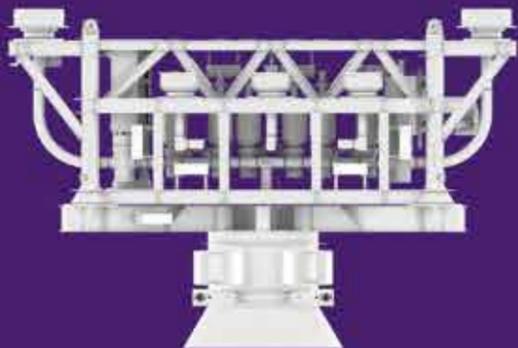
At the Who Dat brownfield expansion and subsea boosting project, we employed an aggressive integrated approach at an early FEED stage, increasing value for LLOG through scheduling assurance, lowered costs and risk mitigation. LLOG expects the project to increase production by at least 2,500 b/d and reserves by at least 6 MMboe.

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TechnipFMC's IEPCI™ subsea solution is gaining greater market acceptance as client confidence grows in the early engagement, technology-enabled business model. This fully integrated approach strengthens the economics of subsea projects and helps unlock first oil and gas faster.

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All events in conjunction with OTC 2019 will be held at NRG Park in Houston, Texas.

Tuesday, May 7

7:30 a.m. to 5 p.m.	Registration
7:30 a.m. to 9 a.m.	Topical/Ethics Breakfasts
8 a.m. to 11 a.m.	OTC Energy Challenge
9 a.m. to 10 a.m.	Coffee on Arena Exhibit Floor
9 a.m. to 12 p.m.	Around the World Series Mexico
9 a.m. to 4 p.m.	International Trade Center
9 a.m. to 5 p.m.	Exhibition
9 a.m. to 5 p.m.	University R&D Showcase
9:30 a.m. to 12 p.m.	Panel Session
9:30 a.m. to 12 p.m.	Technical Sessions
9:30 a.m. to 3 p.m.	Poster Lounge
12:15 p.m. to 1:45 p.m.	Topical Luncheons
2 p.m. to 4:30 p.m.	Panel Session
2 p.m. to 4:30 p.m.	Technical Sessions
2 p.m. to 5 p.m.	Around the World Series Canada
2 p.m. to 5 p.m.	Around the World Series France
4 p.m. to 6 p.m.	Networking Event

Wednesday, May 8

7:30 a.m. to 5 p.m.	Registration
7:30 a.m. to 9 a.m.	Topical/Industry Breakfasts
7:30 a.m. to 9 a.m.	WISE: Diversity Drives Innovation: Start the Conversation
9 a.m. to 10 a.m.	Coffee on Arena Exhibit Floor
9 a.m. to 12 p.m.	Around the World Series U.K.
9 a.m. to 4 p.m.	International Trade Center
9 a.m. to 5 p.m.	University R&D Showcase
9 a.m. to 5 p.m.	Exhibition
9:30 a.m. to 12 p.m.	Panel Discussion
9:30 a.m. to 12 p.m.	Technical Sessions
9:30 a.m. to 2:30 p.m.	Poster Lounge
12:15 p.m. to 1:45 p.m.	Topical Luncheons
2 p.m. to 4:30 p.m.	Technical Sessions
2 p.m. to 4:30 p.m.	Panel Discussion
2 p.m. to 5 p.m.	Around the World Series Ghana
2 p.m. to 5 p.m.	Around the World Series Guyana
4 p.m. to 6 p.m.	Networking Event

Thursday, May 9

7:30 a.m. to 2 p.m.	Registration
7:30 a.m. to 9 a.m.	Topical Breakfasts
8 a.m. to 3 p.m.	Energy Education: Teacher Workshop
8:30 a.m. to 1:30 p.m.	Energy Education: High School STEM Event
9 a.m. to 10 a.m.	Coffee on Arena Exhibit Floor
9 a.m. to 2 p.m.	Exhibition
9 a.m. to 3 p.m.	1-on-1 Mock Interview Session
9:30 a.m. to 12 p.m.	Panel Discussions
9:30 a.m. to 12 p.m.	Technical Sessions
12:15 p.m. to 1:45 p.m.	Topical Luncheons
2 p.m. to 4:30 p.m.	Panel Discussion
2 p.m. to 4:30 p.m.	Technical Sessions



OTC Honors Exxon Mobil for Hebron Offshore Project

Exxon Mobil's Hebron Offshore Project was named recipient of the 2019 OTC Distinguished Achievement Award for Companies, Organizations and Institutions. The award was presented at OTC's Golden Anniversary Gala Dinner on Sunday night, May 5. The project featured one of the largest topsides ever built with an operating weight of 65,000 metric tons (mt) and was successful in producing its first oil in 2017 per the original plan.

The project was executed on a global basis including engineering and procurement with major suppliers from over 20 countries and large labor workforces in Newfoundland and Labrador and Korea. During execution, the largest topsides float-over weighing more than 50,000 mt was safely accomplished. Upon completion, the Hebron Project team worked in excess of 42 million hours in Newfoundland and Labrador without a lost-time injury. (Photo by *CorporateEventImages.com*) ■

Technology Remains Part of Petrobras' Agenda

■ The company also aims to maintain focus on costs, efficiency, presalt and partnerships.

BY VELDA ADDISON

For Petrobras, the world's largest deepwater producer, technology remains on the radar to push forward limits offshore, according to Rudimar Andreis Lorenzatto, the company's chief technology and production development executive officer.

Technological targets for the company include digital twins to help optimize production, subsea hi-sep for CO₂ and gas separation, safety supervisory systems using intelligent visual analytics, well plugging technology with heat emission to reduce abandonment costs in mature fields, and autonomous inspection focused on safety as fewer human divers are used, Lorenzatto told attendees of the sold-out breakfast session on OTC's opening day.



Rudimar Andreis Lorenzatto

"Digital transformation is already happening in people's lives and in the business world. In Petrobras, we can say it's a company strategy rather than a technical challenge," he said. "We have a strong belief that this digital transformation and digital technologies can significantly change our process and activities, bringing more efficiency and improving results."

But that will happen only if teams are open to change, he added.

Deepwater technology is among the items on Petrobras' agenda as the company reaches a turning point, having chopped down debt as part of a massive divest-

ment program and continued focus on value creation and efficiency. Other items include building and maintaining a strong exploratory portfolio, focusing on presalt, improving digital transformation efforts and strengthening business partnerships.

"We'll continue to dedicate our time to make sure that Petrobras will grow and will be better," Lorenzatto said.

Petrobras, the company behind the closely watched ultra-deepwater Libra Field in the Santos Basin offshore Brazil, aims to produce about 1.2 MMbbl/d in the presalt area this year and about 1 MMbbl/d from its deepwater assets. Lorenzatto called its breakevens attractive and pointed out a Wood Mackenzie analysis showing a less than \$40/bbl breakeven for Brazil deepwater and less than \$7/boe presalt lifting costs.

"I believe we can unlock higher returns," Lorenzatto said. "In our project implementation, we have managed costs with good outcomes."

Using technology, repeatability and scale, the company was able to lower the ramp-up days for presalt projects by 42% in the last seven years, he said. Improvements included, for example, reducing the number of well construction days by 51% in the Búzios Field since 2014.

This came as the company brought more platforms onstream—including seven in the last 11 months—marking a new phase for Petrobras' upstream segment, he said. The P-68 platform, the first for the Iara area, is nearing completion with entry set for the second half of this year.

Meanwhile, Petrobras—like many others in the E&P business—continues to focus on reducing costs, generating cash and streamlining its portfolio.

As the industry faced unfavorable market conditions and lower oil prices, Petrobras worked to improve its financial health. Between 2014 and 2018, the company's capex fell by 64% to \$13 billion. It divested 35 assets worth about \$5.8 billion, which helped enable the company to lower its debt.

The effort was supported by three pillars: capex reduction, cost reduction and divestment, according to Lorenzatto.

"It was hard and painful to make it happen," he said. "We have to do more with less."

Petrobras is not alone. Amid increased competition, companies are "targeting profitable projects, divesting noncore assets to optimize capex and operating costs in order to obtain better results with fewer resources. It's tough; it's challenging. But it brings us good opportunities to improve, to create and to renew," Lorenzatto said.

Growth remains core to Petrobras' strategy. The company plans to spend about \$69 billion—including \$3.5 billion for Libra—while growing annual production by 5% over the next five years. Plans also include bringing 11 new production systems online, including seven in presalt areas, Lorenzatto said.

In addition, Petrobras aims to step up exploration spending following an industrywide slowdown. Lorenzatto said Petrobras' exploration capex will rise to about \$11 billion by 2023. The Campos Basin will see an infusion of about \$20 billion in planned capex over the next five years, mainly for projects in areas such as the Marlim and Roncador fields, he said. ■

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- 11:00 - 11:30 Optimizing Subsea Design Solutions through Digital Collaboration
- 13:00 - 13:30 Driving Project Delivery with Reporting and Analytics
- 14:00 - 14:30 The New Amazon, J-Lay with Ultra-Deepwater Capability
- 15:00 - 15:30 Starting with the End in Mind: a FEL 0 Digital Twin
- 16:00 - 16:30 Optimizing Subsea Design Solutions through Digital Collaboration

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Wireless Autonomy Key to Disrupting Subsea IMR Market

■ A new wireless solution enhances future offshore operations.

BY MARY HOLCOMB



Jack Vincent

An untethered structure has shown promise in reshaping offshore operations. To improve ROVs and the inspection, maintenance and repair (IMR) activities that they perform, a wireless solution called the uROV has been introduced.

“When you’re down there and see something interesting along your pipeline and want to go back to it, uROV gives you the ability to send down the adjustment of the commands so you get to start a new mission in the middle of a mission and it’s all live [streamed]. That’s really the beauty of supervised autonomy,” said Jack Vincent, a product champion at OneSubsea, a Schlumberger company, at the OTC session “Robotic Technology Enabling Future Offshore Operations” on Monday, May 6.

As a mix between the AUV and ROV framework, the supervised autonomous technology would not have to be piloted or rely on a preplanned mission.

“This is the idea that you have the best of both worlds. You have a fully autonomous vehicle that has everything, but you monitor everything that it does with supervised autonomy—that’s where the value comes in,” Vincent said.

The design of the uROV is meant to target efficient deployment solutions, integrate advance sensing to the ROV platform and promote digital enablement.

“You could automate ROVs to make them a little more efficient, but most likely you’re not going to get the type of savings that you would with fully removing the vessel. That’s going to be a little bit more of a challenge,” Vincent said.

The uROV is a unique advancement that unlocks supervised autonomy through live video feedback prompting real-time solutions. Vincent said that unlike AUVs, the uROV platform achieves an optimal level of autonomy by balancing the system development cost with life-cycle operations and support cost.

“If you’re coming up to a drill center and you see the tree, in supervised autonomy you would want to stop before you reach it and have a little verification check before you go closer to manage your risks and make sure

everything is in place before you start flying around the more sensitive equipment. This technology allows you to do that without having to guess based on time and position,” Vincent said.

While an AUV’s lack of real-time supervision is ideal in open water surveying, this is ineffective when producing subsea fields that require a different level of supervision, he pointed out.

“The advance sensing can be translated into an actual product that you give your clients that helps them have a better idea of the integrity of their equipment,” he said.

Vincent said the biggest advantage of the uROV is that it is a cost-reductive option by being untethered. The wireless communication cuts the dependency on an IMR vessel, thus cutting a huge cost to a company’s offshore operations.

Enabled by the vehicle platform, wireless communications, supervisory command and control, advanced sensing and perception, and digitalization tools and techniques, the uROV will be able to deliver the next-generation IMR service for customers, according to Vincent. ■

Diversity Drives Innovation: Is the Industry Changing?

■ The annual WISE event expects to prompt conversations about diversity and innovation in organizations.

BY FAIZA RIZVI

Diversity of perspective and experience is an untapped resource for global competitiveness in the industry. However, statistics prove that the oil and gas industry has historically struggled to create a diverse and inclusive workforce. A study by the World Petroleum Council and Boston Consulting Group found that women account for only 22% of the global oil and gas workforce, one of the lowest proportions of any major industrial sector. The study further reveals that these women have a very limited presence in technical roles since oil and gas companies do not fully leverage a potentially sizable and critical pool of talent. Addressing many such vital issues, OTC’s Women in the Industry Sharing Experiences (WISE) is hosting the breakfast session “Diversity Drives Innovation: Start the Conversation,” which will cover how diversity and inclusion of the workforce can shape innovation.

“This event offers an opportunity to change the thought process and grow as an individual,” said session chairperson Mayra Black, buyer at Forum Energy Technologies. “Working in a primarily male-dominated field, it is difficult for women to find a chance to network at their offices and having events of this nature gives us a chance to share experiences and learn from one another.”



Mayra Black



Samina Farid

Black added that previous WISE events have received remarkably positive feedback, and as in past years, the 2019 WISE event will be open to male attendees.

“I do not plan on giving a speech; I would rather have a conversation,” said Samina Farid, session speaker and energy expert. “It’s extremely important that we have discussions on diversity of thought and exchange of ideas, because how we handle and adopt diversities will impact the success of the industry. For instance, statistics from Wood Mackenzie reveal that companies in the top quartile for gender, racial and ethnic diversity show 35% better financial results

than their peers.”

Farid expressed delight over the fact that diversity issues are being recognized and discussed at international platforms like OTC. “It’s fabulous that woman-centric discussions are taking place at OTC, which in my opinion has been a male-dominated event. Moreover, by discussing

such valuable issues, OTC gives out a strong message that this conference is not just about new equipment or technologies, but also about the most important resource of the industry, which is the people. It also shows that the industry is recognizing increasing diversity of workforce, adapting to the transition and realizing that diversity can add value to the table,” she said.

Farid expects the audience to walk away with an understanding that although gender is a large part of diversity, it’s equally important to highlight racial, ethnic and other kinds of diversities. “I want to ensure that individuals recognize the importance of diversity of thought and expand their learning of other cultures and genders at the workplace. It’s also important to create an environment that allows minorities to speak up, be accepted, have support and feel comfortable. To achieve this, companies certainly require an inclusive culture and right leadership,” she said.

In addition to diversity, session organizers expect the audience to understand the definition of innovation in a broader sense. “Innovation is not just in technology or products; rather we want attendees to understand how they can incorporate innovation in different aspects of work and do things differently at their workplace,” Farid said.

The WISE event is scheduled for 7:30 to 9 a.m. on Wednesday, 8 May. ■

Industry News

BP and Enpro Subsea Announce Global Frame Agreement

On March 5, BP and Enpro Subsea announced the execution of a global frame agreement aimed at providing an enhanced subsea architecture and smart standardization using Enpro’s Flow Access Module (FAM) technology.



Enpro Subsea’s FAM is shown ready for deployment. (Source: Enpro Subsea)

Enpro Subsea supplied the FAM technology to BP on the Kepler K3 project in the Gulf of Mexico, enabling project specific technologies to be seamlessly added to BP’s standard subsea trees and manifolds. This significantly reduced project costs and schedule, and it supported BP in achieving sanction to first oil in less than 12 months.

See **INDUSTRY NEWS** continued on page 10



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Panelists Address Reactivating Stacked Rigs

■ Lessons learned include enabling better communication.

BY BRIAN WALZEL

This year's OTC kicked off Monday with a series of early morning sessions, among them a discussion on processes to reactive mobile offshore drilling units (MODU). Tony Beebe, senior vice president, project management and engineering for Northern Offshore, and Doug McEwan, director of newbuilds and reactivations for Borr Drilling, discussed their companies' processes and lessons learned in ramping up drilling rigs for reactivation after they have been cold- or warm-stacked for a period of time.

According to Bassoe Analytics, of the 126 drillships worldwide, 25 are currently warm-stacked and 18 are cold-stacked.

Beebe explained that one of the challenges facing the MODU industry is that operators often do not wish to

activate a rig that has been cold-stacked for an extended period. Beebe cited a recent survey that reported 86% of operators do not want to hire a rig that has been stacked for more than one year.

"It isn't fun to build rigs and stack them," he said. "They're not meant to do that."

To prepare a warm- or cold-stacked rig for reactivation, Beebe said Northern Offshore looks to maintain service and preserve the rig's mechanical and technical components, such as BOPs and mud pumps. He also said they work to maintain the rig's "curb appeal" by keeping the rig clean, looking as it does on the day it was delivered.

"We put in a lot of work to prepare the rigs to be idle for a period of time," Beebe said.

He said that during his visits to other shipyards, he has seen stacked drilling rigs that have yet to be in operation

suffer from a lack of maintenance resulting in equipment wear and severe rust.

"Taking care of the electrical stuff is probably priority No. 1," he said.

Beebe said Northern Offshore works to follow maintenance plans suggested by original equipment manufacturers (OEM), and he stressed the importance of maintaining a good relationship with the shipyard and vendors.

"Our relationships with the yard and our vendors have been really critical because it's really helped us see that extra little bit out of [the rigs] and keep them in top shape," he said.

McEwan said Borr Drilling has 16 drilling units built and stacked.

"I'm pleased to see over the last six months, we have started making inroads into changing that," he said.

McEwan said Borr Drilling works closely with its two service providers—National Oilwell Varco and Cameron—while being fully engaged with the rig's OEMs to maintain a preservation program.

Among the lessons learned for Borr Drilling during rig reactivation programs that McEwan cited was to understand that the individual steps in the process, such as purchase order (PO) generation, crew assignments, technical issues and building a working team environment, often take longer than planned.

"It always takes longer than we all think," McEwan said. "However long we think it will take to reactive the rig, it will take longer."

McEwan said, for example, that it's a common misconception that POs can be fulfilled in a single day. He cited an instance in which, even in an expedited process, POs often weren't fulfilled for more than two weeks.

However, McEwan explained that implementing and designing common systems and components can alleviate delays and problems during rig activation.

"The unique luxury we have is that we do have a huge amount of commonality," he said. "I would hate to have to do this for 19 different designs." ■



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Digital Platform Makes Subsea Development More Efficient

■ Advanced platform for subsea projects can improve internal workflows and provide a digital twin.

CONTRIBUTED BY MCDERMOTT

McDermott is building an advanced platform for subsea projects to improve internal workflows and develop a digital twin from planning through engineering to first oil or gas and beyond.

McDermott is using FutureOn's Field Activity Planner (FieldAP) as part of an extensive digital collaboration to develop different applications as part of its SubseaXD program, which will address all aspects of subsea development from initial planning to installation to operations.

SubseaXD is a collaborative, cloud-based platform that surfaces complex subsea knowledge visually for faster early concept development and sign-off.

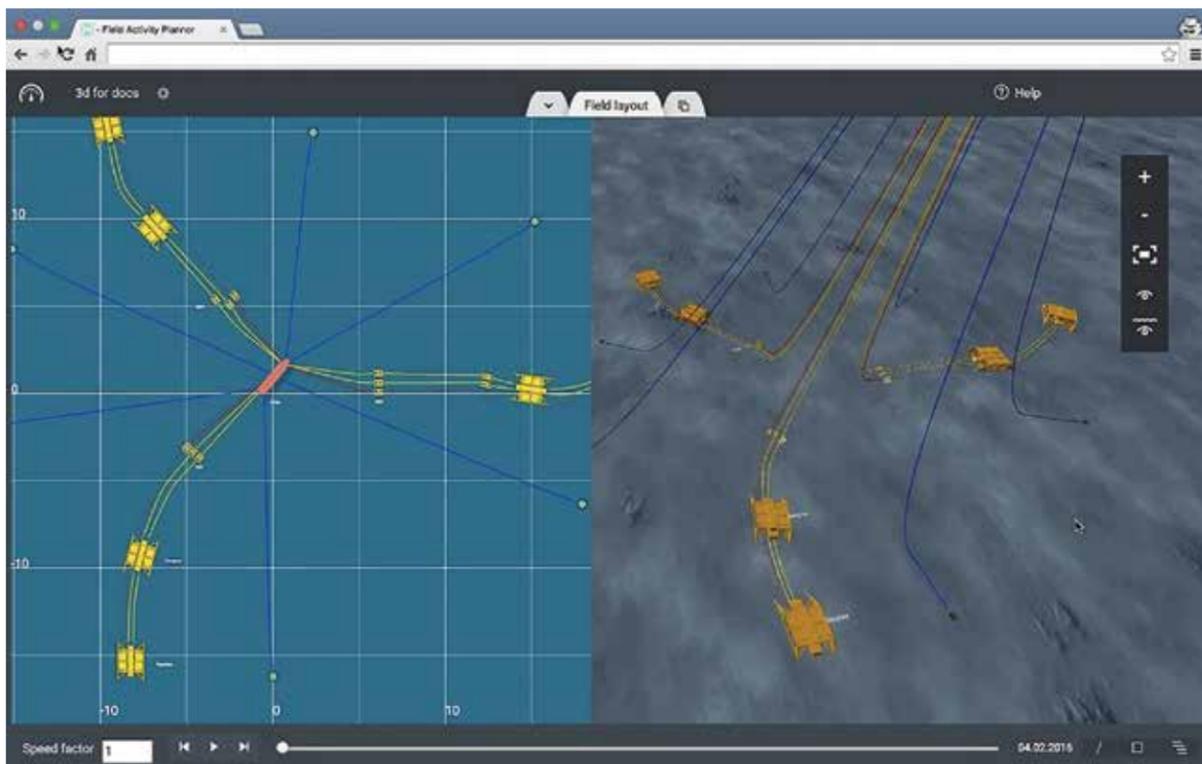
Using a cloud platform means McDermott can securely and digitally send and receive operators' projects, ensuring the data remain secure and up-to-date throughout all phases of the project. McDermott plans to use the platform to develop and install subsea fields significantly faster while lowering overall risk.

"The biggest advantage is internal efficiency," said Harit Naik, McDermott's director of knowledge management, innovation and research, who is leading McDermott's efforts on SubseaXD development. "It will serve as an external differentiator in terms of product delivery and will eventually provide our clients with a digital twin, which is a digital representation of the as-built subsea field. Our goal is to develop a more data-driven approach that will differentiate our product delivery."

Although the system runs as a standalone platform, it will also become a component of McDermott's GeminiXD, an advanced platform that improves efficiency and productivity throughout the project life cycle for McDermott's global projects. With digital workflows and an environment specifically tailored for oil and gas project execution, the platform makes it easy to link, share and retrieve information instantly.

By merging previously separated data silos into one collaborative platform, McDermott is able to provide clients with an assimilated and real-time view of their projects.

"A key advantage to SubseaXD is it allows McDermott to share information digitally while retaining control," said Gautier Noiray, McDermott's principal engineer and one of the leads for SubseaXD development. "Key project stake-



McDermott is using FieldAP to do its planning for subsea field developments. (Source: McDermott)

holders are kept current and up-to-speed on crucial decisions for a faster, more efficient collaborative experience."

"McDermott is using FieldAP to internally develop a digital strategy that enables a more robust, efficient structure and architecture for project management and digital field development," said Darrell Knight, FutureOn's senior vice president for global accounts.

The system is being used for subsea planning and will eventually consolidate the engineering processes, eliminate work silos and focus on developing a single, integrated platform that serves as the single source of truth for the overall project.

"By employing a centralized cloud platform, the parameters of a subsea field development can be used by multiple disciplines for their processes and calculations," said Matt Boisne, McDermott's senior director of subsea engineering. "By simply eliminating the constant entry and re-entry of data for use in different applications, we will improve efficiency. Another key advantage is it will

be easy to share data with everyone during all stages of subsea field development, and they will always have access to the latest, most current data."

McDermott is developing five SubseaXD applications in the very near future for areas such as field concept comparison, riser catenary design, analytical pipeline design and vessel utilization.

"McDermott understands the value of data integration and visualization pooled in one application versus siloed in many different systems," said Thornton Brewer, FutureOn's digital experience and marketing lead. "Our solutions don't reinvent the wheel; we aren't developing competing expert systems. FutureOn is creating technologies that connect to existing systems to better visualize and integrate the industry's deluge of disparate data—digitally."

McDermott and FutureOn will demonstrate SubseaXD at booth 2463 daily at 11 a.m. and 4 p.m. FutureOn's FieldAP was selected as an OTC Spotlight on New Technology award winner. ■



OTC Asia preview: During OTC 2019, Malaysian operators and service providers are showcasing innovative technologies and services to promote Malaysia as Asia's oil and gas service hub as well as the upcoming OTC Asia, which is scheduled for March 24-27, 2020 in Kuala Lumpur. The Malaysia Pavilion is located in booths 6801, 6811 and 6817. For a list of companies in the Malaysia Pavilion, visit otcnet.org.

INDUSTRY NEWS (continued from page 6)

The FAM technology enables fast-track, capital-efficient subsea tiebacks. It essentially creates an enhanced production "USB port" within the jumper envelope. This allows the operator to use standard subsea trees and manifolds, with FAM and a distributed manifold system providing life-of-field flexibility within the system design, delivering smart standardization and the capability to maximize the ultimate recovery from subsea wells.

On the K3 project, BP used FAM technology to install multiphase metering, water cut metering and sand detection at the christmas tree end of a 3.2-km (1.9-mile) single spur tieback in addition to hydrate remediation and flow assurance hydraulic intervention module adjacent to the manifold. This removed the costs, risks and schedule associated with modifying standard hardware or adopting the dual flowloop alternative. Following the success of the Kepler K3 project, Enpro and BP are collaborating on follow-up FAM projects, including BP's Ariel 6, due to be installed later this year.

Ashtead Technology Acquires Aqua-Tech Solution

Ashtead Technology has acquired Aqua-Tech Solutions, a

subsea equipment rental and cutting services specialist, as part of the company's international growth plans in the U.S.

The combined business will see clients in the Gulf of Mexico (GoM) region benefit from a robust and enhanced offering, allowing more timely and cost-effective access to the group's full range of equipment and services from locations in Broussard and Houma, La.

The acquisition significantly strengthens Ashtead Technology's ROV and mechanical tooling offering, broadening its already well-established survey sensor rental fleet. It also sees the firm's specialist subsea services capability extended with the introduction of subsea cutting equipment.

This latest transaction is the fourth deal completed by Ashtead Technology, since the business was acquired by Buckthorn Partners and APICORP in 2016.

Ampelmann reaches a double milestone

Ampelmann has enabled the safe transfer of 5 million people and 10 million kilograms of cargo worldwide—a double milestone for the company.

Safe transfer No. 5 million took place during a project in Qatar, where the A-type is operating on the POSH Skimmer vessel for a local oil major.

See **INDUSTRY NEWS** continued on page 19

Low-pressure-impact Drilling Fluid Minimizes Risk in Narrow Pressure Windows

■ A fluid's unique formulation and viscosity clutch enable operators to stay in a critical drilling window.

CONTRIBUTED BY BAKER HUGHES, A GE COMPANY

Drilling within a tight pore pressure/fracture gradient window in critical offshore wells is always fraught with peril. That's because once a well starts taking losses, the cost of pushing more fluid—and the hidden cost of slower penetration rates and increased nonproductive time (NPT)—can get out of control.

In recent years, the typical solution for overcoming these challenges has been a low-equivalent circulating density (ECD) drilling fluid. Although these low-ECD fluids are often effective at reducing many of the risks associated with drilling these formations, they are still susceptible to pressure spikes, barite sag and surge pressures. Because of this, they often cannot reliably or efficiently meet an operator's drilling objectives.

Baker Hughes, a GE company (BHGE), has released the DELTA-TEQ low-pressure-impact drilling fluid, a nonaqueous fluid designed specifically to drill in narrow windows.

Fluid design for tight pressure windows

The nonaqueous DELTA-TEQ fluid has been engineered with two key differentiators: its unique formulation and a built-in "viscosity clutch."

BHGE engineered these fluids using a mixture of specialized clays and polymers to provide a nonprogressive gel structure that reduces hydraulic impact with a "rapid-set/easy-break" profile. When circulation stops, the gels set rapidly to suspend cuttings and minimize the risk of sag. When circulation resumes or during casing runs, the gels break easily at lower pressures, protecting the formation against induced fractures and reducing or eliminating the risk of costly mud losses. In addition, during casing runs, it protects the formation from surge pressures.

The DELTA-TEQ fluid also offers a viscosity clutch, enabling operators to stay in the critical drilling window by optimizing low shear rate viscosity (LSRV) without negatively impacting high shear rate viscosity (HSRV). The fluid's ability to achieve an optimal LSRV allows operators to maintain a constant rheology across a wider range of temperatures and pressures to improve hole cleaning without generating excessive pressures in the circulating system, while achieving optimal penetration rates.

Limiting HSRV minimizes wasted pressure in the drillpipe to maximize flow rates in the annulus to carry cuttings and improve ECD, again achieving optimal penetration rates.

To date, the DELTA-TEQ drilling fluid has had several successful applications in the North Sea as well as in deep water offshore Mexico, Brazil and the Gulf of Mexico.

Case study

A customer in the Norwegian sector of the North Sea needed to drill and navigate through complex geological formations with a narrow pressure window. Maintaining low ECD was essential in protecting the formation against excessive hydraulic pressure and avoiding losses.

The operator chose the DELTA-TEQ fluid because of its highly stable properties and ideal rheology for low hydraulic impact.

Using this fluid, the operator drilled the 8½-in. and 6-in. sections in a water depth

The nonaqueous DELTA-TEQ fluid has been engineered with two key differentiators: its unique formulation and a built-in viscosity clutch. (Source: Baker Hughes, a GE company)

of 414 m (1,358 ft) with a maximum inclination of 85 degrees and a mud weight set at 13.2 lbm/gal. Successful drilling intervals were recorded with no mud-related NPT. The DELTA-TEQ fluid displayed remarkable performance with stable properties throughout all intervals, and no barite sag or hole cleaning incidents were observed.

Additionally, the fluid remained within the critical mud-weight window, minimizing risks throughout the



See **DRILLING** continued on page 26



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Bolting with Electric Torque Tools

■ Electric torque tools improve performance, productivity and safety.

CONTRIBUTED BY HYTORC

Bolting is everywhere in the industrial world, including oil and gas, power plants, refineries, pipelines, machinery, manufacturing, mining, transportation, structural applications and many others. Bolting is almost always in the critical path to maintenance, and these industries are constantly looking for ways to improve quality, safety, productivity and performance. With the use of new bolting technologies, especially advancements in electric torque tools, industries now have capabilities never before seen in traditional manual, pneumatic, hydraulic and other bolting technologies.

Historically, particularly in the oil and gas industry, electric tools have been avoided, as a hot work permit may be required to use the tool. Although, in recent times, many companies discovered the major benefits of these tools and found the permit worth pursuing. One of the most impactful advantages of electric tools is data acquisition, a feature that is generally unavailable in other bolting technologies. Advancements in electric torque tools led the ability to record operational data, create job profiles and provide a permanent work record, thereby eliminating potential human errors, improving quality control and establishing accountability of work performed at the site.

Electric torque tools are the ultimate solution in portability and convenience while improving safety. These tools are powered by portable cordless batteries, which means there are no attachments to hoses, air lines or compressors, eliminating potential trip hazards. This

convenience also allows bolting operations where air lines and AC lines are inaccessible. The ease of use improves safety in itself. Clicker wrenches require significant physical effort that can be a source of potential injury and fatigue. On the other hand, electric torque wrenches are much safer, as these tools are ergonomically designed and require just a simple trigger pull to operate. Other features, such as an integrated work light, increase visibility of the working area, further increasing safety and productivity.

Performance also is enhanced with electric torque tools. Electric torque tools are lightweight by design, yet quite powerful with some models capable of reaching up to 5,000 ft-lbs. This is achieved with the use of a high-strength planetary gear drive driven by a DC electric motor. Some electric torque tools are available



HYTORC has developed the latest generation in electric bolting technology, the Lithium Series II Electric Torque Tool. (Source: HYTORC)

with brushless motors, which increases motor life while operating at a lower sound level. In regard to accuracy, a manual tool's margin of error is highly dependent on the skill and quality of work performed by the technician. However, an electric torque tool can provide greater level of accuracy with more repeatable results. Battery performance has made significant advancements particularly lithium ion cells capable of allowing numerous high torque load operations within a single charge.

The electronic design of these tools has become more sophisticated and now offers myriad functions previously unavailable in other bolting technologies. HYTORC has developed the latest generation in electric bolting technology, the Lithium Series II Electric Torque Tool, winner of a 2019 OTC Spotlight on New Technology award. Offering data acquisition coupled with Bluetooth wireless technology brings added convenience to quality management. The integrated transducer directly measures torque providing more repeatable results while enabling advanced bolting functions. The sliding directional switch located near the trigger allows the user to quickly change from tighten and loosen, enhancing overall productivity. These features along with many others serve as an example of how electric torque tools are revolutionizing bolting.

As electric torque tools continue to make advancements, industries are recognizing the significant benefits they gain in quality, safety, productivity and performance. It is clear that electric torque tools are quickly becoming the go-to choice for bolting operations worldwide. ■

Equinor Pushes Forward with Mariner as Global Heavy Oil Production Falls

■ Equinor and partners are investing more than \$7 billion in the development east of the Shetland Islands in the U.K. North Sea.

BY VELDA ADDISON

As the global appetite for oil remains, one of the world's biggest heavy oil projects is moving forward in the North Sea despite obstacles that have included rougher weather than expected among other logistical challenges, according to its operator, Equinor ASA.

"The Mariner project is now in the hookup and commissioning phase offshore," Erik Haaland, a spokesman for Equinor, told Hart Energy in an emailed statement. "All the modules are in place and we are preparing for production start. All work is focused offshore on getting the platform prepared for startup."

Citing unnamed sources familiar with the project, Reuters recently reported that startup of the heavy oil field had been pushed back to the fourth quarter of 2019 after having already been postponed several times. Haaland referred to the "communicated plan" of starting production in the first half of 2019 when asked by Hart Energy.

Key to success at Mariner is to focus on "preparing for a safe startup of production and delivering oil to the market," Haaland said.

Equinor and partners JX Nippon (20%), Siccar Point Energy Ltd. (8.89%) and Dyas BV (6%) are investing more than \$7 billion in the development. Costs rose about 10% above the original estimate in 2015 as the operator grew reserves by 50 MMbbl to 300 MMbbl at the same capex estimate.

The Mariner Field development and some other heavy oil developments such as Kuwait Oil Co.'s Lower Fars and Brazil's Maromba, which is being acquired by BW Offshore Ltd., are progressing as global heavy crude oil production falls amid production slowdowns from places such as Venezuela and Canada.

In 2018, about 12 MMbbl/d of heavy oil was produced worldwide. But that is expected to drop to 11.5 MMbbl/d in 2019, according to analysts at Stratas Advisors.

"Another drop of about 76,000 bbl/d is projected for 2019 with Canada curtailing production from Alberta," Xiangyu Mu, senior analyst for Stratas, told Hart Energy after also noting Venezuela's falling production. "In 2019, heavy crude output is expected to become sweeter as Canada and Venezuela contribute less heavy sour oil to the market."

The trend, Mu said, is expected to last until 2020 when heavy oil production is forecast to be around 12.2 MMbbl/d, with total production growing to more than 13 MMbbl/d in 2025 and hitting 14 MMbbl/d in 2028.

"Most of the increase will be contributed from the Middle East, mainly driven by Iraq and Iran," Mu said.

Mariner is among the industry's largest heavy oil projects underway, carrying one of the heftiest price tags offshore U.K.

"For the Mariner project, Stratas Advisors estimates that the total finding and development capital will end up being approximately \$5.8 billion. This economic analysis would put the total capital layout at about \$17.5 per boe [barrel of oil equivalent]," Mu said. "We also estimate real

operating costs [opex] to be around \$7 per boe, resulting in a total cost of \$24.5 per boe. From development forward, Stratas Advisors' current forecast shows a real IRR of around 14.8% and an NPV10 about \$5.9/boe."

Located east of the Shetland Islands in the U.K. North Sea, the Mariner heavy oil field was discovered about 38 years ago. With more than 2 Bbbl of oil in place, the field targets oil from the Heimdal reservoir and the deeper Maureen Formation.

The field is expected to have a 30-year lifespan, according to Equinor, though it sees upside potential. Currently, plateau production is expected to average about 55,000 barrels per day. Its development plan calls for a production, drilling and quarters platform on the Mariner A steel jacket, connected to the Mariner B floating storage unit.

Haaland called the hookup of Mariner one of the largest in Equinor's history.

"Mariner is a huge topside of 38,000 tonnes," Haaland said. The Mariner A topside, which was constructed at South Korea's Daewoo Shipbuilding & Marine Engineering Co. Ltd., was lifted into place in 2017.

"The topside consists of eight large modules [plus] the flare, and all this is to be connected offshore. On top of the complex hookup scope, adverse weather and related logistical challenges led to the startup date being moved from end of 2018 to first-half 2019," Haaland said. "Close cooperation between the suppliers and Equinor has been important to ensure progress on the project." ■



THE RBIDZ SPECIAL ECONOMIC ZONE - KEY INVESTMENT DESTINATION IN KWAZULU-NATAL, SOUTH AFRICA - CALLS FOR BUSINESS ACTION

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- Close proximity to one of the deep sea water Port with the ability to handle large ships;
- This Port is South Africa's premier dry bulk and liquid bulk port as well as break bulk cargos;
- It has specialised cargo handling facilities, efficient ship turnaround and deep water infrastructure;
- Existence of multiple shipping berths, deep sea rescue crafts and Ship repair facilities;
- This Port handles over 91 million cargos annually, and is in operation 365 days of the year;
- Closest SA port to the majority of 'takers' as well as multi-national industries utilising maximum electricity within Richards Bay and seek alternative energy;
- Port has the Use of a direct pipe to carry fuel inland using existing servitudes or an even shorter pipe to link to the existing multi-product pipeline;
- Substantial rail capacity to rail refined products and/or gas inland and into countries such as Zambia, Zimbabwe and the Democratic Republic of Congo;
- Significant existing electrical infrastructure which can be used to evacuate power from a gas power plant into the grid; and
- Indigenous African companies in the continent also seek for alternative energy mix.

SECTORAL INVESTMENT OPPORTUNITIES FOR PROSPERITY INCLUDE:

- Ship and rig construction and repair;
- Drill pipe manufacturers;
- Drill mud compilers;
- Aluminium fabricators for offshore applications;
- A gas to power plant for over 2000MW as announced in 2016;
- Oil refinery;
- Upstream, midstream, downstream and power segments;
- Offshore supply services; and
- Petroleum pipelines in the Gas Corridors SEA.

ABOUT RBIDZ

The Richards Bay Industrial Development Zone – Special Economic Zone (RBIDZ - SEZ) is a purpose-built and secure industrial estate on the North-Eastern coast of KwaZulu-Natal, linked to the international deep-water port of Richards Bay.

It is tailored for manufacturing of goods and production of services to boost beneficiation, investment, economic growth and the development of skills and employment. The RBIDZ, is a Special Economic Zone (SEZ), that aims to encourage international competitiveness through world-class infrastructure as well as tax, VAT and duty free incentives to qualifying companies.

South Africa as a country is taking a turnabout on issues relating to energy and the diversification of its energy base and this stature is supported by its strong hold as the continent's leading power player, with more than 45,000 MW of installed capacity and several new projects under development. Remarkably, there are prospects in the projects in the upstream, midstream, downstream and power segments.

RBIDZ BRIEF OVERVIEW

The RBIDZ focuses on the following sectors: **Metals Beneficiation** (Aluminium, Iron Ore & Titanium), **Marine Industry Development** (Ship Building & Repair, Oil Refinery, Oil & Gas), **Renewable Energy** (Solar, Fuel Cells Biomass), **ICT** (Techno-parks, Innovations Hub) and **Agro-processing**.

The RBIDZ Special Economic Zone has been identified and announced as the host of 2000MW Gas-to-Power plant to be developed in the country. In response to this development, the KwaZulu-Natal Province is in the process of exploring gas opportunities in the province, and the RBIDZ has taken lead in the process. The identified 65 Hectares of land has been set-aside for the Oil and Gas hub, and a further 600-1200 Hectares of land is proposed for the Oil Refinery in this SEZ.

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Composite Solution Fortifies New Construction Offshore

■ Resourceful approach to pipeline construction increases field life.

BY BUDDY POWERS, JAVIER ARBULU AND JOSE ZAPATA, CLOCKSPRING|NRI; AND IRVIN LOPEZ, NIRSA

Making sure offshore assets function safely is critical, but achieving that goal is becoming more challenging as structures remain in service beyond their original design life. Many companies are taking measures to restore the integrity of aging assets to ensure continued safe operation, while others are taking steps down a different path, protecting and fortifying installations during construction to mitigate operational wear and tear and reduce pipeline integrity events in the future.

Regulations outline construction and performance criteria for offshore pipelines, but meeting those expectations is the minimum, not the ideal. For companies that want to install pipelines that will perform safely for a longer life in the field, the minimum is not enough.

Going beyond the minimum

A North American pipeline operator was planning construction of a 500 m (1,641 ft) section of 1,067-mm (42-in.) diameter gas pipeline offshore Mexico. The line was coated with fusion bonded epoxy (FBE) to protect it from wear, but the installation process had the potential to damage the FBE. If the FBE were to be compromised, the steel would be exposed to corrosive elements from the moment it was installed.

The installation plan called for the pipe to be pulled through a 1,422.4-mm (56-in.) casing and then drawn along the seabed, using sacrificial anode collars to protect the line. The operator was concerned because these metallic components are not designed to handle all the loading conditions that would be experienced during the pipe pull. The operator had reasons for being skeptical as things had not gone well on the first pullout operation, during which the collars had failed.

Unfortunately, while there was a desire to protect the pipeline, there was a major time constraint. The entire job had to be completed in less than five days due to shipping agreements from the platform owner.

Because it was of paramount importance to protect the line, the operator began looking for a company that could provide spacers to replace the anode collars along with a composite wrap to protect the pipeline. Based on feedback received from other contractors that had used ClockSpring|NRI composite products, the operator contacted the company and requested a solution. After careful consideration of the requirements, the engineering team suggested covering a section of pipeline with abrasion-resistant composite wrap and using centralizing composite casing spacers to align the pipeline during installation.



A 60-person crew from Nirsa performed the installation, placing the casing spacers and wrapping the line with composite protection, alternating among operations to complete the entire installation in five days working two shifts 24/7. (Source: ClockSpring|NRI)

Replacing the metallic collars would deliver multiple benefits. By using the composite spacers, it would be easy to center the pipe in the casing, minimizing deflection and reducing friction during the installation process. The spacers prevent coating wear much more effectively than the metallic collars, and using the spacers would not only reduce construction time and eliminate build time of the metallic collars, but drastically decrease future maintenance costs.

Implementing the solution

The engineering team designed a solution to provide proper support for the loading conditions during the installation using 42, 101.6-mm (4-in.) thick spacers 0.91 m (3 ft) in length along the pipeline. The entire 500 m (1,641 ft) length of the line was protected with Contour WA, an engineered, bi-axial stitched e-glass tape impregnated with a water-activated polyurethane resin.

All the products for this installation shipped to the site in less than one week, allowing trained and certified installers from dba Nirsa SA de CV (Nirsa), an authorized local contractor, to begin the installation process. A 30-person crew from Nirsa performed the installation with the support of two field engineers and three assistants under the oversight of a ClockSpring|NRI supervisor. The technicians carried out the surface preparation and installed the casing spacers and composite wrap along the line, alternating among operations to complete the entire installation in five days working 24/7, executing the expedited installation of field-proven products that will provide protection from day one in the field.

These composite components have the potential to prevent line damage, delivering long-lasting performance and reducing maintenance costs and lost production. ■

Expert Data Analysis Can Increase Efficiencies, Cut Costs

■ Predictive analytics is saving companies millions.

CONTRIBUTED BY LLOYD'S REGISTER

The oil and gas industry's mindset can be shifted from a retrospective to a predictive approach by finding and analyzing data to give visibility around currently "opaque corners" for the world's biggest oil companies.

Predictive analytics is saving companies \$7 million on gas pipelines in the eastern U.S. by providing a heads-up on failures, and other companies are saving \$325,000 per rig by using machine learning to predict drillbit locations.

More than half (57) of the world's 100 largest oil and gas firms have already figured out the trick to winning

the game. But why are 40% still lagging behind? It's a mixture of psychology and awareness. Some fear the unknown and others are distracted by the business of hitting commercial targets amid colliding pressure points of challenging oil prices, stricter environmental goals and rising energy demand.

However, embracing predictive analytics and the wider toolbox is only half the story; successful application is the other.

There are almost limitless reams of numbers. The majority can be "data diamonds"—information that needs product data management (PDM) and expert

analysis to reveal its potential to increase efficiencies and cut costs. Admittedly, PDM may not be the most exciting aspect of the Fourth Industrial Revolution. However, the less care that companies take during this stage, the duller the shine of the predictive analytics later on. Approximately 3% of the possible data on an oil rig is harvested, for example. What knowledge are we missing in the remaining 97%? How many other safety improvements can be made and spending saved?

Predictive analytics is still in the early stages of its exploratory journey; this is just the tip of the digital iceberg.

Meet Lloyd's Register experts at booth 376. ■

Condition-Based Maintenance and Monitoring for Drilling Riser Systems

■ Process can assess the condition of important components and their remaining life expectancy.

CONTRIBUTED BY STRESS ENGINEERING SERVICES INC.

The drilling riser on a mobile offshore drilling unit (MODU) typically consists of 75-ft to 90-ft-long riser joints connected together and serves as the critical conduit between the drilling rig and well system. The drilling riser system becomes the main conduit to drill through after connecting to the top of the BOP, which is latched to the wellhead and casing system on the seafloor. During a well control event, high-pressure lines on the outside of the riser main bore are used to control the pressure. In addition to the choke and kill lines, hydraulic lines deliver control fluid to operate the subsea BOP and a mud boost line to deliver additional mud to the bottom of the riser to lift cuttings.

During its lifetime, the riser system experiences significant wear, erosion, corrosion and damage as a result of fatigue. Presently, drilling riser joints are inspected every five years. Each year, 20% of the riser is rotated onshore to be disassembled and inspected. This costly, logistically complex process calls for a large number of boat trips and trucking of the riser.

To address this issue, Stress Engineering Services Inc. (SES) and LaserStream LP have developed a condition-based maintenance (CBM) and monitoring system, which has been recognized by OTC with a 2019 Spotlight on New Technology award. This system is compatible with all present equipment owners' maintenance programs and ensures maintenance requirements are supported with robust engineering. The system integrates preventive, corrective and CBM (with monitoring) and is applied in a continuous improvement cycle and predictive manner.

The CBM and monitoring process can be used to assess the condition of drilling riser joints, determine when important components will need service or replacement and assess the remaining life of the component.

The program consists of utilizing

- Synchronized drilling and metocean data;
- Measured loads on the riser and well-head system;
- A digital twin of the riser system;
- Data analytics; and
- Onboard inspection driven by data analytics.

The CBM process

SES collects detailed measurements including vessel, metocean, drilling conditions and either real-time or stored load measurements during the drilling operation on the riser system using Subsea Vibration Logger (SVDL) technology to assess the fatigue damage. LaserStream uses its BEMIS Laser Profilometry system to collect measurements on the inner diameter (ID) of the main bore and axillary lines between wells to characterize the state of drilling riser joints.

Vibration sensors and data-acquisition electronics are housed in the SVDL. The data are then processed using SES-patented technology that integrates a computer algorithm to synthesize stress estimates along the entire riser length using a database of riser dynamic modes. The estimates are then processed chronologically via rain-flow counting to determine fatigue damage accumulated during a drilling riser campaign, thereby providing actionable information to the drilling crew.

The laser ID inspection consists of deploying the BEMIS through the ID of the riser via a tethered crawler. The scanner head rotates at 250 rpm, collecting more than 3,000 measurements per rotation, beginning in the launch tube and traveling through the riser, taking measurements that are accurate to ± 0.002 in. The auxiliary lines are inspected in the same manner.

This inspection system generates high-resolution data points that can be used to

- Determine material loss due to pitting and/or mechanical wear;
- Characterize features to deduce if they were caused by wireline, drillpipe, corrosion or a manufacturing flaw;

- Perform a detailed analysis of the entire tube, including the pin end and ID weld dimensions, as well as locations where ultrasonic testing cannot provide adequate inspection; and
- Ultrasonic testing is utilized to validate remaining body wall thickness.

The value of CBM

By facilitating a move to a life-cycle CBM, monitoring and inspection system that can be deployed on the MODU, the CBM system process benefits and adds value to the driller and operator, resulting in lower overall costs, reduced risks, greater efficiency and improved management of assets. ■



GD 1000Q HD

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Underwater Balloon to Defend the Seas

■ Saipem awarded for innovative technology that puts a lid on oil spills.

CONTRIBUTED BY SAIPEM

At OTC Saipem will present a technology capable of remotely capping oil well spills due to incidents or blowouts, significantly speeding up intervention times and consequently minimizing environmental impact. This technology, known as Offset Installation Equipment (OIE), was honored with OTC's Spotlight on New Technology award, which recognizes the latest and most advanced technologies that are leading the industry into the future.

This capping system addresses the problem of how to get access to blowouts in medium-low depths where it is not possible to operate a vessel positioned vertically above a damaged well.

The system was developed in the aftermath of the BP disaster in the Gulf of Mexico in 2010 for Oil Spill Response Ltd., an industry-funded group backed by BP, Chevron, ConocoPhillips, Exxon Mobil, Petrobras, Royal Dutch Shell, Equinor and Total SA. The technology, entirely developed and manufactured in Italy, took six years to be finalized, involved more than 200 engineers and specialists, with 4,000 technical designs and documents produced, half a million



The OIE is a property technology of Oil Spill Response Ltd. developed by Saipem. (Source: Saipem)

hours worked and more than 150 companies involved in the process. After two years of testing offshore Norway, Brazil and Croatia, the OIE was officially launched in 2018.

The main element of the OIE intervention system is the carrier, a sort of underwater balloon weighing about 250 tons, remotely controlled by a robot (ROV)

capable of aligning the capping stack within an inch of precision while the well is still discharging oil. The OIE's trained personnel safely control the carrier from a vessel located 1 km (.62 mile) away from the incident zone. The carrier mainly consists of four tanks, which can be filled with air to generate a net variable positive up to 150 tons. This characteristic allows the safe transportation of the capping stack and the materials necessary to operate on the well through the incident zone. The carrier stands 14 m (46 ft) in height, is 11 m wide (36 ft) and 13 m long (43 ft). It includes over 120 remote executions and more than 200 sensors that enable its functioning in extreme environments.

Saipem's equipment is stored in Trieste, Italy, and four more capping stacks have been placed in Norway, South Africa, Singapore and Brazil to provide global coverage and ensure relatively quick access. The OIE allows blowouts to be capped in just a few days compared to the months it took BP in 2010 when they had to build its capping stack from zero.

Moreover, the OIE was included in the Google Arts and Culture initiative, the largest online exhibition ever made dedicated to inventions and discoveries.

For more information, visit Saipem at booth 4639. ■

Nonrotating Wellbore Seal Brings Fundamental Changes to MPD

■ Device extends seal life and enables condition-based maintenance, which increases MPD system availability and reduces costs.

CONTRIBUTED BY AFGLOBAL

Deepwater managed pressure drilling (MPD) has long contended with the operational and maintenance challenges inherent in traditional rotating control devices (RCDs). Recent deployment of AFGlobal's Active Control Device (ACD) for a deepwater project in the Black Sea marks a significant departure from past constraints and introduces a fundamentally new technology.

The industry's first active, nonrotating MPD wellbore sealing technology eliminates the RCD's high-maintenance bearing assembly and passive sealing element that rotates with the pipe. Instead, the ACD is based on a hydraulically controlled, nonrotating sealing element. The technology, described in the SPE-194079-MS paper, pioneers active compensation for wear and enables condition-based seal monitoring for proactive MPD maintenance strategies.

The ACD is a significant departure from passive RCD technology adapted from land applications. It has been recognized by OTC with a 2019 Spotlight on New Technology award. In its first deployment, the device was integrated with a full AFGlobal MPD system to successfully provide drilling support for operations in the Black Sea.

Deepwater sealing

The ACD's dual, nonrotating API 16RCD seal sleeve elements are each externally energized by an API 16A annular packer assembly. Control is achieved by adjusting the annular packer closing pressure.

As the seal material wears, the active control system maintains closing force to ensure the wellbore seal. Variations in packer closing pressure and lubrication pressure indicate when an element should be replaced. The control system feeds data to the condition monitoring system, which alerts the crew when the seal sleeve assembly should be changed.

The alert supports maintenance when necessary, instead of relying on a time-based schedule that must anticipate the risk of losing wellbore pressure. Condition-based maintenance reduces unnecessary interven-

tion and increases on-bottom drilling time. In addition, rigorous full-scale trials indicated the ACD seal element lasts nearly 40% longer than the elements used in conventional RCDs.

ACD integration

The ACD is integrated with the drilling riser as part of an MPD specialty joint. The wellbore seal is initialized by the control system. Hydraulic fluid closes the packers on the seal sleeves, pushing the seal element inward to contact the drillstring and form the seal.

The seal sleeve elements are manufactured from a polymer-based honeycomb seal insert co-molded with a polyurethane buffer material. The seal insert provides wear resistance during drillstring rotation while the buffer material supports the seal insert and acts as a secondary seal material after the seal insert is worn.

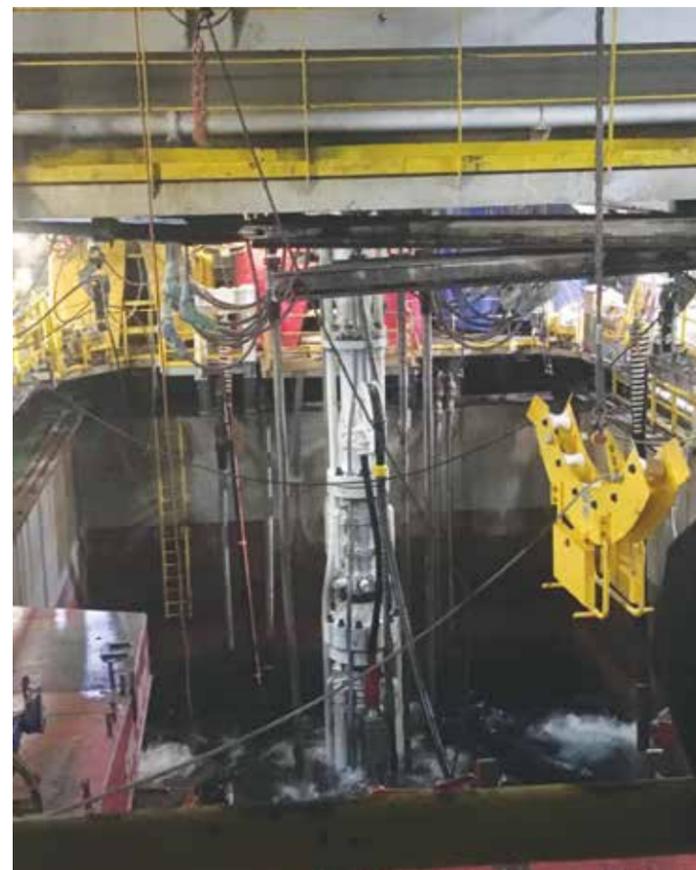
Drilling mud is injected between the seal sleeve elements to lubricate and cool the seal faces. Lubrication pressure is maintained above wellbore pressure, providing a unique ability to ensure any leakage across the lower seal travels into the well rather than toward the rig.

Condition monitoring

Seal condition monitoring acquires data to quantify seal wear. The insert and buffer material in the elements have distinctive material characteristics. Taken together, the two materials act as one and require one closing pressure to create a seal.

As the insert wears, its contribution to the closing pressure decreases, resulting in a different closing pressure. The resulting pressure change indicates the wear state and alerts the crew that a replacement element will soon be required, allowing maintenance to be scheduled to optimize rig operations.

The ability of the ACD to actively monitor the seal condition and compensate for wear provides deepwater



ACD deployment introduces a fundamental change to MPD wellbore sealing. (Source: AFGlobal)

rigs with a new capability for managing maintenance. Extensive full-scale testing and API monogram certification show that the ACD offers a significant advance for extending seal life and enabling condition-based maintenance that increases MPD system availability and reduces maintenance and operating costs. In these challenging drilling environments, the active MPD wellbore seal monitoring and control technology provides a unique opportunity to improve rig economics, operations and safety. ■

Advancing Concepts for Normally Unattended Installations

■ Innovative concept unlocks new opportunities for exploiting marginal fields in the UK North Sea and beyond.

CONTRIBUTED BY SIEMENS AND CRONDALL ENERGY

The combined value of small, stranded (i.e., marginal) oil and gas reserves globally is estimated at more than \$700 billion. In the U.K. Continental Shelf (UKCS) alone, there are more than 360 marginal discoveries holding more than 3.5 Bbbl of technically recoverable oil. Unfortunately, the vast majority of these reserves are either too small for traditional FPSO vessels or too far away from existing facilities for tiebacks.

In recent years, increased attention and resources have been dedicated to advancing concepts for normally unattended installations (NUIs) to increase the economic viability of exploiting marginal offshore fields. Today, there are many NUIs in operation that are producing gas; however, very few house the necessary equipment for the processing of oil and none are floating installations.

In 2018, a group of international companies set out to change that by launching a study whose primary objective was to expand the capabilities of NUIs. The initiative—which has been led by Buoyant Production Technologies Ltd. (a wholly owned subsidiary of Crondall Energy) and co-funded by the U.K.'s Oil and Gas Technology Centre (OGTC) and collaborating partners, including Siemens—focuses on applying existing technologies in novel ways and utilizing recent advances in digitalization to develop low manning concepts for offshore production by facilitating remote control, remote monitoring and reducing maintenance requirements.



The production buoy has been developed in collaboration with multiple partners and is now ready for a pre-FEED study. (Source: Siemens)

The specific NUI concept explored in the study was an unmanned floating production buoy designed for the recovery of small hydrocarbon pools in typical UKCS conditions. The standalone facility is based on a deep draught, single-column slender hull structure and integrated, buoyant "deck box." Key to the concept is the integration of compact process, separation and compression technologies and, where possible, low maintenance materials to reduce the need for both maintenance and overall weight. This minimalist philosophy ulti-

mately results in an ultracompact floating facility that has a much lower capex than conventional production facilities of equivalent capacity.

The buoy was developed in accordance with relevant international standards and builds incrementally on accepted best practices, with a desire to stay at the forefront of technological advancements. Overall, the design aims to minimize HSE risks by operating responsibly while unattended; reduce opex through remote operation and monitoring of production operations; and minimize unplanned downtime with a robust management system and the adoption of a condition-based maintenance approach.

To achieve these goals, equipment for the buoy was selected on the primary basis of reliability and maintainability. This is a significant enabler for NUI operations and provides improved life-cycle costs and performance.

Leveraging technology to create a digitally enabled facility was also a key focus during development, as it allows for reduced opex through remote operation, condition-based maintenance and data-driven decision-making. To realize these benefits, a fully integrated digital solution was specified, which con-

See **INSTALLATIONS** continued on page 27

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New Connector Enables Re-use of Pipeline Bundles

■ The reconfiguration or relocation of subsea equipment transforms the economics of marginal field development.

CONTRIBUTED BY SUBSEA 7

The reuse of subsea infrastructure is widely recognized to be the key to unlocking many challenging fields—marginal fields, stranded reservoirs and longer tiebacks—by significantly reducing both capex and decommissioning costs. In addition, the reuse of existing structures makes a significant contribution toward environmental sustainability.

Subsea 7 and OneSubsea, collaborating as Subsea Integration Alliance, are developing a new multibore connector that enables the serial subsea connection or reconfiguration of the company's Pipeline Bundle product utilizing ROV tooling.

The connector development enhances the versatility of the Pipeline Bundle concept by introducing the potential to reuse a Pipeline Bundle (or elements of it) for long-term service with different duty cycles in multiple locations.

"Our unrivalled experience with Pipeline Bundles has demonstrated that they still have considerable remaining integrity at the end of their design life," said Thomas Sunde, Subsea 7's vice president of strategy and technology.

"Some marginal fields may have potentially short lives, with a number of reservoirs in close proximity to an existing host," he said. "In these circumstances, we can use a single Pipeline Bundle for a period, and then redeploy it using the new connector to exploit a different pool.

"Recovery, refurbishment and reuse of Pipeline Bundles is a high-performance concept that greatly reduces

capital cost amortizations, making marginal fields viable where they were previously uneconomic."

The Pipeline Bundle concept

Since the 1980s, Subsea 7 has constructed and installed over 80 Pipeline Bundles, including two in Australia, all assembled and fully tested in controlled onshore conditions before being transported to site.

The finished Pipeline Bundles are transported and installed in position by the Controlled Depth Tow Method, a low-stress and low-fatigue process using local anchor-handling tugs, which eliminates one of the major technical challenges for the reuse of traditional pipelay systems.

Prefabricated Pipeline Bundles incorporate all the structures, valve work, pipelines and control systems for field operation contained in a corrosion-free environment within a single, large-diameter carrier pipe.

Onshore fabrication and testing allows year-round installation with simplified campaigns and eliminates the need for specialist pipelay or heavy construction vessels. Pipeline Bundles can operate at pressure and temperature limits beyond conventional tieback options and deliver active control of the arrival temperature across the production life.

"We have already installed a Pipeline Bundle with the functionality for refloating and repositioning, although it is still in service in its original position 11 years after installation," Sunde said. "The ability to bring into play the recycling and reuse of subsea equipment is a hugely

exciting proposition, which has not been technically feasible until now."

The multibore connector

The new multibore connector enables the serial connection of multiple Pipeline Bundle sections to create longer tiebacks of any desired length without intermediate towheads and tie-in spools.

It also allows altering the length of Pipeline Bundles in the future or changing out a towhead to accommodate high-integrity pressure protection systems, cooling spools, boosting pumps or isolation valves, with options for removal or interchangeability to meet developing field conditions.

The innovative connector development is based on existing and proven technologies and enables the connection of a combination of three pipelines and multiple control tubes in a single diverless operation.

"Being able to design Pipeline Bundles for cost-effective refloating, reconfiguration, reuse and even removal creates a completely new insightful type of thinking," Sunde said.

"[In addition to] the benefits of cost reduction and project acceleration, the concept is also environmentally considerate. Although the commercial model for reuse and re-purposing is widely understood and utilized for FPSOs, this important new technological development now enables a similarly versatile approach to be adopted for subsea production infrastructure." ■

Dark Clouds Hang over US Gulf Rig Market, but Drillers See Silver Lining

■ Within the floater segment, drillships have taken a substantial lead over semisubmersibles.

BY EIVIND DRABLØS, RYSTAD ENERGY

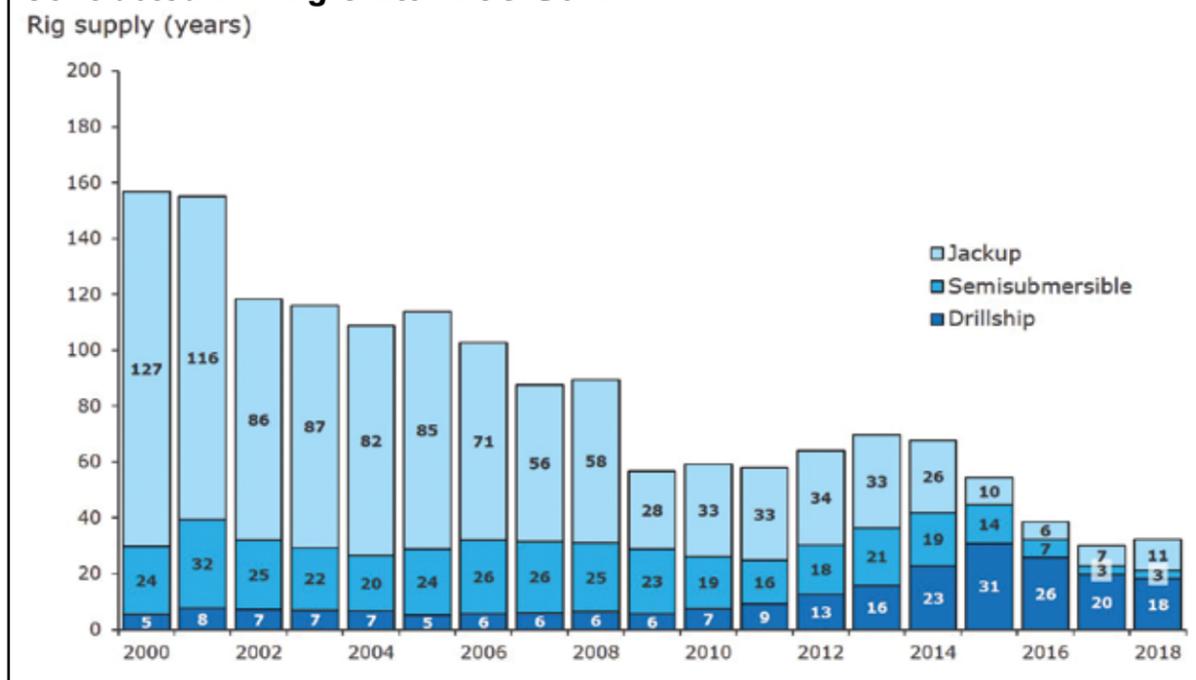
The trajectory of the offshore drilling rig market in the U.S. Gulf of Mexico (GoM) has been nothing short of brutal for nearly 20 years. Jackup demand has dwindled to a near standstill, but things are looking up for owners of deepwater rigs.

The shallow-water drilling scene on the offshore continental shelf is merely a shadow of what it was during the glory days at the turn of the millennium. More than 1,000 wellbores were completed on the shelf in 2000, and the number of contracted jackups that year reached a lofty 127 units. Fast forward 10 years—a time during which the U.S. shale industry began to blossom in earnest—and the volume of completed wellbores had fallen dramatically to below 200 on the shelf. After the oil price collapse in 2014–2015, that number bottomed out in 2016 at a paltry 29 wellbores in the shallow-water U.S. GoM, with only six contracted jackups.

After 2015, the offshore rig market in the U.S. witnessed an unprecedented shift, with the pendulum swinging from the long-standing dominance of jackup activity in shallow waters to becoming predominantly a market for mid-water and deepwater floaters. The floater segments were also exposed to significant declines over the past 15 to 18 years, but this was nowhere near the drop-off in activity that jackups faced.

In terms of wellbores completed in the U.S. GoM, 2018 displayed increased activity across all water-depth segments. This applies in particular to the ultradeepwater sector, beyond 1,500 m (4,921 ft), where activity levels reached an all-time high in 2018 with 85 wellbores completed, representing a 52% rise versus 2017. Last year's growth in the number of deepwater spuds in U.S.

Contracted Drilling Units in US GoM



(Source: Rystad Energy RigCube, March 2019)

waters was fueled by majors drilling development wells in the Mississippi Canyon area.

The accompanying graph illustrates the extent to which floaters have overtaken jackups to assume the lead role in the U.S. GoM in recent years. In 2017 the region had more than three times as many contracted floaters as jackups. Simultaneously, within the floater segment drillships have taken a substantial lead over semisubmersibles in recent

years. This was evident last year, with 18 drillships contracted, against only three semisubs. Extreme water depth targets, benign operational environments and exploration focus in remote locations make drillships the preferred choice for operators, as they benefit from having excellent mobility and higher variable deck load capacities.

See **MARKET** continued on page 27

The Changing Face of the Offshore Energy Industry

■ New technologies are driving efficiency, safety gains and linkages to other forms of energy production.

BY RANDALL LUTHI, NATIONAL OCEAN INDUSTRIES ASSOCIATION

Today, the U.S. leads the world in discovery and production of oil and natural gas thanks largely to technological advancements, like those on display annually at OTC. Horizontal drilling and hydraulic fracturing have revolutionized American energy production, making it possible to produce energy in previously impossible areas. Technological innovations have also generated needed advances in offshore safety.

Nine years ago, in response to the tragic *Deepwater Horizon* accident, the industry and federal regulators launched a robust safety review. Industry initiatives and reforms since then have prioritized innovation, efficiency and safety. The Center for Offshore Safety promotes continuous safety improvement offshore. The Marine Well Containment Co. and the HWCG LLC can quickly deploy systems designed to stem any uncontrolled flow of hydrocarbons from a subsea well. And the industry has published more than 100 new and revised E&P standards over the past 10 years.

On the regulatory side, the Bureau of Safety and Environmental Enforcement (BSEE) strengthened requirements for safety equipment, well control systems and BOP practices offshore; issued new requirements for determining the worst-case blowout discharge and the associated demonstration of capability to effectively respond to such a discharge; introduced a new risk-based inspection pro-



Randall Luthi

gram; increased inspection time for offshore facilities; and expanded its reporting program to include confidential reporting of near-miss episodes and early equipment failure. Most recently, BSEE announced a revised final Blowout Preventer Systems and Well Control Rule (WCR) addressing industry concerns that certain requirements in the 2016 WCR were overly prescriptive, did not increase safety and, in some cases, could instead actually increase risk.

As a result of these industry initiatives and regulatory reforms, offshore energy development is safer than ever, and U.S. oil and natural gas operations are the world's gold standard for safety and environmental protection. And yet, the U.S. remains one of the only nations to keep the majority of its offshore energy resources off limits to development. Currently, a full 94% of the U.S. Outer Continental Shelf is locked away, and with it, up to 90 Bbbl of oil and 327 Tcf of natural gas.

While large new oil and gas discoveries have been made off Canada, Brazil, Guyana and Mexico, the U.S. is still years away from any new leasing under a final version of the 2019-2024 National Oil and Gas Leasing Program, which was recently delayed indefinitely.

On a more encouraging note, with Incidental Harassment Authorizations finally in hand, four companies eager to conduct the first seismic surveys in U.S. Atlan-

tic waters in three decades may soon be able to proceed, pending the issuance of permits from the Bureau of Ocean Energy Management. The last surveys of offshore resources in the Atlantic, conducted in the 1980s, resulted in estimates of 4.7 Bbbl of oil and 37.5 Tcf of natural gas. However, since today's surveying technology is exponentially more sophisticated than technology used 30 years ago, those estimates are likely drastically low.

The Atlantic seaboard, with strong winds, a shallow continental shelf and close proximity to population centers is also driving strong interest in offshore wind development, and the offshore oil and gas supply chain stands to benefit. The participation of companies that traditionally service the offshore oil and gas industry is a win-win for everyone involved. Wind companies get the unrivaled expertise and skill of companies operating in the Gulf of Mexico, and, in turn, these service companies tap a new, and much needed, revenue stream.

As new technologies drive efficiency and safety gains and further linkages to other forms of energy production, the face of the offshore energy industry is changing. The U.S. has an abundance of traditional and renewable energy resources off its shores and the offshore energy industry has the technology and the know-how to safely tap all of these valuable resources. ■

Randall Luthi is the president of the National Ocean Industries Association, an offshore energy trade group located in Washington, D.C.

INDUSTRY NEWS

(continued from page 10)

A project with Siemens on the Deep Cygnus vessel in the North Sea, in turn, is what tipped the counter past the 10 million kg mark. The E1000 has for over two years now, primarily in the offshore wind industry.

Pioneering the Walk to Work (W2W) market more than 10 years ago, the company has come a long way in enabling the safe and efficient access of crews and cargo to and from offshore structures. What started as an idea during an offshore wind conference has turned into a company with 11 offices globally and an international workforce. Ampelmann maintains a fleet of more than 60 systems and has enabled more than 300 projects to date.

Newpark Opens Service Facility for GoM Clients

Newpark has launched a second service facility at Port Fourchon, La., to support offshore rigs in the Gulf of Mexico (GoM). Built to maximize speed and efficiency, Newpark's first facility specializes in simultaneous operations and efficiently for faster turnaround times at sites offshore. Newpark's second facility is designed for the distribution of completion fluids. It includes features intended to assist customers in executing goals swiftly and efficiently.

Newpark Fluids Systems will be highlighting its portfolio of stimulation and completion fluids, the Kronos deepwater drilling fluid system and a new hydraulics modeling software at OTC.

The new completion fluids line includes wellbore cleanup and displacement chemicals, filtration equipment and services, displacement modeling software and preplanning/post-analysis displacement laboratory services.

As for stimulation fluids, Newpark's NewStim is engineered to enhance production from newly completed wells or to restimulate production from older wells that may require attention.

For deepwater drilling, Kronos is a synthetic-based invert emulsion system designed to comply with the environmental requirements for nonaqueous fluids.

In addition, Newpark's hydraulics modeling software provides users with a realistic view of a given fluid product and tests how it will perform within a particular environment.

For more information, visit Newpark at booth 105.

Aker Solutions Wins FEED Contract for Subsea Compression System

Aker Solutions has been awarded a master contract to support the delivery of a subsea compression system for the Chevron Australia-operated Jansz-Io Field offshore Australia. The first service order under the master contract will be for FEED of a subsea compression station that will boost the recovery of gas from the field. The FEED scope also will cover an unmanned power and control

See **INDUSTRY NEWS** continued on page 26

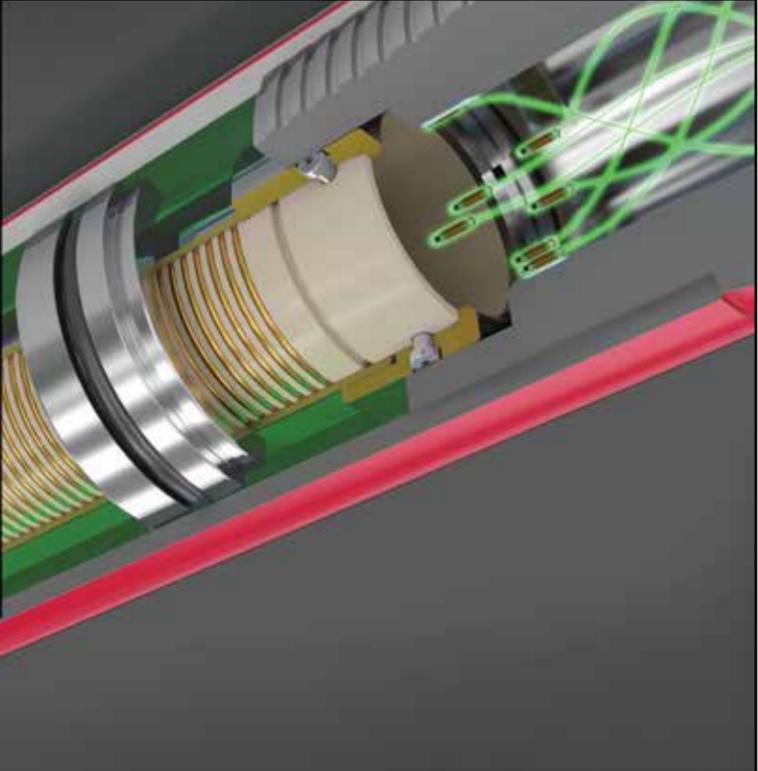
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Subsea Technology Improves Project Economics

■ Configure-to-order, standardized architecture is essential to rapid field development.

BY LISA ALBISTON, TECHNIPFMC

Even as cash flow improves and is expected to continue to do so, operators are taking a disciplined approach to field development. Subsea fields become an even more attractive option in these cases, as subsea production systems can offer ample opportunities to decrease costs through their technology, execution and lean engineering. However, the current economics of subsea field development require fundamental change to become a sustainable option over the long term. Achieving this requires an overhaul to the way fields are designed, managed and developed. A critical eye also should be turned to field architecture.

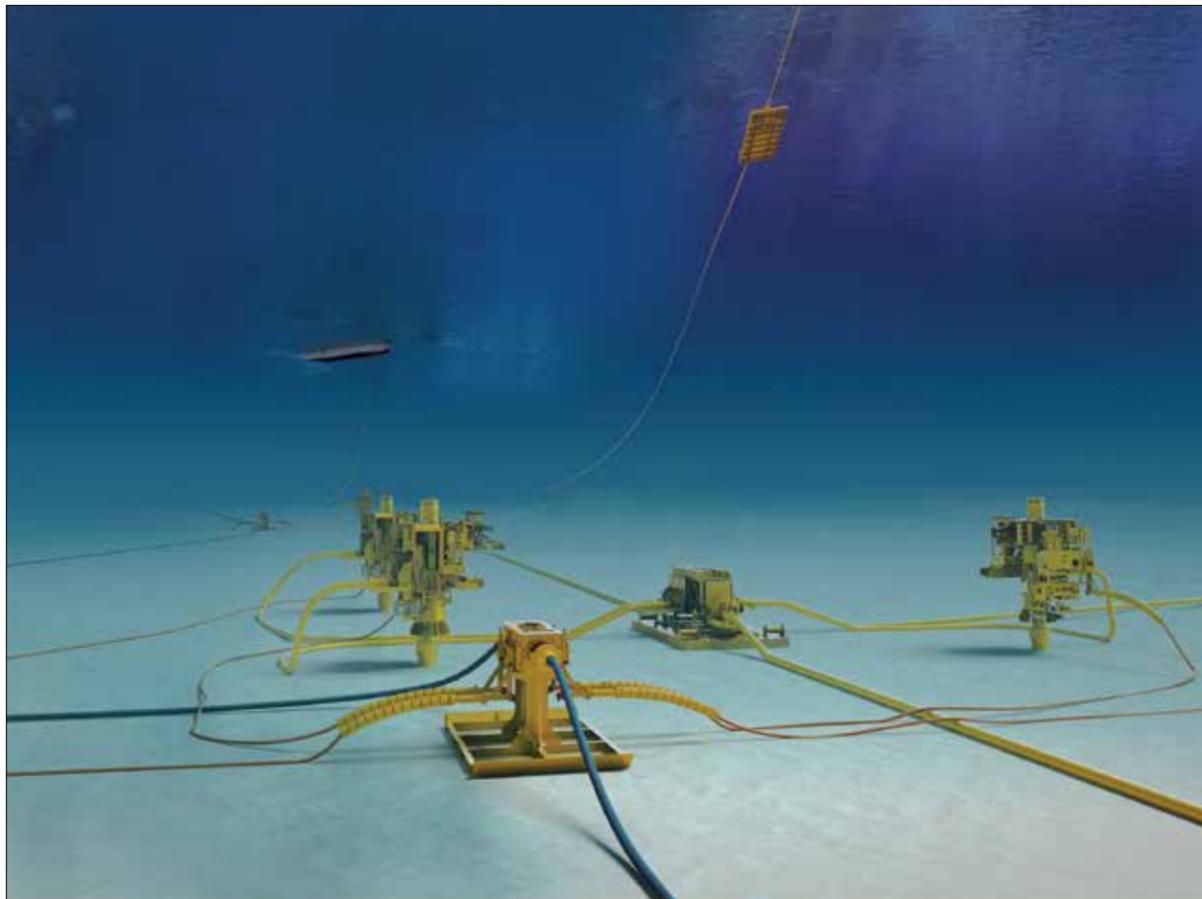
Tailored, customized subsea solutions were a primary cost driver prior to the downturn. Now, the industry is seeking standardized products that can be configured-to-order rather than engineered-to-order. TechnipFMC pioneered this area, recently commercializing its Subsea 2.0 product platform, which uses standardized components configured in modular designs for simpler, leaner and smarter subsea projects.

Subsea 2.0 is made up of six core products: compact trees, compact manifolds, flexible jumpers, distribution, controls and integrated connectors.

This year TechnipFMC was awarded an OTC Spotlight on New Technology award for a product in this platform, the Subsea 2.0 In-Line Compact Robotic Manifold. The compact robotic manifold is half the size and weight of its conventional counterpart and reduces cost and delivery up to 30%. In addition, its production schedule can be compressed up to 30%, providing faster time to first oil and return on investment.

The compact manifold can be installed by flowline with the same pipelay vessel, saving the need for a purpose-built heavy-lift vessel and increasing the flexibility for capex spend over the life of the field. All of these factors serve to improve field economics, which is a main driver for the entire Subsea 2.0 product platform. It can be optionally coupled with an integrated robot that operates the manual valves assembled into the block. The Robotic Valve Controller is an all-electric system operated by the topside master control station.

All hydraulic functions have been eliminated to further reduce compact robotic manifold's complexity. The result is a simpler manifold that can be produced with 10 times fewer parts, eliminating fabrication complexity, and requires no structure for support or lifting. Again, this reflects with the platform and the company's



TechnipFMC recently commercialized its Subsea 2.0 product platform, which uses standardized components configured in modular designs. (Source: TechnipFMC)

overall goal of producing simpler products and field architecture. The smaller, lighter products in the Subsea 2.0 product platform can be up to half the size and half the part-count of a traditional offering, providing significant savings and reduced complexity and risk without losing functionality. TechnipFMC uses less material and is manufacturing fewer parts, driving down the cost of hardware and shortening delivery times for each project.

Furthermore, the manifold's production now shifts from a customized project design to a modularized, configurable product that enables true standardization and industrialization. Overall, the Subsea 2.0 products allow for greater automation in manufacturing, which significantly reduces engineering hours. TechnipFMC can cut 70% to 90% of manual activities and product lead time up to 12 months.

The compact robotic manifold and all of its complementary products in the Subsea 2.0 platform are designed to enable predictable execution with reduced risk while decreasing engineering hours and delivery schedules.

Integrated approach

The Subsea 2.0 product platform enables a faster project execution schedule, lowers the total cost of ownership and maximizes profit, which causes a true shift in project economics. When combined with iEPCI, the company's integrated approach to field architecture and project execution, Subsea 2.0 further strengthens the project economics of subsea projects and unlocks first oil faster, as it did for Shell's Kaikias project in the Gulf of Mexico (GoM). Shell believes it is the most competitive project in the GoM due its results: First oil achieved one year early, and the project delivered under budget. ■

Making the 'One Gulf' Dream a Reality

■ GoM producers have to make the most of the resources they have at hand.

BY AMANDA DUHON, EIC NORTH & CENTRAL AMERICA

Ever since Mexico's historic energy reform in 2013, the idea of being able to approach the Gulf of Mexico (GoM) as "one Gulf" has been a tantalizing prospect for the governments, operators and contractors on both sides of the border. With at least 50 Bbbl of recoverable resources left across the GoM, it is not hard to see why.

The industry is seeing the benefits of collaboration in Mexico's shallow water with a consortium of Mexico's Sierra Oil & Gas, the U.S.' Talos Energy and the U.K.'s Premier Oil making the Zama discovery. Holding up to 2 Bbbl, Zama has been described as one of the largest shallow-water finds in the past two decades.

To date, Pemex has not entered the deep water on its side of the GoM in any meaningful way. With such an

abundance of oil closer to the shoreline, it has not really needed to. However, with Mexican oil production at a low ebb and stiff regional competition from the Permian Basin, Brazil's presalt and now Guyana, GoM producers have to make the most of the resources they have at hand.

In the U.S. GoM, more than 3,000 deepwater fields have been developed, some of which are now reaching maturity. With operators and contractors looking for new destinations for their crews, where better than the Mexican side of the GoM, where only 50 or so deepwater fields have been developed? The similar geology should make it a relatively easy crossover technically, and given the datasets EIC has seen, it is a safe E&P investment too.

The Mexican GoM would benefit from 20 years of U.S. GoM deepwater drilling and production experience as

well as the efficiencies and cost savings, which could be brought about by the joint development of multiple plays and shared assets and infrastructure.

While both parts of the GoM share similar geology, the regulations, procurement and procedures on either side of the GoM are quite different. Doing business across the GoM is something Houston-based EIC is well positioned to help with. EIC knows just about everyone in the area, from operators, Tier 1, 2 or 3 contractors to all the chambers of commerce and governmental bodies.

Recently, EIC held its first EIC Connect event in Mexico City, bringing one of the largest delegations of U.K. companies working in the energy sector to Mexico to meet buyers and procurement specialists from a range of Mexican companies active in the GoM.

For more information, visit EIC at booth 1539. ■

While Offshore is a Complex Business, Cybersecurity Should be Simple

■ The industry needs an approach that puts measurement of risk at the heart of its strategy.

BY RICK SCOTT, ABS

With more than a century of drilling under its collective belt, the maturity of the offshore sector's safety culture is arguably more advanced than in other maritime sectors. The very public consequences of past failures have forged the discipline required of offshore leadership.

Essential security practices such as physical security, robust change management and continuous improvement are for the most part already embedded in the industry's safety management systems. A disciplined cybersecurity practice should be next.

The growth of digitalization might make that process more complex, but the answer still lies in rigorous engineering and in a model that measures cyber risk in simple terms that empower offshore companies to prioritize their resources.

Much of the new operational functionality is being provided by partners in the offshore supply chain—equipment and systems suppliers who have been granted digital connections into operationally critical systems and remote access to monitor the performance of their products.

As the industry moves deeper into the digital revolution, more and more identities, both from the public and private sectors, will push for remote access to these systems. Once access is granted, it's often only the integrators who know exactly how they are connected.

Anyone responsible for ensuring the cyber resilience of those offshore assets—and the safety of the people and environment on or around them—may be destined to lose a lot of sleep if they are relying on the current methods of identifying and resolving cyber risks that are simply not readily actionable.

They may look different but offshore assets are effectively the same when measuring cyber risk. They are differentiated only by the number of systems that need to be protected, the number of ways in which those systems are accessed and the number of identities having access to the asset's digital environment. These differentiators are known and understood fully, and they have little to do with how the assets look.

As a result, cybersecurity risk assessment guidance is often confusing, insufficiently instructive or bewilderingly complex. To calculate the risks to offshore operating technology, abstract concepts such as "consequence," "vulnerability" and "threat" need to be replaced with observable and measurable elements.

ABS is moving the discussion with its clients away from vague terms such as cyber awareness and hygiene to encourage a return to engineering rigor and discipline. The quickest and most efficient route to "safer" is through detailed discussions about an asset's identity management, and the digital connections to its safety-critical systems.

ABS believes cyber risk assessment should be easily understood. To make it so, the company leveraged a methodology known as Functions, Connections and Identities (FCI) Cyber Risk. FCI is used to generate risk contribution scores on an asset, across fleets and within an organization.

These risk contributors cover three critical areas: the functions on an asset such as

navigation or propulsion, the digital connections among functions (including remote facilities), and human and digital device identities (people and devices that have access to the digital Connection endpoints).

Applying the FCI Cyber Risk methodology gives owners the ability to look asset by asset across a fleet, or by types or groups of assets and determine the relative risk associated with each one in terms of how critical systems are operated, accessed and protected.

This methodology is grounded in the cybersecurity framework offered by the National Institute of Standards and Technology, mature guidance that will be familiar to the experienced cyber manager.

ABS believes this approach is the missing link in maritime and offshore cybersecurity. By employing a strategy that considers all the risk elements and generates a calculated relative risk contribution rating, ABS has made the subject easier to understand and address. ■

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Subsea Automated Pig Launcher Enables Long Tieback Developments

■ This Spotlight on New Technology award winner is permanently installed on the seabed and reduces typical development and retrieval costs.

CONTRIBUTED BY NOV

The subsea automated pig launcher (SAPL) from National Oilwell Varco (NOV) is designed to reduce the development costs of subsea tiebacks in wax-prone fields and remove slug in gas transportation lines, potentially eliminating the need for a second production line, or loop system, in such scenarios. The SAPL is permanently installed on the seabed and qualified for up to 1,000 m (3,280-ft) water depth, a 5,000-psi pipeline and a liquid line. Mounted on a subsea structure and loaded with pigs from a retrievable cassette, the SAPL enables operational pigging without vessel or ROV support, which reduces typical deployment and retrieval costs versus conventional subsea pig launchers.

The SAPL has a control system with multiple sensors for redundancy that provides the operator with position monitoring and control of individual pig launching. The cassette typically holds four pigs, which are stored on the seabed and deployed in stages. The pigs can also be launched from shore or a platform at any time, and they can be replaced with “intelligent” pigs for inspection operations. The SAPL uses a magnetic pig tracking system first tested by a major operator on its flowlines in the North Sea to eliminate the concerns of radiation with standard pig-tracking technology, which was considered a critical safety issue. Designed to simplify both precommissioning and commissioning operations as well as wax and slug control operations, the SAPL could make long tiebacks in marginal fields economically fea-



The SAPL is permanently installed on the seabed and qualified for up to 3,280-ft water depth. (Source: NOV)

sible in scenarios where traditional technologies would be ineffective.

The SAPL is ideal for remote areas requiring long tiebacks on which a conventional loop simply is not economical. The system will enable a wet insulated single-line tieback, eliminating the need for pipe-in-pipe/hybrid loop/electrically trace heated pipe and thus reducing capex. In addition, the SAPL will be able to operate in severe environments where a vessel is not available on call and there is a high risk of waiting on weather. The SAPL is useful when frequent pigging operations are needed because of complex fluid with high wax appearance temperature, it reduces opex by limiting vessel mobilization time to cassette replacement, and it minimizes wax inhibitor usage. A lower operational impact, including production shortfalls, is also to be expected with the SAPL versus conventional subsea pigging technology.

Magnetic pig tracking took place as early as 2016, while testing of the full SAPL prototype began in Norway in 2017 and 2018 with Total, Shell and The Research Council of Norway. The system was tested in a water-filled loop to simulate launching and receiving, with a magnetic sensor system for pig positioning and passage detection. The cleaning pigs were successfully positioned and launched individually, and the inline inspection tool was also launched successfully.

Total recently co-presented a business case with NOV at the 2019 Marine, Construction & Engineering Deepwater Development conference in London. The presentation discussed the potential impact of implementing the SAPL, determining that during a 20-year span the system could reduce opex by up to 60% to 65% and reduce production shortfalls by up to 80%. Assuming five piggings per year, the cost of the SAPL would be less than that of a conventional subsea pig launcher after just four years and would save \$20 million or more. In this model, the return on investment and cost savings improve if more piggings are necessary.

Future development of the SAPL will enable deployment in water depths up to 3,000 m (9,842 ft), with the system able to withstand 10,000 psi to 15,000 psi of pressure without stopping production. Already well underway are improvements to the cassette, which will hold six to 10 pigs versus four. This year a proposed new development is an SAPL for ultradeepwater and multi-phase applications. ■

Accessing Deepwater Basins in the Americas

■ Multiple offshore play types offer different risk, cost and maturity levels.

BY JULIE WILSON, WOOD MACKENZIE

Global deepwater investment is staging a strong comeback following severe cuts in the wake of the oil price crash in late 2014. During that difficult time,

exploration spend was slashed, the number of new fields receiving a final investment decision fell dramatically and production declined in many places. Short-cycle projects with lower capital commitments became popular, with North American shale plays favored in particular.

Since the beginning of 2017, the industry has seen large tracts of deepwater acreage licensed, rising capex and increasing production. Unlike shale, deep water offers an investment profile that can be counter-cyclic. Regardless of short-term price fluctuations, onstream fields are able to produce at stable rates, with relatively small operating and maintenance costs.

Countries in the Americas must compete on a global basis to attract investment. To attract and retain industry is to provide access to promising acreage by capable, responsible operators. None of the benefits from endowed resources can be realized without access.

The region has historically experienced high variability in approach by governments—to access, fiscal terms and regulatory regime. This has led to wide variations in the pace and success of activity in the sector. As a result, some basins have matured faster than others.

In the Americas, the industry has the benefits of attractive geology and robust petroleum systems. There are multiple offshore play types of different risk, cost and

See **BASINS** continued on page 27

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Cloud-based Heat Exchanger Management

■ A case study outlines how digital transformation facilitated a refinery's predictive maintenance strategy..

CONTRIBUTED BY EMERSON AUTOMATION SOLUTIONS

Navigating the countless options that upstream producers face when deciding to invest in Industrial Internet of Things (IIoT)-based solutions can be daunting without expert help. Realizing this, many industry leaders have begun working with automation experts to digitally transform areas of their operations that can leverage advancements in sensors, wireless technologies and cloud-based applications to gather and analyze data from the field. By doing so, producers can gain better insights from equipment and take proactive measures to prevent failures and avoid unplanned shutdowns.

One international oil and gas company has taken such an approach by implementing a predictive reliability and maintenance program that will save millions of dollars per year in operational costs by instrumenting and monitoring heat exchangers in one of its refineries.

Heat exchangers are critical to refinery operations due to their ability to recover and transfer heat input. Most refiners operate anywhere from 200 to 400 of these units per facility. However, heat exchangers can also represent a major source of inefficiency, process downtime and maintenance expense primarily due to fouling caused by several factors including chemical composition of fluids and temperature excursions.

For years, the company in question had relied on manually checking every heat exchanger in the refinery, which took personnel away from other issues that required attention. The system was vulnerable to situations where fouling and other issues that developed between checks could escalate by the time they were discovered.

To remedy this, the company approached a group of third-party automation technology companies to develop a digital transformation strategy to improve heat exchanger reliability by leveraging a scalable portfolio of IIoT solutions that included innovative sensing technologies, advanced instrumentation, data analytics and services.

A unique sensor network was designed based upon novel surface-sensing technology that provides accurate and repeatable temperature measurement in real time. These wireless sensors are clamped directly onto the heat exchanger, reducing installation costs and eliminating potential leak points common with thermowells.

The company also worked with its automation partners to design a physically independent, wireless architecture that would transmit the data safely and securely to a cloud-based platform where they could be analyzed and used to optimize maintenance activities. The network was built specifically for monitoring purposes and kept separate from the existing network infrastructure to ensure fast data exchange and avoid the security concerns of connecting to the cloud via critical operational control networks.

To close the maintenance loop, the company selected an IIoT-based asset monitoring application to provide remote analytic support. The software uses preconfigured algorithms to interpret heat exchanger health data and generate a report, which is sent back to the refinery and displayed on user-friendly dashboards, alerting plant personnel to potential fouling issues and enabling them to optimize performance.

The key to this process is the company's ability to securely transfer heat exchanger health and performance data from the refinery floor to the cloud where it can be accessed for analysis in near real time. The cloud-computing platform provides an ideal way to manage the data in large quantities where it can be analyzed quickly anywhere in the world, giving secure access to third parties and outsourcing equipment monitoring tasks without jeopardizing security.

Systems like these help refiners prioritize their heat exchanger maintenance efforts and develop effective schedules for cleaning and repair, thereby avoiding extended downtime and ensuring optimal heat transfer. As a result, facilities can reduce energy and capacity loss due to fouling by up to 10%. For a 250,000-bbl/d refinery, that could translate to a savings of as much as \$3.5 million

or more annually. Thanks to the scalable nature of this solution, it can be extended to other critical plant assets, such as pumps and cooling towers, to achieve measurable operational improvement across the entire enterprise.

To hear more, join Emerson's CTO Peter Zornio on Tuesday, May 7, at 9:30 a.m., for his presentation "How Digital Transformation Paved the Way for One Refinery's Predictive Maintenance Strategy." ■

OTC Brasil 2019

Plan now to attend OTC Brasil Oct. 29-31, 2019 in Rio de Janeiro. OTC Brasil is organized by OTC and the Brazilian Petroleum, Gas and Biofuels Institute (IBP). Visit otcbrasil.org for more information.

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DISCOVERY THROUGH IMMERSION

Efficient Wellbore Cleanups: Predictive Fluid Modeling Digital Twin

■ An analytical methodology evaluates, models and simulates fluid interface effects within eccentric-annulus wellbores.

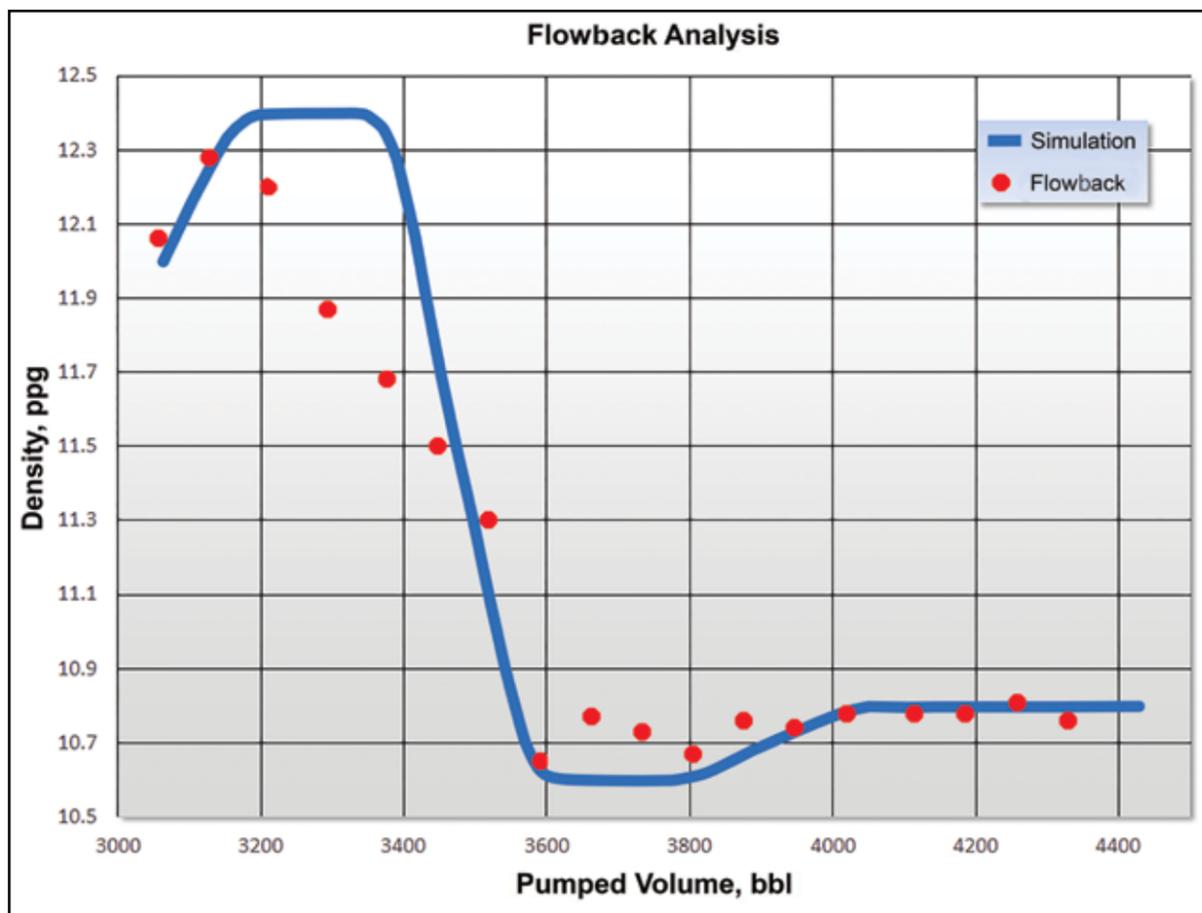
BY VÍTOR LOPES PEREIRA AND DALE E. JAMISON, HALLIBURTON

Wellbore cleanups from drilling fluid to completion brine are critical operations to the industry, ensuring not only that the well is prepared for IP but also that the life of the well is maximized. Any residual material left downhole by a sub-optimal cleanup has the potential to interfere with completion hardware and ultimately reduce productivity.

A typical cleanup is performed using a sequence of engineered pills (spacers) designed to provide both chemical and mechanical cleaning actions. Several factors are taken into account when designing the pill train, including but not limited to wellbore geometry, annular volumes, operational restrictions, environmental regulations and rig equipment.

One aspect that impacts the final wellbore cleanliness and volume of waste generated during displacements is spacer contamination. It is known that some interface mixing and channeling will likely occur during the pumping operation, which could potentially impair the desired performance of the designed pills; however, an accurate, precise and timely predictive digital twin to optimize the displacement design while minimizing waste has not been developed before. An analytical methodology has been developed to evaluate, model and simulate these fluid interface effects within eccentric-annulus wellbores.

Interface mixing has been calculated using an empirical pipeline flow mixing model, while the interface kinematic viscosity was calculated based on fluid densities and apparent viscosities, adjusted for downhole conditions including the effects of varying shear rates during the displacement. The model for interface channeling utilized assumptions contained within the Rayleigh-Taylor instability theory. Eccentric-annular flow profiles also were accounted for in the model, with every eccentric-annular section split into a number of segments. This meant that each segment could be treated individually as a pipe with an effective hydraulic diameter and its own resulting fluid interface velocity. Pipe rotation effects also are factored into the calculations.



Evaluation of field data indicates a good agreement between actual and predicted return fluid density curves. (Source: Halliburton)

Push pills, spacer integrity

Predictions made using the model showed that spacer interface growth rates were higher for cases where the density difference between two fluids was aligned against the gravitational direction. This increased further if the apparent viscosity difference also was aligned against gravity. The results were in agreement with the Rayleigh-Taylor instability rule and led to the conclusion that the use of a “push pill” of a higher density and apparent viscosity compared to the active drilling fluid is vital to act as a barrier to help minimize the comingling between pills.

When applied to a full displacement train consisting of oil-based mud, base oil, push pill, wash pill, sweep pill and brine, the model was observed to predict a maximum of 70% spacer integrity for the push pill returning to surface. This translates to a contamination of 30%, which may be interpreted by the engineer as insufficient to achieve a good displacement. When the simulation was repeated with an increased volume of push pill, the spacer integrity value improved to 90%.

To validate the model using field data, an evaluation was made of the chemical and physical properties of returned fluid samples from 20 displacements along with the time in which they were obtained. These data were then compared to the theoretical expectations utilizing the model predictions. The graph indicates a good agreement between actual and predicted return fluid density curves. Equivalent behavior was demonstrated for all 20 displacements assessed.

Conclusion

A new accurate predictive model was developed to ascertain the level of interface mixing and channeling that might occur during a wellbore cleanup in an eccentric annulus at downhole conditions. The model was validated successfully utilizing data from the field; this will enable engineers to better understand the impact of flow path geometry, operational conditions and fluid properties on the effectiveness of the displacement train. The improvements that can be made during the planning phase of a wellbore cleanup using this model will bring substantial benefits to global operations, both in terms of quality of displacements and in the reduction of waste generated due to fluid mixing downhole. ■

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FOCUSED ON THE FUTURE

PROMISES

(continued from page 1)

sports and industries relying on high tech, such as airline manufacturers. In oil and gas, however, not so much.

“The good news is you’re late to the party, and that’s not a critique,” Frank said. “It’s just the nature of your industry structure. You actually can use all these different industries as petri dishes—your little R&D labs—to figure out what works well, what doesn’t work and then apply them to the energy sector.”

Start with training. Place new crew members in a classroom to teach them skills and they will retain about 10%

of what they learn, he said. Utilize augmented reality or virtual reality (VR) and the retention rate leaps to 75%.

“It just completely explodes,” he said.

Walmart, encumbered by high turnover with their associates, uses 17,000 VR headsets in its training of new associates to get them up to speed. With the technology, “the world becomes this highly ambient, very rich place where you can’t break the physical from the digital—it becomes ‘phygital’—it becomes one and the same.”

The opportunity for offshore oil and gas is particularly apparent. A typical platform, he said, incorporates almost 33,000 dat points. However, only 2% of them today are instrumented.

Bots excel at the science of the work but are useless at judgement. That’s the strength of the worker. The winning combination in the future is something akin to the “Star Trek” characters of the emotional Capt. Kirk (human) and the intensely logical Mr. Spock (machine), Frank suggested. Somehow the two traits have to be glued together on the job.

“We’ve actually found, in 75% of the cases, it will enhance the job; it will protect the job,” he said. “When you ask somebody in 10 years’ time, ‘Who is your most trusted colleague at work?’ the answer may be ‘My bot.’” ■

ANNIVERSARY

(continued from page 1)

In celebration of all things 50, the event paid homage to historical events of 1969, including the NASA Moon Landing, the Woodstock Festival and the first OTC. Cobb noted in his remarks that SBM Offshore also was celebrating 50 years of operations this year, while Halliburton and the American Petroleum Institute are each celebrating their own 100-year anniversaries.

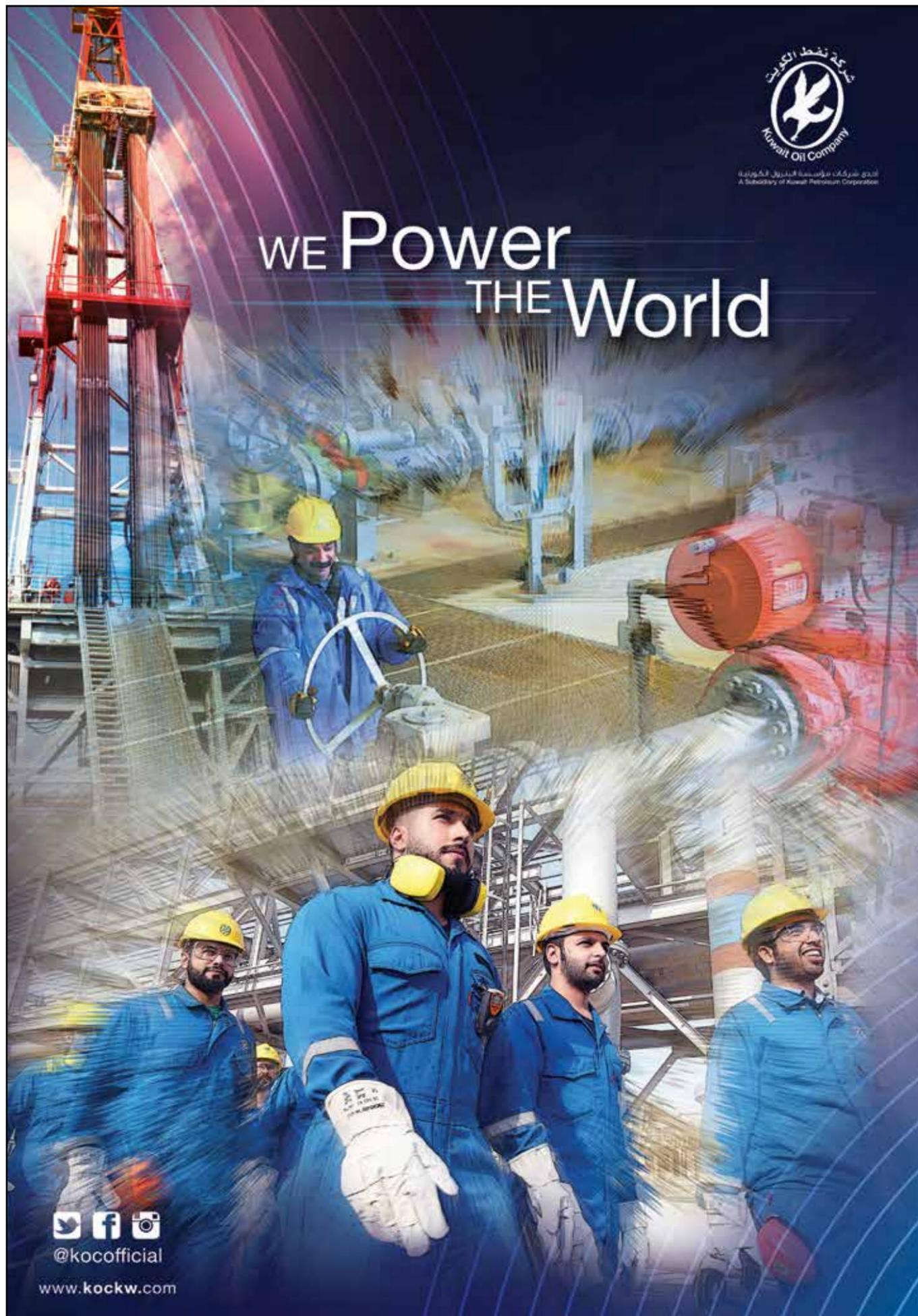
The winners of the Distinguished Achievement Award for Individuals; the Distinguished Achievement Award for Companies, Organizations and Institutions; and the Hoover Award were recognized during the event. The first was given to Carlos Mastrangelo for his pioneering efforts in the design and adoption of cost-efficient FPSO units.

Exxon Mobil Corp. received the company award for its Hebron Offshore Project, with its president of Global Projects Neil Duffin accepting the award on behalf of the Hebron Project team. Among the team’s many achievements was the more than 42 million hours worked in Newfoundland and Labrador without a lost-time incident.

The Hoover Medal was presented to David Baldwin, co-president of SCF Partners, in recognition of his outstanding extra-career services by engineers to humanity by a board representing five engineering associations.

The money raised from this year’s event is going to Spindletop Charities to support programs for at-risk youth in the Greater Houston area. Constance White, executive director for the charity, and Liam

Mallon, Spindletop chairman of the board, accepted a check for \$300,000. In the past eight years, more than \$1.7 million has been raised by OTC for charitable causes. ■



NETL Presentations

Tuesday, May 7, 2019
Booth 1325

Big Data, Science-driven Tools— Reducing Risks and Costs for Offshore Energy Systems

Presented by Jennifer Bauer and Kelly Rose
Organization: National Energy Technology
Laboratory (NETL)
10 a.m. – 11 a.m.

Spill Prevention, Worst Case Discharge Planning – Virtual Data-driven Platforms for Offshore Energy Planning & Safety

Presented by Jennifer Bauer and Kelly Rose
NETL
12 p.m. – 1 p.m.

Hexagonal Boron Nitride Reinforced Multifunctional Well Cement for Extreme Conditions

Presented by Rouzbeh “Rouz” Shahsavari
Organization: C-Crete
1 p.m. – 2 p.m.

Big-Data Tools for Evaluation of Offshore Infrastructure Integrity

Presented by Jennifer Bauer
NETL
2 p.m. – 3 p.m.

INDUSTRY NEWS

(continued from page 19)

floater as well as overall field system engineering services.

Compression will help maintain plateau gas production rates as reservoir pressure drops over time. Placing compressors on the seabed and near the wellheads improves recovery rates and reduces capex and opex.

Australia will be the first location outside of Norway to use the subsea compression technology.

Shearwater Awarded Troll Unit 4-D Contract by Equinor

Shearwater GeoServices Holding AS announced in late March the award of a 4-D seismic survey at the Troll Unit by Equinor AS to be conducted this summer. The project adds further to Shearwater's 4-D program in the North Sea and Barents Sea this season. The Troll Unit survey will last about two months and be conducted by the *Amazon Conqueror* using Shearwater's Isometrix system. Isometrix is an advanced multi-component streamer system, allowing true 3-D deghosting.

TechnipFMC Awarded Contract for Johan Sverdrup Phase 2 Development

TechnipFMC has been awarded a significant subsea contract by Equinor for the Johan Sverdrup Phase 2 development, located in the Norwegian sector of the North Sea at a water depth of 120 m (394 ft). The contract covers the delivery and installation of the subsea production system including integrated template structures, manifolds, tie-in and controls equipment. For TechnipFMC a "significant" contract ranges between \$75 million and \$250 million.

Shell to Sell GoM Caesar-Tonga Interest to Delek

Shell Offshore Inc., a subsidiary of Royal Dutch Shell Plc, signed an agreement in April to sell its 22.45% nonoperated interest in the Caesar-Tonga asset in the U.S. Gulf of Mexico to Delek CT Investment LLC, a subsidiary of Delek Group Ltd. The total consideration for this deal is \$965 million in cash.

The sales and purchase agreement is subject to certain conditions, including regulatory approvals. The transaction is likely to close by the end of the third quarter, with an effective date of Jan. 1, 2019. ■

CLIMATE

(continued from page 1)

Birrell, who has more than 30 years of upstream oil and gas experience with BP, stepped into his current role at the company in March 2017. He previously served as regional president for BP's Azerbaijan, Georgia and Turkey business.

During his presentation at OTC, Birrell also spoke about the "dual challenge" faced by oil and gas companies.

First, companies need to meet continued energy demand growth as 2.5 billion people move from low to middle incomes and the world population grows by another 2 billion people over the next 20 years. Secondly, companies need to reduce emissions by 50% over 20 years to meet the goals from the Paris Climate Accord.

In BP's 2019 Energy Outlook released in February, the company projected 85% of the growth in future energy supply will be generated through renewable energy and natural gas. In particular, BP claims renewables will become the largest source of global power generation by 2040.

However, despite renewables being on track to becoming the fastest-growing energy source, Birrell said that oil and gas also will continue to play a role in the energy transition.

"The dual challenge can't be about a race to renewable ... It's got to be a race to lower carbon emissions," he said.

In its latest projection, BP expects demand for oil will grow in the first half of its outlook period before gradually plateauing at about 108 MMBbl/d by the mid-2030s.

Across all scenarios concerning oil demand considered in the BP Outlook, the company said trillions of dollars of continued investment in new oil will be required to meet oil demand in 2040.

Birrell addressed the massive need for ongoing investment in the oil and gas industry and also warned against the movement to divest from fossil fuels.

"Some would argue we should just stop investing in oil and gas—that has huge ramifications," he said. "Ramifications for rising prices, potentially financial instability, will impact economic prosperity in the world and ultimately impact the quality of the lives of people around the world." ■

DRILLING

(continued from page 11)

two hole sections, with an average range of 1 lbm/gal between ECD and equivalent static density.

The fluid's low hydraulic impact formulation reduced surge pressures against the formation and successfully drilled the well and cemented 7-in. and 4½-in. liners in what the customer classified as one of its toughest wells. Total losses while cementing both 7-in. and 4½-in. liners were reduced more than 50% compared to offsets.

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BASINS

(continued from page 22)

maturity levels, which allow an operator to take a portfolio approach within the region.

Governments are the ultimate steward of their hydrocarbon resources, and the terms and frequency of access is their prerogative. On the industry side, it is important to make a thoughtful case for change that is based on a robust and responsible exploration plan—while taking into account the strategic, political, environmental and economic rationalizations of countries.

The value of hydrocarbon resources can be maximized when contracts provide structure and terms that are equitable and fair to both the government and the investing companies, while also being globally competitive. Determining the appropriate fiscal terms for access is undeniably complex. A fair share of revenue should accrue to the country, while terms also need to incentivize explorers to invest.

Ultimately, fiscal terms should reflect the risk assumed by explorers. In turn, governments can promote a stable and sustainable business environment by ensuring a high degree of certainty in contract and fiscal terms, legal frameworks and rule of law. Durable contracts can be especially important to the industry, given the high level of investment required in oil and gas developments and the long duration of these projects.

In addition, maintaining balance between government take and industry share of profit can be addressed through contracts that contain moderate progressivity with respect to project profitability. This allows for government take to increase in the case of low unit costs or higher

prices and to decrease in the case of high unit costs or lower prices.

The deepwater sector operates much like any other industry—it thrives in a space with high levels of competition, collaboration and idea sharing.

Stronger competition leads to modernization and technology advancements. As many countries throughout the Americas have an energy industry structured around a national oil company, there is room for growth and improvement through offshore basin activities in collaboration and competition with international oil companies.

Allowing access to external companies can give the region a fresh chance at the innovation that has made mature basins, such as the U.S. Gulf of Mexico, thrive. ■

The Coming to Americas technical session at 9:30 a.m. on Wednesday, May 8, will be moderated by Julie Wilson, research director at Wood Mackenzie, and Sandeep Khurana, senior manager at Granherne Inc.

INSTALLATIONS

(continued from page 17)

sisted of five key pillars: 1) Enhanced Data Acquisition, 2) Integrated Control and Safety System (ICSS), 3) Cybersecurity, 4) Unified Data Storage and 5) Onshore Data Analytics. Together, these pillars provide the quantity and, most importantly, the quality of data required to safely and efficiently operate an unmanned installation.

The production buoy has been developed in collaboration with multiple partners and is now ready for a pre-FEED study. Overall, its development widens the scope of what a NUI can deliver by expanding the envelope of both water depth and oil production capabilities, opening up new opportunities for unlocking value in marginal fields in the North Sea and further afield.

OTC attendees interested in learning more about this topic are encouraged to attend the presentation “New Concepts for a Normally Unattended Installation (NUI)—Design, Operation, Automation and Digitalization” on Wednesday, May 8, at 9:50 a.m. ■

MARKET

(continued from page 18)

Going forward, development drilling programs are expected to be a mainstay of activity for the floater fleet in the U.S. GoM. In the near term, projects such as BP’s Mad Dog Phase 2 and Shell’s Vito Field will generate activity with continuous drilling of subsea wells toward 2021, while in the longer term rig demand will be driven by drilling programs from several upcoming projects awaiting final investment decisions (FIDs) in the next couple of years. The majority of these fields are located around the deepwater/ultradeepwater transition zone and are poised to be developed as either subsea tiebacks or via new floating production facilities.

Higher commitments toward deepwater exploration, and with FIDs anticipated soon for multiwell development projects such as Whale, North Platte and Ballymore, should facilitate for steady activity levels in the deepwater and ultradeepwater sectors in the U.S. GoM.

In the shallow waters of the continental shelf, on the other hand, no FIDs are expected over the next three years, and Rystad does not see any major developments or large exploration campaigns coming up. Apart from a few rigs conducting brownfield work at currently producing fields, jackup demand in the U.S. GoM looks bleak in the coming years. ■

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Acher Aviation (Pty) Ltd, Bayside Marine (Pty) Ltd, Blue Ocean Oil Supply (Pty) Ltd, Cape Diving (Pty) Ltd, Elgin Brown & Hamer (Pty) Ltd, First Subsea Services (Pty) Ltd t/a Global Riser, Global Spec (Pty) Ltd, Hall Longmore (Pty) Ltd, Improchem (Pty) Ltd, ISS Palumbo South Africa (Pty) Ltd, Linsen Nambi Bunker Services (Pty) Ltd, Omnia Group (Pty) Ltd, Profloat Pty Ltd, RGR Technologies (Pty) Ltd, Richards Bay Industrial Development Zone SOC Ltd, Saldanha Bay IDZ Licensing Company (Pty) Ltd, South African International Steel Fabricators Business Council, South African Oil and Gas Alliance NPC, Southey Holdings (Pty) Ltd, Sturrock Grindrod Maritime (Pty) Ltd

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DAILY TECH TALKS AT BHGE BOOTH #2827

Tuesday, May 7

- 9:30 am Discover BHGE's Innovative Commercial Models for Project Success
- 10:00 am Leveraging Subsea Connect for A Radically New Approach to Planning Your Next Subsea Project
- 10:30 am Learn How io oil & gas consulting Partners with McDermott and BHGE on Integrated Project Management for Improved Economics
- 11:00 am Learn How BHGE is Enhancing Offshore Power Generation Solutions
- 11:30 am Delivering Uptime & Enhanced Productivity Through Your Projects' Life of Field with Subsea Connect
- 1:00 pm Reduce Non-productive Time with the Intelligent Subsea Stethoscope
- 1:30 pm Achieving Step-change Efficiency Improvements in Offshore Sand Control
- 2:00 pm Improving Production Outcomes with AI
- 2:30 pm Spotlight on New Technology Award Winner NovaLT16: Maximizing Production and Minimizing Offshore and Onshore Risk
- 3:00 pm Carbon Management—Securing the Sustainability of Oil and Gas in the Energy Transition
- 3:30 pm Explore Advanced Developments in Autonomous Subsea Pipeline Pre-commissioning
- 4:00 pm Drilling Through Narrow Hydraulic Windows Without Risking Losses or Restricting Performance
- 4:30 pm NextStream: a Strategic Path to Market for Advanced Technology