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| THE OFFICIAL 2018 OFFSHORE TECHNOLOGY CONFERENCE NEWSPAPER | DAY 4

CEOs Talk Relevance, Strategy, Alliances

■ Partnerships, mergers and acquisitions play prominent roles.



Rod Larson

BY VELDA ADDISON

Like many offshore players Oceanering International CEO Rod Larson is concerned about staying relevant in a world of competing sources of energy, attracting top talent in a growingly digital world and maintaining safety.

“I’m pretty sure that my enemy is not on this stage. It’s somewhere in West Texas. The truth is we have to stay relevant,” Larson told a full house gathered to hear CEOs of oilfield service companies speak Tuesday, May 1, at OTC. “Rather than working on incremental commercial models—figuring out how to get into each other’s pockets over a small market—you need to figure out how to have a bigger market, and that really is making sure that we are driving costs.”

But it’s more than that longer term. The industry must be safer and more efficient with resources, he said, adding the industry will be judged on its recovery factor. “Are we actually delivering energy for the footprint we’re

making or the risk we’re taking offshore?” The industry must solve these issues to stay relevant, and “if we spend too much time arm wrestling with each other we may miss the real opportunity,” he added.

Larson was among the CEOs who shared thoughts on improving efficiency and economics through partnerships and mergers and acquisitions (M&A), implementing new technology and addressing other issues facing the industry as market conditions improve.

The current environment has focused the industry, and showing up with a half a million hours’ worth of customized engineering is not sustainable, said Neil Saunders, president and CEO of oilfield equipment for Baker Hughes, a GE company (BHGE).

Speaking on technology and the impact of standardization, Saunders described BHGE’s R&D deck as being



Neil Saunders

See **CEOs** continued on page 26

Digital Transformation’s Impact on Innovation

■ In the quest for operational excellence, companies need to embrace the digital disruption to succeed.

BY JENNIFER PRESLEY

The term “digital oil field” has been used by the industry for many years, decades even. In the quest for operational excellence, the industry has made great strides in its use of downhole sensors and data to automate systems and processes. Even with these digital advances, the industry is still plagued by inefficiencies in the system.

Rustom Mody, vice president of technical excellence for Baker Hughes, a GE company, shared with attendees of Tuesday’s OTC luncheon “Digital Transformation: Impact on Innovation and Operational Excellence” his insights on the digital journey that the industry finds

itself on and how it is necessary to adopt digital as the way forward to ensure its survival.

The market downturn placed an increased focus on costs, requiring companies to find new ways to be innovative and new ways of using new technologies to change the way business has been conducted, and productivities improved.

“In the lower-for-longer market, the continuous seeking of productivity improvements is the new reality,” he said. “The success in unconventional, in shale oil and gas, is what brought the [oil] price down due to innovation,” he said. “Innovation will be what brings us

See **TRANSFORMATION** continued on page 27

Shell Shares Successes of Malikai

■ The project’s safety record and TLP design was noted by speakers.

BY BRIAN WALZEL

At a Tuesday morning OTC technical session a host of speakers offered a wide-ranging summary of Shell’s Malikai project, which was Malaysia’s first tension-leg platform (TLP). The project began production in 2014 and has a peak annual production of 60,000 bbl/d. The presentations highlighted Malikai’s cost-effective platform design, its recognized safety program and the design and operation of its coupled mooring system.

Shell’s Edmund Adrian offered the initial overview of the Malikai project, touching on the various design and development plans over the course of the three years between the time of discovery in 2004 and 2008.

“It was a struggle right from the beginning to make the economics work,” Adrian said. “Given the challenges, it’s not surprising the main driver of the project was cost.”

Among the challenges Shell faced during the design and installation of Malikai was the removal of the tension support buoys (TSBs), challenges with simultaneous operations and butterfly valve operations, which Adrian said did not work as they should have during offshore operations.

Ultimately, Shell opted to reuse eight TSBs from the company’s Mars B project. Adrian said the Malikai project was ultimately delivered on time and on budget, resulting in Shell’s first TLP outside the Gulf of Mexico (GoM).

Alvin Ratnasingam reviewed the safety achievements during the construction phase of Malikai. For Malikai, the hull and the topsides were constructed separately over the course of three years requiring more than 18 million man-hours and 4,000 workers, he said. As the safety engineer for the Malikai project, Ratnasingam said his team adopted a “Goal Zero” campaign to identify and minimize safety issues. Among the challenges Ratnasingam and his team identified were dropped object hazards, working at height, hot works, confined space and health issues.

“Goal Zero was a journey from the start of construction to the end to ensure that everyone goes home safely,” he said.

See **MALIKAI** continued on page 27

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OTC2018

SCHEDULE OF EVENTS

All events in conjunction with OTC 2018 will be held at NRG Park in Houston, Texas, unless noted otherwise.

Thursday, May 3

7:30 a.m. to 2 p.m.	Registration
7:30 a.m. to 9 a.m.	Topical/Industry Breakfasts
7:30 a.m. to 3 p.m.	Energy Education Institute: Teacher Workshop
8:30 a.m. to 1:30 p.m.	Energy Education Institute: Student STEM Event
9 a.m. to 2 p.m.	Exhibition
9 a.m. to 2 p.m.	University R&D Showcase
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.	Technical Sessions



Innovative technology exhibits and dynamic technical discussions were expected to draw more than 60,000 attendees from around the world during OTC April 30 to May 3. Delegates can pick up a commemorative coin as a memento of OTC's 50th anniversary at several counters in NRG Arena. (Photos by CorporateEventImages.com)

Senior Exhibits Manager Retires After 23 Years

■ Katz managed OTC as well as multiple other events for the Society of Petroleum Engineers.

BY LEIGH ANN RUNYAN, DIRECTOR, AMERICAS EVENTS, SOCIETY OF PETROLEUM ENGINEERS



Barbara Katz

This year has been a true celebration of 50 years of OTC. We've seen leaders in the industry, visited more than 2,000 exhibitors, picked up an OTC commemorative coin from the NRG Arena, partied at the Party on the Parkway and experienced excellent technical education through more than 200 papers.

Now that we have arrived at the end of OTC week, there is one last person to celebrate and unfortunately say goodbye to.

Barbara Katz is a familiar sight to the OTC exhibitors. She has been working in OTC exhibits for more than 23 years. Beginning as a coordinator and rising to her position of senior exhibits manager, she not only manages OTC but also multiple events for the Society of Petroleum Engineers.

One of her favorite things about OTC is forming relationships with the exhibitors. She has worked with some of her contacts for as long as she has been with OTC. On the other hand, her work with exhibitors has changed over the last three years as the oil and gas industry has weathered the downturn.

Her OTC stories could fill the Library of Congress, but some of her most memorable include

- The year a horse was on display in the outdoor exhibits;
- Several years of flooding from massive rainstorms during move-in or move-out;
- The annual crawfish cookout on the loading dock; and
- Dealing with an evacuation during show hours from a fire in the exhibit hall.

Katz has traveled extensively and enjoys experiencing a wide variety of cultures, foods and venues. Most recently, she joined a Sights and Soul Travels, Tours and Vacations for Women to Brazil and down the Amazon. She has toured Poland with the same tour group and is looking forward to a vacation in Sicily this fall. She has visited Israel and also has traveled through Italy and France, to name only a few more of her many adventures.

She is an avid reader and anticipates indulging that habit in retirement. Although she is retiring from the exposition business, she nevertheless hopes to keep helping out on a part-time basis on various tradeshow.

Her late husband, Stephen Katz, was an award-winning movie and television screenwriter. They have two children, Eric and Jeremy.

Katz has been a fixture at OTC, and she will be missed by staff and exhibitors alike. We wish her the best as she starts the next chapter in her life. ■

Visit EPmag.com for additional OTC-related articles. Look for stories tagged "OTC Extra"!

Mastering Avatar Technology in the Workforce

■ Offshore oil companies will be forced to tackle avatar technology with the upcoming ‘crew change,’ while maintaining legacy experience.

BY MARY HOLCOMB

The digital shift happening in the oil and gas workforce has made the preservation of legacy knowledge trivial. But there can be a happy medium between human experience and digital platforms.

During OTC’s “Capturing and Creating Avatar Talent” breakfast session on Tuesday, May 1, a panel of speakers made up of operators, engineers and human resources representatives detailed the strategies needed to prevent the loss of knowledge while still creating and adopting avatar talent.

Dave Wisch, global technical authority for civil, structural and marine engineering at Chevron, said that while

avatars have great potential, the challenge with replacing people is that there is a total absence of contextual information and situational awareness. He said avatars need to be coupled with experience to account for the scenarios that require intuition and ultimately a subconscious.

Wisch said most incidents that occur in the industry happen on the “fringes of the abnormal” and, because of the automated nature of avatars, they are incapable of thinking outside of the box during these instances while humans have the ability to feel and explore the situation.

“Avatars could be fabulous tools, but they’re probably going to stay within the box,” Wisch said. “People are best at handling abnormal situations.”

Still, the workforce is evolving around the digital

transformation, and the pace of that change is happening even quicker so companies must keep that in mind as they adapt, according to Accenture Management Consulting’s Managing Director Stephanie Rogers.

Rogers said it is important for organizations to know that the balance in that comes from one key concept: upscaling. She defined upscaling as helping employees gain more skills while they are doing their current activities, which she said was the key to closing and removing gaps in the workforce.

“When you’re starting to build the avatar talent and you start to play with digital twins, you’re bringing together various workforces to build that,” Rogers said. “It’s not about removing roles or taking jobs away, it’s about how they work together.”

Particularly, she said it is just as important to have humans to detect anomalies, interpret scenarios and exercise creativity as it is to have sensors, data and video feeds in the field.

“We need the information coming off the machines and technologies, but we’re also needed in terms of dissecting a lot of the key information and the missing middle is around some of that new way of operating,” she said.

Dr. Satyam Priyadarshy, technology fellow and chief data scientist at Halliburton, said companies will actually create value from integrating the knowledge that is already in the organization with avatar technology. By leveraging new innovation and computer paradigms, he added, companies will be able to change with the new talent workforce and eliminate the skill gap between veterans and newcomers.

“That’s what Big Data is ... creating value from all the data so you can remove inefficiencies and go the distance in a continuous manner,” Dr. Priyadarshy said.

But he warned that the industry must now start thinking differently about avatar technology or risk the possibility of being disrupted soon.

“The process is very simple. You have to think about the reach of the digital transformation beyond [your] own sites and think of the business as a comprehensive unit,” he added. ■



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Flow Assurance Solution

CONTRIBUTED BY SHAWCOR

One of the critical challenges for hydrocarbon production is the deposition of solids (organic and/or inorganics) on the internal surface of production tubing and process equipment, leading to high downtime and intervention costs. One emerging flow assurance solution for such applications is the Diamond Like Carbon Coating. Shawcor has the sole license to apply this patented coating to the internal surface of downhole tubulars. The coating was co-developed by Shell & Southwest Research Institute.

OTC Paper 28902, which is scheduled to be presented on Thursday morning, further describes this novel coating (Session 602: “Flow Assurance in a Cost Sensitive Environment: Engineering and Project Learning”). ■

OPEN FOR BIDS: FIRST ABU DHABI EXPLORATION LICENSING ROUND

Six historic oil and gas licensing opportunities open for bidding in Abu Dhabi, comprising a total area of almost 30,000 km² in what is one of the world's largest hydrocarbon super basins.

The Abu Dhabi National Oil Company (ADNOC) has established a dedicated website where interested bidders can register to participate* and find roadshow dates and locations for technical and commercial information on the new blocks:

www.adnoc.ae/Block-Bid

*Subject to a strict prequalification process undertaken by ADNOC.

Big Data Theme Continues

■ OTC panelists address challenges and solutions in data analytics.

BY BRIAN WALZEL

This year OTC featured Big Data and digitalization in three technical sessions and in a Wednesday morning panel. OTC continued with the theme on industry-wide implementation of data analytics that it initiated two years ago with a panel of speakers who addressed trends in Big Data, artificial intelligence and machine learning in its “Big Data Next Chapter” session.

Several panelists spoke to this year’s theme of challenges and solutions in data analytics and digitalization. Egidio Marotta of Landmark, a Halliburton business line, said the topic of analytics was introduced at OTC in 2016 after event organizers realized a need for session conversation to focus on the emerging trends in digitalization.



Egidio Marotta

Also among the panelists was Wood Mackenzie’s Preston Cody, whose work includes conducting research into how upstream companies are delivering value through digital technologies. He described digitalization as falling into two categories: data analytics and Internet of Things/process control automation.

“Where we see impact [of digitalization] is across the entire upstream value chain,” he said. “Most impacted is drilling, completions and supply chain management.”

Each of the panelists’ presentations featured a real-time Q&A with attendees through text message responses shown



Preston Cody

in each presenter’s slide presentation. During Cody’s presentation, responses from audience members showed 39% believed production optimization technologies would offer the most significant impact through digital technologies.

In a similar question Cody posed to companies with which he has worked, most (more than 60%) also said production optimization would be widely transformative, but they also believed structural cost savings would be a significant result. He said cost savings through industrywide digital transformation could result in “something on the order of \$150 billion per year on actual value delivered.”

“The real disruption of transformation is to come as we move to scale,” he said.

Cody believes the companies that will emerge as leaders through digital transformation will be those whose leaders embrace the change digitalization promises.

“Those are the ones I would bet on,” he said.

Shell’s Francesco Menapace discussed how the industry needs to cross generational divides and discipline boundaries to adopt new digital technologies.

After most session attendees (52%) answered via text message that they believed automation and optimization were the primary components of digital transformation in the oil and gas industry, Menapace said there was “almost no discourse” on the option to the audience to consider the human component.

For the industry to successfully transition through digitalization, a “reverse mentoring” dynamic would need to occur between those representing the Baby Boomer generation and millennials, thereby trading the wealth of industry experience with natively high technoliteracy, he said.

Simon Sheather, professor of analytics at Texas A&M University, discussed the need for the industry’s subject matter experts to become data experts to successfully utilize machine learning capabilities. Sheather explained a need for the industry to put into production the best-performing machine learning methods with the best-performing traditional methods, essentially marrying the concept of a digital future with more traditional practices of the past.

“Machine learning is great in some circumstances, but I love the challenge of beating the machine,” he said. ■

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New Minimum Facility Platforms Withstand North Sea Conditions

■ Company intends to make wellhead facilities production cheaper and faster with a ‘design once, build many’ ethos.

BY ROB GILL AND STEVE HENZELL,
INTECSEA (WORLEYPARSONS GROUP)

The pressure to reduce the cost of new developments has never been greater for North Sea operators. The combination of low oil prices, decreased North Sea development opportunities and increased competition from the U.S. shale industry means the industry is being forced to adapt to new ideas.

One development concept that is starting to gain traction is the use of low-cost wellhead platforms for the development of small satellite fields. These are typically newly discovered fields close to an established host plat-

form, which can provide control and power and also carry out fluid processing. Although wellhead platforms have long been a favorite in the shallow waters of the southern North Sea, up until now the preferred option for the development of satellite fields in deeper water has been to use a subsea manifold with a tieback to the host facility. Subsea manifolds are tried, tested and trusted, but WorleyParsons has carried out several studies showing that subsea manifolds don't necessarily provide the best value solution for a multiple well development. The difficulties and additional costs associated with maintenance and future well intervention operations can all contribute to increased costs over the lifetime of a project.



WorleyParsons has come up with a new concept in wellhead platforms suitable for installation in deeper water and able to withstand North Sea conditions. (Image courtesy of WorleyParsons)

WorleyParsons has accumulated a reference list of more than 500 installations that are currently operating throughout the world, and its team has combined its experience with ideas borrowed from the shale

industry—where standardization and modularization of equipment is the key to low-cost field development. The company has come up with a new concept in wellhead platforms suitable for installation in deeper water and able to withstand North Sea conditions.

The new design uses piled foundations, can be deployed in water depths of up to 120 m (394 ft) and provides space for a maximum of 12 well slots. No accommodation has been provided for personnel, who will gain access for four monthly maintenance visits by vessels equipped with a “walk-to-work” gangway. The platform design includes a 5-tonne crane and sufficient deck space to allow full access for future well intervention. WorleyParsons also has designed the new platform for construction in its covered yard near Stavanger, Norway, with one flat side to permit installation by either barge launch or jackup platform to widen the choice of installation contractor.

The platform is designed with a “design once, build many” approach to capture economies of scale and efficiencies more closely associated with a production line than a North Sea construction yard. The design borrows from the philosophies that WorleyParsons has previously followed in the Persian Gulf and Gulf of Thailand and uses a minimum number of different profiles to reduce procurement and stock-holding costs.

Topsides and jacket weights are comparable to more traditional North Sea designs at about 650 tonnes and 3,500 tonnes, respectively, for a 100-m (328-ft) water depth platform, with almost all of the topsides and much of the jacket being identical for any platform regardless of water depth. However, there is scope for significant savings in project schedule by both reducing setup times and by allowing construction to start in parallel with detailed design. The design is so standardized that water depth, seabed conditions and well slot arrangement are the only pieces of information required to completely define an individual platform, further reducing project schedule and minimizing construction risk.

WorleyParsons sees an immediate market for at least 20 low-cost modularized platforms in the Norwegian sector of the North Sea alone and is talking to several operators who have been carrying out studies to assess their viability. They also see applications in U.K. waters, where the upcoming 30th licensing round will be targeting small pool discoveries that will require especially low-cost development schemes. ■



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Exxon Mobil Offers Details on Hebron project

■ Eastern Canada project overcame extreme weather and logistical challenges on the way to first oil.

BY BRIAN WALZEL

Exxon Mobil representatives shared details of its Hebron project Tuesday afternoon to a near-capacity session. The company's Hebron project is located 350 km (217 miles) offshore Newfoundland and Labrador (NL) in the Jeanne d'Arc Basin and began production in November, despite the field being discovered in 1980. Session speakers addressed the multitude of logistical challenges the project overcame throughout the lifetime of its development, construction, transportation and installation. According to Exxon Mobil, the Hebron Field holds more than 700 MMbbl of recoverable reserves.

Vincent Cornaglia said that it took 20 years and six wells to fully appraise the field, and first oil wasn't struck until

the early 2010s. He said that during the exploration of the field five pools were discovered with "Pool 1," located in the Ben Nevis reservoir, containing 80% of the field's resources.

Cornaglia said Exxon Mobil's development plan focused on Pool 1 using a waterflood drive and a sand and gravel completion method. The drilling campaign began last year, with the first producer having been drilled in the Pool 1 reservoir. Cornaglia said the well's IP rate was 28,000 bbl/d.

Today, Hebron features three oil-producing wells in 1,400 m (4,593 ft) with the third producer having been completed "just a few weeks ago," Cornaglia said. The project's ultimate targeted depth is 1,500 m (4,921 ft), he said.

The Hebron platform was developed using a stand-alone concrete gravity-based structure (GSB) supporting a topsides deck weighing 65,000 tonnes. The Exxon

Mobil team speaking Tuesday explained how the GSB was designed to withstand sea ice, icebergs and wave events, as evidenced by "wave-slammng steel" having been installed on the underside of the topsides to reduce the impact of large-scale waves on the facility. Karl Wolfe said the GSB was the largest single-shaft base ever constructed, rising 122 m (400 ft) and featuring 52 well slots.

Wolfe described the many technical and executional challenges the project team had to overcome: icebergs, strong winds, freezing sea spray, sea ice and viscous oil. He said the field's API gravity presented a separation challenge, which required the application of new technologies to improve separation processing. Wolfe said among the technologies implemented to improve separation were electrostatic coalescers and enhanced digital capabilities as a result of the installation of fiber-optic cable.

The different components of the Hebron platform were constructed at various sites around the world, including Korea and NL. Wolfe said the transportation and integration of the various components required specialized jacking towers more than 70 m (229.6 ft) high. At the time of the topsides float in December 2017, it was the heaviest float in history, Wolfe said.

The float, delayed six months due to extreme sea ice, eventually took place on May 5, 2017, across a 700-km (435-mile) route. Finally, on June 14, 2017, the platform was set into place within 1 m (3 ft) of its target location. Wolfe said Hebron achieved first oil one month early and since the initiation of production has surpassed 4 MMbbl of oil.

Justin Haddock discussed the widespread efforts Exxon Mobil enacted to ensure the safety of the more than 17,000 workers on Hebron throughout the life of its construction and transportation. Haddock said safety teams worked to break down communication barriers between craft workers and management while regularly and often conducting "cultural surveys."

"When we started we decided we will deliver the safest project in Newfoundland's history," he said. "That was something a lot of people did not believe was possible." ■

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Industry News

DSM, Vryhof Anchors Announce Contract

The contract will result in full-scale engineering, prelay mooring design and analysis from Deep Sea Mooring that will be provided to Diamond Offshore's semisubmersible drilling unit, the Ocean Monarch.

The Ocean Monarch forms part of a 10-well drilling campaign for Cooper Energy in the Otway and Gippsland basins. The campaign will take place between January and August 2018.

Deep Sea Mooring and Vryhof Anchors' equipment and anchor handling vessels will be coordinated and based out of Karratha, West Australia, and at Port Melbourne. The Ocean Monarch semisubmersible is managed by Diamond Offshore Drilling. The rig can operate in water depths of up to 10,000 ft (3,048 m) and drilling depth of 35,000 ft (10,668 m).

See **NEWS** continued on page 17



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BY JENNIFER ECKERT, INGERSOLL RAND

The oil and gas industry constantly fluctuates based on producer capacity and end-user demand. Falling oil prices put drilling companies in a challenging position wherein they have to balance production, equipment investments and operational decisions with the changing market conditions. To respond effectively to changing market climates, operators need to carefully manage their assets by minimizing costs and maximizing efficiencies, while upholding worker safety.

Effective maintenance strategies can pay huge dividends for contractors in the areas of worker safety,

uptime and equipment costs. An effective maintenance program saves operators time and money by avoiding unnecessary equipment repairs and failures, while providing continuous, uninterrupted production uptime. There are three primary approaches to maintaining equipment for the oil and gas environment:

- Reactive maintenance: maintenance that is conducted when a need develops or when a failure occurs;
- Planned maintenance: maintenance that follows the timeline suggested by the original equipment manufacturer (OEM) for routine care; and
- Preventative maintenance: maintenance that includes utilizing historical operational data to antici-

pate when maintenance will be needed and conduct the maintenance before a problem occurs, or it can utilize more advanced, real-time data from remote monitoring devices and sensors.

High-value material handling equipment, such as winches and hoists, require an effective maintenance program to keep equipment performing optimally, extend the equipment life and minimize equipment repair costs and unplanned downtime. Maintenance and service technicians can use testing, timing and technology to establish an effective maintenance strategy and implementation plan.

Testing procedures can help prove that maintenance work is required eliminating guesswork and demonstrating to management that planning downtime for maintenance is worth the investment.

Also, there are a number of ways to use timing to your advantage in your maintenance program, both when maintenance is performed and how often. For instance, utilize a scheduled maintenance regimen that can be implemented over time.

Finally, there are emerging technologies such as remote monitoring tools that will soon offer real-time information to notify the service team as to when services should be conducted, before they go past due.

Testing: the first step

Visual inspections are the baseline level of testing and should be conducted annually by a trained and authorized service provider who can spot critical issues. On offshore rigs, visual inspections can quickly identify rust or salt buildup, cracks or distortions in support structures and leaks. While a visual inspection is helpful for identifying common, high-priority maintenance requirements, further analysis is required to identify internal wear.

Diagnostic testing using the fluids and other indicators on the equipment is another testing method that can provide valuable information. For example, a technician can take a sampling of oil from an equipment motor to test the particulates. Rust particulates in the oil can be an indicator that the motor is starting to experience rusting, which can be a flag that the equipment is starting to age.

Timing as an ally

While the factors that govern the timing of maintenance for material handling equipment will vary based on the equipment type, the frequency of equipment use, the rig location and site conditions there are some guideposts that can help. These include implementing an OEM-recommended maintenance and inspection schedule, conducting planned maintenance during scheduled downtime and scheduling maintenance "early and often."

Technology for preventative maintenance

True preventative maintenance strategies require data that indicate trends and then forecast and plan when maintenance will be required. Performance data are the only way operators can truly know when maintenance is required, and sometimes that might be shorter or longer than the OEM time-based schedule. They also support accurate budgeting and planning and prevent unnecessary equipment overhauls

See **MAINTENANCE** continued on page 27

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New Digital Twin Concept Predicts an Efficient Future

■ A high-fidelity simulation model of an asset combines historical and simulated data.

CONTRIBUTED BY KONGSBERG DIGITAL

At Kongsberg Digital's OTC booth 4029, the focus is on predicting the future with asset life-cycle optimization, autonomous operations and value chain transformation enabled by the Kognifai open ecosystem and the company's cross-industry digital twin concept. Through continuous data-driven integration and enabling new operating processes, the company's concept improves performance from a simple component, such as a turbine, to a complex asset or facility, such as an entire offshore platform or ship.

While the theory behind a digital twin is not new, Kongsberg Digital's approach is. The company is integrating machine learning, Big Data, process-specific applications, visualization tools and simulation technology to forecast the outcome of any process in real time.

"Everything from the asset life cycle, testing and changes, operations and maintenance, training, various degrees of remote operation to autonomous operations, can be enabled by our digital twin concept," said Andreas Jagtøyen, senior vice president of energy at Kongsberg Digital. "The goal is higher efficiency and better utilization of resources."

Digital autonomy

To deliver the insight needed to enable more operational efficiency, Kongsberg Digital is convinced that a digital twin must be supplemented with models describing behavior, real-time data and operating data, both from logs and from sensors on the component, system or asset itself.

"Today we can visualize a simulated sensor value and compare it to a real measured value, and if there is a very big deviation between what the simulator expects and what we measure, an alarm will go off," Jagtøyen said.

The digital twin concept by Kongsberg also is helping to shape the future of autonomous operations. The machine learning algorithms that are trained by the simulation model can learn how to react to unexpected situations, which can augment the safety of remote or autonomous operation of assets.

"With our concept, it's possible to combine multiphase models for flow protection, process, maritime and many other component models in a large dynamic process. This gives the user a 3-D interface to the platform where they can access, monitor and predict the outcome of processes that over time can be made more autonomous," Jagtøyen concluded.

1-1 simulation

The greatest benefits of digital twins are obtained when they are combined with models for simulation. The basis of a digital twin that can provide 1-1 fidelity is the use of historical and real-time data from the physical asset. However, with simulation models, this can be combined with simulated data and used to train a machine learning algorithm. This enables it to identify future events and process outcomes.

It increases the efficiency of the physical assets immensely. Digital twins can help operators visualize data and documentation, but when they are combined with simulation models, they can provide reliable forecasts, allowing operators to train on and plan maintenance operations or

check out changes on the asset before they happen for real. In addition, since the training models are in the cloud, they can be used to provide decision support for real-time operations.

"The difference in what we are doing now is in how deep the twin goes. Many people think of a digital twin in its simplest form: a 3-D drawing or 3-D model you can dive into and spin around and watch on a screen or with VR [virtual reality] glasses. But we are building a high-fidelity simulation model of an asset that combines historical and simulated data, which essentially enables our customers to open a window to the future and predict the outcome of processes on any asset," Jagtøyen said. ■



While providing a facility to predict the outcome of any process, Kongsberg's digital twin technology also is contributing to the development of autonomous operations. (Photo courtesy of Kongsberg Digital)

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Customizing Digital Inspection Solutions for Oil and Gas Assets

■ Holistic assessments enhance evaluations of facility health.

CONTRIBUTED BY AVITAS SYSTEMS

Oil and gas operators have diverse field operations, making the process of inspecting assets—some with unique repair needs—difficult and costly. Traditional manual inspection, or even some uses of drones, often put asset safety and data quality at risk when the process is not customized to asset requirements. Data flow between different inspection teams can be cumbersome, susceptible to error and time-consuming as well.

Today's manual inspection methods are inherently dangerous since they often require workers to enter confined spaces or use ladders, scaffolding, cherry pickers, ropes and

harnesses to inspect equipment. Assets are typically shut down during inspection, causing operators to lose revenue.

Avitas Systems, a GE Venture, is advancing from time-based to more efficient risk-based inspection, providing holistic assessments of facility health, reducing asset downtime, maximizing predictive modeling and utilizing robotics to keep inspectors out of harm's way. The Avitas Systems solutions integrate and tailor innovative technologies for upstream, midstream and downstream assets.

Avitas Systems uses aerial and ground sensors to collect vital inspection data, following precise 3-D models of assets and incorporating existing industry data sources. A cloud-based platform, built on GE's Predix



Avitas Systems automates defect detection in its original AI Workbench. (Photo courtesy of Avitas Systems)

system, centralizes and stores the data, allowing for archival searches of records, including images. The Avitas Systems Platform houses many types of data, including inspection data from manual and autonomous inspection, regulatory requirements and systems data such as weather and operational data. The platform fuses these data sources together for analysis in the Avitas Systems AI Workbench.

The platform uses predictive analytics to detect and classify defects, such as cracks and corrosion, and recommends targeted, risk-based inspection planning. Network-wide asset maps, localized by facility, are displayed on a dashboard for holistic views. Dashboards are customized to user persona, such as enterprise managers, operations managers, inspectors, data scientists and administrative roles.

Aerial inspection

Avitas Systems develops autonomous aerial inspection systems to inspect industrial assets, including flare stacks, well pads and pipelines. These systems integrate rotary-wing aerial robotics and sensor technology such as RGB, infrared and light detection and ranging. Inspectors can select points of inspection on digital 3-D models of assets. This point-and-click method reduces the inspection planning time from hours to minutes. Avitas Systems autonomously converts these 3-D models—integrated with existing requirements—into precise flight paths for data collection.

Ground-based inspection

Avitas Systems also uses robotic, ground-based crawlers with integrated control systems and swappable sensors, which climb or latch onto assets to capture images of defects, such as weld cracking, or perform ultrasonic thickness testing.

Subsea inspection

Avitas Systems integrates AUVs, acoustic and laser sensor technology and artificial intelligence (AI)-based navigation software into unique subsea inspection solutions for the oil and gas industry. Advanced sensors attached to AUVs and ROVs combine laser scanning and camera imaging to provide detailed data on defects, such as corrosion, cracks and marine growth for inspectors and operators. The scanning process can be repeated, generating coordinate values for inspection points

See **INSPECTION** continued on page 26

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Teledyne Marine and Research Products Development Company Sign Agreement

■ Initial contract to commercialize customized inspection ROVs for Saudi Aramco.

Teledyne Marine and Research Products Development Co. (RPDC) have announced an agreement to collaborate on global commercialization of new technologies developed within Saudi Arabia. “We are pleased to have entered into this cooperation agreement with RPDC,” said Mike Read, president of Teledyne Marine. “It formalizes our support of new technology and collaboration in the offshore oil industry with the belief that it will facilitate new and innovative solutions.”



Mike Read, president of Teledyne Marine joins Abdulmohsen Almajnoui, CEO, Research Products Development Co., on day two of OTC to announce an agreement for development of the Shallow Water Inspection & Monitoring Robot (SWIM-R), which integrates a unique sensor design developed by Saudi Aramco. (Photo courtesy Aramco Services Co.)

A first success under this agreement is the award of a development contract, which will integrate a unique sensor design developed by Saudi Aramco. Ahmad Al-Khowaiter, CTO at Saudi Aramco, said, “We are excited about collaborating with Teledyne SeaBotix, in developing an advanced technology that will address the challenges posed by shallow-water pipeline inspection monitoring. The technology will substantially reduce underwater infrastructure inspection costs.”

The integrated sensor can perform both ultrasonic thickness readings and cathodic protection voltage measurements at a single touchdown reducing inspection costs for shallow-water pipelines, minimize inspection safety hazards and enable the inspection of hard-to-reach sections. “We are pleased to work with Saudi Aramco and RPDC in providing groundbreaking robotic inspection capabilities that enable safer and more efficient shallow-water pipeline inspection,” said Grace DeForest, director of Global Business Development for Teledyne Marine.

These advancements in small ROV capabilities, for shallow-water inspection, were first developed within Saudi Aramco by members of the Network Integrity Team within the Research & Develop-

ment Center. Collaboration with Teledyne has provided improvements in reliability and opportunities for global

commercialization of these groundbreaking capabilities on an inspection-class ROV. ■

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Preventing Dropped Objects on Offshore Units and Installations

■ New standards issued on safety issue.

BY CHRIS CORCORAN, ABS

Dropped objects are among the top three causes of injuries in the offshore work environment and accounted for 14% of fatalities in the U.S. upstream oil and gas industry from 2003 to 2014.

The approach taken to manage dropped objects in the offshore work environment has been to apply best practices for existing equipment. This method has been maturing over the past seven to 10 years with significant advancements being made on recommended best practices within the last three years. Even with application of best practices, one operator reported that nearly 25% of all of its incidents involved dropped objects.

Although the industrial well construction capabilities of the latest generation of drilling units has been the focus of design changes to achieve greater efficiencies and capabilities, the design of outfitting type equipment has remained largely unchanged. Consequently, with the fitting of an increased amount of equipment used to improve the efficiency of well construction processes combined with an increase in outfitting type equipment, a corresponding increase in dropped objects has been experienced. In response to this safety issue, ABS has published the first international class standard on the subject of dropped object prevention. The objective is to promote offshore safety through improved asset integrity management and the use of inherently safe design principals.

The magnitude of the dropped object issue can be seen by first looking at incidents reported from the U.S. through the National Institute of Occupational Safety and Health (NIOSH). Statistics across all industries in the U.S. between 1992 and 2002 are contained in Table 1.

In this study, fatalities caused by dropped objects are included in the general category of “Contact with Objects and Equipment.” However, in a later study carried out over the 10-year period from 2002 to 2013, NIOSH further categorizes fatalities resulting from being struck by a falling object. For the period studied, there were 1,221 fatalities reported in the U.S. upstream oil and gas industry, 171 of which were caused by the victim being struck by a falling object. Consequently, during this period, 14% of all fatalities in U.S. upstream oil and gas were caused by falling objects.

The results of this research demonstrates the following facts and gaps in addressing this issue:

1. Available best practices offer traditional means to manage drop prevention for existing equipment. Current national and international standards do not address this subject.

2. Prevention of dropped objects is not addressed in equipment design standards.

The “ABS Guide for the Prevention of Dropped Objects on Offshore Units and Installations” fills the gap by

WORKPLACE FATALITIES- US INDUSTRY

Table 1. Number and Lifetime Costs¹ of Fatal Occupational Injuries by Event or Exposure², U.S., 1992-2002

Event or Exposure	No.	Total Cost	Mean Cost	Median Cost
Transportation Accidents	27,062	\$23,017,465	\$851	\$867
Assaults and Violent Acts	11,021	9,402,451	853	832
Contact with Objects and Equipment	10,570	7,983,334	755	787
Falls	7,355		754	801
Exposure to Harmful Substance and Environments	5,933		907	900
Fires and Explosions	2,041		901	932
Body Reaction and Exertion	-	-	-	-
Other Events and Exposures	-	-	-	-
Nonclassifiable	105	78,878	745	750

¹Costs are expressed in thousands of 2003 U.S. dollars. ²Event or Exposure codes were assigned based on BLS Occupational Injury or Illness Classification System. NOTE: Dashes indicate data that do not meet publication standard.

(Data courtesy of U.S. Department of Health and Human Services Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health)

See **DROPPED OBJECTS** continued on page 26

New Digital Anomaly Detection App Improves Asset Inspection Efficiency

■ Anomalies identified rapidly and precisely.

CONTRIBUTED BY CLARUS SUBSEA INTEGRITY

Rapid, accurate detection of anomalies from inspection video footage of subsea assets poses an ongoing challenge. To identify potential defects and anomalies, asset owners typically invest long hours spent visually reviewing inspection films.

The days of manual review are nearing the end, with the iCUE Digital Anomaly Detection App, a new technology from subsea integrity management specialist Clarus Subsea Integrity.

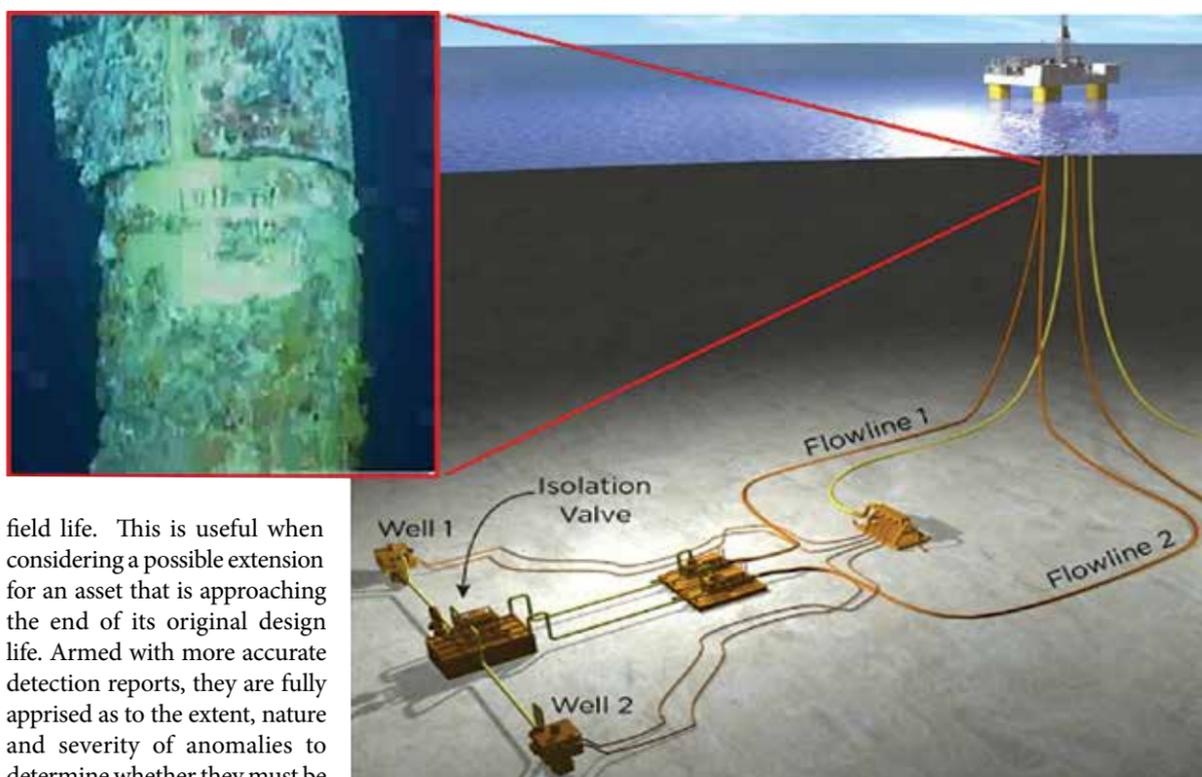
As the latest addition to the company’s Digital Integrity Management Services portfolio, the Digital Anomaly Detection App quickly pinpoints anomalies that appear in videos of subsea assets recorded during inspection.

“By using the app to assess footage of subsea risers, pipelines or moorings, for example, operators immediately receive a more accurate account of conditions that might otherwise go undetected,” said Dharmik Vadel, vice president of Clarus Subsea Integrity. “In addition, the speed at which it analyzes footage and identifies anomalies is at least 10 times faster than manual review, which is significant when assessing whether an asset is fit for continued service or requires attention.”

To achieve this, the app automatically carries out an engineering assessment of the inspection footage. The app is based on machine learning and draws upon image analysis technologies. Clarus trained it with a machine learning algorithm to accurately qualify an anomaly by using a structured dataset of positive examples of anomalies.

Using the app to screen footage to identify and characterize anomalies reduces the number of unknowns. As a result, the risk profile of the asset is improved by making it possible to positively confirm its integrity or develop a plan to mitigate identified anomalies.

Integrity managers can also use it to trend anomalies from multiple inspections conducted on an individual asset



field life. This is useful when considering a possible extension for an asset that is approaching the end of its original design life. Armed with more accurate detection reports, they are fully apprised as to the extent, nature and severity of anomalies to determine whether they must be addressed immediately, require ongoing monitoring or remediation before qualifying the asset for life extension.

Conducting efficient, cost-effective inspections depends upon how swiftly they’re executed. Because the app is designed to conduct anomaly detection screening following inspection data gathering, it’s a completely separate operation. This means that inspections, whether conducted by ROVs or AUVs, focus solely upon capturing accurate video data of subsea equipment. As a result, this phase is completed faster,

The new iCUE Digital Anomaly Detection App rapidly pinpoints anomalies in subsea assets by conducting an engineering assessment of inspection footage, saving time and providing a more accurate reflection of conditions that might otherwise go undetected. (Image courtesy of Clarus Subsea Integrity)

reducing time and expense. Given that inspection video is screened automatically, the app essentially lowers the time and expense typically required.

Currently, Clarus is advancing the development of the app by testing additional subsea equipment anomalies. It is scheduled to be commercially available in fourth quarter 2018. ■

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NEWS (continued from page 10)

ASME Recognition Program Held at OTC

ASME (The American Society of Mechanical Engineers) has presented seven awards recognizing technical achievement and distinguished service in the field of petroleum engineering.

Don Wells received the 2018 Geoca Mechanical Engineering Achievement Award during a ceremony held during the OTC.

ASME also bestowed the 2018 Arthur Lubinski Award recognizing the best technical paper delivered during ASME-sponsored technical sessions at OTC. Juan Liria, Henrique Coelho, Dave Sproson, Paulo Martinho, Cody Webb, Fernando Oropeza, Jill Bradon, Rosemary Smith, Zhong Peng Fugro—Fugro House were honored for “A Novel Approach to Generating a Hurricane Database For the Gulf of Mexico Based on Numerical Weather Prediction Models.” Baker Hughes, a GE company, won the 35th Annual Woelfel Best Mechanical Engineering Award (BMEA) for its product, the Kymera Mach 4 Hybrid Drill Bit.

Two BMEA Awards of Merit were presented: the first to Safe Marine Transfer LLC for Safe-Stor and the second to Synergy Industries for the SMD (Synergy Machine Drum).

The first annual Petroleum Fluids Engineering Award was awarded to Gerald L. Morrison.

Bruce E. Morris won the 2018 Silver Patent Award.

The 2018 honorees for the Ross Kastor Educator’s Award and Keith Thayer Exceptional Early Career Engineer Award were Matthew Franchek and Madeleine Kopp, respectively.

The 2018 awards program was sponsored by the ASME Petroleum Division, which provides technical programming, networking events, continuing education and other services to engineers and other technical professionals in the oil and gas and related industries.

Wood Combines Engineering Knowledge with IBM’s Advanced Digital Technology

Wood has signed a multiyear agreement with IBM to develop digitally enabled engineering and technical services. The demand for increased technical efficiency and greater engineering innovation were the catalysts for this collaboration, which brings together Wood’s industry-specific technical knowledge with IBM’s digital and emerging technology strength.

The partnership creates single-sourced expertise for digital asset performance. Covering a broad range of industries and market sectors, the collaboration creates the ability to offer end-to-end solutions throughout the whole asset life cycle from design to decommissioning. Both companies also plan to develop global, scalable industry solutions platforms.

“It effectively means we can provide single-source specialist engineering, digital intelligence, consultancy and systems integration,” said Bob MacDonald, CEO of Wood Specialist Technical Services.

This is the company’s first showcase at OTC following the merger of Wood Group and Amec Foster Wheeler in 2017. ■

OTC Brasil 2019

Plan now to attend OTC Brasil from Oct. 29 to Oct. 31, 2019 in Rio de Janeiro. OTC Brasil is one of the world’s foremost events for the development of offshore resources in the fields of drilling, E&P and environmental protection. This biennial event is organized by OTC and Instituto Brasileiro de Petróleo, Gás e Biocombustíveis. Visit otcbrasil.org for more information.

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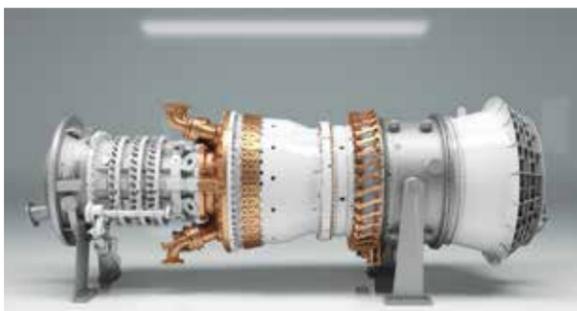
Gas Turbine Powers the Offshore

■ Engine features a compact, modular design suited for offshore environments.

CONTRIBUTED BY BAKER HUGHES, A GE COMPANY

Doing more with less. Optimizing equipment life. Increasing production while lowering costs. Reducing risk. These cries have reverberated throughout the current economic cycle. There is little doubt that operators will reduce their focus on operational efficiency in production as the industry climbs into recovery. It will be incumbent on original equipment manufacturers to continue innovations that meet customers' business objectives.

"Whether in an onshore or offshore environment, gas turbines are central to operations," said Marco Caccavale, vice president of onshore and offshore power, Baker Hughes, a GE company (BHGE). "Developing technology that enables operators to optimize assets and deliver a lower total cost



The sub-20MW NovaLT family of gas turbines were developed for the highest efficiency in this power class. Some of the system's components are 3-D printed, reducing complexity and costs during development. (Photo courtesy of Baker Hughes, a GE company)

of ownership has been the focus of the team. One of these innovations is the NovaLT family of gas turbines developed by BHGE to offer an efficient, flexible solution that delivers maximum power and mechanical drive availability. It is a low-maintenance solution in a compact, modular package making it well-suited for offshore environments."

With the NovaLT, producers can expect maintenance intervals up to five years or 35,000 hours (mean time). Maintenance involves a process of swapping out the engines, an activity that is designed to be carried out in less than 24 hours, including time for plant cool-down and ramp-up.

Putting turbines to the test

In 2017 BHGE was awarded a contract for three compression trains equipped with NovaLT16-driven barrel-type compressors for a FPSO in Asia. The project required BHGE to deliver innovative, high-performance equipment with quick installation as well as commercial guarantees to mitigate risk for the customer.

BHGE's approach to the project was to complete assembly work at its manufacturing facility in Florence, Italy. These pre-assembled units consist of the complete turbomachinery trains and the balance of plant.

Pre-commission assembly and rigorous testing that simulated operating conditions was completed on the modules before they were shipped from the factory. On a dedicated test bench constructed at the BHGE campus in Florence, tests simulated the gas turbine bearings operations during pitch and roll movement of the FPSO supporting the GTC train. This testing helped to mitigate against quality issues or delays that might impact time to first oil once the modules were onsite.

The test bench included an electric motor that spun the NovaLT16 bearing at its operating speed (10,000 rpm). Lube oil was supplied and returned at the same condition (flow and pressure) as in the complete gas turbine operation. A pneumatically actuated platform that supported the bearing and motor moved up to +/-15° roll and +/-10° pitch, simulating actual operating conditions.

A test of the turning capabilities of the centrifugal compressor while the gas turbine in motoring mode was completed. This test consisted of operating the motor in very low speed (down to 1,500 rpm) rotation of the gas turbine shaft, allowing the centrifugal compressor to be turned to avoid its bending during the cool-down period and to exclude any need of a prolonged startup period for distension.

Using the power of digital offshore

To further optimize offshore operations, BHGE has been heavily investing in digital technology to simplify rotating equipment, reduce maintenance activities and boost asset performance. GE's Predix platform for the Industrial Internet of Things has been designed to connect equipment, analyze data, and deliver insight in real time. Predix cloud-based apps, such as Asset Performance Management, are said to make operations safer and more reliable while helping to ensure optimal performance at a sustainable cost.

New control algorithms and digital twins—physics-based models—are tied into analytics that are used to estimate and predict the future state of a turbomachinery asset. Customers can then leverage the Digital Twin to estimate process value and avoid the use of real sensors that in case of failure may negatively impact the equipment performance. ■

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Digital Yard to Increase Efficiency

■ Software system offers proactive scheduling maintenance and time savings.

CONTRIBUTED BY MCDERMOTT

What if we could look at items and instantly know the complete health and history of each as it arrives and moves around the fabrication yard? McDermott is developing new software to know the latest status and health of assets at its Altamira fabrication yard in Mexico. Altamira is serving as a testbed for McDermott's "Fabrication Yard of the Future" digital yard initiative.

The initiative improves automation within the yard and does away with tracking project activities and handoffs of assets and materials using time-consuming manually created spreadsheets and uses advanced sensors instead. The digital yard solution improves visibility into yard operations through management dashboards that track equipment (Smart Assets) and materials usage and progressing (Material Track & Trace).

Improved yard operations

Smart Assets track status (use and location), health (pressure, temperature and vibration), availability (if equipment is healthy and available to be used) and utilization (operating hours). Each asset is connected via sensors and wireless technology used for collecting and sending data to a centralized server. The goal is to reduce equipment downtime, increase equipment utilization and provide on-time delivery at the fabrication yard.

The typical spool life cycle starts with cut, fit, weld, nondestructive test, paint and erection. In the past there was no automated way to mark the spool, track its location and understand its availability at the fabrication yard and improve utilization.

Material Track & Trace creates an automated method for collecting consumption data on the spool at the fabrication yard, visualizes the spool data and provides actionable data-driven insights to the fabrication operations team. Radio-frequency identification (RFID) sensors collect and aggregate data on the spool. RFID uses radio waves to read and capture information stored on a tag attached to an object. In addition, the digital yard uses a web-based application to easily view and analyze the spool data on any device, 24 hours a day.

Equipment tracking

Material Track & Trace tracks spool components (fittings, flanges, etc.) in the yard and then allocates on a priority basis spools that need to be fabricated. Once issued to the pipe shop, fit and welded, yard personnel can track spools through the various shops while attaching quality control records and test records to the spools. Tracking the life cycle of the spool and attaching all associated quality control documentation provides real benefit. Incorporating digital tablets and RFID readers to speed the documentation process—moving away from hard copy paper—increases accuracy and streamlines the process.

Besides tracking assets such as power systems equipment like forklifts, various metal-working machines and spools, the dashboards also track the progress and health status of about 22 different machines at the yard. The system even monitors local weather conditions, which can impact fabrication activities.

A key component includes collecting data from the activities at the yard into a

centralized digital database, ensuring it can be easily accessed and understood. McDermott plans to apply the digital yard concept to every McDermott fabrication yard.

"Next steps are for us to continue to enhance the digital yard solution in Altamira and collaborate with the respective supply chain and fabrication teams to deploy the solution globally," said Jonathan King, manager of the McDermott Digital Center of Excellence. ■

An Internet of Things sensor on top of a forklift tracks its location and health at the Altamira fabrication yard. (Photo courtesy of McDermott)







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Program to Bring Safety-critical Digital Solutions to Market

■ Digital technology will transform the pace of change within the safety and risk sector.

CONTRIBUTED BY LLOYD'S REGISTER

Rapid developments in technology, the digital economy and the convergence of physical and cyber, the drivers of the fourth industrial revolution, are transforming the way we live and work, creating enormous opportunities and challenges for society and business.

Digital innovation already has permeated sectors such as retail, finance and consumer technologies, but its full potential in deep industrial sectors has yet to be realized. While the safety and risk market is significant, it is still relatively untapped by digital technology companies.

There are huge opportunities for the industry to innovate to enhance safety in operations.

So why has adoption in the industry been relatively slow?

Digital technologies, from the early computers of the 1950s to internet-equipped smartphones of the 21st century, have fundamentally changed the way industries function and have opened the way to trillion-dollar industries such as internet infrastructure, enterprise software, mobiles, online retail, gaming and apps, as the world exploded into the “digital revolution.”

These technologies have emerged incrementally and with varying degrees and speed across industrial sectors, growing hand in hand with increased levels of IT and

automation. It is only recently that industry executives and analysts have started talking about another revolution taking place owing to the digitalization of the industry—the fourth industrial revolution, or Industry 4.0.

What makes Industry 4.0 different is the prospect of a new level of digital interconnectedness and integration between firms, supply chains, production, products, customer and end-use applications, with the prospect of generating the same dynamics we have seen in the evolution of the internet.

Several transformational digital technologies are contributing to open up the possibilities: cheap sensing and pervasive wireless connectivity, the ability to capture, store and perform sophisticated analytics of vast quantities of data, the internet and cloud, robotics and autonomy, blockchain and additive manufacturing.

Adoption of new technology is rarely driven by curiosity. For many organizations the imperatives are to keep increasing efficiency and revenues and the fact that suppliers and customers now expect a firm to have digital interfaces to their operations. However, digital technologies also have the capability to fundamentally reduce risk and improve safety.

In this rapidly changing landscape and faced with these imperatives, companies in industrial sectors need to relearn how to innovate faster and better. While R&D is still needed as strong a role as ever, market-facing innovation in the digital era requires companies to adopt an agile innovation culture driven by pilots, rapid iterations driven by customer feedback loops and an open-innovation, collaborative mindset to partner with best-in-class technology providers.

However, adoption in our industries has been limited by the financial risk of partnering in an innovation pilot and, as a result, technology companies are struggling to find a route to market.

That's why Lloyd's Register has announced plans for the Lloyd's Register Safety Accelerator, a new initiative aiming to remove barriers preventing industry uptake of cutting-edge safety and risk solutions.

Funded by the Lloyd's Register Foundation, the program will work with key industry players to identify areas of operation with the most significant challenges to safety and risk.

Technology businesses seeking an application for existing digital solutions are invited to apply for funding to trial these products in an industrial environment, through the accelerator collaborators.

The Lloyd's Register Safety Accelerator will support industry business partners by offering the opportunity to focus digital innovation on key business challenges, support for trialing new solutions in a de-risked environment with early adoption opportunities and access to innovative new technologies and startups.

At the same time, the Safety Accelerator will support small innovative business through offering the ability to trial solutions in the real world with a leading industry player, funding toward the costs of the trial, industry-specific specialist support and training (regulator, data, systems) from Lloyd's Register and its clients and entrepreneur development (e.g., marketing, IP, minimum viable product, business case and investor pitching).

For more information, visit booth 3005. ■

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Using Inflatable Casing Annulus Packers for Casing Integrity Security

■ Valve system provides fail-safe when using inflatable packers during multistage cement jobs.

CONTRIBUTED BY TAM INTERNATIONAL

The Deadbolt Valve system is an innovative security measure added to TAM International casing annulus packers (CAPs) to prevent any leak path inside the casing. The valve provides operators with a means of running inflatable CAPs without risking casing integrity.

Thousands of inflatable CAPs are utilized every year to facilitate two-stage and three-stage cement operations for intermediate casing sizes. These inflatable CAPs are

used globally to support the hydrostatic weight of cement when operators encounter weak or lost circulation zones. As part of the casing design program, these CAPs are placed directly above the lost circulation zones, where wash-outs and irregular hole sizes are common. Because of these extreme conditions, inflatable casing packers can overexpand beyond the capabilities of the packer. This may result in packer failure, which could create a flow path from inside to outside, compromising casing integrity. Consequently, remedial work, such as a cement squeeze job, must be performed before drilling can continue, resulting in significant rig downtime.

The Deadbolt Valve is integrated into the existing inflatable CAP technology to preserve casing integrity during overexpansion. (Image courtesy of TAM International)

operators can simply increase rate and pressure to activate the Deadbolt Valve. Once activated, the valve shuts off all flow into the CAP, and casing integrity is re-established immediately. Operators are free to proceed with casing cementing and drilling as required without any remedial work.

This use was demonstrated in the Delaware Basin by a major operator who required CAPs to facilitate a three-stage cement job for its 9⁵/₈-in. intermediate casing. Weak zones near the 9⁵/₈-in. shoe prevented a single cement job, so two inflatable CAPs and stage cementing collars were run in the string to support a second and third cement job. The CAPs were placed to hold the hydrostatic pres-

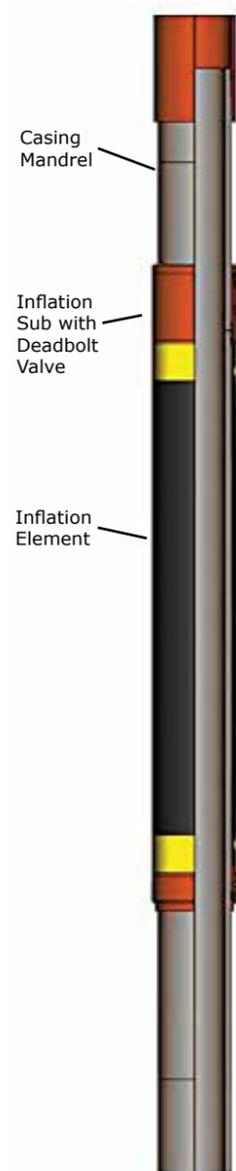
sure of both cement jobs off weak formation zones, allowing the cement to set up all the way to surface.

Because of the limitations of a three-stage cement job, placing the inflatable CAPs above the weak formation zones and inside of a competent rock formation was a challenge. To mitigate the risk of placing the CAPs in a washed out and irregular wellbore, both CAPs were run with the new Deadbolt Valve system.

After successfully completing the first stage cement job, pressure applied to the casing string initiated the inflation process. Overexpansion was observed during inflation indicating a leak in the casing string. To shut off the leak path, pressure was applied down

the casing string at a small pump rate. Internal pressure activated the Deadbolt Valve and shut off the flow path. At this point, the operator re-established casing integrity.

After activating the valve, the operator immediately resumed operations and proceeded with the third stage cement job. Without the Deadbolt Valve, the operator would have had to shut down drilling and casing cementing operations to perform a cement squeeze job to regain casing integrity. The valve saved the operator more than a day of rig downtime and any additional cost in repairing the casing leak. ■



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A Novel Approach to Subsea Installation and Field Development

■ Technology aims to reduce spending by increasing the efficiency, economics and safety of deepwater installation and equipment recovery operations.

BY COLLIN GASKILL, TRELLEBORG SEALING SOLUTIONS

Much of the cost of offshore deepwater oil and gas production is related to the significant challenges associated with subsea equipment installation. Costs, which can increase rapidly, as installation operations of large and complex equipment rely on the service of a limited global supply of specialized offshore construction vessels (OCVs).

Forward-thinking companies are investigating innovative technologies that allow the safe, effective and optimized installation of subsea equipment in deep waters.

One such technology under development has recently achieved significant qualification milestones, providing the foundation necessary to bring operational advancements to deepwater installation methodologies.

Breaking with tradition

This new installation technology does not depend on traditional OCVs to install payloads from the surface to the seafloor. Rather, this design utilizes column stabilized shuttles to safely lower equipment from the sea surface to the installation site.

The shuttle design employs an adjustable buoyancy package that allows the movement and placement of discrete macro buoyancy spheres to trim uplift and facilitate vertical movement of the shuttle and payload through the water column.

This approach has the potential to attenuate a number of the challenges associated with traditional installation techniques using a heavy-lift crane and payed out wire. One of the more significant advantages is the removal of the requirement for lifting equipment reserving the full lifting capacity of the shuttle for the subsea equipment,

irrespective of water depth, and decoupling the installation payload from a surface vessel.

In addition, large intricate subsea equipment can be installed and tested on the shuttle deck quayside, minimizing on water installation time, improving safety and reducing costs and complexities.

Improving safety with increased operational flexibility

Having the equipment remain on the deck of the installation shuttle and lowering the entire system removes operational concerns and potential safety hazards associated with the relative motion of an installation vessel and its deployed payload. This allows seafloor landing procedures to be controlled with a very high level of accuracy and potentially increases the weather windows in which installations can be performed.

An additional advantage is the ability to shift a level of project expenditure from capital to operational costs. Dynamically moving the shuttles' buoyancy package from inside the buoyancy tanks of the installation shuttle to a surface support vessel after installation means the buoyancy may be reused elsewhere.

This means a model can be used in which the buoyancy is a service, and costs are distributed over numerous shuttle operations rather than as a capital investment for each individual shuttle under a fixed buoyancy design.

Validating performance

Development and qualification work on this new Subsea Shuttle installation technology is being carried out under a joint development agreement between Safe Marine Transfer LLC and Trelleborg's offshore operation. The companies have partnered to ensure rigorous qualification of the technology's individual components and of the system design as a whole.

In an effort to mitigate the risks inherent in new technological developments, the installation shuttle design capitalizes on current industry accepted technologies, combining and reintroducing them in an innovative approach to improve offshore installation operations.

The core technology in the shuttle's dynamically adjustable buoyancy is developed from macro buoyancy sphere technology. These spheres have been used as uplift in the offshore industry for decades in static conditions to provide buoyancy to a wide range of offshore structures, such as risers, pipelines, midwater arches and for installations.

Buoyancy sphere designs present an excellent opportunity to extend their application to dynamically adjustable buoyancy. ■



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Diversity Study Identifies Activities Needed to Advance Women in the Workplace

■ Inclusion and diversity is not only a good business practice, but it brings results.

BY LESLIE BEYER, PESA

The Petroleum Equipment & Services Association (PESA) has performed a gender diversity study across the oil and gas industry's service and equipment sector to analyze the current state, inflow and outflow of female talent and identified actions organizations can take to advance women into greater leadership positions within the sector.

Why should PESA and its member companies care about diversity? Inclusion and diversity is not only a good business practice, but it brings results.

Numerous studies show companies that promote diversity perform better than their industry peers. For example:

1. **Margin:** Companies with at least 30% female leaders end up raking in 6% higher net margins, according to The Peterson Institute for International Economics.
2. **Market Share:** 48% of companies in the U.S. with more diversity at senior management level improved their market share the previous year, while only 33% of companies with less diverse management reported similar growth, according to Center for Talent Innovation.
3. **Decision-making:** 600 business decisions made by 200 different teams over a two-year span found that more gender diverse teams made better decisions up to 73% of the time, according to Forbes.

The oil and gas industry has historically struggled with attraction and retention of female talent. In the U.S. women make up 47% of the workforce (14.5% within the energy sector overall). PESA has discovered that 16% of the services and equipment sector of the energy industry workforce are women.

Only 38% of U.S.-based technical operational roles within the sector are filled by women, and only 8% of top leaders in technical operational roles are women. Alternatively, the percentage of women in U.S.-based top leadership positions in support function roles is significantly higher at 27%.

When looking at 2017 inflow of female talent into the sector of total 2017 U.S. entry-level sector hires 16% are women as compared to 18% of female experienced hires.

Increases in inflow are an important step toward companies achieving equality; however, there has historically been a discrepancy between the number of women entering the sector industry versus their overall percentage in the workforce over time. Lack of flexible work programs is the most cited reason for why women exit the sector workforce, seconded by better career prospects. In addition, 50% of companies do not track why women are exiting.

Through PESA's research with Accenture, it has outlined three steps the sector can take toward creating a diverse workforce and creating an environment where women are significantly more likely to excel and advance:

1. **Bold leadership:** Be open about targets and plans to make diversity a way of operating.
2. **Comprehensive action:** Supporting everyone, not only women, is the best way

to create an inclusive environment where everyone can succeed.

3. **Empowering environment:** A place where people can feel free to be their authentic selves and inspired to do their best work.

Retention and advancement programming with C-suite endorsement and visibility can make substantial impacts to individual women's experiences as well as on overall gender diversity in the industry. By working to understand unmanaged attrition and implementing solutions in response, the service and equipment sector of the energy industry can reduce the outflow of women and become an increasingly diverse place to work.

For more information regarding the PESA Diversity Benchmarking Study, please visit pesa.org.

Methodology

PESA surveyed more than 35 companies, covering more than 250,000 working men and women to understand what it will take to create a workplace in which women and men have equal opportunities for advancement. PESA also analyzed published data related to a range of workforce issues, including labor force, progression, talent gaps, culture at work, sexual harassment, company gender by level and company best practice. ■



The graphic features a blue and white color scheme. On the left is the logo for the Offshore Technology Conference Asia, which consists of a red circle with a white wave and the text 'OFFSHORE TECHNOLOGY CONFERENCE ASIA'. To the right of the logo, the text 'OFFSHORE TECHNOLOGY CONFERENCE ASIA' is displayed in large, bold, blue and red letters. Below this, the dates '24 - 27 March 2020' and the location 'Kuala Lumpur, Malaysia' are written in blue. The website 'www.otcnet.org' is also present. The background shows an offshore oil rig at sea, with a large red banner at the bottom right that says 'SAVE THE DATE' in white capital letters.

Innovative Clear Fluid Solutions

■ A company's high-density clear brine can approach the densities normally achieved using either zinc bromide or caesium formate.

BY SAMY HELMY, TETRA TECHNOLOGIES INC.

Delivering a project safely, on time and in budget requires an innovative approach to project design, meticulous planning and flawless execution at the well site. TETRA Technologies Inc. believes project design activities should not be restricted by the limits of "legacy technologies." The company recently developed a number of game-changing technologies that address industry challenges, reduce risks, increase efficiencies and lower overall costs. One of these new technologies is outlined below.



The photo shows the company's offshore fluids facility located in Galveston, Texas, where production of its TETRA CS Neptune heavy-brine completion fluid was accomplished. TETRA completed a major TETRA CS Neptune project for a GoM customer in 2017. (Photo courtesy of TETRA Technologies Inc.)

High-density completion fluid

The TETRA CS Neptune completion fluid system is a high-density clear brine that can approach the densities normally achieved using either zinc bromide or caesium formate. However, TETRA CS Neptune is formulated without the use of undissolved solids, zinc or formate ions.

The first generation of TETRA CS Neptune was developed specifically for a project involving deepwater and complex high-pressure wells. A completion brine density

of greater than 14.4 ppg was required to control reservoir pressures within the project (i.e., above that of commercial calcium bromide brines). Typically, this would have necessitated the use of either a zinc bromide or caesium formate brine; however, neither of these options was viable for this project. The operator approached TETRA for help and these discussions resulted in the development of a high-density fluid that avoids the undesirable environmental impact of zinc salts and the cost and availability issues associated with the use of caesium formate brines.

Zinc brines are classified as "marine pollutants," and there are strict controls governing their use in the Gulf of Mexico (GoM). The use of zinc brines has been banned in many areas of the world, including the North Sea and Brazil. Until recently in the North Sea, caesium formate was the only environmentally acceptable brine with a density greater than 14.2 ppg. Caesium formate is sourced exclusively from a single mine in Western Canada. This mine is almost depleted. Consequently, caesium formate is no longer available in sufficient quantities to service some major projects and its cost has risen exponentially.

TETRA CS Neptune meets all the environmental requirements of the GoM and North Sea as well as those of other environmentally sensitive areas. It is an engineered solution formulated with renewable chemistry, stable at elevated temperatures and during storage, and can be mixed with standard clear brine blending equipment. It is compatible with most elastomers, poses a low corrosion risk and performs at low temperatures and high pressures without crystallization.

Although TETRA CS Neptune was originally developed as a completion fluid, it also could be used as the basis of high-density, low solids reservoir drilling fluids or in other applications where a high-density, environmentally acceptable fluid is required.

The completion fluid system was initially deployed on four ultradeepwater completions in the GoM where the operator was required to produce into a host facility with the production stream free from zinc and priority pollutants. Alternative solutions, such as extended flowback



TETRA Advanced Displacement System (TADS), another completion fluids system, was introduced to the market in 2017 through the company's TETRA Innovation Group. The TADS fluids system performed well for a GoM customer, successfully demonstrating effective wellbore cleaning performance and water-wetting of tubular surfaces. (Photo courtesy of TETRA Technologies Inc.)

to temporary storage or caesium formate, were considered but were deemed not viable. The wells required 14.5 ppg to 15.0 ppg completion brines, with the well depth exceeding 9,150 m (30,000 ft) in a water depth of 2,200 m (7,200 ft) and seabed temperature of 3.8 C (39 F) and bottomhole temperatures approaching 132 C (270 F).

The completions were installed successfully, and the fluid performed as designed with no issues, including no problems with true crystallization temperature or pressure crystallization temperature during a 15,000-psi BOP test. TETRA's proprietary completion fluid displayed no compatibility issues with lost circulation materials or polymers. The synthetic oil-based mud used to drill the reservoir was displaced without issues and without deterioration of the drilling fluid properties.

Following extensive corrosion and elastomer compatibility testing, the operator also used TETRA CS Neptune completion fluid as the packer fluid for the project.

For more information, visit tetrathec.com. ■

Connected Equipment for a Smarter Back Deck

■ Next-generation technologies to bring data closer to the client.

CONTRIBUTED BY AQUATIC

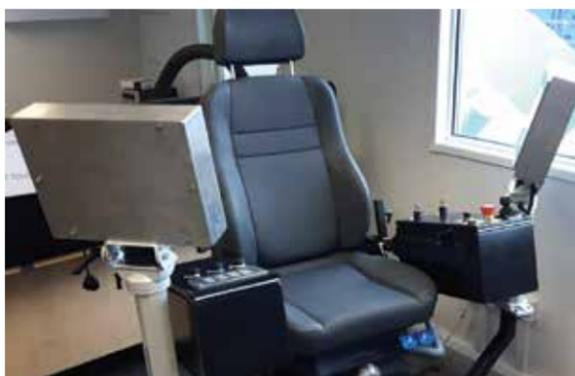
Getting the data you need, when and where you need it, is becoming ever more important as the industry races toward the development of 'smart' oil fields. While the gathering of vital data will always be an essential part of planning and determining a project's next steps, it's clear that the means of delivering and accessing that information is becoming just as important.

Connectivity—the capacity for the interconnection of systems and equipment—will continue to prove a differentiator as partnerships are forged to provide efficient and cost-effective solutions to maximize the potential of oil and gas fields today and tomorrow.

One such demonstration of connected equipment, which has been designed and developed by Aquatic Engineering & Construction Ltd., an Acteon company, is a control system for its range of tensioner systems, which offer reliable handling of flexibles, umbilicals and steel pipes for the oil and gas and renewables markets.

The next-generation technology has been developed by Aquatic's in-house engineering team, in collaboration with clients and a range of operators, to provide improved real-time data logging, reduce maintenance requirements and keep downtime to a minimum.

While today's equipment measures vast amounts of data on almost every aspect of its performance, this data



Aquatic's next-generation tensioners control system uses an interactive chair for ease of use and increased operator ergonomics. (Photo courtesy of Aquatic)

are generally only available easily to the person operating it. Aquatic's connected equipment has the capability of providing data measured from its sensors, in real time, to other locations or systems on the vessel. That can include the control system of another piece of equipment, the vessel survey system, or just a simple informational display on a screen in an office to be monitored.

Aquatic's new control system has incorporated the latest programmable logic controller technology from the initial design stage and has been successfully built, run and tested by Aquatic's Technical Excellence Group.

"Designing and building our own systems has meant that we are able to satisfy our client's needs; we own the IP rights to our systems; updates can be carried out seamlessly; client modifications/integration can be carried out quickly and any feedback requiring changes can be developed and implemented without the use of third-party vendors, which can be a slow, expensive process," said Steven Kilpatrick, general manager, for Aquatic.

With minor modification, the system has the ability to operate without a control cabin, using a remote control suitcase, should a client's deck space be of a premium. It will go on its first job for a marine company shortly, using this configuration, where there will also be the facility to monitor the job 'live' from Aquatic's offices in Scotland or remotely.

Improved interaction with client equipment is at the heart of this technology development. Advantages include

- Data logging an entire job and sharing data in real time, provided an internet connection is available, or the vessel is within GSM cellular phone range;
- Retransmission of vital data to remote displays round the vessel as required;
- Ability to send vital data in various formats to client equipment;

See **EQUIPMENT** continued on page 26

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INSPECTION (continued from page 14)

that become highly accurate 3-D models of subsea infrastructure. Avitas Systems also uses sonar technology and navigational software to optimize robots' abilities to follow supervisory commands, track pipeline or subsea field positioning with AI-powered swim paths and identify priority areas for inspection.

Fugitive methane detection

Avitas Systems uses tunable diode laser absorption spectroscopy (TDLAS) and optical gas imaging (OGI) with mid-wave infrared sensors for fugitive emission detection. TDLAS uses unique light absorption characteristics on molecules to identify methane, measuring average concentrations in gas along a laser beam. An OGI camera detects the presence of methane and volatile organic compounds from 30 m to 90 m (98 ft to 295 ft) without requiring direct contact with the gases.

Corrosion under insulation

Avitas Systems can curate analytics to screen and evaluate corrosion under insulation and pitting corrosion. Engineers identify statistically significant factors that explain the onset of corrosion with historical data that depict changes over time. Avitas Systems offers an efficient engineering tool that automatically analyzes through historical data to identify impactful factors used to predict corrosion accurately.

Overall, through these solutions, Avitas Systems improves human safety and compliance by reducing and automating high-risk tasks, reducing inspection costs and decreasing asset downtime and time required to complete inspection up to 80% with higher quality data. ■

CEOS (continued from page 1)



Thierry Pilenko

more focused. "It no longer looks like we are chasing every customer in a different way with a different mousetrap in a different geography for a different depth for a different color tree, which means you are essentially working on a hundred things and you are doing them OK," Saunders said.

Instead, the entire life of an asset is examined along with the total cost of ownership for a customer, bringing in technology, he said, referencing a subsea tree that can reconfigured through its lifetime as an example. Added capabilities include boosting and metering as the tree moves through its life. "Those are things we're doing. ... There are a lot of customers that are pushing for vendor-led solutions," Saunders said. "I think we can all probably produce a new class of products that are more cost effective and can be there for the life of field."

Technology is an area that is bringing companies together. When Subsea 7 looks at M&A it considers the technology aspect, CEO Jean Cahuzac said. Technology can be a differentiator and make a project viable. In the last couple of years, Cahuzac said the industry has seen two types of combinations: companies that provide similar services coming together, "providing more synergies and efficiency of scale" and combinations of complementary businesses that can perform better as one. Subsea 7 has pursued both.

In 2018 Subsea 7 completed its acquisition of Siem Offshore Contractors, expanding its renewables presence, and acquired stake in Xodus Group. In 2017 Subsea 7 grew its presence in the Middle East through its acquisition of certain businesses of EMAS Chiyoda Subsea, and it acquired Seaway Heavy Lifting, adding to its renewables, heavy lifting and decommissioning services.

"We are prudent. We invest in new business but only at the right price," Cahuzac said, adding the downturn presented the company with investment opportunities.

When Aker Solutions partners with other companies it looks for leaders in their respective areas, according to Aker Solutions CEO Luis Araujo. "We don't believe that everybody can develop all technologies to attract companies."

Aker Solutions partnerships include one with SBM that seeks "solutions that combine the floater and subsea" and another with ABB and MAN Diesel & Turbo, which delivered the world's first subsea compression system for Statoil's Åsgard Field. The company is also working with Aker BP and Aker Solutions to develop tiebacks.

Forming partnerships with clients is low-hanging fruit, Araujo said. "We have to stop, in this industry, being so confrontational, so price oriented. ... If you look at other industries clients and suppliers align."

Subsea companies have been successful in working

together to bring new technologies and solutions through partnerships and mergers, but they still face challenges.

Thierry Pilenko, executive chairman of TechnipFMC, addressed some of these challenges. His biggest concern in the medium term is not about the company but about customers, he said.

"There has been so much deflation in the market—most of the deflation, in my opinion, coming from discount price concession, bankruptcies, investors being wiped out ... We are not so capable of making the difference between what is coming from pure price concession versus what is sustainable," Pilenko said. "For the medium term, my biggest concern is that many of our clients say the current cost environment is sustainable because many of the changes that happened are structural, and I don't believe so."

Expecting 50% off of umbilicals compared to three years ago will not last forever, Pilenko said. "Inflation is going to come back."

In the meantime, companies continue working to advance technologies through partnerships and mergers. This includes the combination of McDermott International and Chicago Bridge & Iron Co. (CB&I).

Shareholders of both companies approved the merger May 2 to create a vertically integrated company that combines McDermott's offshore/upstream focus with CB&I's technology and infrastructure offerings.

McDermott CEO David Dickson spoke about how the company overcame challenges a few years ago, changed leadership and entered an optimized phase to control cost before looking for ways to better compete. In early 2017 McDermott saw an opportunity in CB&I to develop technology with an aim to become more diversified and generate scale to compete.

"McDermott really is a story about turnaround and transformation focused on diversification rather than consolidation," Dickson said.

Partnerships also continue to take shape in the subsea sector. This includes Schlumberger and Subsea 7's plans to form a joint venture that builds on the success of their Subsea Integrated Alliance. The alliance merged the sub-surface, subsea production system and subsea processing systems skills of Schlumberger's OneSubsea with Subsea 7's subsea umbilical, riser and flowline systems expertise.

Olivier Le Peuch, president of Cameron Group, a Schlumberger company, said the alliance is moving to the next level with life-of-field technology advancements and performance-based delivery.

In addition to lowering costs, making subsea developments more attractive and competitive requires more cooperation with operators, more integration, taking risks and investing in optimization and digital assets, Le Peuch said. "If we do this right not only will subsea survive but will thrive." ■

EQUIPMENT (continued from page 24)

- System can be remotely logged into from shore side for client peace of mind. This assists in keeping any downtime to a minimum and allows for remote data logging;
- Vastly reduced maintenance requirements;
- Intelligent enough to aid in fault finding, again keeping any downtime to a minimum;
- Quick single connections between equipment, allowing reliability and ease of connectivity, and reducing mobilization time;
- Use of an interactive chair for increased operator ergonomics; and
- Ability to hand over aspects of tensioner control, in various protocols, should the client wish. ■

DROPPED OBJECTS (continued from page 16)

following key points of an effective on board dropped object prevention program:

1. Two levels of class notations are defined (DOPP and DOPP+). DOPP class applies best practices with prescriptive requirements for program content.
2. DOPP+ class expands upon the requirements of DOPP by requiring equipment to be designed in accordance with a set criteria, reviewed and approved by ABS.

For equipment that is designed with drops-resistant features for DOPP+ class certification, failure mode and effects analyst type risk assessments apply a hierarchy of risk controls that include the process of eliminating the hazard, engineering barriers and requiring administrative controls.

There are both "hard" and "soft" aspects of achieving optimal conditions for dropped object prevention. The hard part involves the application of inherently safer equipment design practices and the soft part involves personnel roles and responsibilities, together with defined management processes. Dropped object prevention in equipment design complements the dropped object prevention effort. ■

MALIKAI (continued from page 1)

Ravikiran Kota discussed the design and operation of the coupled mooring system for the tender-assisted drilling program at Malikai. Kota explained that among the challenges Shell faced in drilling Malikai were challenging seabed conditions, which included several areas of shallow gas and a “significantly large” biosensitive area in which Shell was not allowed to drill.

Kota said a key element of the success of the drilling program was the implementation of single-casing combo top tensioned risers.

Kyle Hyatt with Heerema Marine Contractors shared details of the efforts to transport and install Malikai, for which Heerema was contracted. Heerema

deployed its new deepwater construction vessel *Aegir*, a single-crane vessel.

Hyatt said Malikai was the first TLP installed with a single-crane vessel. Among the challenges that were overcome in the transport and installation of the Malikai TLP were installation tolerances of the TLP itself, which were based on GoM conditions, Hyatt said.

The project also required the use of divers to complete the TLP installation, he said. Among the lessons learned on the Malikai project were that the TLP size and environmental conditions should be taken into consideration, Hyatt said. In addition, he said a diverless installation of the TLP should be considered early in the design phase. ■

MAINTENANCE (continued from page 12)

and costly repairs. Because data can more accurately show whether or not equipment needs maintenance, they can potentially extend the equipment’s overall life. Performance data also reduce the frequency of unanticipated failures that can lead to after-hours service calls, immediate response times and rush parts orders.

Testing, timing and technology are business processes that support risk mitigation for worker safety, production efficiency and costs. Oil and gas companies that use these approaches can gain an advantage by focusing on continually improving and extending the life of their equipment, and thus their operations. ■

TRANSFORMATION (continued from page 1)

out by being much smarter about how we do business.”

Creating value through innovation must meet three critical factors, he noted. The first is the new technology must unlock market potential—if it “doesn’t fit the need of the market, then that baby won’t fly.”

The second is the new technology must reduce the risk vector. “The overall risk of using the technology must be lower than what it is replacing,” he said. “If it is more risky, then people will shy away from it.”

The third is that it must increase efficiency for the user because “only then will it create market opportunities,” he said, adding that if any one of the factors is not met, then the technology will not succeed.

But what exactly is innovation? “I’d bet that if I talk to five different people about what innovation is that I would get five different answers,” he said to the full room of attendees.

Mody sees it as the process by which an idea or product is translated into a good or service that can be marketed and traded.

“It is tied to customer need,” he said. “It happens by creatively thinking about how to connect seemingly unrelated ideas and combine them in a new way to produce something novel or original. It is built on knowledge.”

And the beauty of knowledge, he noted, is that it is everywhere, it is “like the sun, one just needs to soak it in so that when it is needed, you have it.”

He also said talent should be brought in from other industries that have been on a digitalization journey into our industry. “The digitalization journey this industry is embarking on is a must,” he said.

There’s a big digital gap in the energy industry. “We are so data rich in our industry that we don’t know how to use it all,” Mody said. “It was because of the fall in oil prices that we were forced to figure out how to use data.”

The digital journey cuts across all internal and external boundaries, delivering cultural and organizational transformations, he noted.

Digital transformation is data transformation and use of both can deliver radical transformation for a company. In addition to connecting mindsets—both commercial and economic—it helps develop trust between customers and the service sectors, he added.

Digitalization improves the sharing of the key building block of innovation—knowledge.

“And as our company’s founder—Thomas Edison—once said, ‘Innovation without execution is hallucination,’” Mody concluded. ■

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