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Subsea Tiebacks
(Tying) Back to the Future

Technology
Mooring Solutions

VOL. 45 / NO. 3

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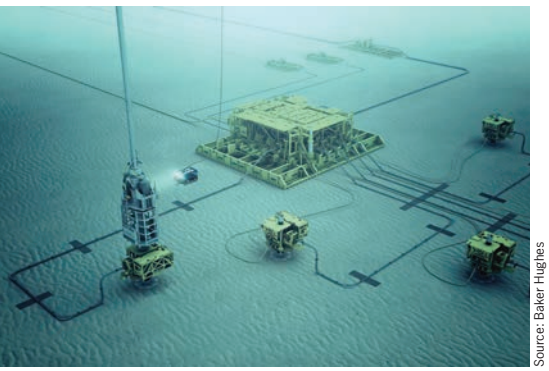
FEATURES

Source: Bourbon

ON THE COVER: **Image Source: Ørsted**

FEATURES



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BY THE NUMBERS

RIGS

Worldwide

Rig Type	Available	Contracted	Total	Utilization
Drillship	20	60	80	75%
Jackup	125	320	445	72%
Semisub	24	67	91	74%

Africa

Rig Type	Available	Contracted	Total	Utilization
Drillship	4	9	13	69%
Jackup	13	23	36	64%
Semisub	0	0	0	0%

Asia

Rig Type	Available	Contracted	Total	Utilization
Drillship	4	7	11	64%
Jackup	47	99	146	68%
Semisub	6	19	25	76%

Europe

Rig Type	Available	Contracted	Total	Utilization
Drillship	4	4	8	50%
Jackup	17	31	48	65%
Semisub	11	24	35	69%

Latin America & the Caribbean

Rig Type	Available	Contracted	Total	Utilization
Drillship	2	18	20	90%
Jackup	3	3	6	50%
Semisub	3	8	11	73%

Middle East

Rig Type	Available	Contracted	Total	Utilization
Jackup	23	118	141	84%
Drillship	2	0	2	0%

North America

Rig Type	Available	Contracted	Total	Utilization
Drillship	3	21	24	88%
Jackup	19	38	57	67%
Semisub	4	6	10	60%

Oceania

Rig Type	Available	Contracted	Total	Utilization
Drillship		1	1	100%
Jackup		2	2	100%
Semisub		6	6	100%

Russia & Caspian

Rig Type	Available	Contracted	Total	Utilization
Jackup	3	6	9	67%
Semisub		4	4	100%

This data focuses on the marketed rig fleet and excludes assets that are under construction, retired, destroyed, deemed noncompetitive or cold stacked.

Data as of June 2020.
Source: Wood Mackenzie Offshore Rig Tracker

DISCOVERIES & RESERVES

Offshore New Discoveries

Water Depth	2015	2016	2017	2018	2019	2020
Deepwater	25	12	16	16	18	5
Shallow water	85	65	73	49	78	10
Ultra-deepwater	19	16	12	17	17	2
Grand Total	**129**	**93**	**101**	**82**	**113**	**17**

Shallow water (1-399m)
Deepwater (400-1,499m)
Ultra-deepwater (1,500m+)

Offshore Undeveloped Recoverable Reserves

Water Depth	Number of fields	Recoverable reserves liquids mbl	Recoverable reserves gas mboe
Deepwater	549	40,953	20,367
Shallow water	3,219	421,182	144,812
Ultra-deepwater	326	39,477	26,161
Grand Total	**4,094**	**501,611**	**191,340**

Contingent, good technical, probable development.

The total proven and probably (2P) reserves which are deemed recoverable from the reservoir.

Offshore Onstream & Under Development Remaining Reserves

	Water Depth of fields	Number reserves liquids mbl	Recoverable reserves gas mboe
Africa	592	20,240	13,107
Asia	842	17,232	7,455
Europe	789	12,990	14,689
Latin America & the Caribbean	197	6,867	37,389
Middle East	119	91,040	148,210
North America	569	3,202	14,671
Oceania	89	12,042	1,506
Russia and the Caspian	57	8,711	13,819
Grand Total	**3,254**	**172,324**	**250,846**

Onstream and under development.

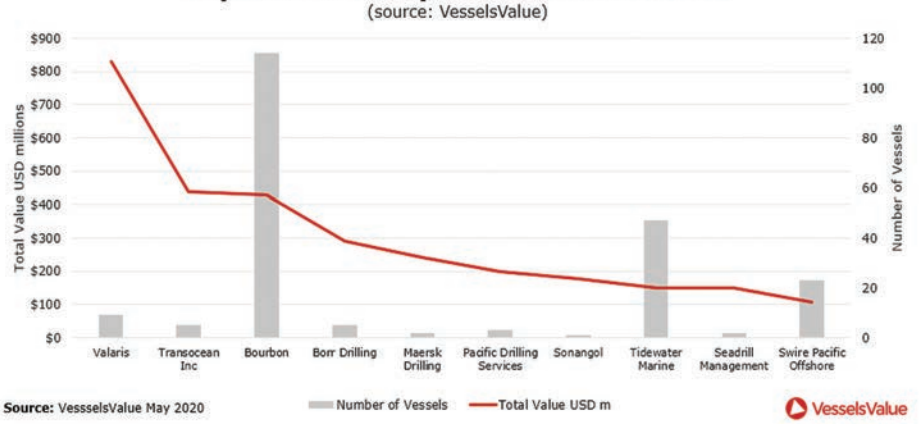
The portion of commercially recoverable 2P reserves yet to be recovered from the reservoir.

Source: Wood Mackenzie Lens Direct

REGION IN FOCUS
WEST AFRICA

Data & Statistics powered by VesselsValue

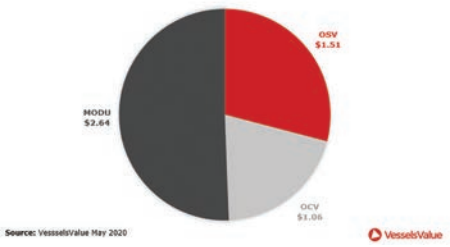
Top Owner Companies in West Africa
(source: VesselsValue)



Source: VesselsValue May 2020

VesselsValue

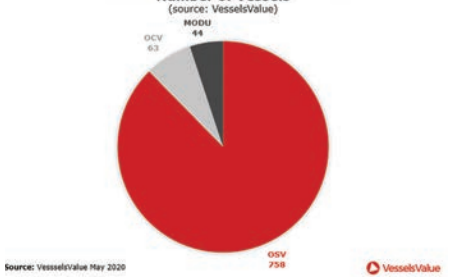
West African Offshore Fleet
Value (USD billions)
(source: VesselsValue)



Source: VesselsValue May 2020

VesselsValue

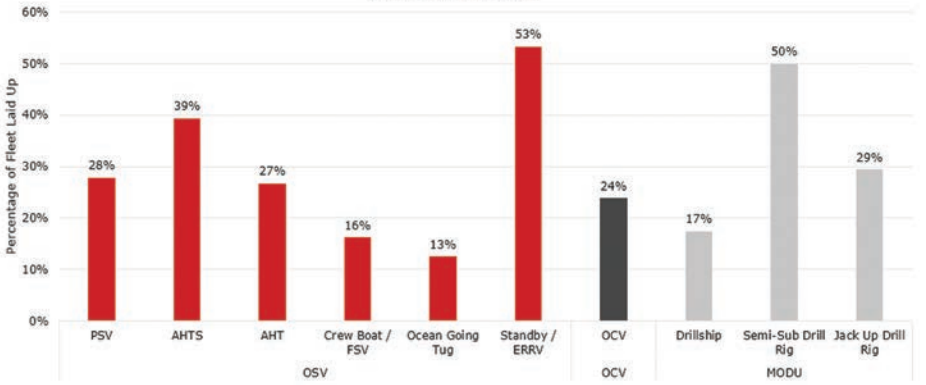
West African Offshore Fleet
Number of Vessels
(source: VesselsValue)



Source: VesselsValue May 2020

VesselsValue

West Africa Operating Offshore Fleet Utilisations
(source: VesselsValue)



Source: VesselsValue May 2020

VesselsValue

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Pourciau


Robbins


Strømberg


Toews


Tomic

PLOTTING YOUR COURSE

As we enter our third month of working remotely from our headquarters in New York City, I keep waiting anxiously for the return to the 'new norm' when it hit me the other day ... this is the new norm! I've always been an early riser, but now when I wake at 5:00 a.m. and fire up the coffee, I'm staring ahead at a 30-second commute to my home office rather than a 1.5-hour slog via car-to-train-to-subway into Manhattan. While I miraculously have reclaimed nearly 20 percent of my waking hours, I can't say with any degree of certainty that I'm accomplishing that much more, premised mostly by the fact that it seems to be taking twice the time and effort to achieve half of the results as we – like you – systematically dig for new and emerging opportunities.

One of those emerging opportunities lies in the growth and potential that is Offshore Wind Energy. I know that 'Wind' is the literal four-letter-word to the traditional oil and gas sector, but we see that stance loosening, driven by public sentiment and policy and empowered by economic need as traditional offshore energy plays face a protracted period of depressed oil and gas prices.

Don't get me wrong: oil and gas will remain the dominant source of world energy long after I've left this seat and I'm spending my days fishing on Great South Bay. But the rapidity with which offshore renewable energy is picking up speed is notable, and the need for proven solutions in working effectively, efficiently and safely in one of the most hostile environments on the planet presents a premium opportunity for traditional offshore O&G players to leverage their experience in this sector.

This month **Eric Haun** reports on a new study from World Energy Reports' (WER), the *Outlook for Offshore Wind Power: The Frontier of Future Energy* released on June 17, 2020. Haun's report starts on page 32, and while I don't want to steal his thunder, the numbers are impressive:

- WER expects 16 GW of additional offshore capacity to be added in 2020 and 2021, driven by mature markets in Northern Europe and fast-emerging markets in China;
- WER identifies some 500 GW of projects and development zones currently in the planning and development stages, mainly coming from Europe, Asia and the U.S.
- WER identifies floating offshore wind turbines as the future, as floating solutions will enable wind farm construction in deeper waters that hold some 80% of the world's wind capacity potential. A pipeline of more than 50 GW of floating capacity requiring $93 billion to $148 billion of capex investment has been identified.
- Everyone likes a big number, and WER delivers, projecting offshore wind projects will require between **$1 trillion and $1.5 trillion of capex** over the next two decades.

Regardless of exact size, shape and direction of all energy markets, it remains a fertile place for innovation, and in that regard our mission at Offshore Engineer remains the same: the delivery of timely, topical, insightful and analytical information here and 24/7/365 on **OEDigital.com**.

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WALK TO WORK TECHNOLOGIES

By Dr. Wei Huang

Traditional safety technology designed to help personnel transfer between vessels and offshore facilities is finding new applications as demand for more renewable forms of energy and aquaculture products gathers pace.

Euphemistically known as 'walk-to-work' technology, the equipment and systems were originally designed to help workers and service technicians safely transfer onto and off of offshore assets, which were increasingly moving into deeper water and harsher environments.

With demand for lower-carbon forms of energy increasing demand for renewable power, the booming offshore windfarm market presents a new opportunity for a safe, flexible, and proven system for transferring service personnel.

Although the offshore wind sector is still comparatively small – it provided about 0.3% of global power generation in 2018 – development is booming.

A recent study by the International Energy Agency (IEA) predicted that the 150 new offshore wind projects currently being developed globally would see the sector's power generation grow 15-fold in the next 20 years, becoming a $1-trillion industry.

Construction and operation of these projects will require the delivery of specialist experts on a variety of support vessels, including jack-up construction units, survey vessels, service operation vessels, cable-laying ships and crew transporters.

Once in operation, regular maintenance work will require even more industry personnel to be safely transferred between a variety of marine assets, and potentially in inclement weather conditions.

Modified versions of today's walk-to-work technology are also being applied in the territorial waters of countries such as Norway, Scotland, Chile, and China, where expanding offshore fish farms are creating a new market for mobile gangways. To serve these assets and systems, worker access may be required in multiple locations, and in challenging marine conditions. Walk-to-work technology – which generally takes the form of a telescoping gangway system – started on offshore production platforms. It was created to improve the safety performance and cost-effectiveness of transferring personnel by basket, ladder or helicopter, methods that may be unsuitable when space is limited, or when the weather becomes more severe.

The modern gangway system, which often utilizes a motion-compensation arrangement to fix its position relative to the wind turbine, allows it to operate safely in almost any weather conditions within the operational profile.

These relatively complex systems require specific safety measures, which need to be accounted for when applying for class approval. A Register for Offshore Access Gangways needs to be maintained on-board the transfer vessel, where the technical data for its design, maintenance history and certification documents need to be kept to support these activities.

Items that need to be reviewed can include: the landing mechanism; the landing device and its supporting structures; the emergency release; lashings and shock-absorption systems, any protection for the landing area; and any motion-sensing apparatuses.

Reviews are also required for emergency systems such as those that support: the recovery of the gangway system, if it loses power; redundancy of hydraulic systems and rotating machinery; and the provision of alarms, monitoring and fire protection.

Compliance appraisals of the motion-compensation system cover both passive and active motion units. For an active-motion compensation system, safety requirements focus on the adequacy of redundancy design, motion sensing and monitoring, and assessments of structural strength.

A risk assessment of the gangway operation needs to be submitted for approval. This process can include the use of Failure

Mode Effects and Criticality Analyses to assess the complexity of the gangway systems (especially those that compensate for active motion) in each phase of operation. This is to verify that enough consideration has been given to the potential failure of critical components and that sufficient redundancy is available when those components are found not to be failsafe.

ABS has carried out several recent approvals for gangway installations from the three main original equipment manufacturers. The systems were assessed in accordance with the ABS Guide for Building and Classing Offshore Access Gangway.

As more types of marine assets move into deeper water, and greater distances from shore, personnel transfer systems are evolving to suit changing safety requirements. Today's advanced offshore access systems no longer need to be permanently attached to an offshore platform. When the conditions at sea change rapidly, the system can be shut down and stowed, and the vessel can move off station, away from potential problems.

As more companies discover the benefits of using walk-to-work technology, classification societies have the responsibility to create and adapt guidance to help the offshore industry maintain safe operations.

Ampelmann's E1000 a system for lifting heavy loads offshore safely and efficiently. Source: Ampelmann

DUTCH TECH DRIVES SAFE OFFSHORE CARGO & CREW TRANSFERS

By Greg Trauthwein

Founded in 2007, Ampelmann is a relatively young but fast-growing company that was built on providing "motion compensated offshore access systems and services" to the offshore energy industry, both traditional oil and gas, as well as offshore wind. While the 'Walk to Work' (W2W) concept might sound simple in premise, delivery in the offshore environment, one of the most hostile and fast-changing on the planet, is anything but simple.

Working offshore is a challenge, and transferring people and cargo to and from offshore structures has been the guiding principle of Ampelmann since its beginning.

The E1000 a system for lifting heavy loads offshore safely and efficiently was launched about three years ago.

At the outset, the system was used exclusively in the offshore wind sector, providing an extra bit of stability in an area where, traditionally, the workers are less acclimated to the rigors in working the offshore environment.

While the E1000 had been used exclusively in offshore wind, in late 2019, the company identified an opportunity to use it in the oil and gas sector, too.

The E1000 performed its first cargo lifts in the O&G industry for Apache North Sea. It provided not only the W2W solution but also the capacity to lift the necessary tools and equipment to the helideck.

As a result, it supported critical maintenance work on a Single Point Mooring (SPM) platform, as well as the refurbishment of a helideck. Throughout the 30-day campaign, the system enabled more than 1,925 safe personnel transfers and 354 lifts, transferring 118 tons of cargo. The system was installed on a 12.1m pedestal and operated at a height of nearly 40 meters above sea level.

"There are about 10 (E1000) systems operating in the field today," said Diederick Nierstrasz, Ampelmann's Manager Business Unit Offshore Wind.

Ampelmann has worked on a rental and sales business model, the former more so at the beginning when its name and technology were less well-known. The decision to rent or buy is dependent largely on the scope and duration of the project.

CONTINUOUS INVESTMENT IN R&D

The E1000 system measures 30 meters long and is capable of transferring people and up to 1,000 kg of cargo in wave heights up to 4.5m. Though developed and introduced three years ago, Ampelmann continues to invest in refining and optimizing the system.

For example, the E1000 was designed to transform from a gangway for personnel transfers into a crane boom for cargo transportation, and in the past, this transformation was manual.

Pins used to be manually deployed to change from people to cargo transfer mode, and the entire conversion process took at least ten minutes to complete.

As the E1000 gained traction in the market, and efficiency became increasingly sought-after, there was the need to reduce operational time and risk, and improve flexibility. Ampelmann responded by developing a mechanism that made the switch from people to cargo transfer mode easier and faster, as the E1000 now uses remote-controlled hydraulic pin pushers to fixate the gangway booms in less than one minute with the push of a single button.

To switch from cargo to personnel transfer mode, the crane hoisting cable is placed in a freewheel mode to allow the booms to telescope, significantly increasing the available working time.

AMPELMANN IS NOW WORKING ON AN OPERATOR ASSIST (NOT OPERATOR REPLACEMENT) SYSTEM DESIGNED TO HELP THE OPERATOR MAKE A CONNECTION TO AN OFFSHORE STRUCTURE. **"IT'S MORE LIKE SOME OF THE AUTOMATION SYSTEMS YOU'RE SEEING IN CARS TODAY;** *THERE IS A FEATURE TO ASSIST THE DRIVER, AND FOR EXAMPLE, HELP PARK THE CAR, BUT YOU ARE NOT REMOVING THE DRIVER FROM THE SYSTEM ALTOGETHER."*

DIEDERICK NIERSTRASZ
MANAGER BUSINESS UNIT OFFSHORE WIND, AMPELMANN

Source: Ampelmann

"A few years ago, we recognized the opportunity to enhance the current system to reduce the time and physical effort taken to change the gangway work mode from personnel to cargo," said Nierstrasz. "It now takes less than one minute."

Ampelmann is now working on an operator assist system that Nierstrasz said is designed to help the operator make a connection to an offshore structure. Stressing that the innovation is not designed to remove the operator from the operation, he compared it to some of the innovations being seen in the automotive sector. "It's more like some of the automation systems you're seeing in cars today; there is a feature to assist the driver, and for example, help park the car, but you are not removing the driver from the system altogether."

MEET THE E5000

As offshore wind turbines continue to get larger, so do the demands and scale of the systems designed to serve them. Quite simply, there is a growing need to conduct more, heavier lifts offshore, coupled with a demand to work in increasingly harsh conditions to maximize 'up time.'

With a close eye on the market and input from key clients, Ampelmann is currently manufacturing the first E5000 system, with the aim of completing it in July 2020, followed by testing in August and available for projects in September.

With the ability to lift up to five tons, the system will help increase the work scope clients can deliver and improve the efficiency of W2W operations.

"The moment you launch a successful system and the clients benefit from the added value and see the full potential, there is an appetite for more," said Nierstrasz. "We like to think along with our customers and design the best possible solutions to match their needs."

AUTOMATED MAINTENANCE REVIEW TO BOOST PROJECT EFFICIENCY AND SAFETY

By Chris Bell and Matthew Celnik, DNV GL - Oil & Gas

Rapid increases in the development and deployment of machine learning (ML) technologies in E&P is offering offshore operators the chance to automate high-cost, error-prone tasks which can adversely impact safety or production.

For instance, as part of the asset and verification maintenance review process, it is standard practice to review text records for insights - with a focus trending defects and identifying improvements. The goal is to ensure the asset is performing safely and effectively, with high reliability, while adopting the most cost-effective strategies for all maintenance work.

To better analyze a large number of records in full, one solution is to use an ML classification algorithm with natural language processing. Asset owners can then analyze the trends across the entire set of maintenance records for each safety and environmental critical element (SECE) on the asset (Figure 1).

SWIFT, SMART AND THOROUGH

By quickly analyzing hundreds of maintenance records in just a few seconds, the algorithms can deliver an effective means of determining relevant audit findings and irregularities. This increases project efficiency for the team and allows more accurate findings and recommendations to be made as part of the audit.

As opposed to a random sample method currently used by most companies, ML can detect anomalies in the way maintenance has been recorded i.e. fail records marked as pass, allowing the reviewer to focus purely on those which have inconsistencies. Equally, such techniques can be applied on datasets for which analysis is repetitive, labor-intensive, or prone to human error.

POSITIVES AND PITFALLS OF ML

As an example, DNV GL considered a single fire and gas

Figure 1: Web tool developed by DNV GL to review free-text maintenance records using ML

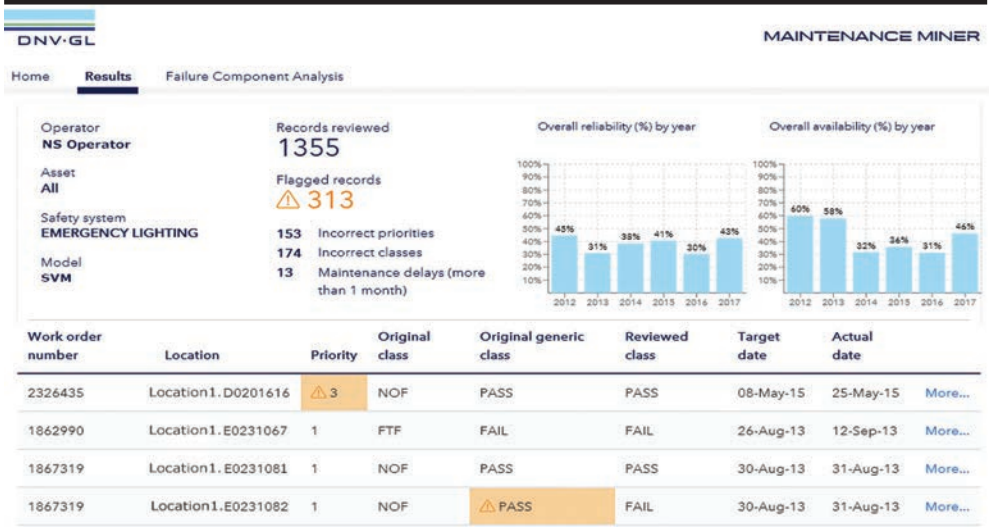
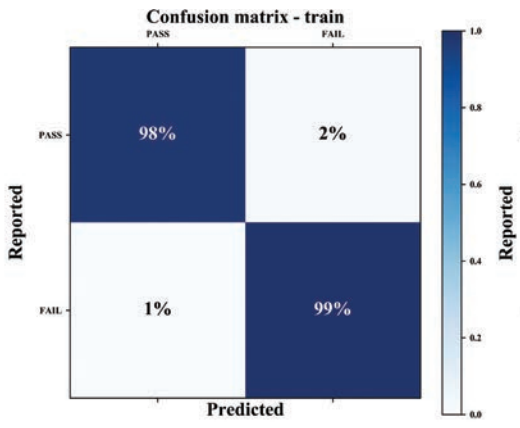


Figure 2: Confusion matrix showing ML accuracy ag



detector inspection dataset, containing more than 2,000 records, from an offshore operator. Generally, such records contain information regarding failures or miscalibration. The study used a linear support vector machine (SVM) algorithm and natural language text processing to classify inspection records based on the free-text field.

Before using an ML model, the dataset was processed and cleaned. This transformed the raw maintenance text data into the limited feature set. While it is the most time-consuming part of the program, the importance of maintaining a high-quality dataset cannot be overstated.

The ML model was then trained to make predictions. This step used a subset of the data as a testing basis, while the ML model used the training subset to determine its internal parameters to make predictions.

To verify if initial assumptions were correct, an offshore verifier performed a manual verification of the entire dataset. Overall, this gives confidence in the predictions based on the unverified dataset.

Nevertheless, the company re-trained the model using the verified classes. DNV GL intends to further refine this approach as it is rolled out across its offshore verification services and activities.

By gathering data from a variety of assets in the North Sea, the ML algorithm will develop to be more robust and reliable (Figure 2).

Several other classification models were also trained to compare results; however, it is difficult to draw a direct comparison between each of these classifiers as each one is subjective to its own set of hyperparameters.

As part of the research, the company identified several pitfalls, particularly in the way operators currently record their data. For instance:

- *Numerical test results should be stored as separate fields in the management system. This will greatly simplify subsequent machine analysis and trending*
- *Operators should consider revising how they report tests in their management systems as some types of text, such as guidance notes (boilerplate text), can detrimentally impact the predictive power of ML models*
- *Existing records should be reworked with additional fields, to facilitate future verification and trending activities*
- *Training is essential to demonstrate and facilitate the potential use of maintenance logs for trending. For example, staff leaving good comments and descriptions will make text classification easier.*

CONCLUSION

The DNV GL study demonstrated that a trained SVM algorithm can rapidly identify records with potential anomalies, although the predictive power is dependent on the pre-processing cleaning steps. Additional prediction improvements can be gained by limiting the feature set to a known vocabulary of important words and phrases, informed by expert knowledge. This method works well, even for highly skewed datasets with few recorded fails (Figure 3).

ML ultimately gives maintenance and reliability teams a more focused approach to check records by specifically targeting the anomalous maintenance records.

Crucially, by reducing the amount of time spent reviewing non-erroneous maintenance records, this method increases project efficiency and allows more useful findings and recommendations to be made. Importantly, this also enables operators to reconstruct data missing from their management systems, as well as identify potential systemic misreporting issues.

gainst manually verified training and testing data

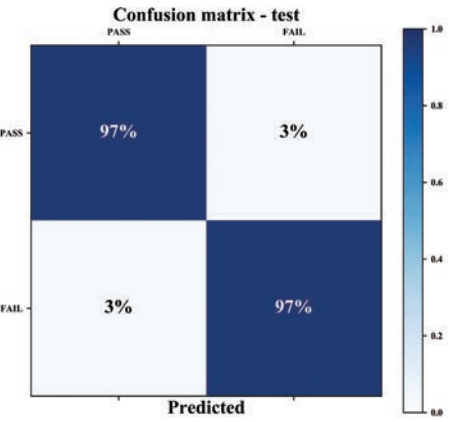
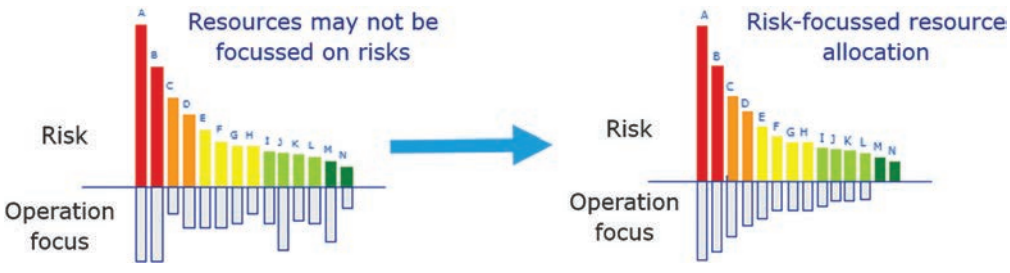
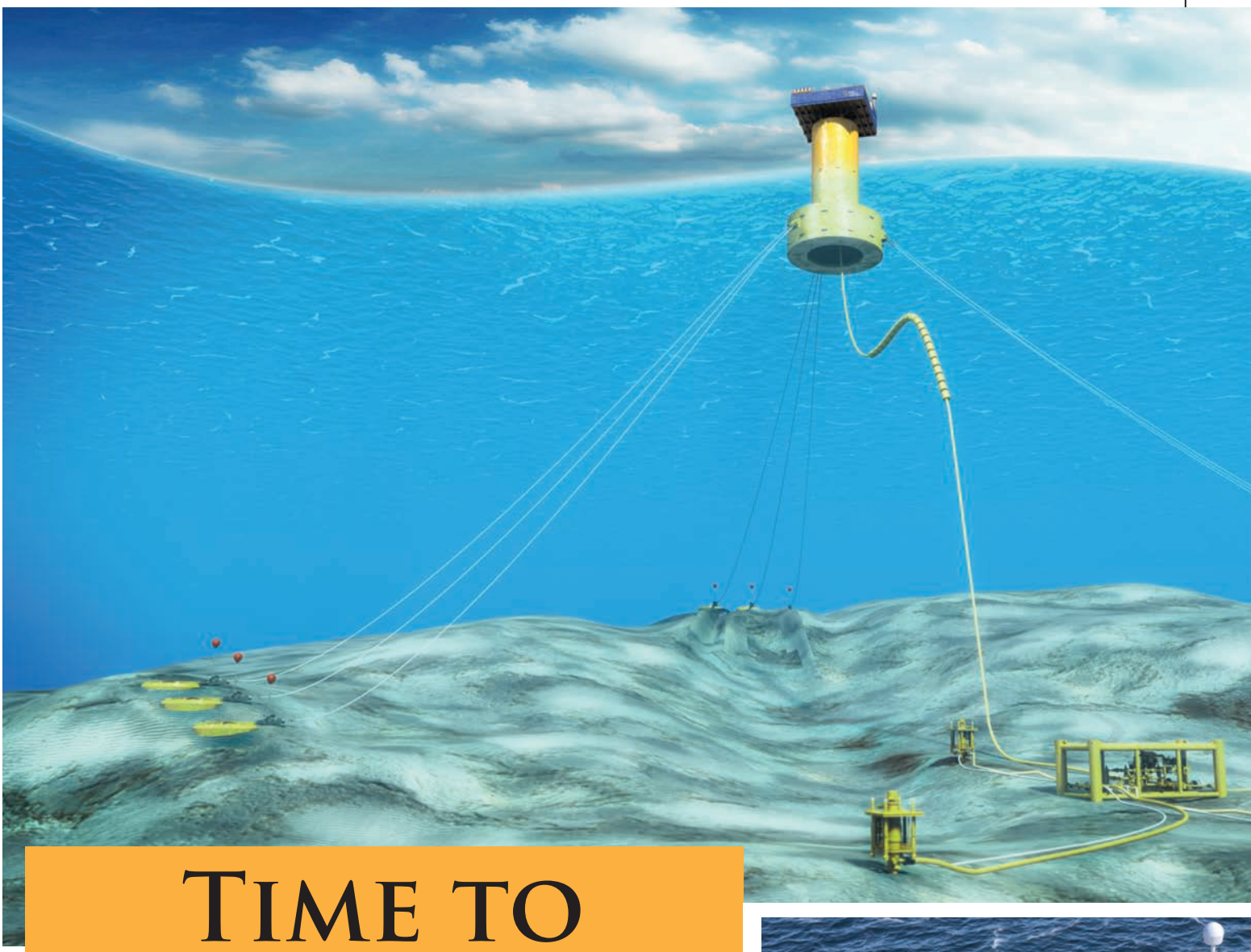


Figure 3: More time/focus on records of concern allows engineers to target the highest-risk threats

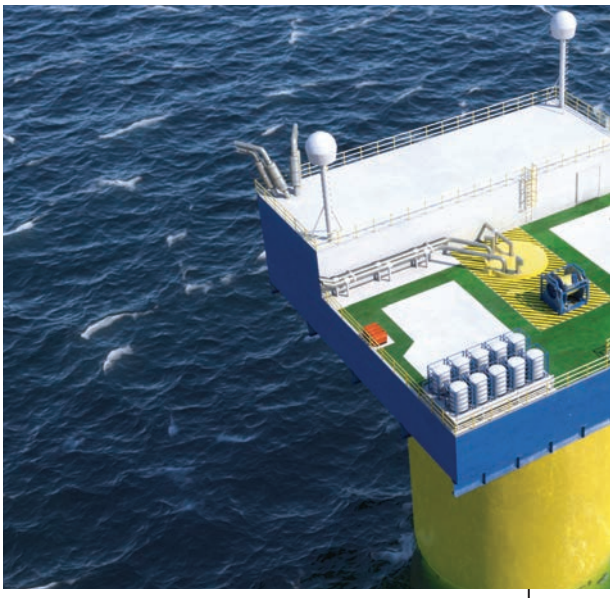


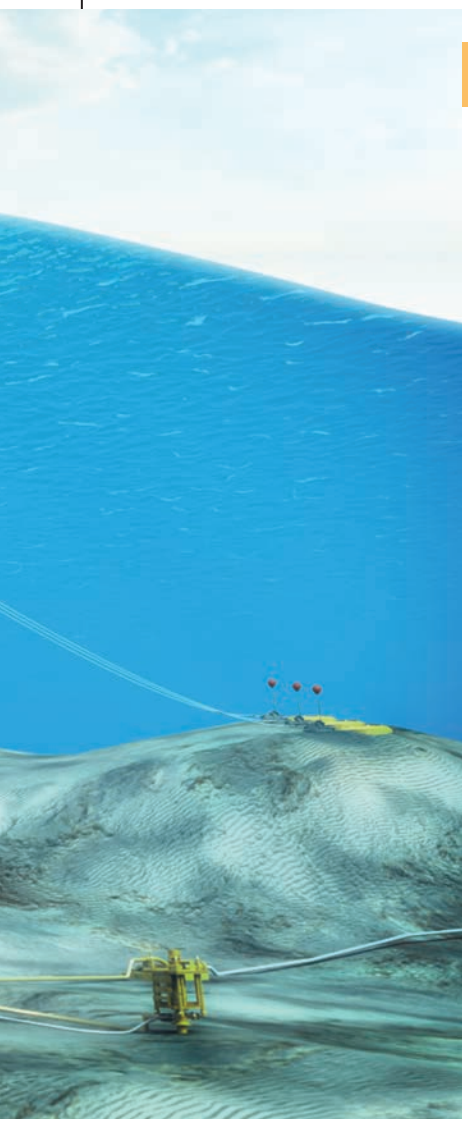


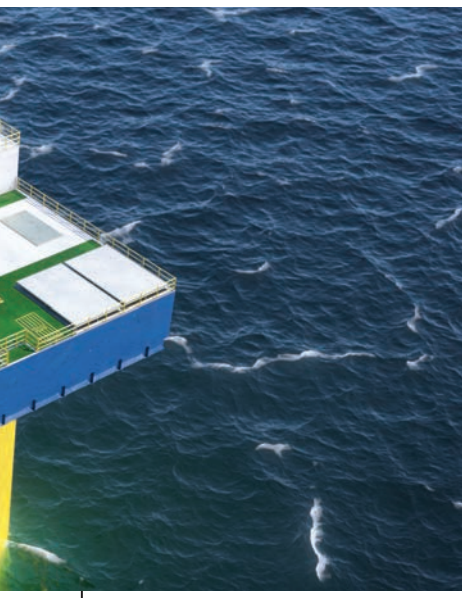
All images source: BPT/Crondall

Time to target production buoys?

BY ELAINE MASLIN







Both images: BPT's power and control buoy design, configured to support long-range and challenging tiebacks by providing utilities at the wellsite and removing the need for an umbilical from the host facility.

Buoyant Production Technologies (BPT), a subsidiary of Crondall Energy Consultants, is promoting a floating NUI for low life-cycle cost developments of marginal fields, which are unsuitable as subsea tiebacks due to distance, power and host facilities requirements, or to enable the development of long-range or challenging tiebacks, e.g. providing the utilities at the wellsite. David Steed, general manager at BPT, told Subsea Expo in Aberdeen that the firm's single column floating facility design, suitable for harsh environments, could support a 20,000 b/d subsea tieback with power – which could be for subsea pumps, or electric downhole pumps, etc. - or provide full production support to a 30,000 b/d field. The concept, which has Lloyds Register Approval in Principal, would have remote operations and monitoring and periodic maintenance via walk-to-work. The firm has worked on a non-field specific pre-FEED study under the OGTC's Facility of the Future programme to demonstrate what is feasible. It looked at a 20,000 bo/d oil development with 25,000 b/d of produced water and 400 scf/bbl in 150m water depth. Steed says opex for this, using their NUI, would be $7/bbl, at $9/bl capex, based on a six month visit frequency and recovering 25 million barrels over 10 years.

"The challenge for us is that operators think in a certain way," says Steed. "There are subsea people or floating people. It's difficult to get them to think about the whole infrastructure and think outside the box." Dealing with produced gas is the biggest challenge, but there are options, like gas to wire and integration with offshore wind, he says, which also aids emissions reduction. The hull design could also be used for floating sub stations for offshore wind, he adds.

SBT Energy

SBT Energy, which used to be known as Offshore Production Buoy (OE: August 2017), also has a production buoy design which it recently put through wave tank testing at the University of Edinburgh's FloWave Ocean Energy Research Facility. SBT also has a storage tank concept, that could be deployed with the buoy, so that applications from power and communications through to production and storage systems could be supplied.

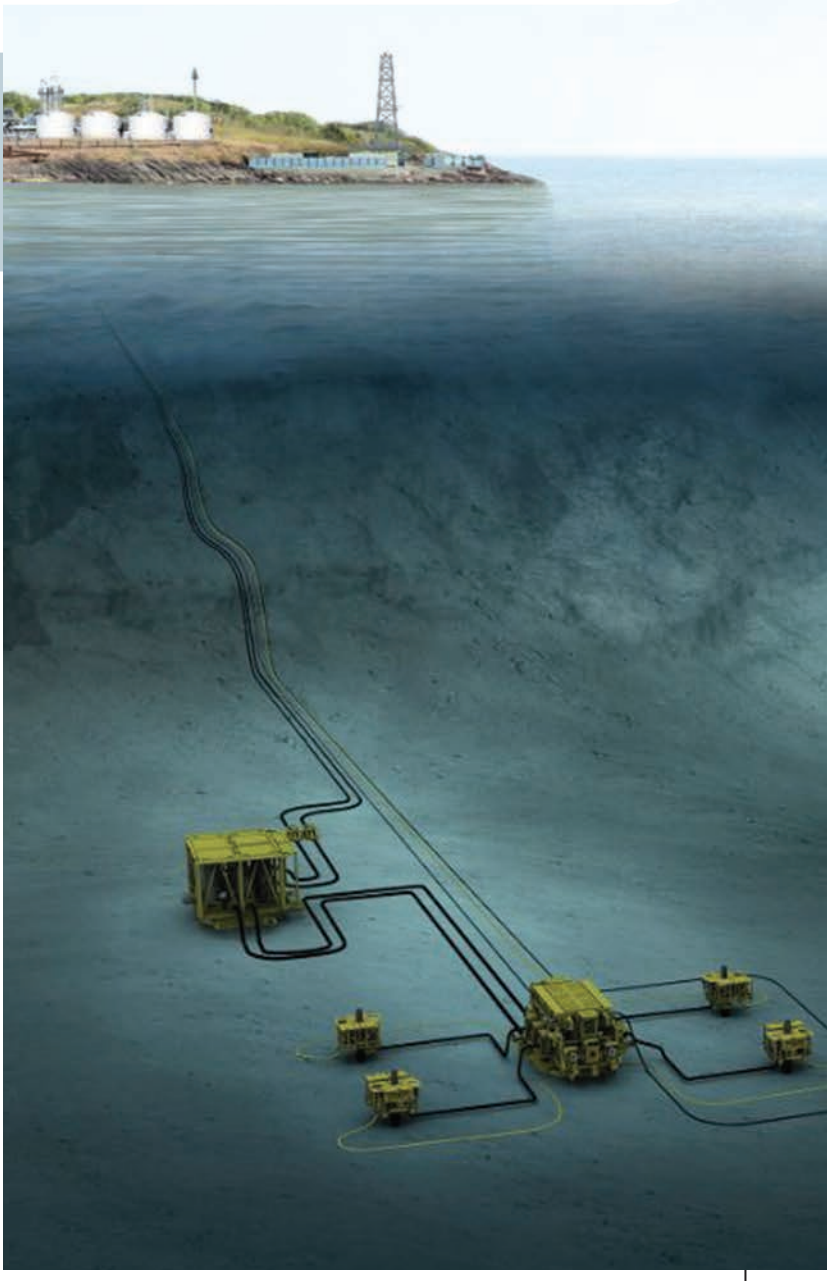
Malcolm Bowie, consultant, at SBT Energy, says an example use of SBT's catenary moored system could be on a two-well 10-15,000 barrel a day field, which would require a 24m-diameter, 60m-tall part submerged buoy, comprising 2000-tonne of structural steel. For a two-year field life tieback, that would be and economic way to remove the pain of platform modification and engineering, says Bowie. For just a control buoy, the system would be about half the size. It could also be deployed with wind energy or battery back-up he says, depending on system and functionality requirements.

A key design challenge SBT has focused on is motion, says Bowie, using distributed ballast weight at the bottom of the buoy, to reduce the natural period of the buoy; so pitch and roll is as small as possible by adding mass, not weight. The wave tank testing, done last year, saw 7-degree pitch, in the most extreme conditions and Bowie says they think they can get less than that. "A [normal] FPSO rolls up to 20-25 degrees in even operational sea states," he says. "We're now engaging with operators and doing a study for operator for a field life extension solution. It can plug into existing infrastructure and continue production when existing facilities are no longer economic to run or be used as an early production system to better understand a reservoir. "The sweet spot is as a control buoy for oil and gas tiebacks, where operators would otherwise need modification to platform which could be painful. It could also extend to water injection."

Another idea the firm is working is subsea gas storage, to smooth out demand supply cycles when gas is used as part of the system. It could also be converted to electricity and exported, i.e. gas-to-wire, says Bowie, or, if deployed with a wind turbine, used to create hydrogen.

TYING BACK TO THE FUTURE

By Svein Strømberg,
Executive Director for Subsea Tie-backs at Baker Hughes



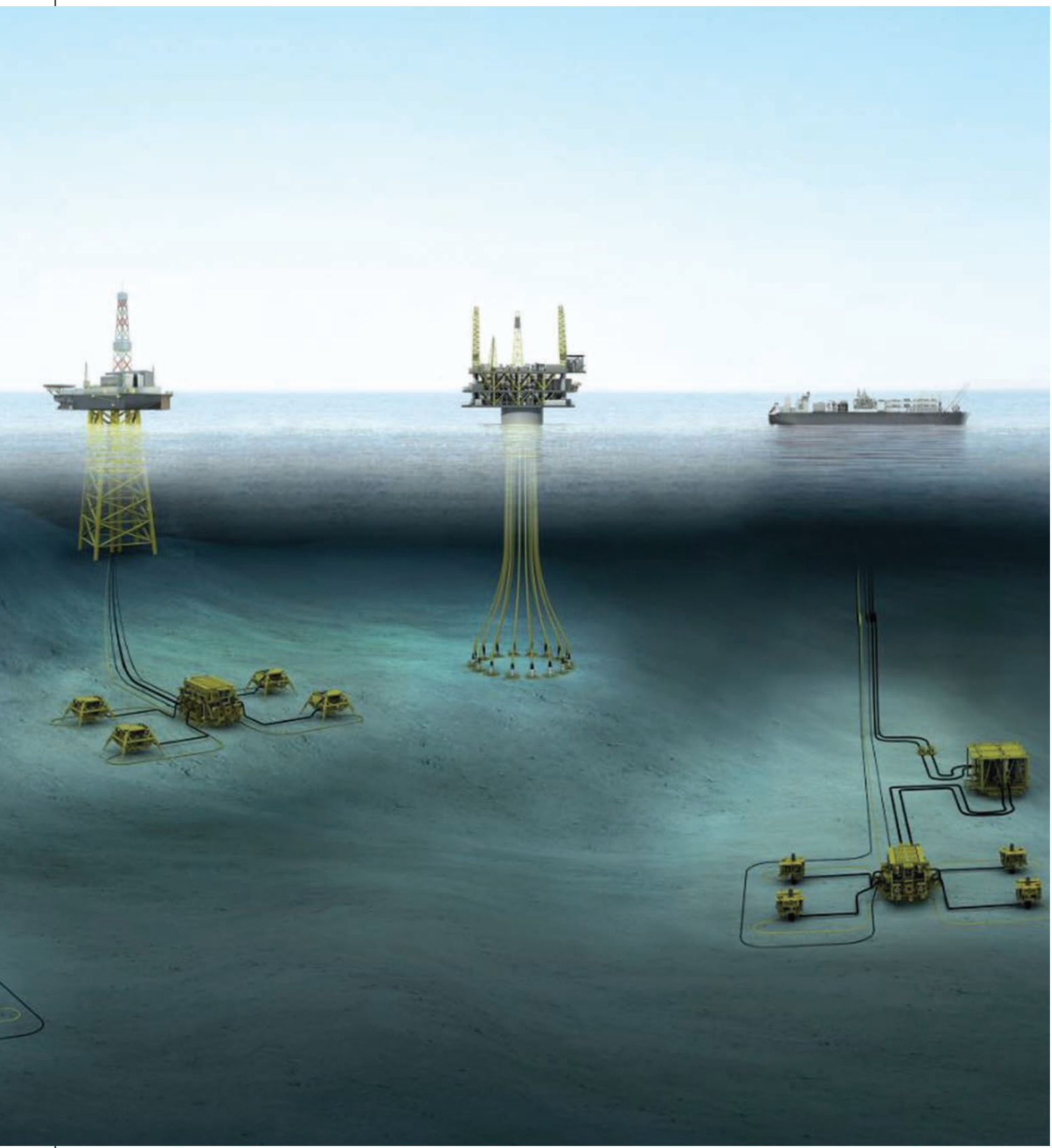
Lower costs, improved productivity and increased yield. These have always been the goals of the global energy industry. However, after the exceptionally difficult business conditions of the past five years and current market volatility, this mantra has become more meaningful than ever. It is now the driver of significant advances in technology, design methodologies and integrated implementation processes.

The past few years have re-shaped the energy industry and locked in a new way of doing things. For example, the industry has made solid progress when it comes to reducing the average costs of subsea projects. Indeed, offshore tie-backs to existing hosts can now be considered competitive with certain onshore basins, such as some shale production.

Investment emphasis has also moved away from high-profile standalone developments, which have the potential for big rewards but come with a higher risk of cost overruns and delayed returns. Instead, the focus is now on more tactical exploitation of existing discoveries, converting contingent resources to reserves. Priorities are now shorter cycle: adding cost-effective capacity to existing pumping processes, for example, or maximizing extraction at lower lifting cost.

The significance of small differences

In these circumstances, increasing margins is not just a question of increasing capacity. Instead, it's about creating a significant impact from small differences across the entire



Source: Baker Hughes

value chain and developing the capability of identifying where those small changes can be most effectively made.

At Baker Hughes, we believe there are significant volumes of contingent resources that can be made economic by adopting a new approach to product development and supply (Rystad data indicates this volume could be as much as 16 billion barrels oil equivalent). Our research suggests that the economic development point of subsea projects can be reduced by an average of 30%.

Nonetheless, these small changes do require a big shift in mindset. It requires meaningful partnerships between suppliers and operators at a much earlier stage in the design and development process. Digital tools, planning and risk management are central to that process. To reach the economic target, it is imperative to design flexibility and modularity into subsea technology.

The potential of tie-back capabilities

Developments in tie-back technology are just one illustration of the value that can be created. The industry has come a long way since tie-back connections of 2-3 km were considered extraordinary and has continued to push the boundaries of technical capability to tie back fields. From fiber optic cabling to vessel size, all have expanded aggressively – as have the number of potential reservoirs that could be exploited in a financially viable way.

Today, we are looking at tie-back distances of more than 100 km. Fields in the Gulf of Mexico that have been producing since the 1970s and have reached what was considered to be end-of-life, can now realistically increase their capacity by using tie-back technology to keep pipelines running.

By having advanced technology in terms of tie-back capabilities, another shift is underway as firms like Baker Hughes endeavour to extract redundant costs through improved design.

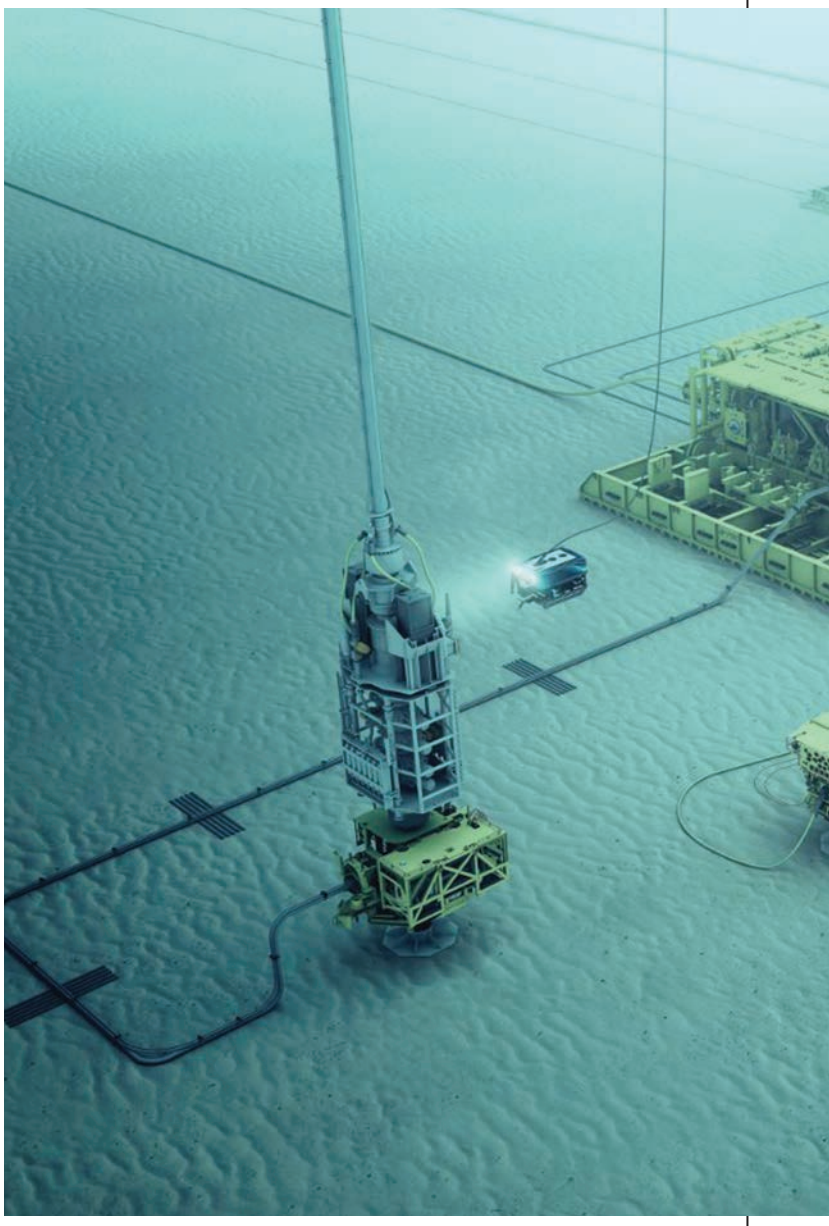
As with the components of our Aptara TOTEX-lite subsea system, we have been re-thinking our tie-back technologies to make them modular, structured, compact and more responsive to changing conditions across the life of field.

That means looking at materials in a new way, for example, by bringing in composite materials from the aerospace industry to create pipes that are vastly lighter than traditional products. That can achieve significant cost savings: there may be an initial front-loaded expenditure, but eventually, fewer materials means fewer costs and less impact on the environment.

Although making things less expensive and lighter weight is essential, re-thinking design goes beyond that. The fundamental design can present further opportunities to eliminate costs that have traditionally been overlooked. In this case, we have re-designed the flow path of our pipes, which means they require fewer valves and smaller valve blocks. Fewer components means lower costs, and less risk.

Manufacturing and digital

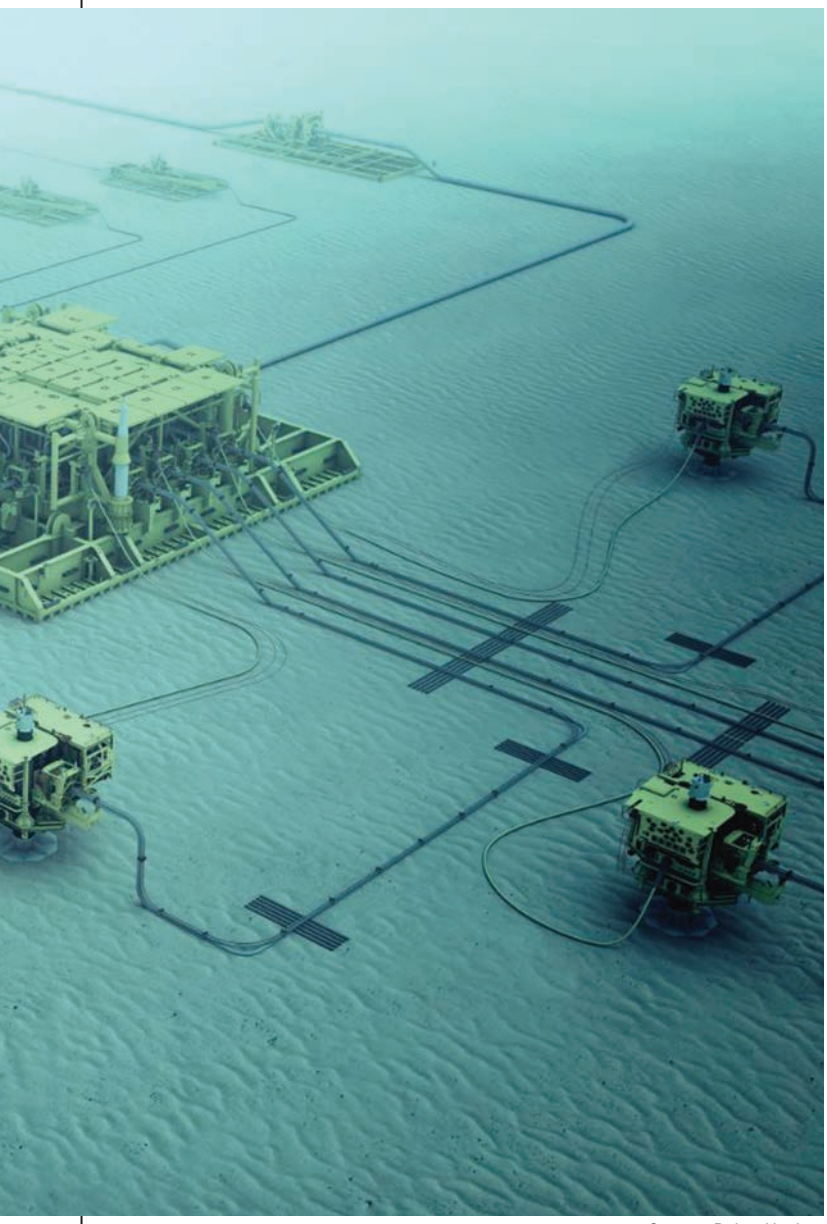
With new designs and material specifications in place, manufacturing the product becomes easier and quicker – and the cost savings start to ripple out through the value chain. Logistics and transport consume less budget as smaller and lighter pipe can be transported by smaller and lighter vessels. Deployment and installation are quicker and easier, which then makes it possible to identify and address any quality issues that arise much earlier in the process.



Of course, digital developments also come into play. The advantages of Industrial IoT, digitalization, and automation are already understood. It's certainly true that smart sensors on a subsea tree can deliver data that transforms our understanding of platform operations, maintenance and integrity.

Robotics in fabrication plants have long automated several processes, but with machine learning capabilities they can improve their own performance over time. Each iteration of the manufacture becomes an opportunity to improve for suppliers and operators, and embeds quality consistency, productivity and on-time delivery into the process. Again, there are cost and productivity benefits to be gained.

Other seemingly straightforward changes can cause profound shifts in attitude and approach. If, as Baker Hughes believes, early and consistent engagement with operators is a critical part of improving equipment design and manufacture, then that engagement needs to be enabled.



Source: Baker Hughes

Digital publishing technologies give operators real-time information on where their specific product is in the manufacturing stage. It enables them to view their equipment as it goes through production, view testing results and assess ongoing plans for bringing it onsite and installing it.

Fifty-fifty thinking

Our goal is to ensure our tie-back initiatives are 50% lighter than traditional alternatives, with shorter lead times and sufficiently flexible technologies so that they can evolve to suit the changing needs of a field over its lifetime. The ultimate goal is another 50%, by which we plan to cut the total cost of ownership associated with our products.

Of course, current developments raise questions about where to go next. With tie-back technology becoming more robust and critically more cost-effective, does it really need an existing platform to tie-back to? That's just one of the questions posed by the new technology and the capabilities it introduces. Could it be possible to use a vehicle to inspect, manipulate and control the field and then use tie-backs to transmit power locally? Can we use data produced by smart subsea sensors to challenge field design still further and produce something that is genuinely transformative?

Those questions are best answered in close collaboration with operators rather than being considered in theoretical isolation by suppliers and designers. It's another indication that the relationship between suppliers and operators is moving away from the straightforwardly transactional – and that this can only result in improved outcomes for all parties.

The fundamental truth is that, so far, the energy industry has not needed to innovate at the rate seen in other industrial sectors. But the productivity curve is changing. Staying ahead of it is going to require a combination of big changes, 'Eureka!' moments, incremental shifts and 0.1% adjustments at the edges. Simply accepting existing working practices and cost centers just because they've always been there is less sustainable than ever. And as we have seen recently, price stability has not returned and we at Baker Hughes are focused on delivering economic projects in uncertain markets.

This is the opportunity to move forward, establish more sustainable ways of doing business, bringing in the technologies and changes to create sleeker businesses – Baker Hughes is well prepared to manage these volatile times and deliver value to our customers.

The Troubled History of Protecting Marine Assets

Source: Vesper

BY JEFF ROBBINS

The Akaroa installation

The history of protecting marine assets is a tale of endless perseverance. From the moment humans have put infrastructure in the water, it has been damaged by other humans. Despite incredible advances in technology and installations, incidents still occur at an unacceptable rate.

The types and volume of marine assets have exploded since the 1850's when the first submarine telegraph cables were laid. Today oceans, seas and lakes are the home of thousands of cables, tens of thousands of miles of subsea pipes, and countless underwater storage tanks. Above surface, assets are also still at a surprising level of risk. Offshore wind farms, oil and gas platforms, and even fish farms still suffer from vessel collisions.

The first lesson on protection was learned on the first subsea cable in the first week

The first commercial underwater communication cable was laid on August 28, 1850 across the English Channel by the Submarine Telegraph Cable Company. On only the second night, a French fishing boat accidentally pulled up the cable and cut a piece out of it, apparently believing it was a strange species of seaweed! It was a taste of things to come. Fishing vessels have since been the bane of subsea cables, with the International Cable Protection Committee (ICPC) advising that more than two-thirds of all submarine cable faults are caused by fishing and anchors.

First steps to protect cables against fishing vessels

As subsea cable infrastructure rapidly grew from the 1860s, the threat that fishing vessels presented was internationally recognized. It was taken so seriously that in 1884 The Convention for the Protection of Submarine Telegraph Cables was signed by 27 countries. Among other provisions, the treaty created a mechanism by which fishing vessels could claim the cost of cutting fishing nets that were caught on a cable.

Pipelines followed 100 years later

Despite the first onshore pipelines appearing in the 1850s, it wasn't until 1954 when they were first commercially constructed offshore. This was a 10 miles long gas pipeline in the Gulf of Mexico that was laid at a depth of between 20 and 32 feet.

Although obviously more robust than cables, and with the benefit of 100 years of technology improvements, pipelines have not been impervious to the threat of sea vessels. Armored enclosures and burying pipes in high traffic areas haven't eliminated pipeline damage by vessels. When they are damaged, the impact can be severe, with loss of lives, assets, and serious harm to the environment.

Getting Physical

For the first 150 years, the primary defense against damage by vessels was through enhanced physical protection. Cables and pipes were buried in high marine traffic areas, particularly where there was a risk of dredging or anchoring. Where possible, physical buoys were deployed. Marine charts were clearly marked to show the location and area of some subsea cables and pipes.

But even burying cables and pipes and marking them on charts wasn't a guarantee of protection, as New York Power Authority discovered twice within a 10-year period. Despite its cables across Long Island Sound being buried 10 ft. under the seabed, anchor strikes ruptured cables resulting in millions of dollars in repairs each time.

The risk to subsea infrastructure grew exponentially

Despite all attempts, two factors resulted in ever-increasing risk and damage to marine assets. The first was the incredible growth in subsea infrastructure. By way of example, subsea pipelines in the Gulf of Mexico went from zero in 1953 to over 28,000 miles today.

Secondly, the number and size of vessels dramatically increased. The OECD reports that from 1900 to 2000, the number of maritime shipping vessels grew from under 30,000 to nearly 90,000 ships. The size of these vessels increased even more dramatically, with total Gross Tons increasing more than 11 times, from less than 50 million to over 550 million Tons. Analysis of fishing vessel data found that the world's fishing fleet doubled in size from 1950 to 2015, reaching 3.7 million vessels.

Surely things are getting better

More vessels with bigger anchors, heavier dredges, and larger nets has resulted in more damage to marine infrastructure than ever before. A few recent examples…

April 2018 was a dark month with three major incidents. These included the loss of 5 lives in Indonesia when a vessel dropped anchor in a restricted area and dragged a Pertamina pipeline causing it to burst. In Port O'Connor, Texas, a dredge caught on fire after hitting a subsea gas pipeline, and in the Straits of Mackinac, on The Great Lakes, a dragging anchor dented a major pipeline and damaged electric cables causing a mineral oil leak.

On December 23, 2019, Malta lost power for 3 hours after a vessel's anchor cut a power line to the country. The cost of repair and mitigation is estimated to be over 20 million Euros.

As recently as January 9, 2020, 14 countries in West Africa experienced massive telecom disruption when the FALCON cable was cut in two places by a suspected anchor drag.

Source: Vesper

The Akaroa installation

Why hasn't technology saved us?

In addition to the enhanced physical protection of marine assets, there have been considerable improvements in technology over the last 170 years. Electronic Chart Display and Information Systems (ECDIS) clearly display a large proportion of subsea pipes and cables. All large vessels now operate with AIS, making their size, speed, and identity clear to anyone actively monitoring a potential threat. Interception vessels (boats and aircraft) are sometimes used to protect marine assets from potential threats. In all these solutions, the essential problem remains – human error. In its 2019 annual report, the European Maritime Safety Authority points out that 65.8% of all European shipping accidents investigated between 2011 – 2018 were due to human error.

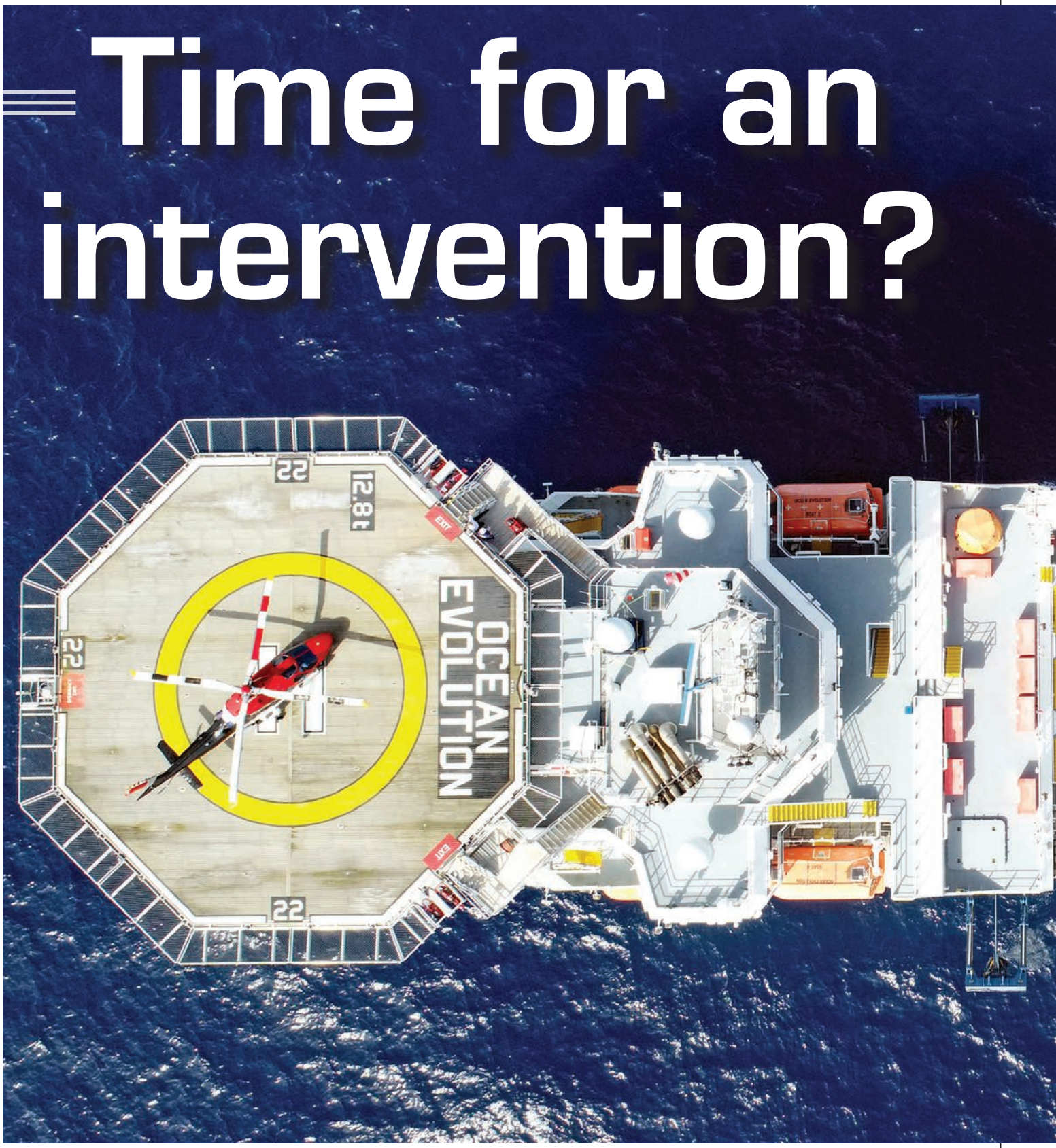
Is there hope on the horizon?

In its review of the Pertamina incident, Indonesia's Environment and Forestry Ministry made its view on how the incident could have been prevented very clear, stating Pertamina "lacked an early-warning system and had no automated monitoring."

Enbridge identified it could reduce the risk of an anchor strike on its Line 5 pipeline in the Straits of Mackinac by 88.4% through automated proactive messages to vessels that present a risk. Combining this with enhanced physical protection reduces the risk of damage by 99.9%.

With the universal adoption of AIS by large vessels, automated solutions have recently become a viable and meaningful method of protecting marine assets. The ability to digitally mark infrastructure for vessels to more clearly see on their ECDIS (navigation station), especially those not marked on charts, along with automated alert messages directly to their ECDIS is the most significant and positive development in preventing damage since that first telegraph cable was cut in 1850. Proactive, automated solutions can often be cost-effective to deploy and manage, and with their significant reduction in the likelihood of fatal and costly damages, are become an essential comprehensive layer of protection.

Time for an intervention?



Source: Oceaneering

Oceaneering's Ocean Evolution with a well stimulation spread onboard.

Just as the oil and gas industry was starting to get back on its feet, Covid-19 and plummeting oil prices have affected the market across the board, including well intervention. But players in this space are optimistic, with new vessels and more compact intervention systems being planned and hopes that production enhancement will be an easy win for operators post-Covid, reports Elaine Maslin.

The light well intervention (LWI) segment – from vessels, rather than rigs - struggled in the downturn, says Catherine MacFarlane, subsea analyst, Energy, at IHS Markit. The only long-term contracts are with Petrobras and Equinor, which means the market is reliant on seasonal shorter-term work and tends to be among the first to be affected in terms of rates and utilization. Yet, prior to Covid-19, 2020 was showing some very modest rate increases and a stabilizing market, she says.

Indeed, 2019 and into early 2020, riserless light well intervention (RLWI) activity had been steadily growing, says Tor Erik Grønlie Olsen, Country and Business Development Manager UK at TIOS (TechnipFMC/Island Offshore).

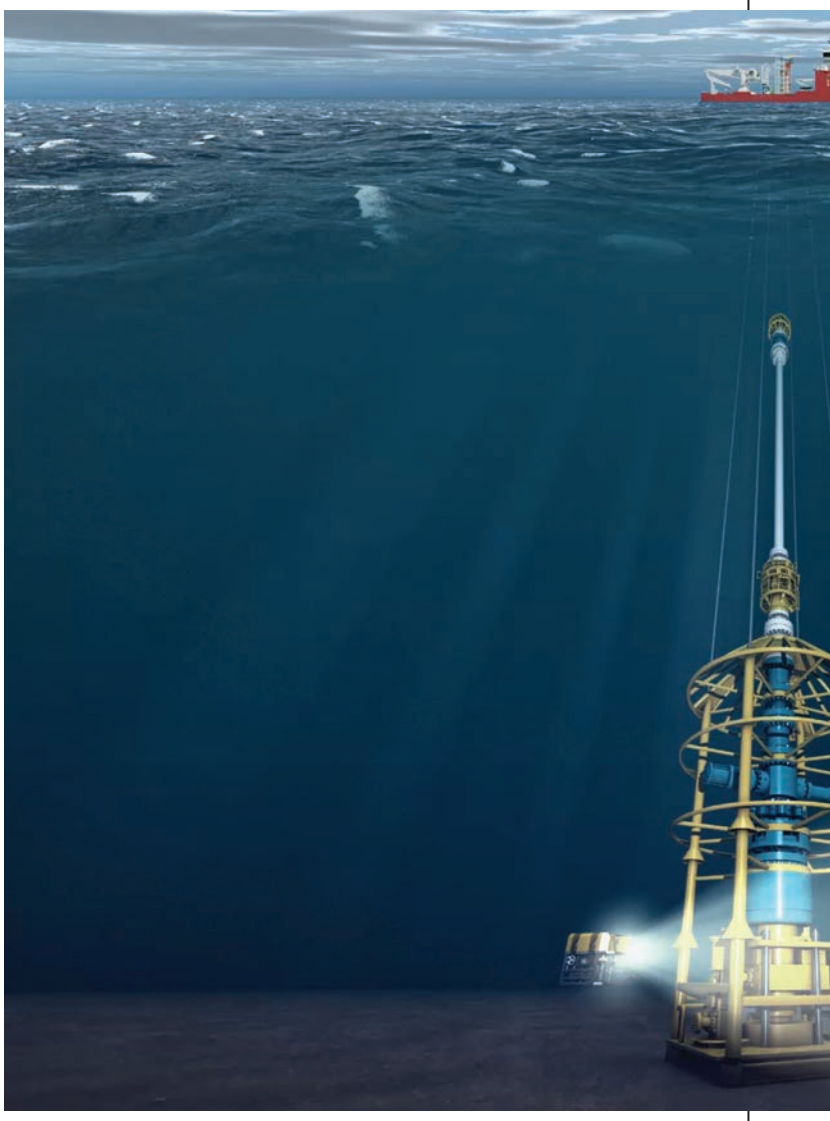
The UK and Norway have been RLWI heartlands, with five RLWI vessels in operation, but other regions had picked up too, says Olsen, such as West Africa, where riserless intervention operations (hydraulic and mechanical) amounted to more than 300 days – up from about 100 days per year – with three major oil companies performing multi-well campaigns across three countries at the same time. Indeed, in February, Oceaneering inked a significant RWLI services contact with BP over Blocks 18 and 31, offshore Angola, running from Q2 into late Fall. The Gulf of Mexico has also been busy, notes Olsen.

The current outlook, however, isn't so great. "Operators very rapidly froze, delayed or cancelled operations, in an effort to preserve cash," Olsen says.

Unlike subsea construction vessels, there are few other markets for dedicated LWI vessels to seek refuge in, says MacFarlane, and competition from rigs could be hard for semisubmersible units.

Units ordered in past years also remain idle. Newbuild semisubmersible intervention unit Etesco Interventor remains at the Dalian yard, China, after Petrobras and Etesco reached an agreement to cancel its charter in 2017, says MacFarlane. The PaxOcean yard is also still home to the newbuild semi Derwent, following the termination of a shipbuilding contract with Hallin Marine in 2014. To date, the Derwent is yet to find a buyer or work. At the same time, the Skandi Constructor, which was Marine Subsea's Sarah and is now owned by DOF Subsea, has spent most of its recent working life as a walk-to-work vessel in the offshore wind market, despite still being equipped with a tower on board, says MacFarlane. That brings the total potential fleet size to 22 vessels, if there are no retirements, she adds, according to data from IHS' ConstructionVesselBase.

Some active vessels could now be warm-stacked (some already are) with the risk that older units might never return to market,

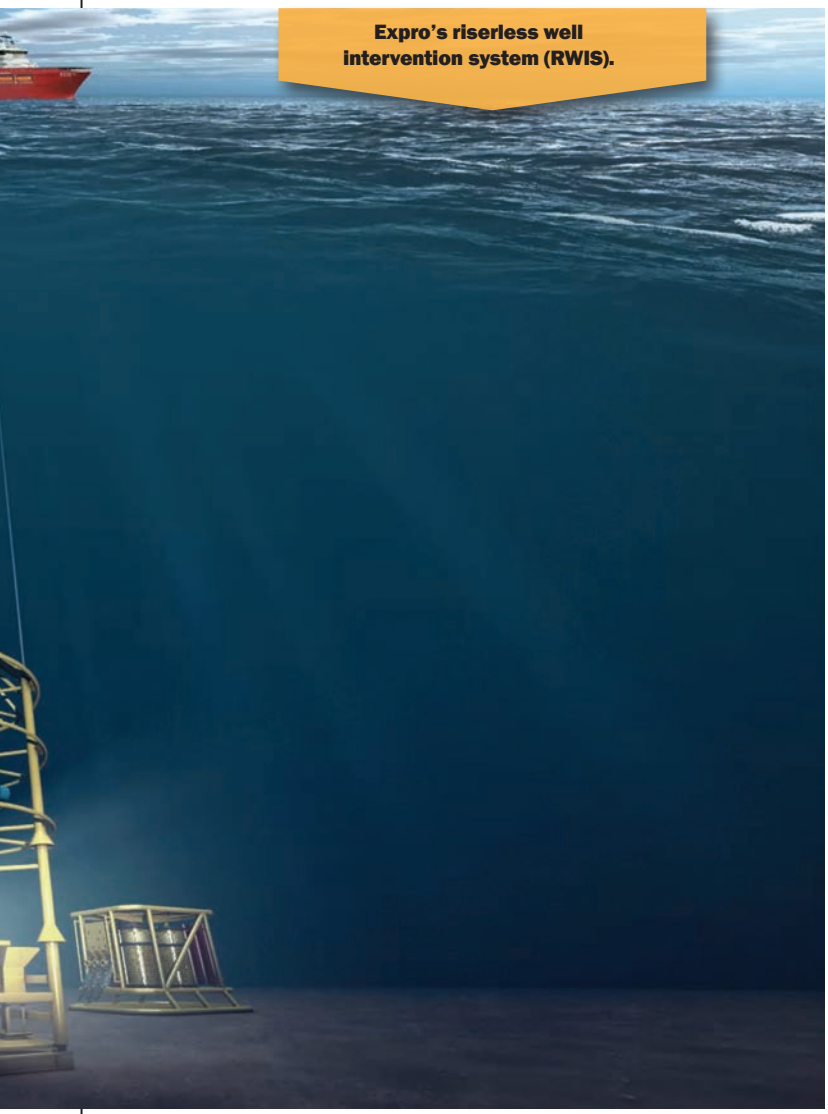


taking experienced assets – including people – out of play.

However, Owen Kratz, CEO of Helix Energy Solutions, told a recent investor event that the competition from rigs should be lower than it was through the last downturn, due to less rig overhang – the "sunk cost" operators had in rigs that they'd already committed to back then.

There's also positivity. Carl Roemmele, Subsea Intervention - Executive Director, at Baker Hughes, says while some are "battening down the hatches" with deferrals, some operators are "embracing intervention harder than before, as it's an instant hit to revenue if you can improve a well performance by 200-400% or tangibly extend field life."

John Attenburrow, managing director at new entrant FTAI Ocean, says that once solutions or vaccines for Covid are available, there's likely to be a focus on revitalizing aging subsea wells, as "well intervention presents one of the lowest cost per accretive barrel production."



Expro's riserless well intervention system (RWIS).

Source: Expro

There's also decommissioning work to be done, points out David Carr, Helix's Senior Vice President, International Development. Indeed, last year, the global LWI fleet carried out 680 days of decommissioning/removal work, compared to 340 days in 2018 and 124 days in 2017, says IHS Markit's MacFarlane, "and this is an area we would expect continued growth in," particularly in the North Sea, she adds.

A successful maiden campaign for Q7000

Helix Energy Solutions has seven well intervention vessels across Europe, the Americas, and Africa. This year, it brought its newbuild semisubmersible, the Q7000, into service with its first project being a 10-week, five-well campaign offshore Nigeria in 1,220 m water depth. The project, completed 25 days ahead of schedule with 96.86% uptime, involved subsea workover and well intervention operations, including water shut off/zonal isolation; hydrate milling/coiled tubing clean up and remedial safety valve operations.

It was Helix's first job offshore Nigeria and the first coiled tubing hydrate milling project done off the country's shores. Going to press, the Q7000 was warm stacked in Tenerife looking for its next job, while the North Sea focused Seawell monohull was warm stacked in Leith, Scotland, having had contracts deferred or canceled. The rest of Helix's vessels are on long-term contracts or contracted into Q3/ until the end of the year, and discussions are ongoing for work for the warm stacked units, the firm said in its Q1 update.

Driving RLWI uptake at operators

TIOS currently operates three LWI vessels. In 2019, it recorded a record of 81 well interventions in a year across its three riserless LWI systems.

In 2019 and into 2020, TIOS had new clients trying RLWI work for the first time. "Once they have directly experienced the efficiency and effectiveness of RLWI, many of them extend the work scope, add new wells and consider RLWI as the base case for more operations that were traditionally performed by the rig," Olsen says.

Recent innovative projects include using an e-line stroker tool to remove and set crown plugs in horizontal trees in deepwater (SPE paper SPE-194241), using an e-line drilling tool to perform gaslift retrofit in an existing well in just three runs and acid fracturing operations at 60 bpm flowrate in simultaneous operations with a stimulation vessel.

The firm's Island Frontier is currently available, after 14 years of continuous service for Equinor until last year, during

which it intervened in more than 230 wells. Island Wellserver remains contracted to Equinor for a minimum of 200 days for another year, having started working for the major in 2009. Island Constructor continues to operate for several operators in Norway and in the UK and is expected to be busy for most of 2020. Replacing Island Frontier is AKOFS Offshore's AKOFS Seafarer, under a five-year, year-round RLWI contract agreed in 2018 with Equinor, starting in 1H 2020. An RLWI system was recently delivered to AKOFS by Aker Solutions.

Introducing new intervention systems to market

Singapore-based FTAI Ocean has contracted UK engineering firm Osbit to design and build a Smart Tower System (STS) for the DP-3 vessel M/V Pride in a move that will evolve further the new designs Osbit had created for the Siem Helix 1 and 2 (OE: April 2017, Making a step change).

According to FTAI, the STS is for riser-based and RWLI in up to 1,500 m (4,921 ft) water depth. It's built around an active, dual-level heave compensated platform, giving access to surface pressure control equipment, slickline, and e-line operations and for building, operating and recovering completions, 90 ft. workover riser joints and subsea pressure control equipment weighing up to 250-tonnes, with a mechanical and control interface to the vessel's existing 250-tonne heave compensated crane and a vertical CWOR racking system. It's set for delivery in Q1 2021, vessel installation in Q2 2021, then targeting projects in FTAI's existing markets in the Asia Pacific region but also available globally.

Osbit director Steve Bedford says there's a move towards installing these systems on to standard lighter, faster and cheaper vessels. The towers for the Siem Helix 1 and 2 were a huge step on that route, productionizing well intervention operations in an effective and safer way, and more will happen in this space.

First to open water coiled tubing market

Oceaneering, with one dedicated intervention vessel, the Ocean Evolution, plus systems it uses on other vessels, has been maintaining "a high level of activity."

It has intervened on 20 wells hydraulically and mechanically over the past year to date, mostly in the Gulf of Mexico and West Africa, according to Ian Still, Oceaneering's Service Line Manager, Intervention Services.

Furthermore, Oceaneering is set to finally demonstrate its open water coiled tubing (OWCT) capability – a new capability for the market - having progressed to proof of concept. The system comprises a subsea jack, to drive the coil into the well subsea, that will be tested later this summer, along with

TIOS' Island Wellserver.

Source: TIOS

the coil, surface injector, and the controls for both systems. The nominal operational range for the system will be 2000 ft - 10,000 ft water depth.

"There are no current riserless live well coiled tubing options in the marketplace," says Still.

"Our OWCT brings the advantages and capabilities of coiled tubing to an otherwise LWI spread. OWCT can be used as needed in conjunction with wireline, whether planned or contingency for live well operations."

Oceaneering's aim is to deploy the OWCT from suitable vessels of opportunity, offering 40% less footprint, reduced crew size (up to 60%), almost eliminating pre-engineering needs, and lowering total cost.

Building tracking record and vessel hunting

Expro has been increasing its weight in LWI. It last year acquired Norwegian coiled tubing, including open water coil hose, intervention firm Quality Intervention, and has launched a new intervention riser system (IRS) and a new riserless well intervention system (RWIS).

The IRS had been deployed on an estimated 360-day P&A campaign from Pacific Drilling's Pacific Santa Ana drillship for Petronas in Mauritania, when the Malaysian oil firm in March declared force majeure on the rig contract. According to Expro, the Santa Ana is stacked in Las Palmas due to the current Covid pandemic, however the base plan is to proceed back to Mauritania and recommence the P&A programme when safe to do so, targeting early 2021.

To date, the IRS has been used on nine of the 15 wells in the program of 15 wells, recovering three subsea Xmas trees on the bottom of the IRS system and "bunny hopping" between the remaining six wells to perform intervention services

Expro had also announced an alliance with COOEC Offshore to bring the RWIS to market from a newbuild vessel, however that partnership is no longer in place, and an alternative vessel, as yet unnamed, will be used. The RWIS is currently being built, with final assembly and testing due at Expro's Aberdeen facility before mobilization to Asia for vessel integration and testing ahead, with a first intervention campaign in Q2 2021, says Kevin Illingworth, Subsea Global Sales Director, Expro.

Building a broad spread, vertically and horizontally

Baker Hughes has also been flexing its muscle. Roemmele says the firm now has about 30% of the market capacity in intervention equipment focusing on large bore capacity with light-weight intervention and ultra-light-weight intervention through the life cycle. That's after investing in a global fleet of 10,000 psi and soon to arrive 15,000 psi fluid skids that can be deployed from field support vessels to inject high-flow chemicals into vertical and horizontal trees to boost production.

In mechanical intervention from rigs, Baker has increased its offering in the completion work over riser and subsea test tree space, adding to its rental fleet.

Baker also acquired Wild Well Control LWI system stacks and put them straight to work on a six-well campaign.

"Add these to the existing fleet in Well Access, Baker Hughes now has around 30% of the global light well capacity," says Roemmele. "Add the multi-WOCS (workover control system) capability and add our Well Services (wireline, chemicals, coil tubing, pressure pumping, and our reservoir expertise), and it's a truly incorporated service offering."

In the UK, since the Oil & Gas Authority's (OGA) 2018 Wells Insight report highlighted low rates of well intervention activity as an issue (see OE: August 2019), 50% of operators have reported an increase in well surveillance activity, says Brenda Wyllie, the OGA's Northern North Sea and West of Shetland Area Manager and now also co-chair of a new MER (Maximizing Economic Recovery) UK Wells Task Force. There's also been a 20% increase in intervention spend, across surveillance and intervention activity, year on year (2018-2019). Reported production losses from wells also decreased for the second year in a row. However, there's still 30% of active well stock shut in or mechanically plugged – an issue raised by the 2018 Wells Insight, and activity has dropped this year, due to Covid and low oil prices.

The new Wells Task Force has been set up to address issues around well activity and performance on the UK Continental Shelf. Within this group, five working groups are being set up to looking at: reservoir and wells optimisation; right scoping; waste removal, seeking to reducing non-productive time and mechanical side-tracks; improved partnerships, to get, amongst other things, multi-operator campaigns; and decommissioning. The OGA is also now sharing wells related data and insights in the form of an online dashboard, says Wyllie, and an updated Wells Insight report is expected later this year.

Another initiative, Oil & Gas UK's Unlocking Brownfield Resource Opportunities Guidelines, published in May, also touches on well intervention. Katy Heidenreich, the body's Operations Director, says there's a clear opportunity to increase the number of well interventions and unlock more barrels. Some of the issues holding up this work include how companies prioritise well intervention, among other operational demands, she adds.

The Well Intervention Market: *An Overview*

By Catherine MacFarlane, Subsea Analyst, Energy, IHS Markit

The well intervention market is a niche one, with only a few main players – including Helix/Well Ops, Island Offshore, AKOFS Offshore, and Siem Offshore – and only three key geographical regions; Northwest Europe, South America, and the US Gulf of Mexico.

Unsurprisingly then, the fleet operates in regions with high numbers of installed subsea wells, particularly those with aging installations.

Regions seen with potential developing well intervention markets include West Africa and Australia.

The fleet is a varied one, with lines sometimes blurred between drilling rigs, heavy well intervention units, light well intervention units, and jack-ups kitted out with modular intervention kits.

IHS Markit categorizes all intervention units as light well intervention vessels, with the following definition:

> *Purpose-built or converted to perform well work, such as riser or riserless well intervention, top hole drilling, and well plug and abandonment. In addition to these main functions, some units may also be capable of doing subsea installation, construction, and survey work.*

IHS Markit currently tracks a fleet size of 20 well intervention vessels within its ConstructionVesselBase database, with the fleet mainly located in Northwest Europe (nine), US Gulf of Mexico (four) and South America (four), with the remaining vessels located in the APAC/West Africa regions.

FTAI Ocean's DP3 subsea construction vessel Pride is also expected to join the fleet in 2021, after Osbit was contracted last year to design and construct a tower system which will enable Pride to undertake riserless and riser-based well intervention and plug and abandonment (P&A) operations in depths of up to 1,500 m of water.

Pride is expected to enter the well intervention services market upon the installation of the tower in the second quarter of 2021.

Newbuild semi well intervention unit Etesco Interventor is also still yet to be delivered from the Dalian yard, China, after Petrobras and Etesco reached an agreement to cancel the charter of the unit in 2017, bringing the total potential fleet size to 22 vessels, if there are no retirements.

In recent years, the LWI fleet, like so many other segments, has struggled with the downturn in oil and gas.

There are few long-term contracts available in this market, with only Petrobras and Equinor offering the security of a long-term charter. Hence, the market is reliant upon securing

Vessel name	Hull shape	Delivery year	Conversion year
AKOFS Seafarer	Ship	2010	-
Derwent	Semi	2013	-
Energy Endeavour	Jackup	1982	2018
Etesco Interventor	Semi	2020	-
Fugro Synergy	Ship	2009	-
Island Constructor	Ship	2008	-
Island Frontier	Ship	2004	-
Island Performer	Ship	2014	-
Island Wellserver	Ship	2008	-
Norshore Atlantic	Ship	2014	-
Q4000	Semi	2002	-
Q5000	Semi	2015	-
Q7000	Semi	2019	-
Seawell	Ship	1987	-
Siem Helix 1	Ship	2016	-
Siem Helix 2	Ship	2016	-
Skandi Constructor	Ship	2009	-
Skandi Santos	Ship	2009	-
Uncle John	Semi	1977	-
Well Enhancer	Ship	2009	-
Pride	Ship	2014	2021
Aker Wayfarer	Ship	2010	

Data from ConstructionVesselBase

THERE ARE FEW LONG-TERM CONTRACTS AVAILABLE IN THIS MARKET, WITH ONLY PETROBRAS AND EQUINOR OFFERING THE SECURITY OF A LONG-TERM CHARTER. *HENCE, THE MARKET IS RELIANT UPON SECURING SEASONAL SHORTER-TERM WORK AND TENDS TO BE ONE OF THE FIRST TO BE AFFECTED IN TERMS OF RATES AND UTILIZATION. DATA SHOWS THAT ONLY SIX LWI VESSELS ARE ON OR ABOUT TO START LONG-TERM CONTRACTS.*

seasonal shorter-term work and tends to be one of the first to be affected in terms of rates and utilization. Data from ConstructionVesselBase shows that only six LWI vessels are on or about to start long-term contracts.

- **AKOFS Seafarer/Equinor about to start**
- **Siem Helix 1/Petrobras**
- **Siem Helix 2/Petrobras**
- **Skandi Santos/Petrobras**
- **Island Wellserver/Equinor**
- **Aker Wayfarer/Petrobras**

While some of the ship-shaped units are able to compete in the subsea construction or diving market during lean times, some of the larger semisubmersible units are too niche to find employment elsewhere. The semisubmersible units also face stiff competition from a struggling rigs market. Prior to the Covid-19 pandemic, 2020 finally promised some very modest rate increases and a stabilizing market, after a protracted recovery period.

The LWI market has been a notoriously difficult market for new entrants, with only a limited market, clients, and regions, and there have been casualties along the way. The aforementioned Etesco Interventor remains at the Dalian yard. At the same time, the PaxOcean yard also ended up with newbuild semisubmersible Derwent in 2014, following the termination of a shipbuilding contract with Hallin Marine. To date, the vessel is yet to find a buyer, or work. Meanwhile, the Skandi Constructor, which started out life as Marine Subsea's Sarah, and is now owned by DOF Subsea, has spent most of its recent working life as a walk-to-work vessel in the wind market, despite still being equipped with a tower on board.

Helix's semisubmersible Q7000, originally scheduled for delivery in 2017, was finally delivered from the yard in November 2019, after securing its first scope of work in Nigeria, West Africa, which it started in January 2020. 3

However, the unit is now another maritime victim of Covid-19 and (at the time of writing) was warm stacked while discussions with clients about future work for later this year remain ongoing.

The outlook for the LWI vessel market will mainly rest on the oil price and the subsequent decisions made by operators.

Unlike subsea construction vessels, there are few other markets for these vessels to seek refuge in, and the semisubmersible units, in particular, may struggle in the jostle to find work against the rig market.

However, one area in which we have seen growth for these units is the decommissioning market. In 2019, the global LWI fleet carried out 680 days of decommissioning/removal work, compared to 340 days in 2018 and 124 days in 2017 – and this is an area IHS Markit would expect continued growth in, particularly with the growing decommissioning market in the North Sea.

Global LWI vessel utilization

Year	Not Working	Total Supply	Utilization
2016	3617	5965	39%
2017	3299	6163	46%
2018	2849	6535	56%
2019	2489	6623	62%
2020 (Q1)	945	1729	45%
Total:	13199	27015	51%

Data from ConstructionVesselBase

Offshore Wi

Offshore wind currently represents just a small piece of the world's energy supply. But that's changing faster than ever before as new and existing players look to tap the huge resource potential—and market opportunities—being unlocked by shrinking costs and technological advances, as outlined in a recent market report.

BY ERIC HAUN

(Photo: Ørsted)

ind's Lift Off

$1.5T
WER EXPECTS OFFSHORE WIND PROJECTS WILL REQUIRE BETWEEN $1 TRILLION AND $1.5 TRILLION OF CAPEX OVER THE NEXT TWO DECADES.

The rapidly maturing offshore wind market is, in the coming decades, expected to become a trillion-dollar business as the pace of installed capacity growth accelerates, according to World Energy Reports' (WER) *Outlook for Offshore Wind Power: The Frontier of Future Energy*, published in June 2020.

Growing, with Huge Potential

Globally, the total installed energy capacity for both onshore and offshore wind farms at the end of 2019 totaled 651 gigawatts (GW), or about 10% of global electricity generating capacity, according to the WER report. While just 25.5 GW, or less than 0.5%, of that installed capacity is currently located at sea, the rate of new installations offshore has been growing at a much faster rate since 2010: 26% compound annual growth rate (CAGR) compared to 14% for onshore. Even amid the current coronavirus pandemic, WER expects this trend to continue, with 16 GW of additional offshore capacity to be added in 2020 and 2021, driven primarily by ongoing activity in the well-established Northern European sector as well as the newer, fast-growing Chinese market. China, already the leader onshore, emerged as a major offshore wind player in 2018 and has continued to expand its substantial project pipeline.

When comparing onshore wind vs. offshore in terms of untapped potential, it's clear that offshore is simply unmatched. The WER report estimates global offshore wind potential to be technically capable of supporting more than 120,000 GW of electricity production capacity (equating to approximately 420,000 TWh), which is more than 20 times greater than current world demand.

By 2040, WER forecasts offshore wind capacity will increase to somewhere in the range of 340 GW-560 GW, led by Europe and China, with newer entrants the U.S., Japan, South Korean and India among top markets. The report identifies some 500 GW of projects and development zones currently in the planning and development stages, mainly coming from Europe, Asia and the U.S. Details for each project are laid out in the report as well as in a corresponding online database (http://www.worldenergyreports.com/wind-db).

Lower Cost

Offshore wind farms are not new; they have been around for decades. So why is offshore wind taking off faster now than ever before? WER's report points to a combination of factors helping to grow offshore wind's role in the word energy mix. The simplest but most important reason for growth is that offshore wind has made great strides over recent years to become increasingly cost competitive compared to other energy sources, including fossil fuels. In the years ahead this momentum will only build as costs continue to fall.

The growing volume and size of offshore wind projects, along with improving supply chain competencies larger, more efficient turbines (the current largest is 14 megawatts (MW)), and the utilization of offshore transmission substation hubs have all helped to reduce offshore wind's levelized cost of energy (LCOE). According to WER, LCOE has declined from a global average $170/MWh in 2010 to strike prices of $60/MWh to $110/MWh in 2016 to 2018 European and U.S. auctions. Recent prices have been seen as low as $47/MWh in recent European auctions. WER says declining LCOE is allowing offshore wind to compete with fossil fuel projects in European and Chinese markets. It's still a different story in the U.S., but WER sees cost parity by the end of next decade. Today, installation capital expenditure (capex) cost for bottom-fixed turbine projects averages just over $3,000 per kilowatt (KW) with transmission. WER projects this will fall to fall to $2,500/KW by 2030 and $1,900/KW by 2040.

Floating Future

Another significant factor leading to a major jump in projected installed capacity over the coming years is the advancement and commercial demonstration of floating offshore wind turbines, which open up new areas to exploit: specifically, in deeper waters where the construction of wind farms was not previously feasible. Currently almost all offshore wind power generation comes from bottom-fixed turbines, which are restricted to water depths of about 60 meters or less. However, as concepts continue to evolve and become proven, floating turbines will enable wind farm construction in deeper waters that hold some 80% of the world's wind capacity potential. Representing another boost for overall capacity potential, these areas are typically further from shore where the wind generally blows stronger, resulting in higher turbine capacity factors.

Today's most proven floating wind turbines are Equinor's Hywind, employed on the 88MW Tampen project, and Principle Power's WindFloat, being used on the 50MW Kincardine project, but WER's report looks at more than 50 floating wind concepts in various stages that are being studied across the globe. Just as is occurring for traditional fixed-base turbine projects, the increasing size of floating projects and the indus-

LCOE

OFFSHORE WIND'S LEVELIZED COST OF ENERGY (LCOE) HAS DECLINED FROM A GLOBAL AVERAGE $170/MWH IN 2010 TO $47/MWH IN RECENT AUCTIONS.

(Photo: Ørsted)

FLOATING TURBINES WILL ENABLE WIND FARM CONSTRUCTION IN DEEPER WATERS THAT HOLD SOME 80% OF THE WORLD'S WIND CAPACITY POTENTIAL. **A PIPELINE OF MORE THAN 50 GW OF FLOATING CAPACITY REQUIRING $93 BILLION TO $148 BILLION OF CAPEX INVESTMENT** HAS BEEN IDENTIFIED BY WER.

trialization of the hull construction process is helping certain concepts reduce project LCOE. For example, as Equinor matures the technology, it aims to bring the LCOE of Hywind projects to €40 -60/MWh by 2030.

A pipeline of more than 50 GW of floating capacity requiring $93 billion to $148 billion of capex investment has been identified by WER. As is the case in the bottom-fixed segment, the U.K. presently has the largest floating pipeline at more than 25 GW, followed by Norway (more than 5 GW) and Japan, the U.S., South Korea, Ireland, France and Taiwan, each with multi-GW pipelines. WER's report highlights the development of a much large pipeline after the middle of this decade, with potential zones discussed in the U.S., Japan, Norway, U.K. and France.

Big Potential Opportunities

Forecasted near- and long-term increased activity bodes very well for the global supply chain. WER expects offshore wind projects will require between $1 trillion and $1.5 trillion of capex over the next two decades. Much is still on the table for the gamut of suppliers and marine services firms, as 80% of offshore wind projects detailed in the report and database are

WIND TECH
FLOATING FUTURE

Bourbon Subsea Services has recently towed the third—and final—Windfloat Atlantic project's floating wind turbine to the offshore location located 20 kilometers from Viana do Castelo on the Portuguese coast.

The turbines are installed aboard Principle Power-patented WindFloat floating support structure. Similar to offshore oil and gas facilities, Windfloat uses seawater ballast to submerge approximately 2/3 of the structure below the mean water line. As for its mooring system, it is a catenary configuration connected to drag embedment anchors.

Principle Power is a leading company in DeepFarm consortium, which is developing a pioneering mooring system for deepwater floating offshore wind platforms.

The DeepFarm project's aim is to enhance currently available open-source software tools for floating turbine design in order to optimize innovative mooring system components for robust operation and lower floating wind cost.

80%
THE MAJORITY OF OFFSHORE WIND'S POTENTIAL LIE IN DEEP WATERS, REQUIRING FLOATING TURBINE TECHNOLOGY TO TAP.

Source: Bourbon

THE REPORT IDENTIFIES SOME **500 GW OF PROJECTS AND DEVELOPMENT ZONES CURRENTLY IN THE PLANNING AND DEVELOPMENT STAGES,** LAID OUT IN THE REPORT AS WELL AS IN A CORRESPONDING ONLINE DATABASE

HTTP://WWW.WORLDENERGYREPORTS.COM/WIND-DB

still in early stages of planning and development.

With a pipeline of activity so large, there's plenty of work to be had by existing players and new entrants alike. We've already seen a number of traditional offshore oil and gas players—from operators such as Shell, Total, Equinor and Repsol, all the way down the supply chain—transfer their skillset into the offshore wind market over the years. For these firms and others, including traditional offshore oil and gas players such as yards for jacket and HVDC substation fabrication, as well as for construction and assembly of floating foundations, opportunities abound as projects get larger, deeper and further from shore. Offshore wind farms need servicing, creating even more work for a wide range of support providers—from boatbuilders to turbine technicians. In Europe, for example, onshore operation support bases are having associated positive impacts (long-term direct jobs, and bolstered local supply chains) in port regions that had been historically active but have struggled more recently due depressed oil and gas and shipping markets. Using the current UK $94,000/MW/year operational expenditure (opex) cost, the current pipeline of projects could require up to $46.6 billion of annual opex spend within the next decade, says WER.

WIND TECH

FEEL THE POWER

Wind turbine maker Siemens Gamesa has unveiled a new SG 14-222 DD offshore Direct Drive wind turbine with 14 MW capacity. The capacity can reach up to 15 MW using the company's Power Boost function, a 222-meter diameter rotor, 108-meter long blades and a 39,000-square-meter swept area.

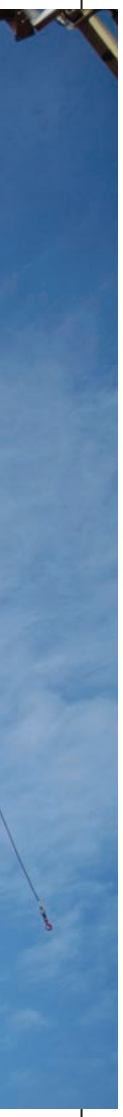
The 14 MW capacity allows one SG 14-222 DD machine able to provide enough energy to power approximately 18,000 average European households every year. Approximately 30 SG 14-222 DD offshore wind turbines could furthermore cover the annual electricity consumption of Bilbao, Spain, Siemens Gamesa said. The turbines have already been earmarked for the proposed 2,640-MW Dominion Energy Coastal Virginia Offshore Wind (CVOW) project in the U.S. The prototype will be ready in 2021 with the turbines expected to be commercially available in 2024.

Source: Siemens

HOW TO EXTEND COATING SERVICE LIVES ON OFFSHORE ASSETS

Using Non-Traditional Systems Enhances Corrosion Protection

By Bruce Toews, Global Market Director – Oil & Gas, and
Johnny C. Pourciau, Oil & Gas Market Director – United States, Canada and the Caribbean, Sherwin-Williams Protective & Marine



Amidst the countless challenges offshore drilling and production operations face, corrosion is a major one. It's an ongoing issue that acts continuously on structures, forcing maintenance workers to frequently intervene to blast and recoat steel assets to restore protection.

Recoating assets can be a costly and inefficient process that often slows down production rates. It also requires available accommodations for applicators, which are at a premium on platforms. Therefore, oil and natural gas producers want to maximize the service life of protective coatings. To them, getting four to six years of corrosion protection from coatings is an ideal target to contain costs. However, coatings on offshore structures more often last only 18 to 24 months before requiring major repairs, leaving producers with higher operating costs and more frequent logistical challenges.

Because stakeholders are realizing the same diminished longevity results from traditionally specified coating systems, the industry could benefit from finding new solutions that deliver longer asset service lives and reduced maintenance costs. To help, Sherwin-Williams Protective & Marine initiated a three-year accelerated testing protocol for offshore coatings in 2017. The study is examining the performance of different coating systems over various surface preparations to find the optimal combinations for long-term corrosion protection.

As the study nears its completion, surprising results suggest the industry should consider adopting new specification strategies to prolong coating service lives. For example, preliminary results demonstrate superior corrosion resistance on assets coated with zinc-rich primers as compared to more commonly specified primers that don't include zinc. In addition, it appears that certain one- and two-coat systems will perform better than some three-coat systems. The study's final conclusions will ultimately help asset owners extend the lifecycle and reduce the downtime of their offshore assets, while also saving money.

NEW TESTING PROTOCOL SEEKS ANSWERS

The accelerated testing study was designed to better predict the performance of currently used coating systems – such as epoxy primers, epoxy intermediates, and epoxy or polyurethane finish coats – and to investigate non-traditional coating systems.

At nearly the end of the testing and data collection process, results are revealing that non-traditional options are enabling improved coating life cycle performance. For example, traditional three-coat epoxy systems with glass-flake or aluminum-flake filler have been thought to provide a longer service life. However, these systems have performed poorly after more than two years into the testing protocol. Instead, systems featuring select one- and two-coat systems are demonstrating superior corrosion resistance. These results are debunking prevailing assumptions, enabling asset owners to alter coating specifications to realize longer maintenance intervals and lower operating costs.

TESTING PROCEDURES MIMIC REAL-WORLD CONDITIONS

To ensure testing scenarios were true to real-life coatings challenges, technicians tested both typical and atypical systems for atmospheric service with different surface preparations and exposure conditions. They also used various substrate profiles to duplicate the angles found on offshore assets.

Surface Preparations. Lab technicians applied 11 coating systems to test panels featuring different surface preparations, including:

- **Grit Blasting According to SSPC-SP10:** This method removed all dust, coatings and mill scale.
- **Grit Blasting Contaminated with 25 µg/cm2 Cl-:** Lab technicians sprayed these panels with an aqueous solution and allowed them to flash rust to a moderate grade (as described in NACE No. 5).
- **Ultra-High-Pressure Water-Jetting (per NACE No. 5 WJ-2/Moderate Flash Rust):** Technicians left these panels to rust in a light industrial environment for 30 days (per SSPC VIS-3 Condition C) and then performed ultra-high-pressure water-jetting (based on NACE No. 5 WJ-2) at 30,000 psi. They let the panels flash rust to a moderate grade before coating them.
- **Power Tool Treatment Contaminated with 25 µg/cm2 Cl-:** These panels were rusted according to the above procedure before technicians used a power tool to prep the surfaces according to SSPC-SP11. They then sprayed a salt solution on the panels and allowed moderate flash rusting to occur before coating them.

Exposure Conditions. To mimic offshore stresses, technicians exposed each set of panels to the following conditions:

- NACE TM0304 (cyclic weathering according to a modified ASTM D5894-16 exposure), in which the electrolyte was synthetic seawater

- Exterior exposure at a 30-degree angle facing the ocean in a warm environment
- Exterior exposure at a 45-degree angle facing south in a light industrial environment
- Exterior exposure at a 30-degree angle facing the ocean in a cold environment

Analyses. Finally, technicians analyzed the panels in four ways. They first looked for damage, corrosion, undercutting and degradation of color or gloss via a visual analysis. Second, they tested the coatings using electrochemical impedance spectroscopy. Third, they evaluated the coating's permeability before and after exposing the panels to the above conditions. Finally, they used Fourier Transform Infrared Spectroscopy to analyze the coatings' chemical properties and evaluate their health before and after the above exposures.

UNEXPECTED SYSTEMS DELIVER BETTER PERFORMANCE

Following 24 months of the 36-month test protocol, select one- and two-coat systems are performing better than the traditional three-coat systems used to protect offshore structures. The best performing systems have featured Corothane® I – GalvaPac 1K Zinc Primer, an organic zinc-rich, moisture-cured urethane primer from Sherwin-Williams. This and other zinc-rich primer systems have demonstrated superior corrosion resistance and have exhibited no major breakdown at the 24-month mark.

Testing has also determined that a coating system's film thickness only helps prevent corrosion in offshore applications if it is extremely high. In addition, testing showed that a thin film of a high ultraviolet-resistant fluoropolymer coating impedes corrosion very well in offshore applications. These conclusions indicate that the ideal combination of a zinc-rich primer, a suitable coating thickness and a fluoropolymer topcoat will deliver the best performance compared to using alternate primers, thicknesses and topcoats.

As this test concludes and additional research and testing continues, the industry will know which systems offer the lowest corrosion potential and longest maintenance intervals. These developments will help owners, operators, specifiers and coatings manufacturers alike optimize offshore asset coatings specifications to enable better corrosion protection and outcomes.

New testing data shows that offshore platform owners are likely to experience better corrosion protection and longer maintenance intervals by specifying select one- and two-coat systems compared to the traditionally specified three-coat systems.

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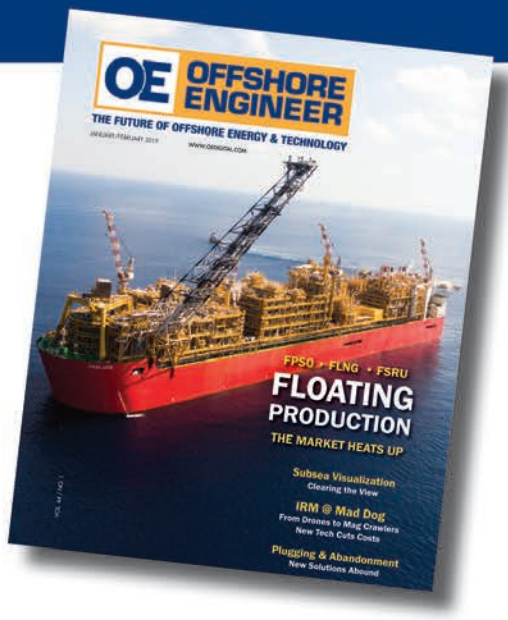

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Photo: Selveste Preben VonSchlanbusch

Johan Castberg: Massive Anchoring Project

A milestone was reached at the Johan Castberg development in the Barents Sea when an enormous anchor system was deployed by Island Victory in preparation for the arrival of an FPSO, which will be processing and storing oil from the 30 wells on the seabed when the production starts in 2022. The client is Ocean Installer, the end customer Equinor.

Each suction anchor weighs between 90 and 105 tons and stands 13 to 17m high. Island Victory was able to load five on board in one go. In addition, the weight of the 170mm chain is 600kg per meter. The objective was to set two anchors a day, as well as attaching anchor chains to each anchor. In total 15 anchors will be placed on the seabed ready for the FPSO to hook up.

ANCHORED

Source: NOV

Submerged Swivel & Yoke.

Offshore Engineer's *previous edition's product feature focused on safety and safety systems, with something "developed" by ancient Babylonians suddenly in the spot again – soap. Read the previous edition to learn how and why soap found itself in the offshore safety section https://bit.ly/SafetySystems This time, we're presenting systems, technology, and methods that will prevent your rig, (floating) wind turbine, or FPSO from floating away. Without further ado, let's dive in.*

NOV Completions & Production Solutions

Submerged Swivel & Yoke

The Submerged Swivel and Yoke (SSY) is a cost-efficient system for mooring of a floating LNG (FLNG) vessel, floating storage and regasification unit (FSRU), or a floating storage and offloading (FSO) vessel in shallow water. The APL™ SSY provides an innovative solution, transporting gas directly through a subsea pipeline without the need for a jetty. SSY is based on APL's proven technology components and is designed to last for the field or terminal lifetime.

The yoke weight is adjusted to the vessel size and environmental condition of the field or terminal. The system can be designed with dual risers and umbilical for redundancy and control on the pipeline end manifold (PLEM). The SSY can be designed for disconnection in cyclone/hurricane environments without tug assistance.

Maersk Supply Services & Intermoor

Installing the next generation of SEPLA anchors

Maersk Supply Service has recently delivered an FPSO mooring installation and replacement in the Gulf of Guinea with the support of InterMoor and its SEPLA System. The permanent replacement mooring system included nine 28-tonne InterMoor SEPLA anchors.

The SEPLA system uses a 120-tonne

Maersk

Lankhorst

suction follower of 4.3m diameter to embed a plate anchor deeply in the soil. The follower is retracted once the plate anchor is brought to design soil depth and can be used again to install additional anchors. This method provides significant savings to project costs while maintaining efficient anchoring of the offshore asset.

Maersk Maker, a 2019 new-build anchor handling tug supply vessel, transported and installed the anchors to 27m below seabed – marking only the second installation of mooring equipment at this large size. Concurrently, subsea support vessel Maersk Achiever deployed 650m-long studless chains of 157mm diameter. In the end, a total of 4000 tonnes of mooring equipment was installed.

Lankhorst Offshore

Quicker Deepwater Mooring Line Make-up

Lankhorst Offshore has developed a hold-back sling designed to reduce the time needed for deepwater mooring line make-up. The device provides a secondary rope termination on a main polyester mooring line to aid the connection of two segments during installation offshore.

Deepwater mooring lines are made up of multiple rope segments. Connecting the lines offshore can be time-consuming as the rope is man-handled into position.

The hold back sling is permanently secured to the deepwater mooring rope and utilizes a high-performance rope to create loading eyes. These eyes can then be secured to a strongpoint or auxiliary winch to transfer the load of the mooring line. In this way, it provides a quick and safe means of holding the tension in the mooring line while connections are being made to other components.

SBM Offshore

High Voltage Electrical swivel

SBM Offshore's sustainable goals aim at contributing to de-carbonizing FPSOs by enabling power from shore. The High Voltage Alternative Current (HVAC) Electrical swivel is the enabling technology for the transfer of electrical power onto Turret-moored FPSO's between the stationary and the weathervaning part.

The company has now developed the 132kV/170kV HVAC Electrical swivel, which will be tested in 2020, to bring the necessary voltage capacity to the market. This will lead to the first 204 MVA prototype, compliant with IEC60071-1.

It is based on two key technologies:

- *dielectric oil protection*
- *a new generation of electrical contact technology, increasing the short circuit rating to 50 kArms-1s.*

Extensive research and development programs since the early '90s, coupled with recent numerical analysis and finally, full-scale prototype testing, will ensure the reliability of this latest development.

Welaptega

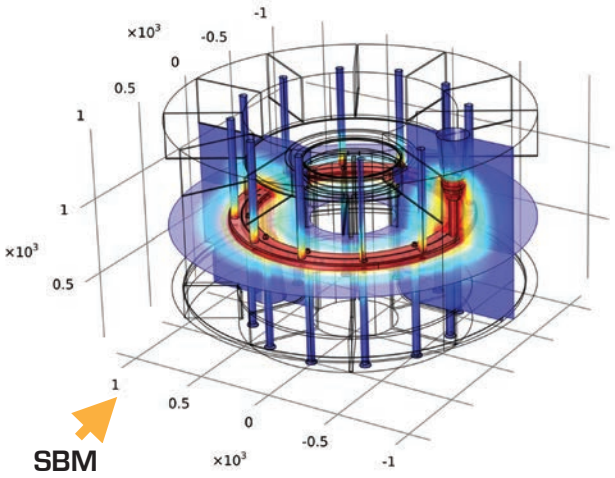
Remote Mooring Inspections

Mooring integrity management specialists Welaptega offer UWILD inspections as part of its remote operations solutions. Leveraging the scale of parent company Ashtead Technology, remote UWILDs are carried out to support the requirements of annual, 2.5-yearly and 5-yearly surveys.

Welaptega has enabled remote use of its proprietary cleaning, inspection and measurement technologies - recognized as best-in-class for manned UWILD surveys - in addition to remote visual inspections.

With BP announcing its goal to reduce the number of people working on IMR vessels by 50% by 2025, the desire for lower cost and lower POB inspection services is a priority for many operators. As the COVID-19 era brings further restrictions, remote inspections offer a compelling, cost-effective service.

Remote inspection services allow operators to utilize experienced subject matter experts like Welaptega to



SBM

Welaptega

STEVADJUSTER

inspect their critical infrastructure. Instead of mobilizing general inspection personnel, operators can have multiple specialists connect to the IMR vessel to perform inspection tasks for limited periods. This increases inspection quality while reducing POB and cost.

Vryhof

Rethinking how mooring lines are installed and adjusted is a real need when hundreds may need to be deployed, such as for commercial scale floating offshore wind farms. Vryhof's STEVADJUSTER is an innovative, cost-effective and time-saving solution for chain adjustment, pre-tensioning of moorings and easy connection or disconnection of anchor lines.

STEVADJUSTER enables modest installation vessels to pre-tension a mooring system, with significant safety benefits and reduced risk profile as the tensioning operation is performed away from the floater.

Adjustment takes place subsea, removing the need for winches or other heavy equipment on the platform being moored.

The unit is designed for the lifetime of the project and requires no specific maintenance. It can be used for a wide range of different mooring systems and is particularly efficient when used in a 3-leg mooring where adjusting a single leg allows tensioning of the complete system.

Global Maritime

GMoor10

GMoor10 is the latest release of Global Maritime's GMoor mooring analysis software. According to the company, GMoor10's modern interface sets it apart from competitors through an enhanced user experience which simplifies the workflow in finding a feasible mooring spread.

New features include a scripting engine for running batch cases and post-processing results, with output to both PDF and Excel; environment tables by heading for different return periods; multi-threaded batch execution and the ability to make any previously saved case interactive.

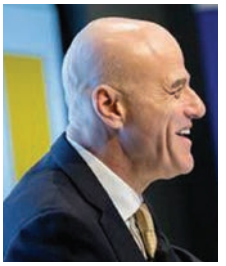
As GMoor10 is capable of solving in the quasi-static frequency domain, results can be obtained very quickly. An optional time domain evaluation of low-frequency motions still allows capturing of transient effects such as 'swing-back', that would not be evident in frequency domain alone. The speed and flexibility of the software enable simultaneous environmental and failure cases to be run in minutes, instead of overnight.

LOC

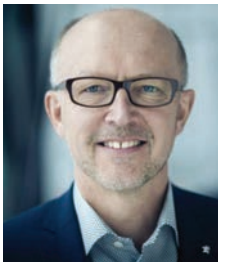
Remote extension to existing DP Inspection service

In response to current market challenges including COVID-19, LOC has developed a Remote Dynamic Positioning Inspection programme, offering an alternative, cost-effective and time-friendly solution, to comply with annual DP trials, regardless of current limits on travel to vessels. The technology allows for continuous, real time remote monitoring, with the trials undertaken by the vessel, as is standard procedure. The footage is assessed in-house by DP specialist consultants, followed by a detailed report. According to LOC, the programme guarantees clients the same level of technical expertise as LOC's traditional physical DP inspections, but with the flexibility to spread the test program over a period of time to work around a vessel's commercial needs and other commitments.

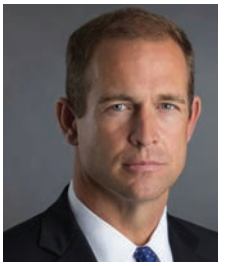

Trowell


Descalzi


Gilbert

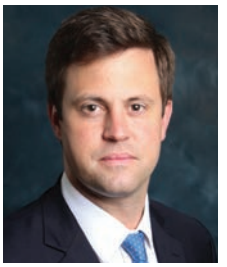

Dodson

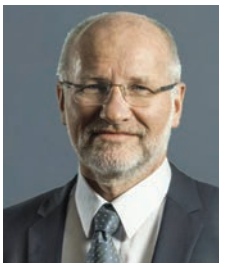

Ramstad


Lawler


Sechin


Wallette, Jr.


Eifler


Garseth


Larsen


Jansen

Acteon appointed **Carl Trowell** as Group CEO, succeeding Richard Higham, effective June 1. Trowell previously served as CEO of Ensco, prior to the offshore drilling company's merger with Rowan which then became Valaris.

Italian oil and gas company Eni has given **Claudio Descalzi** another term as CEO and GM. Descalzi, who has been with Eni in various roles since 1981, has been Eni's CEO since May 2014.

Aberdeen-based research and technology organization the Oil & Gas Technology Center appointed **Martin Gilbert** as its new Chair, succeeding Archie Kennedy.

Equinor's **Tim Dodson** stepped down as EVP Exploration, a role he held since 2011. **Tore Løseth** has been appointed acting executive vice president of Exploration.

Norwegian oil firm Noreco, which last year re-entered the oil and gas business through the acquisition of Shell's Danish North Sea assets, has appointed **David B Cook** CEO, effective July 1, 2020.

Norwegian offshore vessel owner Solstad Offshore has appointed **Kjetil Ramstad** as its new CFO. He comes from the position as Finance Director in Solstad Offshore and has worked for the company since 2018.

David C. Lawler, CEO of BP's U.S. shale business BPX Energy, will add to his portfolio the responsibilities of chairman and president of BP America Inc., succeeding **Susan Dio** on July 1, 2020.

Russian energy giant Rosneft in May reappointed Chief Executive **Igor Sechin**, for another five years. Sechin, who turns 60 in September, turned the company into one of the world's top oil players and earned the accolade of oil tsar.

ConocoPhillips's CFO **Don E. Wallette, Jr.** will retire as EVP and CFO after a 39-year career with the company. Wallette's retirement is effective on Aug. 31, 2020. **William (Bill) L. Bullock, Jr.**, president, Asia Pacific Middle East, will assume the role effective Sept. 1, 2020.

Offshore drilling contractor Noble Corp. in May appointed **Robert W. Eifler** as President and CEO. He succeeded **Julie J. Robertson** who was named executive Chairman of the company.

UK North Sea-focused oil company Repsol Sinopec Resources UK Limited appointed **Jose Luis Muñoz** as its CEO, effective April 1, 2020. Muñoz replaced **Bill Dunnett**, who had been in the CEO since 2015.

Aker Energy appointed **Håvard Garseth** as its CEO. Before this, Garseth served as CEO TRG Energy.

Drilling and engineering company KCA Deutag named **Ole Maier** its new President of Offshore Business Unit.

Norwegian offshore installation company Ocean Installer has established a new business segment focused on Offshore Wind and has appointed **Even Larsen**, currently CEO of Fred. Olsen Ocean, as the director of its new business segment.

Lloyds Register has appointed **Yvo Yansen** as Global Business Development Director for Energy business.

OE OFFSHORE ENGINEER

2020 EDITORIAL CALENDAR

JANUARY - FEBRUARY

Ad Close: Feb 6

FEATURE
Floating Production Outlook

DEPARTMENTS

Engineering, Procurement, Installation, Commissioning
Abandonment & Decommissioning

Subsea
ROV/AUV Technologies

Production
Topsides, Platforms & Hulls

Drilling and Completions
Downhole Data: Sensors, Fiber Optic & Wired Pipe

Regional Report
Asia & Australia

Special Report
Big Data and Digitalization

Product
Coatings & Corrosion Technologies

EVENTS & BONUS DISTRIBUTION
- **FPSO Europe** - London
- **Australasia Oil and Gas** - Perth
- **OTC Asia** - Kuala Lumpur

MARCH - APRIL

Ad Close: Apr 2

FEATURE
Deepwater: The Big New Horizon

DEPARTMENTS

Engineering, Procurement, Installation, Commissioning
Unmanned Platforms

Subsea
Tiebacks: Projects & Technologies

Production
Flow Assurance

Drilling and Completions
Drilling Rigs & Equipment Innovation

Regional Report
Gulf of Mexico

Special Report
TBD

Product
Safety Systems, Equipment & Technologies

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- **Global Petroleum** - Calgary
- **UTC** - Bergen

MAY - JUNE

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FEATURE
Well Integrity

DEPARTMENTS

Engineering, Procurement, Installation, Commissioning
Design & Visualization

Subsea
Well Intervention

Production Operations
Inspection, Maintenance & Repair

Drilling and Completions
Drilling Automation & Robotics

Regional Report
West Africa

Special Report
Communications/SatCom

Product:
Mooring Systems, Anchor Handling & Station Keeping

EVENTS & BONUS DISTRIBUTION
- **Subsea Well Intervention** - Houston

JULY - AUGUST

Ad Close: Aug 6

FEATURE
The Robotics Revolution

DEPARTMENTS

Engineering, Procurement, Installation, Commissioning
Transport & Installation: Projects & Vessels

Subsea
Subsea Processing

Production
Reservoir Management & Surveillance

Drilling and Completions
Drilling Efficiency

Regional Report
Northwest Europe

Special Report
Renewables Review

Product:
Deck Machinery, Equipment & Cranes

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- **ONS** - Stavanger
- **GasTech** - Alberta
- **Oilcomm** - Houston
- **ATCE** - Denver
- **Offshore Energy Europe**- Amsterdam

SEPTEMBER - OCTOBER

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FEATURE
Digital Transformation

DEPARTMENTS

Engineering, Procurement, Installation, Commissioning
Brownfield: Projects and Life Extension Technology

Subsea
Pipeline Inspection, Maintenance & Repair

Production
Production Optimization: Projects & Technologies

Drilling and Completions
Drilling & Completions Fluids

Regional Report
Middle East

Special Report
Geoscience: Data Collection & Processing

Product
Power Generation

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- **ADIPEC** - Abu Dhabi

NOVEMBER - DECEMBER

Ad Close: Dec 16

FEATURE
Offshore Outlook 2021

DEPARTMENTS

Engineering, Procurement, Installation, Commissioning
Marginal Fields: Projects & Technologies

Subsea
Subsea Power Distribution

Production
Processing & Separation

Drilling and Completions
Completions Technologies

Regional Report
Brazil

Special Report
Cyber Security

Product
Subsea Technologies

EVENTS & BONUS DISTRIBUTION
- **Subsea Expo 2021** - Aberdeen

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تحت رعاية صاحب السمو الشيخ خليفة بن زايد آل نهيان رئيس دولة الإمارات العربية المتحدة
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OFFSHORE SUPPORT VESSELS MARKET GROWTH RATE BY REGION, 2020-2025

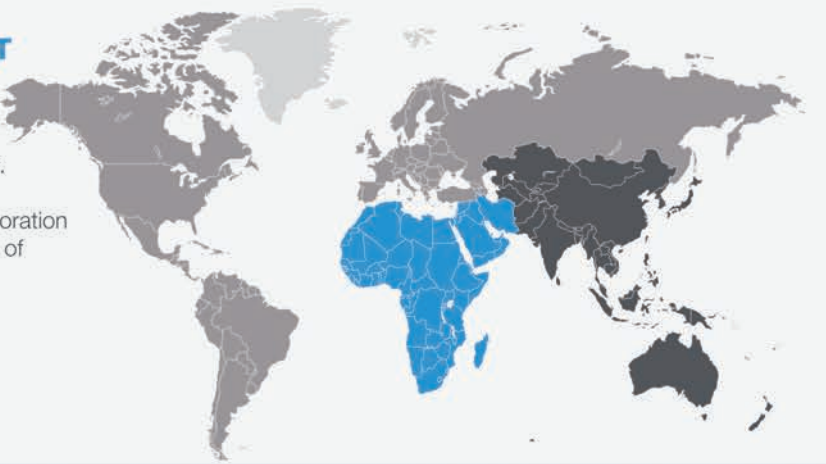
The market for offshore support vessels is expected to grow at a CAGR of approximately 6.50% from 2020 – 2025.

ADIPEC Offshore and Marine provides direct access to exploration and production companies for one of the largest gatherings of offshore vessel owners and operators.

Regional Growth Rates

High | Mid | Low

Source: Mordor Intelligence



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Source: Rystad Energy ECube

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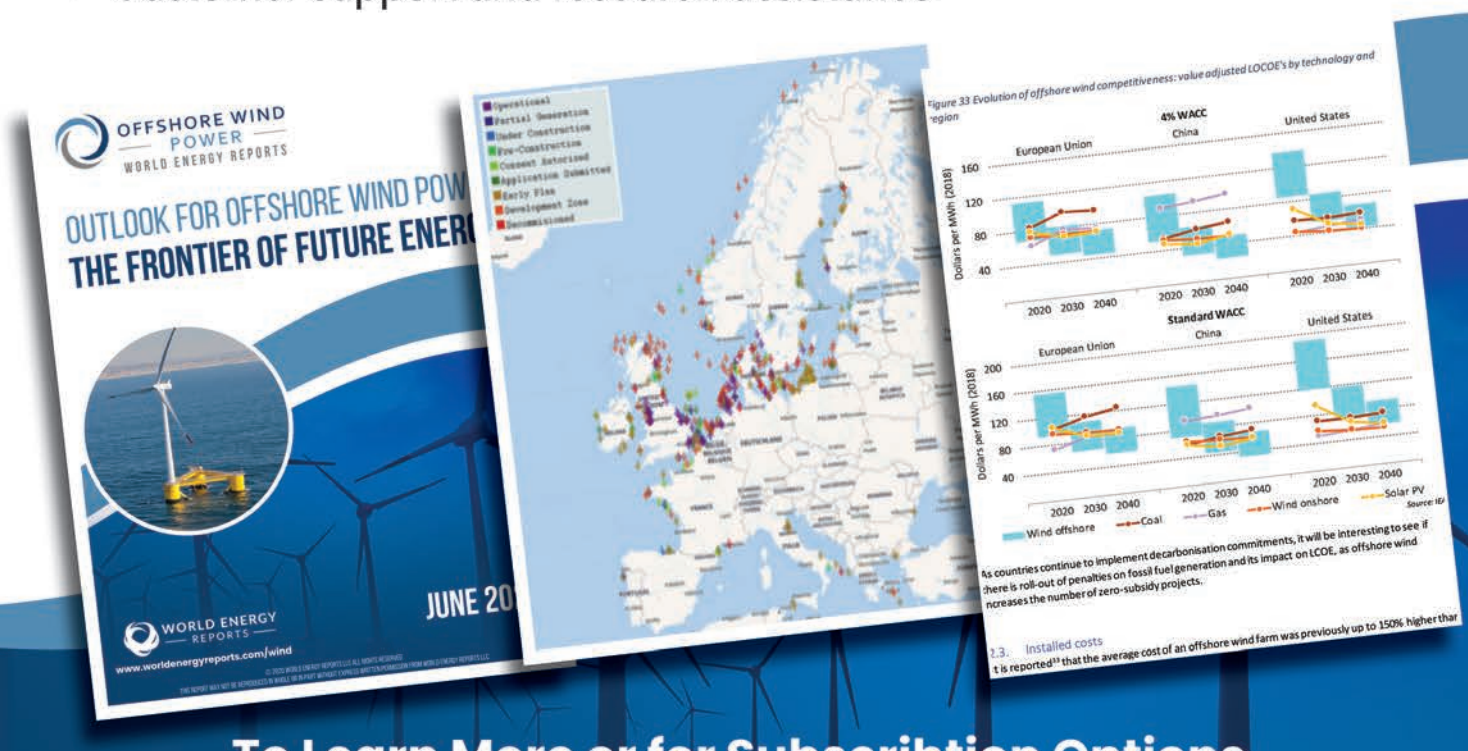

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